Another year of strong growth
China's impact on the semiconductor industry 2012 update

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Welcome

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China's domination in semiconductor consumption continues with no near-term challenge from any other country. The ongoing mobile computing explosion, marked by rapid proliferation of smart phones and tablets, helped China further consolidate its position as the leading consumer of semiconductors, accounting for 47% of the global semiconductor market.

China's semiconductor industry also continued to grow at an impressive pace, having achieved a 10-year compounded annual growth rate of 24%. A significant portion of that growth came from China's IC design or fabless sector, which grew from less than US$200m in 2001 to more than US$7bn in 2011. With the emergence in 2011 of the first Chinese billion-dollar IC design company and two of the worldwide top five fastest growing IC design companies, this sector is helping to accelerate development of the Chinese semiconductor industry.

In addition to semiconductor industry advancements, we see sustained growth supported by China's top position in technology and semiconductor IPOs, an increasing percentage of original issue semiconductor patents and the Chinese government's ambitious policy initiatives that promote domestic innovation.

The following report is our seventh update to the original 2004 study. Our in-depth analysis is the result of careful evaluation of numerous industry statistics and conversations with a number of Chinese semiconductor executives and analysts. You will find a discussion of both geographical and product category demand as well as commentary on changes in the semiconductor value chain.

If you would like to discuss any of the findings and how they might impact your business, please reach out to me or any member of our global technology team listed in the back of this document.

Sincerely,

What you need to know
Executive summary

China's semiconductor consumption market grew by 14.6% in 2011 to reach a record 47% of the global market.

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 was far more significant to the worldwide semiconductor industry than production volumes. That relationship may now have started to change as China's 2011 semiconductor performance far exceeded the worldwide industry! Both China's semiconductor consumption market and semiconductor industry growth were more than ten times greater than worldwide semiconductor industry growth.

China's semiconductor consumption market grew by 14.6% in 2011 to reach a record 47% of the global market. Much of this exceptional growth was the result of China's dominant position in the production of smartphones and media tablets.

At the same time, China's semiconductor industry grew by 14.4% in 2011 to reach a record US$43.5bn. A significant portion of that exceptional growth was attributed to China's IC design or fabless sector, which grew by more than 36% in 2011.

China's semiconductor consumption market has grown 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. Even during the global recession, China's electronic equipment production value grew during both 2008 and 2009 while worldwide production decreased by 3% in 2008 and 11% in 2009. As a result, China's share of worldwide electronic equipment production increased to 28.7% in 2008 and 32.8% in 2009.

In 2011 worldwide electronic equipment production grew by its historical average 6%, while China's electronic equipment production increased 10.7% and its share increased to 33.2%. At the same time, the semiconductor content of the electronic equipment produced in China has continued to be about 25% higher than the worldwide average, which remained at 20% in 2011.

Whether the Chinese semiconductor market will be able to continue to gain global share will be primarily determined by the future transfer of electronic equipment production.

Whether the Chinese semiconductor market will be able to continue to gain global share will be primarily determined by the future transfer of electronic equipment production. Most industry analysts are predicting that the trend of an increasing share of electronic equipment production in China will continue over the next five years.

The major global semiconductor companies continue to dominate the Chinese market. The largest suppliers to the Chinese market continue to be the same multinational semiconductor companies. There have been only thirteen different companies that have been among these top ten suppliers over the past nine years since our initial report. Eight companies have been among the top ten semiconductor suppliers to China every year from 2003 through 2011: Intel; Samsung; Toshiba; TI; Hynix; ST; Freescale and NXP/Philips.

It appears that there is still no Chinese company within the top 35 suppliers to the Chinese semiconductor market. Even if the largest Chinese semiconductor company sold all of its output within China, no Chinese semiconductor company would be among the top 35 suppliers to the Chinese Semiconductor market in 2011.

Sixty-three percent (63%) of all the semiconductors consumed in China were used in components of finished products assembled in China and exported for sale in other countries. This export market has been the major contributor to the growth of China's semiconductor market for the last decade. Since 2003, the consumption of semiconductors for export products has increased by US$75bn and constituted 62% of the overall growth of China's semiconductor market.

At the same time, China's domestic market continues to be of increasing significance to the global semiconductor industry. Since 2003, China's domestic market—the value of semiconductors consumed in China that are used in components of finished products assembled and sold in China—has grown at a 24% compounded annual growth rate (CAGR). That market has grown from US$10bn in 2003 to US$56bn in 2011. By itself, China's domestic consumption market has made up more than 34% of total worldwide semiconductor market growth since 2003. China's domestic semiconductor market grew to represent almost 19% of the worldwide semiconductor market in 2011. It has had a noticeable impact on the semiconductor industry and has been credited with initiating or leading the industry's recovery from the depths of its decline in 1Q/09.

Chinese OEMs influence and/or purchase a significant and increasing number of semiconductor devices. The top 10 Chinese OEMs' (original equipment manufacturers taken from China's Ministry of Industry and Information Technology [MIIT] report of "Top 100 Chinese Electronic Information Enterprises in 2012") 2011 Design TAM (total available market) semiconductor consumption was reported to be US$17.7bn, an increase of almost 24% from 2010. The top 10 OEM 2011 Purchasing TAM semiconductor consumption was reported to be US$14.8bn, an 18% increase from their 2010 reported Purchasing TAM. These values are less than their Design TAM because some of the OEMs (for example Lenovo) will design a product specifying specific key components and then consign manufacturing and purchasing to an EMS (electronic manufacturing services) company.

China's semiconductor industry has achieved a ten-year CAGR of 24% measured in US dollars (or 21% measured in local RMB currency) from 2001 through 2011. During 2011, almost US$8bn of additional fixed-asset investments were made in China's semiconductor industry, down 13% from the slightly more than US$9bn invest-

ments made in 2010. Of that amount, almost US$5bn was made in the IC industry, 34% less than in 2010 and more than US$3bn made in the O-S-D sector, 65% more than in 2010.

Based upon 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, China's semiconductor industry accounted for 12.2% of the worldwide semiconductor industry in 2011, up from 10.8% in 2010 and, more significantly, up from just 2% in 2000.

China's exceptional relative semiconductor performance in 2011 was also evident in the continued growth of China's IC consumption/production gap.

According to the China Semiconductor Industry Association (CSIA), China's IC industry unit production increased by 10% in 2011, while unit average selling price (ASP) increased by 3%. Based upon revenue values, China's IC industry achieved an overall self-sufficiency ratio of about 20% (ratio of production versus consumption value) in 2011, which was about the same as achieved in 2010. However, based upon the CSIA's reported unit volumes, China's IC industry unit self-sufficiency ratio for 2011 could have been much greater.

China's O-S-D (optoelectronics-sensors-discretes) sector performance in 2011 was slightly better than China's semiconductor industry and much better than the worldwide O-S-D performance. China's O-S-D sector revenues increased 14.6%, while the worldwide O-S-D industry grew by 8.5%. China's reported O-S-D production unit output increased by about 5% in 2011, while unit ASPs increased by 10%. Based upon revenue values, China's reported O-S-D industry achieved an overall self-sufficiency ratio of about 106% (ratio of production versus consumption value) in 2011, which was the highest ever reported and about five percentage points higher than achieved in 2010. 2011 was also the first year in which the value of China's O-S-D exports exceeded the value of China's O-S-D imports.

China's exceptional relative semiconductor performance in 2011 was also evident in the continued growth of China's IC consumption/production gap. This gap is the difference between IC consumption and IC industry revenues. Both China's IC market consumption and China IC industry production increased to new record levels in 2011. As a result, China's IC consumption/production gap also increased to a new record level in 2011. China's IC consumption/production gap increased by more than US$13bn in 2011, to a new record of US$100.5bn. At the same time, the ratio of China's IC production revenue to IC consumption value has shown some further degradation. It had grown with some yearly variability from 16% in 2001, to a peak of 22% in 2007, before declining slightly to 20% in 2009 and 2010 and to 19% in 2011. One of the stated Ministry of Industry and Information Technology (MIIT) objectives of China's 12th Five-Year Plan (FYP) is to improve this ratio to 27.5% by 2015. China's IC consumption/production gap represents both an opportunity and a challenge for the established multinational semiconductor industry. Over the near term, it continues to represent an unparalleled market opportunity, but over the longer term, it represents a domestic industry void that will inevitably be filled. The question is how will it be filled: will it be a combination transfer and expansion of multinational companies or the emergence and growth of significant Chinese companies?

This is the first update in which we have tried to evaluate China's O-S-D consumption versus production. Since 2005 there has not been a significant difference between China's reported discrete (including LED) production

revenues and consumption value. That difference has gone from a moderate US$374m (5%) gap in 2005 to a modest surplus in 2008 and 2010 and a notable surplus in 2011. China's discrete (including LED) production/consumption surplus increased by US$900m to reach US$1bn for 2011. China's discrete production/consumption surplus was also reflected in their import/export statistics. In 2011, China's reported imports of discrete (including LED) devices increased 8.3% to US$17.4bn, while their exports of discrete devices increased by 11% to US$33.6bn. This resulted in a first time ever trade surplus of US$16.2bn. This implies that China's discrete industry has grown to be of worldwide significance and, although it still needs further improvement in advanced manufacturing technology, is approaching self sufficiency.

Integrated circuit (IC) design is the only segment of China's semiconductor industry that achieved positive year-over-year (YoY) revenue growth for every year since 2000. China's fabless semiconductor industry benefitted from the booming demand for semiconductors used in cell phones as shipments of mobile handsets designed in China surged by nearly 60% in 2011. Revenue from China's fabless semiconductor companies increased in 2011 to constitute about 10% of the US$75bn worldwide fabless IC industry, up from a 1% share in 2001, a 4% share in 2004 and a 7% share in 2010.

For the 12th FYP period (2011-2015), China has launched ambitious policy initiatives to develop large domestic markets for specific next-generation technologies including mobile Internet, information-based household appliances, 3C convergence, Internet of Things, smart grid and cloud computing. The government is also increasingly emphasizing indigenous innovation in government procurement programs in order to reduce dependence on foreign technology. The effects of the relevant policies of China's 12th FYP are projected to move China's IC manufacturing industry in two key directions: increasing and accelerating concentration within the sector and increasing the number of firms funded from security market listings.

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What you need to consider
Key findings

In 2011, China's semiconductor consumption market grew by 14.6% and its semiconductor industry grew by 14.4%.

From 2003 to 2011, China's share of the worldwide semiconductor consumption market has grown from <19% to >47%.

Sixty-three percent (63%) of all semiconductors consumed in China were used in products assembled in China and exported for sale.

Eight global semiconductor companies have been among the top 10 semiconductor suppliers to China every year from 2003 to 2011.

Since 2003 China's domestic consumption market has made up more than 34% of the total worldwide semiconductor market growth.

In 2011, China's semiconductor industry grew by 14.4% to reach a record US$43.5bn—more than ten times greater than that of the total worldwide semiconductor industry.

From 2001-2011 China's semiconductor industry has achieved a 10-year compounded annual growth rate of 24%.

China's IC design sector has grown from less than US$200m in 2001 to more than US$7bn in 2011—a 45% compounded annual growth rate.

Of the 160 semiconductor wafer fab facilities in operation in China at the end of 2011, 79 are located in the East China region (64% of capacity).

The integrated circuit (IC) design segment of China's semiconductor industry enjoys the unique distinction of positive year-over-year (YoY) revenue growth for every year since 2000. Its revenue comes primarily from China's indigenous fabless semiconductor companies, which in 2011 increased to constitute about 10% of the US$74bn worldwide fabless IC industry, up from a 1% share in 2001, a 4% share in 2004 and a 7% share in 2010. It has been the fastest growing segment of China's semiconductor industry since 2000.

There are currently no more than 100—possibly less—local indigenous IC design enterprises that are truly viable fabless semiconductor companies. As many as 240 of the 503 IC design enterprises that China Center of Information Industry Development Consulting (CCID) reported China had at the end of 2011 could be the design or research & development centers of multinational companies.

The 50 largest indigenous Chinese semiconductor companies with revenues greater than US$44m reported an average 39% increase in revenues, which is notably better than the 0.4% increase for the worldwide semiconductor industry. During the last six years, the number of Chinese semiconductor companies with revenues of US$30m or greater has almost quadrupled from 14 to 55, their average revenue has nearly tripled from US$47m to US$140m and the revenue of the largest company on the list increased by more than 660%, from US$155m to US$1,032m.

In 2011 China reported its first billion-dollar IC design company and two of the worldwide top five fastest growing IC design companies. It may be that 2011 will be the turning point in the development of the Chinese semiconductor industry and of its IC design industry in particular. CCID's current forecast is for China's IC design sector industry to grow by a 22.4% CAGR over the next three years to reach US$14bn by 2014. If this forecast is realized, China's IC design sector would represent almost 14% of worldwide fabless semiconductor revenues and about 4.2% of the worldwide IC market.

Greater China, which includes mainland China, Hong Kong and Taiwan, accounted for more than half of the worldwide semiconductor consumption market in 2011.

There were 30 Greater Chinese OEM, ODM and EMS companies among the worldwide top 100 semiconductor consumers in 2011 based upon Purchasing TAM.

China's consumption of semiconductors has grown to be almost fifteen times that of Taiwan in 2011, while Taiwan's IC industry declined to slightly less than two and a quarter times that of China in 2011. A conspicuous portion of that market consumption in China continues to be created by Taiwanese electronic manufacturing service (EMS) and original design manufacturer (ODM) companies.

The Greater China semiconductor industry has performed better than the worldwide industry, growing 34% compared to a worldwide 17% growth over the last four years.

Greater China continues to dominate contract or outsourced semiconductor manufacturing, representing 69% of worldwide pure-play foundry capacity and 62% of worldwide SATS (semiconductor assembly and test services) capacity.

Samsung's Xi'an NAND Flash memory fab, which broke ground in September 2012, will become China's largest and most advanced technology wafer fab.

China's relative revenue growth will lag significantly if its foundries continue to compete on price rather than leading-edge technology.

Over the past three years, China's share of wafer fab capacity allocated to the O-S-D (optoelectronics-sensors-discretes) sector has been increasing. It could increase to 30% for China versus 15% worldwide by 2015.

Packaging, assembly and test is probably the larger of China's semiconductor manufacturing sectors when measured in terms of value added, production revenue, employees and manufacturing floor space.

China's SPA&T (semiconductor packaging, assembly and test) facilities continue to rank first in share of worldwide SPA&T manufacturing floor space for the third year, ahead of Taiwan and Japan.

The revenue threshold for inclusion among China's top 50 semiconductor manufacturers increased to US$131m in 2011. It is the highest revenue threshold to date and reflects the growing number and size of Chinese semiconductor manufacturers.

China's 12th Five-Year Plan has a goal to more than double the size of the IC industry by 2015 with output exceeding 150 billion units and sales reaching RMB 330 billion (US$51bn), accounting for about 15% of the world IC market and satisfying nearly 30% of its domestic market demand and another goal to cultivate 5-10 key IC design firms with sales of over RMB 2 billion each (US$310m) with one firm ranking among the global top ten design firms.

China continued its dominance over the worldwide technology IPO market with the most technology IPOs—49 Chinese technology companies completed their IPOs in 2011 out of a worldwide total of 86.

For the past five years—from 2007 through 2011—5% to 6% of patents on semiconductor inventions have been first issued in China.

Nine Chinese companies, representing more than 56% of the 16 semiconductor IPOs completed in 2011, raised 50% of the funding realized, almost all in China's financial markets.

China's 2011 IC production dollar revenues exceeded the moderate growth scenario by more than 3%, but with significant diversity among its three sectors.

What you need to do
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 long-term strategy for China. China has launched ambitious policy initiatives to develop large domestic markets for specific next-generation technologies as well as a drive to promote domestic innovation in these areas. These next-generation technologies are expected to be growth drivers for global semiconductor companies in the decade ahead and there is real potential for Chinese companies to emerge in these areas as current global companies have not established clear leadership positions in these applications. Global semiconductor companies should determine their strategic posture now, including a careful intellectual-property strategy combined with a closely aligned operational strategy necessary to hold on to key intellectual property—and thus prosper alongside emerging Chinese players in the increasingly competitive global market.

Understand and leverage China's 12th Five-Year Plan (FYP). Companies that effectively develop and convey a value proposition that tangibly supports and speaks to one or more of the eight priorities implicit in China's 12th FYP could gain a favorable opportunity set and/or allay regulatory pressure.

Reassess company presence. China's semiconductor consumption market weathered the past global recession better than any other regional market. It did so at the expense of semiconductor consumption in other countries. That favorable, preferential difference is expected to continue

through the next semiconductor business cycle, driven in part by China's rapid urbanization, increasing consumer consumption and green energy initiatives. In addition, 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.

Identify and engage in all opportunities to team with Chinese government agencies in strategically addressing how to plan, develop and provide the advanced technology needed to support China's 4 trillion RMB economic stimulus programs that cover railroad and air transportation, telecom networks, rural improvements and healthcare reforms. These programs will need huge investments in advanced technology and should promote the use of semiconductor enhanced products.

Innovate within China. Launch R&D centers in China that focus on developing technologies for the Chinese market and avoid the transfer of core proprietary intellectual property.

Design for the marketplace. China has become the largest site of low-cost consumer electronic system production including a significant white label market 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.

Take advantage of China's National Major Science and Technology Project 02 to work with and evaluate Chinese equipment manufacturers and develop new process capabilities. This may be most applicable for semiconductor packaging and testing operations.

Explore acquisition or partnering opportunities. The majority of Chinese domestic design companies are small. 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 acquisition or partnership opportunities with Chinese design companies as a strategy to address the local market.

Take advantage of China's emergence as a source of financial funding for semiconductor start-ups. During the past three years, China's financial markets have accounted for more than 60% of total semiconductor IPO funds raised. Over the longer term, it is expected that the 12th FYP policies aimed at promoting different levels of market stock transfer mechanisms will help business to expand financial channels in phases as their operations grow in scale which, in turn, will provide greater incentives for semiconductor companies to list themselves on the Chinese exchanges.

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 mature 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.

Keep an eye on local competition. Continuously 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.

Preempt O-S-D competition. Chinese companies continue to compete most effectively in the discrete and LED areas. As such, they could be gaining the scale, qualifications and recognition necessary to grow into potential worldwide competitors or to extend into the commodity IC area. So, leading O-S-D companies should consider preempting these market share losses by participating actively in the Chinese market.

Adapt to China's "dislocated" buying structure. More than 29% of the semiconductors consumed in China in 2011 continued to be purchased outside of China. Suppliers need a team effort with design-in, qualification and purchasing focus at the OEM location outside China coordinated with application and supply chain focus at the manufacturing locations in China to ensure success.

Use Chinese foundries to gain pricing leverage while assuring future capacity. It is likely that the next semiconductor cycle will bring a foundry capacity shortage as a result of expected reductions in capital spending and accelerating IDM shift to the fab-lite business model. With their preponderance of 150mm and 200mm wafer fabrication facilities, local foundries may provide an immediate lower cost alternative and assured future supply source for some product categories.

Adapt to the new Corporate Income Tax and other business laws. Companies with operations in China should carefully examine and monitor their business strategy, model and structure in light of China's new Corporate Income Tax and other business laws and related incentive programs. Recent entrants to the Chinese market, for example, have seen a reduction in expected incentives, while many companies currently in the market have been able to qualify for incentives that seem to favor R&D, design and foundry operations.

Invest in effective human relations. When establishing an enterprise in China, apply the effort and resources from the start to develop a human relations program that is both effective and sensitive to local demographics and environment. The impact on employee retention and operating costs can be quite significant.

Promote participation in global and local industry forums. Encourage the China Semiconductor Industry Association (CSIA) and its member companies to participate in the World Semiconductor Trade Statistics (WSTS) programs. Encourage local subsidiaries of all multinational semiconductor companies to participate in CSIA and CCID statistics programs. Their participation in these industry-wide statistic programs would contribute to a better and more accurate understanding of China's semiconductor market and industry and their capabilities and contributions to the worldwide industry totals, benefiting the entire industry as well as themselves.

Keep an eye on Greater China. Taiwan has started to further loosen its restrictions on semiconductor investments in China and Chinese investments in Taiwan. Taiwan-based companies have already increased their presence in China, and the supply chain has started to follow suit. So, companies should monitor the status of Taiwan and the Taiwan/China relationship with an eye toward new market opportunities and risks in Greater 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 66% of all new fabs and 52% of all fab capacity under construction in 2011

Exceptional relative performance

China's semiconductor consumption market grew by 14.6% in 2011 to reach a record 47% of the global market. Measured in US dollars, China's semiconductor market growth in 2011 was more than ten times greater than that of the total worldwide semiconductor industry.

Exceeding worldwide growth

China's 2011 semiconductor performance far exceeded the worldwide industry! Both China's semiconductor consumption market and semiconductor industry growth were more than ten times greater than worldwide semiconductor industry growth.

China's semiconductor consumption market grew by 14.6% in 2011 to reach a record 47% of the global market. Measured in US dollars, China's semiconductor market growth in 2011 was more than ten times greater than that of the total worldwide semiconductor industry. Much of this exceptional growth was the result of China's dominant position in the production of smartphones and media tablets. From a Chinese perspective, about five percentage points of that increase was the result of China's continuing revaluation of the RMB. Measured in local (RMB) currency, China's semiconductor (consumption) market grew by 9.4% in 2011. Although less than Chinese officials had forecast, that 9.4% local currency growth rate was also several times greater than the total worldwide industry growth and may be understated since most of the semiconductors consumed in China were sourced from multinational suppliers and priced in dollars, euros or yen.

At the same time, China's semiconductor industry grew by 14.4% in 2011 to reach a record US$43.5bn. Measured in US dollars, China's semiconductor industry growth was also more than ten times greater than that of the total worldwide semiconductor industry. A significant portion of that exceptional growth was attributed to China's IC design or fabless sector which grew by more than 36% in 2011. From the Chinese perspective, five percentage points of that increase was also the result of China's continuing revaluation of the RMB. Measured in local (RMB) currency, China's semiconduc-

tor industry grew by 9.3% in 2011, less than half of what Chinese officials had forecast, but still several times greater than the total worldwide industry.

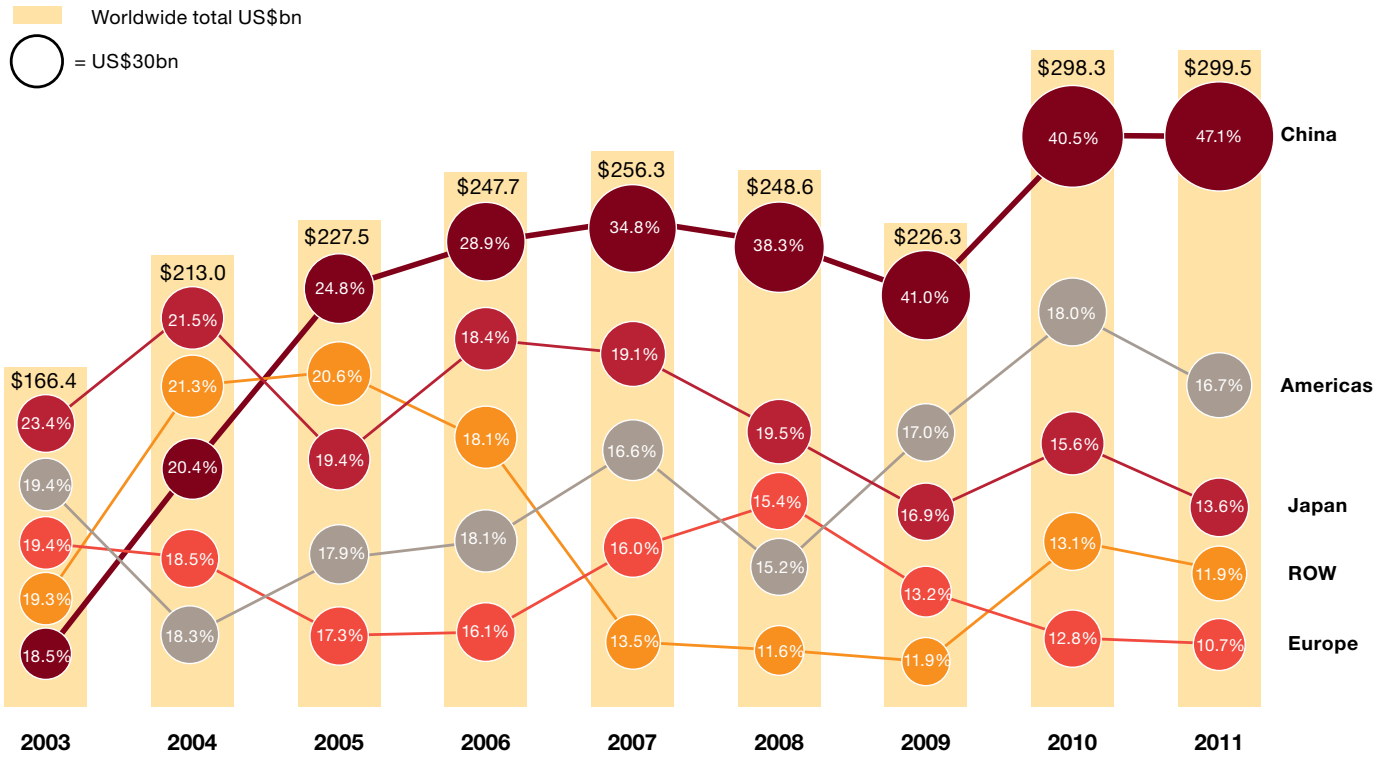
China's overall consumption market

As a result of its much greater than worldwide growth rate, China's share of the total 2011 worldwide semiconductor consumption market increased significantly to a record 47%. Over the past eight years, China's share of the worldwide semiconductor consumption market has grown from less than 19% in 2003 to just over 47% in 2011. China—the fifth and smallest semiconductor consuming region in 2003—has become the dominant consumer of semiconductors, using more than double the amount of any other region for each of the last three years.

During the last decade, China's consumption growth has outrun the rest of the world for nine of the ten years of ups and downs of two semiconductor business cycles. Since 2001, the bottom of the prior semiconductor business cycle, China's semiconductor consumption has grown at a 24.4% compounded annual growth rate (CAGR), while total worldwide consumption has only grown at a 7.9% CAGR.

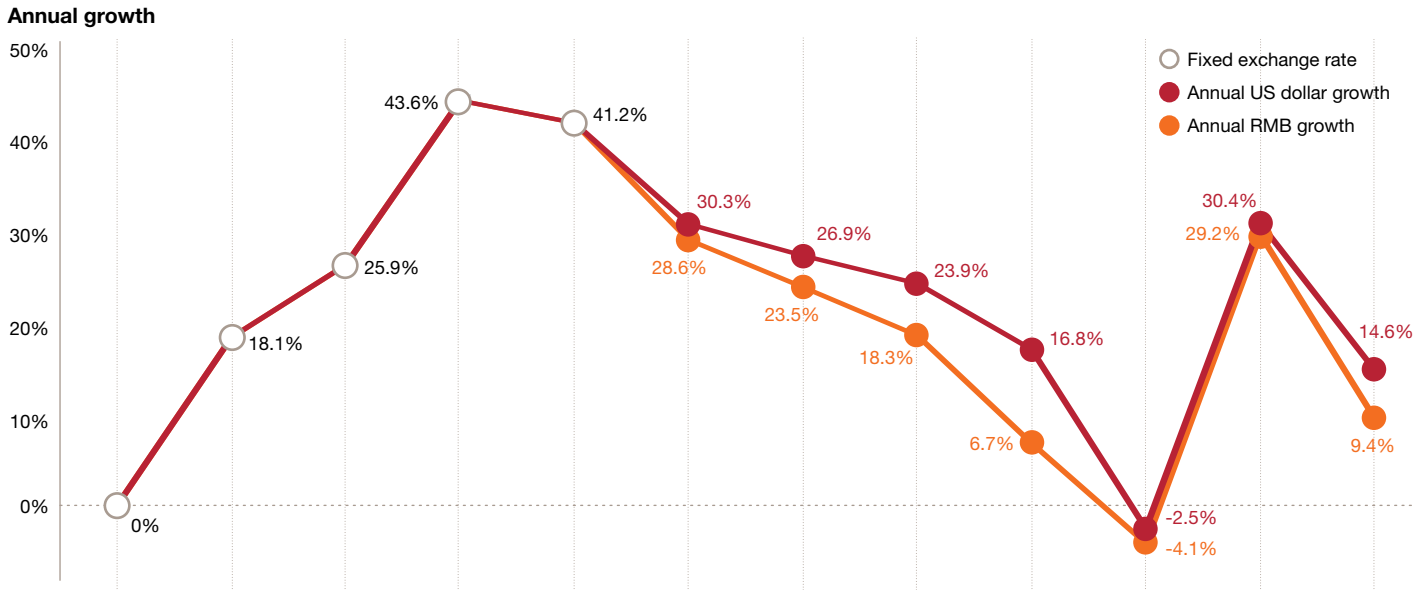
China's market growth has been at the expense of all other regions. Since 2001 China has accounted for 84% of the overall worldwide semiconductor market growth. From 2001 to 2011, China's semiconductor consumption market grew by US$134bn, while the worldwide market grew by US$160bn—from US$140bn to US$300bn. For the past seven years China has accounted for more than 100% of the overall worldwide semi-

Figure 1: Worldwide semiconductor market by region, 2003–2011
(Total worldwide in US$bn)



Source: SIA, MCR12, CCID

Figure 2: China's semiconductor market growth, 2000–2011



Market value

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
US$bn	14.4	17.0	21.4	30.7	43.4	56.5	71.0	88.9	103.8	101.2	132.0	151.2
RMBbn	119.5	141.1	177.6	255.1	360.0	463.0	571.7	676.1	721.5	691.6	893.4	977.5

Note: Market reporting has changed since 2003 with sensors and optical semiconductors included as part of the optoelectronics-sensors-discrete (O-S-D) segment which along with integrated circuits (IC) make up the total semiconductor market.

Source: CCID, CSIA

Figure 3: Comparison of China vs. worldwide semiconductor growth by quarter, 2007–2011

Note: Comparison of China's semiconductor market and China's IC industry growth versus worldwide semiconductor market by quarter 2007–2011 indexed against 2007 quarter average.

Source: SIA, CCID, CSIA Quarterly Reports

conductor market growth. Since 2004 China's semiconductor consumption market grew by US$108bn, while the worldwide market only grew by US$87bn.

China's semiconductor consumption market has grown 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. Even during the global recession China's electronic equipment production value grew, while worldwide production decreased by 3% in 2008 and 11% in 2009. As a result, China's share of worldwide electronic equipment production increased to 28.7% in 2008 and 32.8% in 2009.

The global semiconductor market's peak quarter was the third quarter of 2010, while China's semiconductor market reached a new record in third quarter of 2011.

In 2010, worldwide electronic equipment production recovered to near 2007 levels by increasing almost 16% while China's electronic equipment production increased just 12.8%, still reaching new record levels, but decreasing its share to 31.9%. In 2011, however, worldwide electronic equipment production grew by its historical average 6%, while China's electronic equipment production increased 10.7% and its share increased to 33.2%.

At the same time, the semiconductor content of the electronic equipment produced in China has continued to be about 25% higher than the worldwide average, which remained at 20% in 2011. During the past seven years, from 2004 to 2011, China's share of electronic equipment production has increased from 17% in 2004 to 33% in 2011, while the semiconductor content of that production averaged 25.2% compared to the worldwide average of slightly less than 20%. Table 1 shows China's production and worldwide share of main electronic products for the last four years.

Both the global and Chinese semiconductor markets reached the bottom of the last business cycle in 1Q/09 and then gradually improved in the following quarters. That improving trend continued through 2010, with the global and Chinese markets experiencing somewhat different growth profiles. The global market grew for the first three quarters and then declined in the fourth quarter. The Chinese market was almost flat in the first quarter, but then grew in each of the following three quarters. Both markets were relatively flat for the first two quarters of 2011, with a moderate

Table 1: China's production and worldwide share of main electronic products, 2008–2011

	Production in 1000s				% CAGR	Worldwide market share %			
	2008	2009	2010	2011		2008	2009	2010	2011
Main products									
Mobile phone	559,640	619,520	998,000	1,133,000	26.5%	44.7%	49.9%	71.3%	70.6%
Computer/PC	136,666	182,150	246,000	320,000	32.8%	47.0%	60.9%	73.4%	90.6%
Color TV	90,331	98,990	118,000	122,000	10.5%	43.9%	48.3%	47.8%	48.6%
Digital camera	81,883	80,260	90,000	82,900	0.4%		62.3%	64.9%	

Source: CSIA, MIIT, Digitimes Research 2010–2011

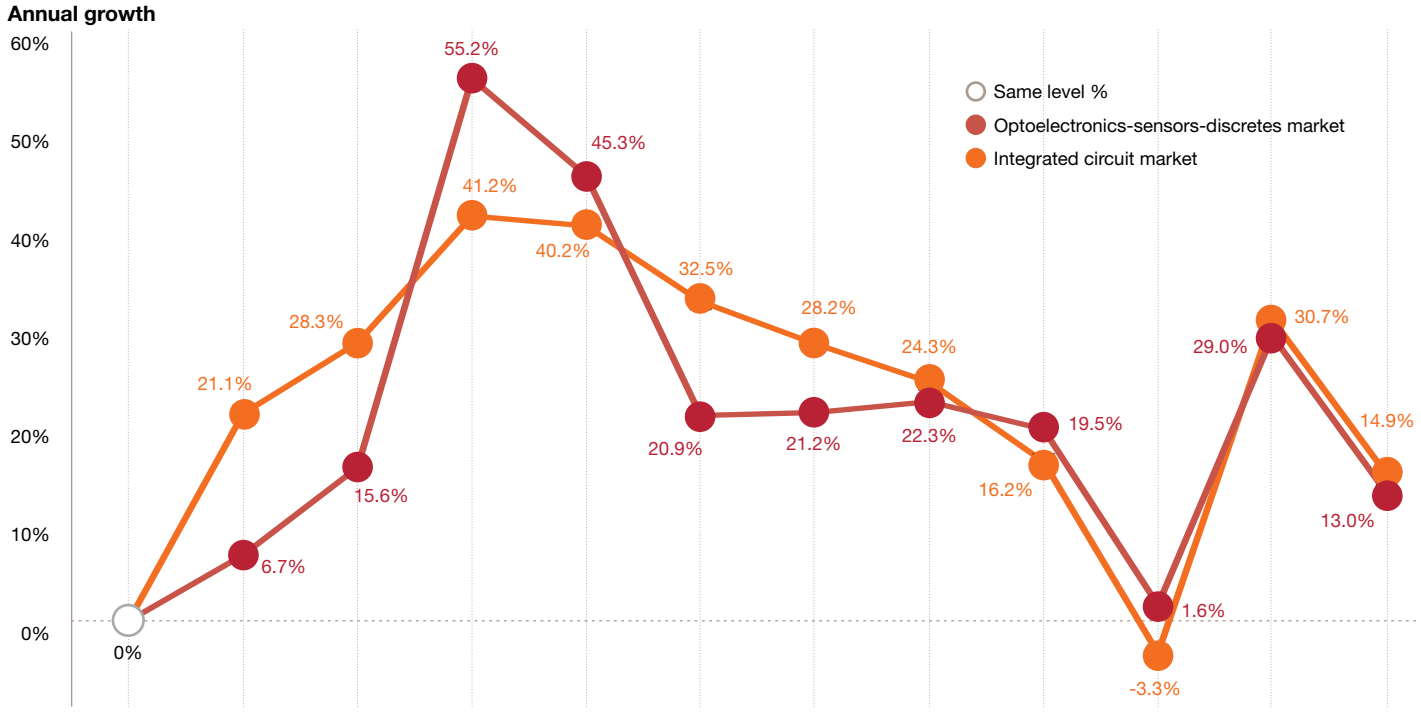
uptick in the third quarter, followed by a decline in the fourth quarter. China's consumption market share increased significantly in 2011 as its overall performance during the business cycle was notably stronger than the global market. The global semiconductor market's peak quarter was the third quarter of 2010, while China's semiconductor market reached a new record in the third quarter of 2011. By third quarter 2011 China's consumption had recovered and grown to a level of 176% of 2007 average-quarter consumption, while the global market had only recovered to about 121%.

Whether the Chinese semiconductor market will be able to continue to gain global share will be primarily determined by the future transfer of electronic equipment production. Most industry analysts are predicting that the trend of an increasing share of electronic equipment production in China will continue over the next five years. According to Gartner, China's share of electronic equipment production is forecast to increase to 40% by 2016 and China's share of worldwide semiconductor consumption to increase by a further 6%.

The market for integrated circuits and optoelectronic-sensor-discrete devices

The integrated circuit (IC) consumption market in China increased 14.9% to US$124.8bn in 2011. This increase was nearly fifteen times greater than the worldwide IC market increase of 1%. As a consequence, China's IC consumption grew to represent more than 47% of worldwide consumption in 2011. Measured in local currency, the increase in IC consumption was 9.7%.

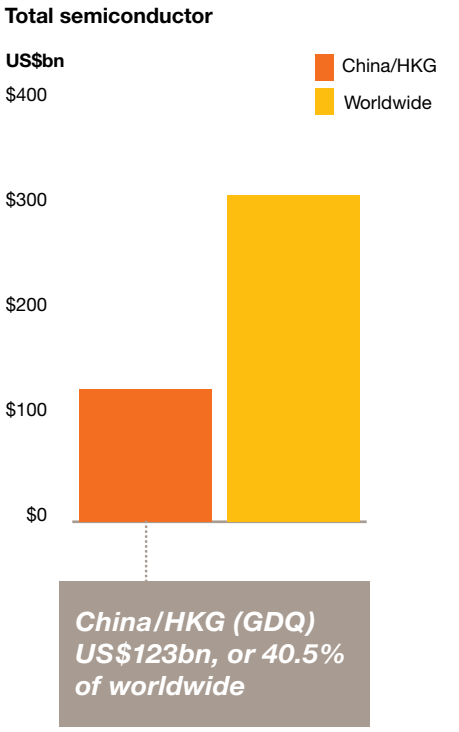
Figure 4: China's IC and O-S-D market growth, 2000–2011



Note: Market reporting has changed since 2003 and the definition O-S-D (optoelectronics-sensors-discretes) market now includes sensors and optical semiconductors.

Source: CCID, CSIA

Figure 5: China compared with worldwide semiconductor market by application, 2011



Source: Gartner Dataquest

The two most significant increases in China's semiconductor consumption during 2011 were for the digital cellular smartphone and media tablet applications sectors, which increased by US$6bn and US$3.6bn respectively.

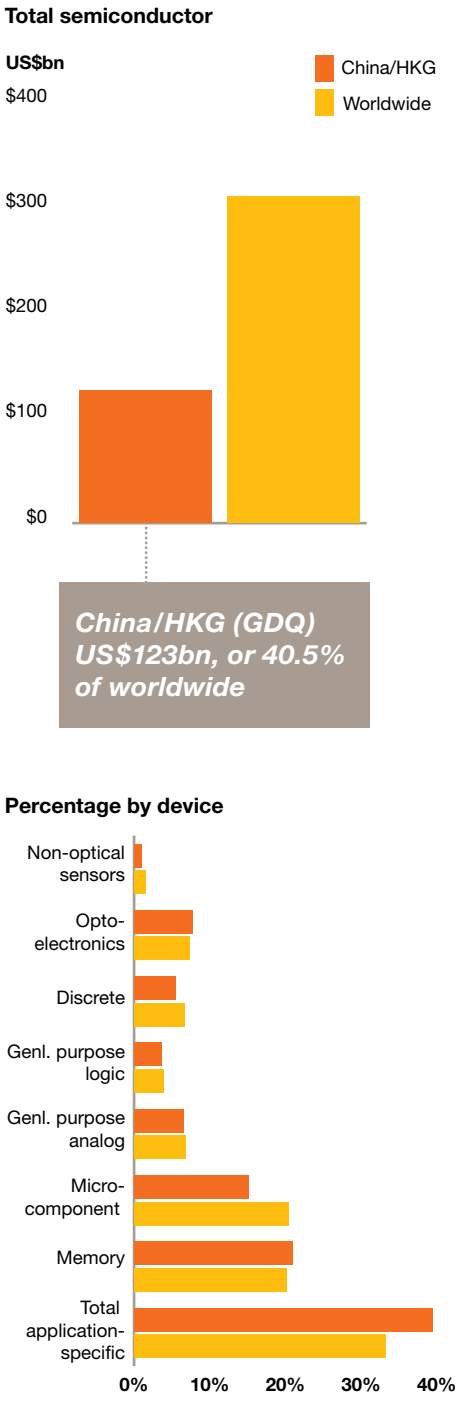
During 2011 China's IC consumption—measured in US dollars—increased by about US$16bn, while the worldwide IC market increased by slightly less than US$2bn. This infers that IC consumption in the rest of the world other than China decreased by more than US$14bn or—9.5%—compared to China's 14.9% increase. This is the fourth time in the past five years that China's IC consumption grew faster than the rest of world's IC market and that China's IC consumption grew at the expense of displacing IC markets in other regions. As such, this may represent a resumption in the dynamics of China's impact on the industry.

During 2011 China's O-S-D (opto-electronic-sensor-discrete) market, measured in US dollars, grew 13% to reach a new peak of US$26.5bn. This increase was somewhat greater than the worldwide O-S-D market increase of 8% and, as a result, China's share of that market increased a couple of percentage points to slightly more than 49%. Sensors was the smallest segment of China's O-S-D market, at US$3.4bn, but the fastest growing in 2011 at 21%. Discrete remained the largest segment of this market at US$13.4bn, while growing at 5%. Optoelectronics continued as the middle segment, at US$9.7bn, while growing 8% in 2011. When measured in local currency, China's O-S-D market increased by 7.9%. It represented 17.5% of China's total semiconductor consumption market in 2011, which is slightly less than the worldwide average of 17.9%.

Market by application

When compared with the worldwide semiconductor market, the distribution of China's 2011 semiconductor consumption continued to be somewhat more concentrated in the computing and communications application sectors, slightly more concentrated in the consumer sector, relatively less concentrated in the automotive and notably less concentrated in the industrial and military/aero sectors. During 2011, worldwide semiconductor consumption became slightly more concentrated in the communications, automotive and industry controls sectors. The share of China's semiconductor market consumed by the communications sector in 2011 increased by 1.7%, while the share consumed by the consumer sectors decreased by 1.5%. The two most significant increases

Figure 6: China compared with worldwide semiconductor market by device 2011



Source: CCIC, Gartner Dataquest 2012

in China's semiconductor consumption during 2011 were for the digital cellular smartphone and media tablet applications sectors, which increased by US$6bn and US$3.6bn respectively. Since 2003, China's consumption of semiconductors for computing applications has grown at a 21% CAGR, while consumption for communications and consumer applications has grown at 20% and 14%. China's consumption of semiconductors for industrial/military applications is smaller, but has grown at the fastest rate of 26%, followed by automotive applications at 24% CAGR.

Market by device type

China's semiconductor consumption market in 2011 remained noticeably more concentrated than the worldwide market in the application-specific integrated circuit sector and less concentrated in the non-optical sensors and microcomponent sectors. At the same time, it also remained somewhat less concentrated in the discrete sector.

During 2011, worldwide semiconductor consumption was noticeably affected by the collapse in DRAM average selling prices (ASPs). As a result, the value of worldwide memory sector consumption decreased by US$6bn, which was more than offset by increases in microcomponent, application-specific, discrete device and optoelectronic sector consumption.

Worldwide semiconductor consumption became less concentrated in the memory sector and slightly more concentrated in all the other sectors in 2011. During 2011 China's increase in electronic systems production volume nearly offset the decrease in DRAM ASPs, so the value of China's memory sector consumption only decreased slightly by about US$0.3bn. That decrease was more than offset by China's increases in the value of consumption of all the other device sectors. During the last eight years since 2003, non-optical sensors, the smallest device sector of China's semiconductor market, was the fastest growing, increasing at a 53% CAGR. Memory was the next fastest growing sector at 23%, followed by optoelectronic at 22% CAGR. The general purpose logic and discrete sectors had the slowest growth at about 9% and 16% CAGR respectively, while all the remaining sectors grew at about 20%.

Suppliers to the Chinese market

The major global semiconductor companies continue to dominate the Chinese market. The largest suppliers to the Chinese market continue to be the same multinational semiconductor companies. Table 2 lists the top suppliers that have the largest sales revenue from the Chinese market. There have been only thirteen different companies that have been among these top ten suppliers over the past nine years since our initial report. Eight companies have been among the top ten semiconductor suppliers to China every year from 2003 through 2011: Intel, Samsung, Toshiba, TI, Hynix, ST, Freescale and NXP/Philips. AMD has been among the top suppliers since 2004. Infineon and its spin-off Qimonda were among the top ten suppliers for the first four years 2003–2006 until exiting the DRAM business; Media Tek for the three years 2007–2009, until it lost market share to Chinese IC design competitors and Renesas for the first and last two years, 2003, 2010 and 2011, returning as a result of its merger with NEC Electronics.

Table 2: Semiconductor suppliers to the Chinese market, 2010–2011

Company	Rank 2010	Rank 2011	Revenue in US$m 2010 IC	2011 IC	% change	2010 Semi	2011 Semi	% change	Market share
Intel	1	1	19,659	23,777	20.9%	19,659	23,777	20.9%	15.7%
Samsung	2	2	8,018	9,388	17.1%	8,175	9,612	17.6%	6.4%
Toshiba	4	3	4,138	4,385	6.0%	4,479	5,322	18.8%	3.5%
TI	5	4	4,248	4,920	15.8%	5,564	5,210	-6.4%	3.4%
Hynix	3	5	5,564	5,087	-8.6%	4,970	5,087	2.4%	3.4%
ST	6	6	3,305	3,616	9.4%	4,449	4,742	6.6%	3.1%
AMD	7	7	4,174	4,408	5.6%	4,174	4,406	5.6%	2.9%
Renesas	9	8	2,634	2,681	1.8%	3,484	3,452	-0.9%	2.3%
Freescale	10	9	2,655	2,913	9.7%	3,233	3,426	6.0%	2.3%
NXP	8	10	1,783	2,106	18.1%	3,751	3,003	-19.9%	2.0%
Infineon	11	11	1,783	1,703	-4.5%	2,634	2,782	5.6%	1.8%
ON Semiconductor	14	12	810	1,176	45.2%	1,843	2,701	46.6%	1.8%
Qualcomm	15	13	1,627	2,270	39.5%	1,627	2,270	39.5%	1.5%
Micron	12	14	2,388	2,086	-12.6%	2,526	2,200	-12.9%	1.5%
Media Tek (MTK)	13	15	2,453	2,016	-17.8%	2,453	2,016	-17.8%	1.3%
Total Top 10			**56,178**	**63,281**	**12.6%**	**61,938**	**68,037**	**9.8%**	**45.0%**
Total Top 10 share of									
Chinese integrated circuit market			51.7%	50.7%					
Chinese semiconductor market						46.9%	45.0%		

Note: Semi equals IC + Discrete (including LED) market.

Source: CCID IC Market China 2011 & 2012 Conferences–February 2011 & March 2012

During 2011 China's consumption of semiconductor products from these ten largest suppliers increased by 9.6%. Although five percentage points less than the growth of the overall semiconductor market in China, it is still notably better than the growth of the overall worldwide semiconductor market. The increase in China's total consumption of semiconductor products from these ten largest suppliers was almost four percentage points better than the increase in worldwide consumption of their products primarily due to the large growth in China's consumption of products from the top three suppliers, Intel, Samsung and Toshiba.

The Chinese semiconductor market continued a trend of being less concentrated than the worldwide market in 2011. The top ten suppliers to the Chinese semiconductor market had a 45% share of that market, while the top ten suppliers to the worldwide market had an almost 51% share in 2011, reversing for a second year what had been a very gradually declining share ranging from 50% in 2004 to 47% in 2007 and 44% in 2009.

Together these ten largest suppliers have maintained their share of the Chinese IC market at about 51% in 2010 and 2011, consistent with the slightly more than 51% share they had maintained for the three years prior to 2009.

Sixty-three percent (63%) of all the semiconductors consumed in China were used in components of finished products assembled in China and exported for sale in other countries.

Although Gartner Dataquest stopped reporting company market share data by country in 2008, it still appears that there is no Chinese company within the top 35 suppliers to the Chinese semiconductor market. Even if the largest Chinese semiconductor company sold all of its output within China, no Chinese semiconductor company would be among the top 35 suppliers to the Chinese semiconductor market in 2011. This is an improvement from 2010, when it would have not been among the top 40 suppliers. It is also notable that Media Tek, the one Taiwanese company that had been within the top ten suppliers to the Chinese semiconductor market from 2007 through 2009, dropped in rank to number thirteen in 2010 and fifteen in 2011 as a result of losing market share to Chinese IC design competitors.

Since China represents almost half of the worldwide semiconductor market, it should not be surprising that many of the same companies are the largest suppliers to both the Chinese and worldwide markets. Seven of ten companies were the largest suppliers to both markets in 2011, the same number as in 2009 and 2010, but more than the six in 2008 and less than the eight in 2007. Among the top ten suppliers to the Chinese market, AMD, NXP and Freescale Semiconductor were not among the ten largest suppliers to the worldwide market. Correspondingly, of the top ten suppliers to the worldwide market, Micron Technology, Qualcomm and Broadcom were not among the ten largest suppliers to the Chinese market in 2010 and 2011.

While nine of the top ten suppliers to the Chinese semiconductor market were the largest IC suppliers, only four were among the largest O-S-D (optoelectronics-sensors-discretes) suppliers. ST, Toshiba, NXP and Renesas Electronics were among the top ten suppliers to the Chinese O-S-D market. The other top ten suppliers to the Chinese O-S-D market included ON Semiconductor, Fairchild Semiconductor, Infineon, KEC, Rohm and International Rectifier. The other top ten supplier to China's IC market in 2011 was Qualcomm. China's IC market is slightly more concentrated than China's combined semiconductor market, while the O-S-D market is less concentrated. The top ten IC companies accounted for 51% of that market, while the top ten O-S-D companies only accounted for 36% of their market in 2011.

While China's semiconductor consumption represented more than 45% of worldwide semiconductor consumption in 2011, the China consumption performance of the individual companies among the top ten suppliers to the Chinese market varied considerably. Three companies had less than 45% of their total sales consumed in China: Samsung, TI and Renesas. Four companies had between 45% and 60%: Intel, Toshiba, Hynix and ST. One company had between 60% and 75%, AMD, and two companies had more than 75%, Freescale and NXP.

Based upon a comparison of CCID's report of China consumption by supplier and GDQ's report of worldwide market share, the variations are even more notable among the top 20 suppliers to the Chinese market. Eight companies (40% of the top twenty suppliers) had less than the average of 45% of their total sales consumed in China. Five companies (25% of the top twenty suppliers) had the average, between 45% and 55%, of their total sales consumed in China. Four companies (20%) had above average, between 55% and 75%, of their total sales consumed in China, while three, NXP, Freescale and ON Semiconductor, had a significantly above-average, more than 75% of their total sales consumed in China.

Table 3: Chinese semiconductor exports by segment, 2009–2011
(in US$bn)

	Total sales			Export sales (% of total)						Domestic consumption (% of total)	
Market segment	**2009**	**2010**	**2011**	**2009**		**2010**		**2011**		**2011**	
Data processing	39.9	56.1	58.8	24.1	(61%)	34.1	(61%)	36.2	(62%)	22.6	(38%)
Communications	27.8	33.1	36.8	19.9	(71%)	22.9	(69%)	24.0	(65%)	12.8	(35%)
Consumer	18.0	21.2	20.4	14.1	(78%)	16.2	(77%)	15.2	(75%)	5.2	(24%)
Automotive	3.1	4.3	4.7	0.9	(30%)	1.2	(28%)	1.3	(27%)	3.4	(73%)
Industrial	1.5	2.4	2.2	0.6	(39%)	0.9	(37%)	0.8	(34%)	1.4	(66%)
Mil/Aero	0.2	0.2	0.3	0	(18%)	0	(18%)	0	(18%)	0.3	(82%)
Totals	**90.5**	**117.3**	**123.2**	**59.7**	**(66%)**	**75.3**	**(64%)**	**77.5**	**(63%)**	**45.7**	**(37%)**

Source: Gartner Dataquest, PricewaterhouseCoopers 2009–2011

The Chinese export market and domestic consumption

Sixty-three percent (63%) of all the semiconductors consumed in China were used in components of finished products assembled in China and exported for sale in other countries. We describe this as the export market. Table 3 shows the relative distribution of this export market by major market segments. This export market has been the major contributor to the growth of China's semiconductor market for the last decade. Since 2003, the consumption of semiconductors for export products has increased by US$75bn and constituted 62% of the overall growth of China's semiconductor market. Its share of total semiconductors consumed in China had risen for three years—from 64% in 2005, to 66% in 2006 and 69% in 2007—before declining to 68% in 2008, to 66% in 2009, to 64% in 2010 and to 63% in 2011.

During the global recession that export market consumption became the overwhelming contributor to the decline of China's semiconductor market in 2009 as it decreased by more than US$3bn, while the consumption of semiconductors for domestic products increased by less than US$1bn. Conversely, the ex-

China became the largest market in the world for PCs in 2011 after becoming the largest market for cell phones, digital TVs and automobiles in 2010. As a result, the following twelve applications each accounted for over US$1bn of domestic semiconductor consumption in 2011.

	(US$bn)
Digital cellular smartphone	*5.6*
PC desktop–professional	*2.8*
Digital cellular enhanced	*2.6*
PC mobile–home (CPU & memory)	*2.4*
PC mobile–professional (CPU & memory)	*2.1*
PC desktop–home (CPU & memory)	*1.9*
PC mobile–professional (subsystems)	*1.5*
RS3 flash cards	*1.5*
PC mobile–home (subsystems)	*1.5*
TV LCD	*1.5*
Monitor flat panel	*1.2*
Digital cellular basic	*1.0*

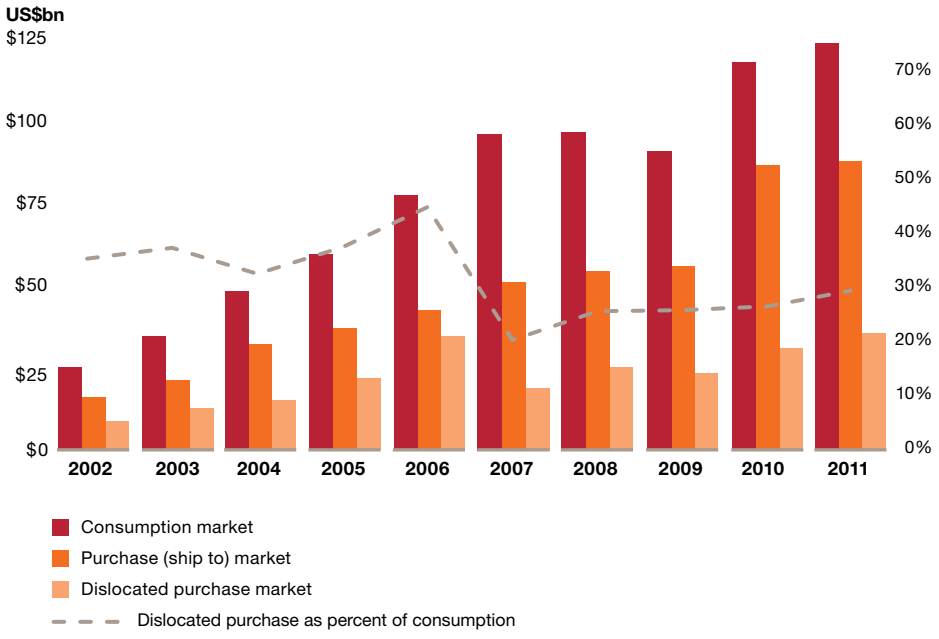
port market consumption also became the major contributor to the recovery of China's semiconductor market in 2010— it increased by just over US$19bn—while the consumption of semiconductors for domestic products increased by almost US$12bn.

China's domestic market continues to be of increasing significance to the global semiconductor industry. Since 2003, China's domestic market—the value of semiconductors consumed in China that are used in components of finished products assembled and sold in China—has grown at a 24% CAGR. That market has grown from US$10bn in 2003 to US$56bn in 2011. By itself, China's domestic consumption market has made up more than 34% of total worldwide semiconductor market growth since 2003. China's domestic semiconductor market grew to represent almost 19% of the worldwide semiconductor market in 2011, up from 15-16% during the prior two recession and recovery years and up from 13.5% in 2008 and 11% in 2007. It has had a noticeable impact on the semiconductor industry and has been credited with initiating or leading the industry's recovery from the depths of its decline in 1Q/09.

Dislocated purchasing

China's reported semiconductor consumption market is greater than most market analysts' Chinese market share reports because a significant portion of the semiconductor devices consumed in China continue to be purchased 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

Figure 7: Analysis of China/Hong Kong consumption versus purchasing TAM semiconductor market history



Source: Consumption market is based upon Gartner Dataquest Semiconductor Forecast Database. Purchase (ship to) market is based upon Gartner Dataquest Market Share Database through 2006. Purchase TAM is based upon Gartner Market Share OEM IDM, and EMS Semiconductor Demand Worldwide 2012 Database.

them to China for use and consumption. This means that a significant portion of buying decisions—and therefore selling opportunities—for customer-specified devices consumed in China continue to made outside of China. For the four years prior to 2011, the largest share of this dislocated purchasing of semiconductors for consumption in China took place in Taiwan, Korea and Japan, which corresponds to the ongoing transfer of electronic equipment production from these regions to China. That changed in 2011, with Americas replacing Japan as the third largest source of dislocated purchasing for China, which was probably associated with the increase in production of smartphones and media tablets in China. Singapore continues to be another region with a smaller share of this dislocated purchasing.

We have been identifying this "dislocated" purchasing of semiconductors for the Chinese consumption market by a comparison of consumption to purchasing TAM (total available market) since 2007. Based upon these comparisons, we find that dislocated purchases for China, which had increased from 20% in 2007 to 26% in 2010, further increased to 29% in 2011. These dislocated purchases represent a significant portion of buying decisions—and therefore selling opportunities—for customer-specified devices consumed in China made outside of China.

We expect that this "dislocated" purchasing share of the total China consumption market will decrease gradually over a number of years in the future as:

- China's domestic market consumption increases its share of China's total semiconductor market and ODM and EMS plants in China achieve greater control over their Bills of Materials (BOM);
- Multinational electronic equipment OEM and semiconductor companies offshore move design and purchasing activities to China;
- Chinese fabless semiconductor companies gain market share in the China market and
- Leading multinational and regional distribution firms establish self-reliant purchasing and warehouse/logistic centers in China.

China's domestic OEM buying power

Table 4 is a listing of the top 10 Chinese OEMs (original equipment manufacturers)taken from China's Ministry of Industry and Information Technology (MIIT) report of "Top 100 Chinese Electronic Information Enterprises in 2012". MIIT ranks these companies based upon a comprehensive assessment of revenue, profit, assets, R&D, etc. rather than revenue alone. Each of the top 10 had 2011 revenues of US$7.7bn or more. These 10 largest Chinese OEMs had a 19% increase in their combined revenues during 2011—after a 31% increase in 2010—to reach a record total of US$160bn. Their combined revenue increase was somewhat less than that of China's electronic information industry which increased 26% measured in US dollars (or 20% reported in RMB) during 2011. Assuming the semiconductor content of their products was 25% (the average for all of China's electronic systems production in 2011), these 10 Chinese OEMs could have been responsible for semiconductor consumption of US$40bn, or 26% of China's total semiconductor market.

During the past six years since 2005 the MIIT top 10 Chinese OEMs have achieved an average CAGR (compounded annual growth rate) of 19% per year.

Table 4: Chinese Top OEMs by revenue and semiconductor consumption 2010–2011
(in US$bn)

	Rank (per MIIT)		Revenue			Semiconductor consumption (Design TAM)			Purchase TAM		
Name of company	**2010**	**2011**	**2010**	**2011**	**Change %**	**2010**	**2011**	**Change %**	**2010**	**2011**	**Change %**
Huawei	1	1	27.5	32.0	16.3%	3.4	4.3	24.9%	2.8	3.2	17.6%
Lenovo	2	2	21.6	29.6	37.0%	6.1	7.8	27.9%	4.7	5.9	24.9%
Haier Group Company*	3	3	20.2	23.7	17.4%	0.4	0.6	35.0%	0.4	0.5	30.7%
ZTE	5	4	10.4	13.5	29.6%	2.1	2.8	33.6%	2.1	2.5	20.4%
Great Wall Technology	4	5	15.6	14.9	-4.4%	0.2	0.1	-42.7%	0.1	0.1	-38.2%
Hisense Group**	6	6	8.3	11.2	35.0%	0.3	0.4	45.6%	0.3	0.4	40.3%
Changhong Electric Co.	7	7	8.1	8.2	0.2%	0.2	0.3	46.5%	0.3	0.4	35.6%
TCL	8	8	7.7	9.6	23.8%	0.9	1.2	25.2%	1.2	1.5	18.6%
Founder Group Co.	9	9	7.8	9.1	15.9%	0.4		-100.0%	0.3		-100.0%
BYD Company Ltd.	10	10	6.9	7.7	10.9%	0.3	0.3	1.5%	0.3	0.3	-5.0%
Total			**134.3**	**159.5**	**18.7%**	**14.3**	**17.7**	**24.0%**	**12.5**	**14.8**	**18.3%**
% Semi penetration						**10.7%**	**11.1%**				
Companies tracked from previous years											
Skyworth		14	3.1	3.6	6.2%	0.2	0.3	51.7%	0.3	0.4	38.3%
Konka Group		19	2.5	2.5	31.1%	0.2	0.3	76.6%	0.2	0.3	76.6%

It is worth noting that Haier Group Company and Hisense Group each own a portfolio of companies. We believe that Haier Electronics (Haier Group Company) and Hisense Electric Co. (Hisense Group) are the actual semiconductor consumers in those portfolios. To help give a deeper glimpse at the actual penetration, we are including a separate table detailing their revenues. Unfortunately, Design and Purchasing TAM were only available for the parent companies.

Subsidiary semiconductor penetration
(in US$bn)

	Revenue		
Name of company	**2010**	**2011**	**Change %**
Haier Group Company*			
Haier Electronics	5.3	7.8	46.4%
Hisense Group**			
Hisense Electric Co.	3.2	3.7	15.8%

**Haier Group Company owns subsidiary Haier Electronics Group which is believed to be the actual semiconductor consumers in the group. Design and Purchasing TAM were only available for the parent company.*

***Hisense Group owns subsidiary Hisense Electric Co. which is believed to be the actual semiconductor consumers in the group. Design and Purchasing TAM were only available for the parent company.*

Source: MIIT, Gartner, Thomson Reuters, Company reports

The US$40bn semiconductor consumption that these top OEMs could have been responsible for is usually identified as "Brand TAM" (total available market) to mean the total semiconductor devices consumed in all the products branded with any of the OEM's brands or names even though some of those products were designed and/or manufactured by other ODM or EMS companies. For example, the motherboard of Lenovo PCs are usually made by ODM's (original design manufacturers such as Quanta), rather than by Lenovo itself. Since 2009 we have had analysts estimate the semiconductor consumption by OEMs based upon design (semiconductor selection by OEM engineers), which is identified as "Design TAM". We feel this provides a more meaningful insight relative to the market influence of the various Chinese OEMs. In 2011, the top 10 OEM Design TAM semiconductor consumption was reported to be US$17.7bn an increase of almost 24% from 2010, but still only 11% of China's total semiconductor market which is up fractionally from 2010 but up by almost two percentage points from slightly more than 9% in 2009. The calculated Design TAM semiconductor content of the combined revenues of these top 10 OEMs increased from 9.3% in 2009 to 10.7% in 2010 and to 11.1% in 2011.

Another way of measuring the influence of these OEMs on semiconductor consumption is based upon their direct purchases. This is identified as "Purchasing TAM". The top 10 OEM 2011 Purchasing TAM semiconductor consumption was reported to be US$14.8bn, an 18% increase from their 2010 reported Purchasing TAM. These values are less than their Design TAM because some of the OEMs (for example Lenovo) will design a product specifying specific key components and then consign manufacturing and purchasing to an EMS (electronic manufacturing services) company.

As a result of this analysis, we continue to believe that Chinese OEMs influence and/or 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 China's economic stimulus projects and 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.

Strong but variable growth

China's semiconductor industry grew by 14.4% in 2011 to reach a record US$43.5bn. Measured in US dollars, China's semiconductor industry growth was more than ten times greater than that of the total worldwide semiconductor industry.

As highlighted in Chapter 1, China's 2011 semiconductor performance far exceeded the worldwide industry! Both China's semiconductor consumption market and semiconductor industry growth were more than ten times greater than worldwide semiconductor industry growth.

A significant portion of that exceptional growth of China's semiconductor industry was attributed to the IC design or fabless sector, which grew by more than 36% in 2011. From the Chinese perspective, five percentage points of that increase was the result of China's continuing revaluation of the RMB. Measured in local (RMB) currency, China's semiconductor industry grew by 9.3% in 2011, less than half of what Chinese officials had forecast, but still several times greater than the total worldwide industry.

Production growth

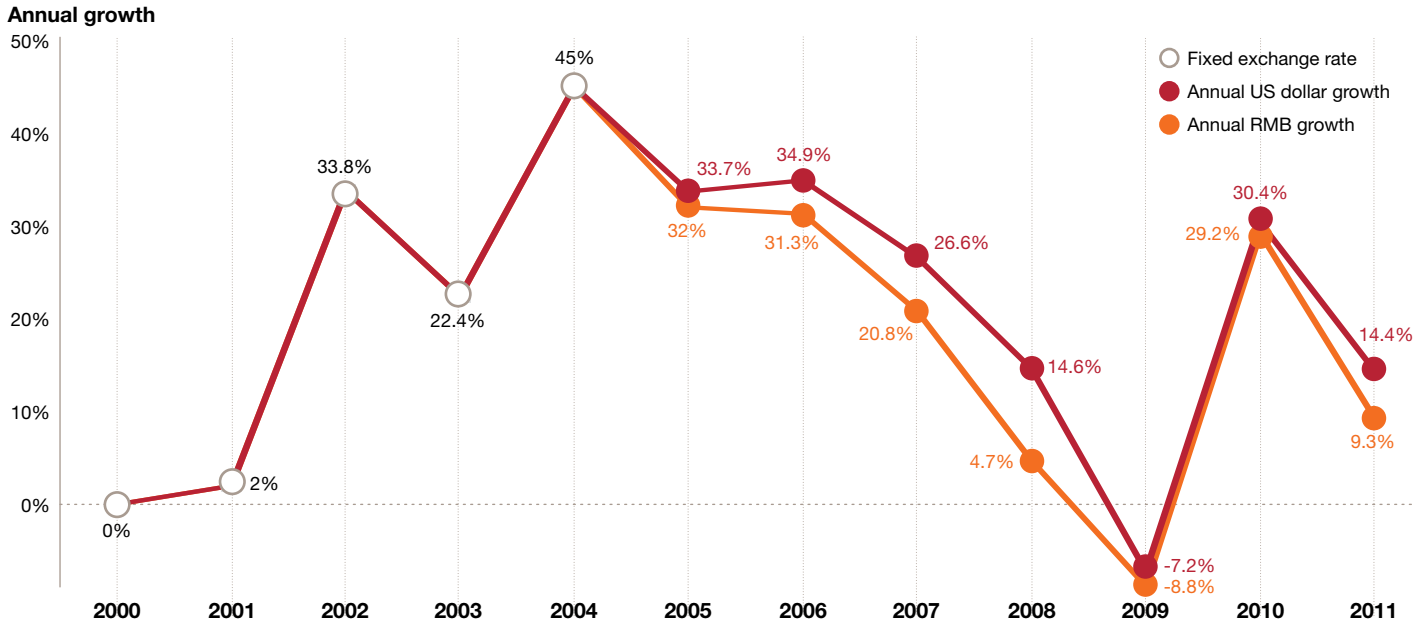
China's semiconductor industry grew by 14.4% in 2011 to reach a record US$43.5bn. From 2001 through 2011, China's semiconductor industry has achieved a ten-year compounded annual growth rate (CAGR) of 24% measured in US dollars (or 21% measured in local RMB currency. During 2011, almost US$8bn of additional fixed-asset investments were made in China's semiconductor industry, down 13% from the slightly more than US$9bn in investments made in 2010. Of that amount, almost US$5bn was invested in the integrated circuit (IC) industry, 34% less than in 2010. More than US$3bn was invested in the optoelectronics-sensors-discretes (O-S-D) sector.

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. As a result, we have measured China's impact on the semiconductor industry through multiple comparisons. Based upon 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, China's semiconductor industry accounted for 12.2% of the worldwide semiconductor industry in 2011, up from 10.8% in 2010, 11.0% in 2009, 10.7% in 2008 and, more significantly, up from just 2% in 2000.

Alternatively, a more conservative comparison against the sum of device sales revenue, plus the value of all wafer fabrication and packaging, assembly and test production indicates that China's semiconductor industry accounted for at least 9% of the worldwide semiconductor industry in 2011. Both comparisons make it clear that China's share of the worldwide semiconductor industry is growing, becoming noticeable and significant.

The overall performance of China's IC industry (the sum of IC design, IC wafer manufacturing and IC packaging and testing) in 2011 generally corresponded to that of China's total semiconductor industry. China's

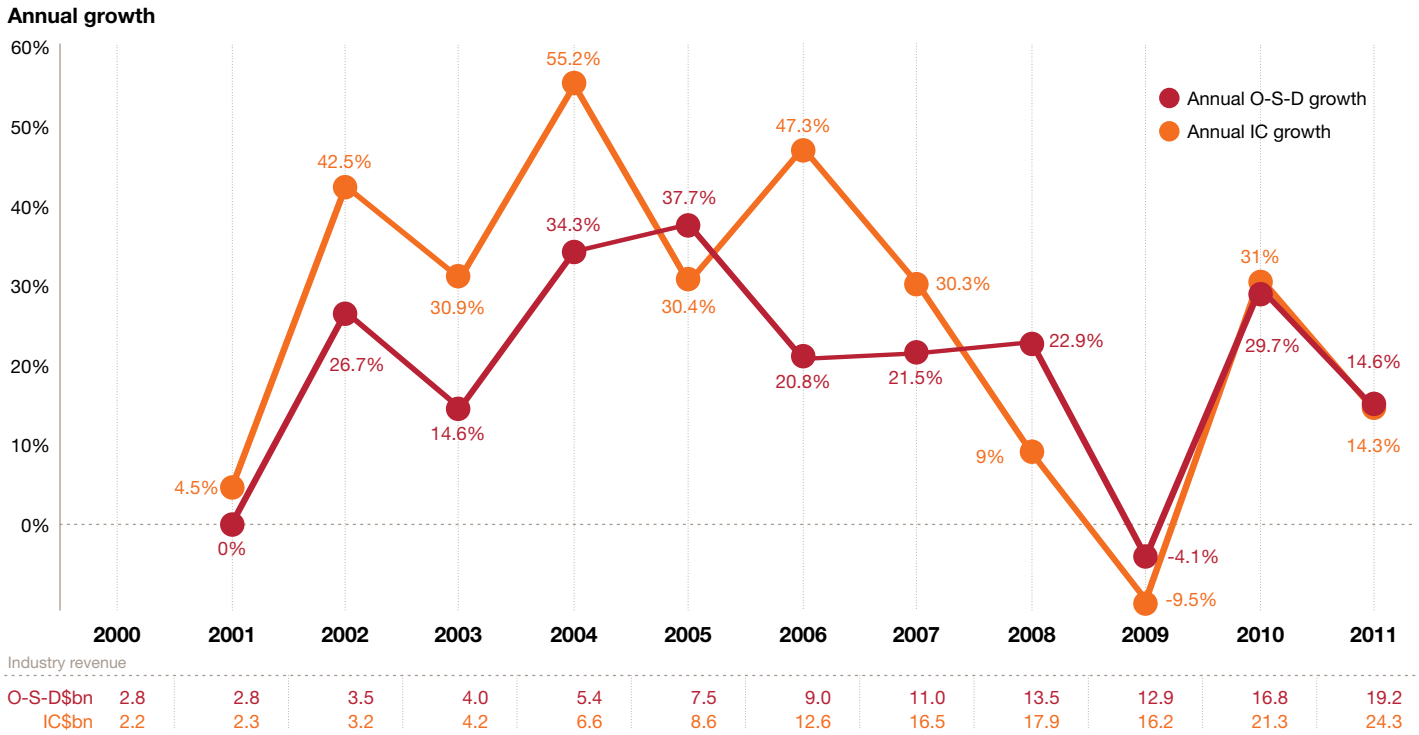
Figure 8: China's semiconductor industry revenue growth, 2000–2011



Industry revenue	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
US$bn	5.0	5.1	6.8	8.3	12.0	16.1	21.7	27.4	31.4	29.2	38.1	43.5
RMBbn	41.3	42.0	56.2	68.7	99.7	131.5	172.7	208.6	218.5	199.3	257.6	281.4

Source: CCID, CSIA

Figure 9: China's O-S-D and IC industry revenue growth, 2000–2011

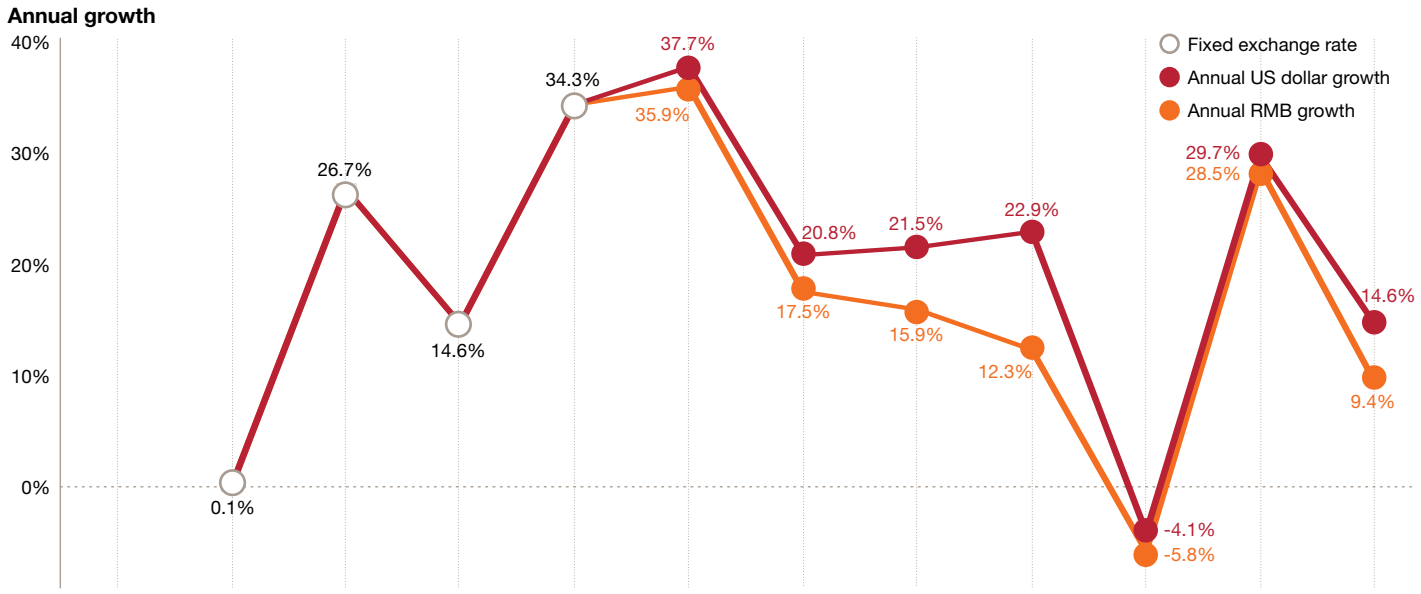


Source: CCID, CSIA

IC industry revenues, measured in dollars, increased by 14.3% to slightly more than US$24bn in 2011. The same IC industry revenues reported in local RMB currency increased by just 9.2% to 157.2 billion RMB in 2011 after increasing by almost 30% to 144.0 billion RMB as part of the industry recovery in 2010. However, the three sectors of China's IC industry continue to perform quite differently. Thanks to both a booming domestic demand and the worldwide market recovery, China's IC design sector repeated its 2010 performance and grew a further 36% to a new record US$7.3bn. The other two sectors, which have greater export dependence and multinational company involvement and had been much more adversely affected by the global recession in 2009, were again impacted by the market slowdown in 2011. Despite several companies experiencing revenue declines, IC manufacturing, which includes China's wafer foundries, reported a 14% dollar revenue growth in 2011 as a result of the successful start up of Intel's 300mm Fab 68 in Dalian. Measured in local RMB currency, IC manufacturing revenues grew by 8.9% in 2011, slightly more than the 8.5% average growth of the past five years. IC packaging and testing, which includes both multinational SATS (semiconductor assembly and test services) and captive facilities, was impacted by a significant reduction in overseas orders and reported a local RMB currency revenue decline of almost 3% and a less than 2% dollar revenue growth in 2011.

According to the China Semiconductor Industry Association (CSIA), China's IC industry unit production increased by 10% in 2011, while unit average selling price (ASP) increased by 3%. Since China's IC industry unit output

Figure 10: China's O-S-D industry revenue growth



Industry revenue

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
US$bn	2.8	2.8	3.5	4.0	5.4	7.5	9.0	11.0	13.5	12.9	16.8	19.2
RMBbn	23.1	23.1	29.3	33.6	45.1	61.3	72.1	83.5	93.8	88.4	113.5	124.2

Source: CCID, CSIA

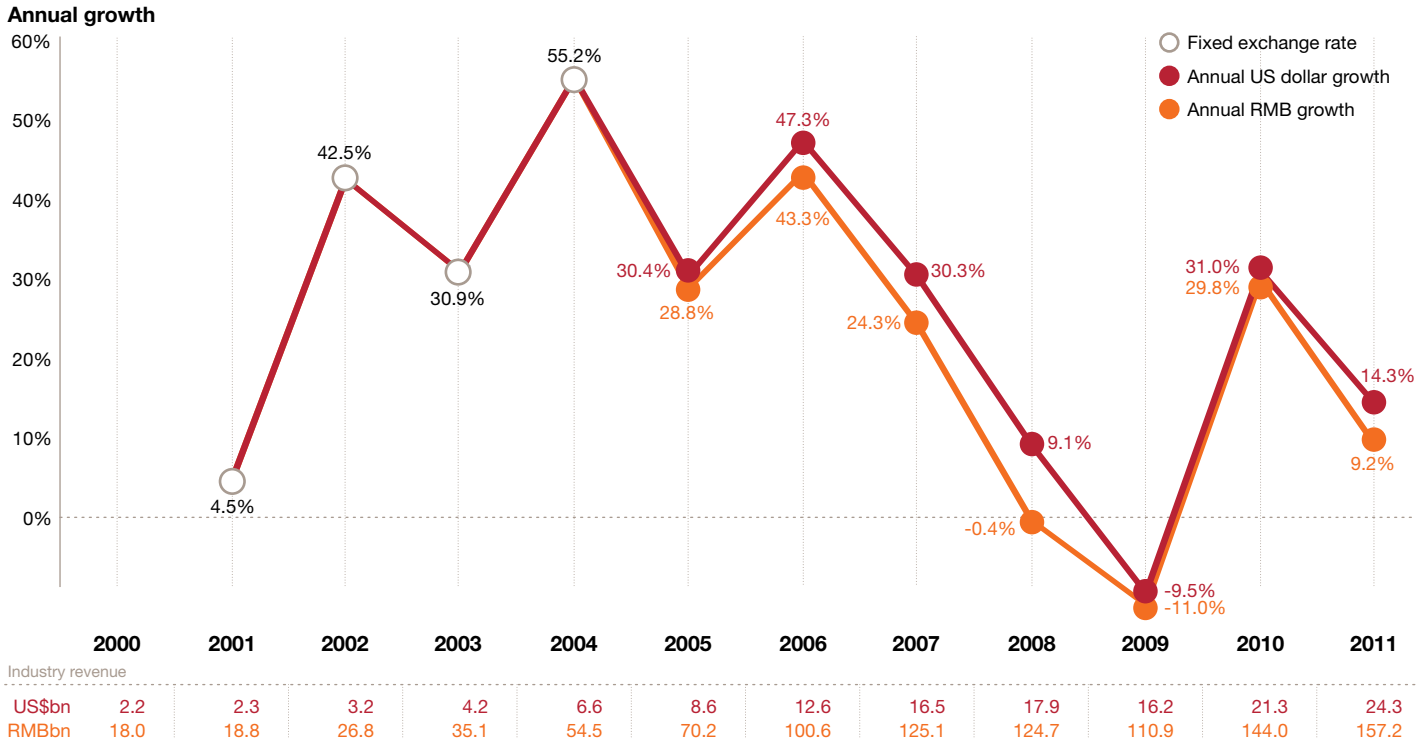
is heavily determined by IC packaging and testing output, this change probably reflects changes in relative unit mix rather than individual unit prices. Based upon revenue values, China's IC industry achieved an overall self-sufficiency ratio of about 20% (ratio of production versus consumption value) in 2011, which was about the same as achieved in 2010. However, based upon the CSIA's reported unit volumes, China's IC industry unit self-sufficiency ratio for 2011 could have been much greater.

China's O-S-D sector performance in 2011 was slightly better than China's semiconductor industry and much better than the worldwide O-S-D performance. China's O-S-D sector revenues increased 14.6% measured in dollars (or about 9% reported in RMB) in 2011, while the worldwide O-S-D industry grew by 8.5%. Because of CSIA reporting protocols, China's reported O-S-D industry sector revenues may not include optoelectronic devices other than LEDs or sensor devices. As a result, China's O-S-D revenues for 2011 may be understated by as much as 6%. China's reported O-S-D production unit output increased by about 5% in 2011, while unit ASPs increased by 10%. Based upon revenue values, China's reported O-S-D industry achieved an overall self-sufficiency ratio of about 106% (ratio of production versus consumption value) in 2011, which was the highest ever reported and about five percentage points higher than achieved in 2010. 2011 was also the first year in which the value of China's O-S-D exports exceeded the value of China's O-S-D imports.

Power transistors and LEDs were the main contributors to China's O-S-D industry growth in 2011. Power transistors production benefited from the market demand for new energy (wind, solar, etc.), electric vehicles, motor-driven frequency appliances and inverter welder applications, with demand exceeding near-term manufacturing and design capacity. LED production benefited from LEDs achieving a dominant penetration of PC notebook and LCD monitor backlight applications and gradually replacing CCFLs as the mainstream backlighting for large and medium-size LCD panels. At 32%, LED revenue growth in 2011 exceeded that of the overall O-S-D industry growth. LED production revenues grew to more than US$5.5bn in 2011 and represented 30% of China's O-S-D sector, up from 26% in 2010 and from an average of about 22% during the prior three years.

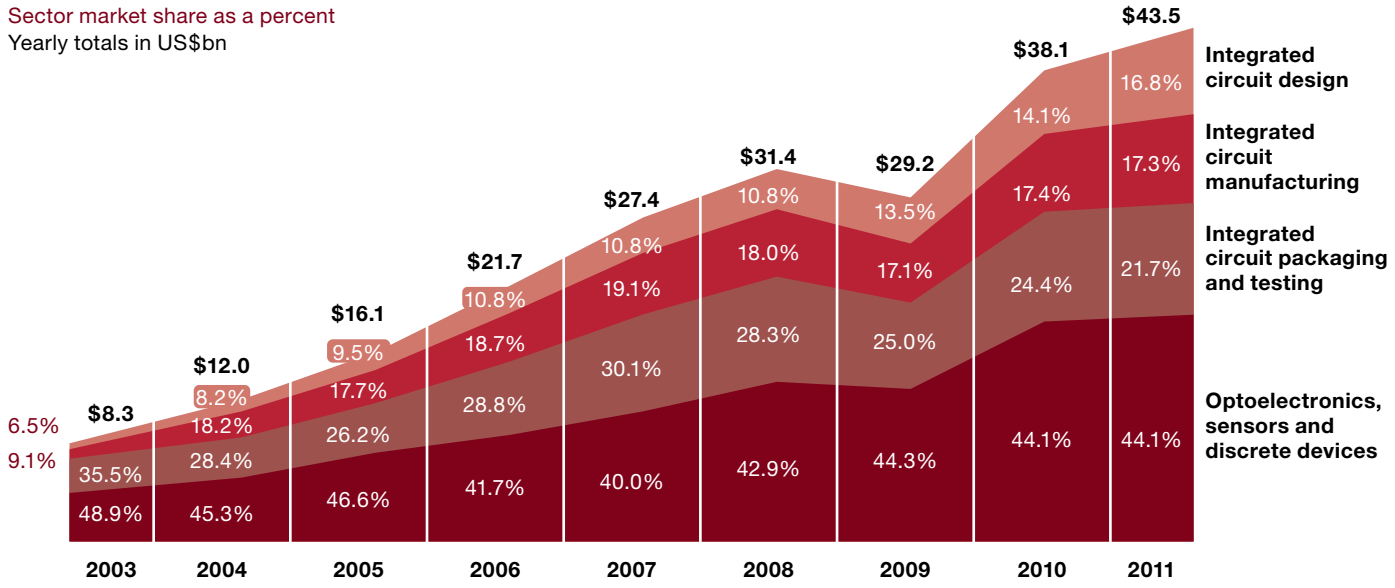
China's LED industry had been experiencing double-digit growth for several years prior to 2008 since the implementation of China's national semiconductor lighting project. That growth rate, reported in RMB, dropped to 9% in 2008 as a result of the global recession's impact on export production, but recovered to slightly more than 16% in 2009 and 33% in 2010 with the help of government policies. Moreover, during the five-year span from 2006 to 2011 China's LED production dollar revenue has grown at a 28.8% CAGR, one and three quarters times the overall O-S-D CAGR of 16.3% and faster than any other sector of China's semiconductor industry. During 2011, almost 82% of China's LED industry revenues came from packaging and testing and more than 12% from IDM and chip manufacturing.

Figure 11: China's IC industry revenue growth



Source: CCID, CSIA

Figure 12: China's semiconductor industry by sector 2003–2011



Source: CCID, CSIA, PwC, 2004–2012

An increasing number of foreign LED companies are establishing LED fabs in China. In fact, 25% of the new LED fabs established in China during the last three years were sponsored by foreign LED companies.

China's LED industry has been growing with specific government policy support. China has established 14 national LED industry bases as part of the "National Semiconductor Lighting Project" sponsored by China's Ministry of Science and Technology (MOST). They include Dalian, Hangzhou, Nanchang, Shanghai, Shenzhen, Tianjin, Wuhuan, Xiamen, Yangzhou and Shijiazhuan, among others, where most of China's LED manufacturers are concentrated.

An increasing number of foreign LED companies are establishing LED fabs in China. In fact, 25% of the new LED fabs established in China during the last three years were sponsored by foreign LED companies. Most new LED fabs receive financial support or subsidies from local governments. As of May 2012, there were 83 LED wafer fabrication companies in China, 64 of which were in production, 6 were equipping and ramping into production and 13 were under construction. Most of them have focused on GAN-based epitaxial wafer fabrication and MOCVD (metal organic chemical vapor deposition) equipment installations. In 2011 the Chinese government instituted a subsidy of 8-10 million RMB on each MOCVD installation in China. That subsidy created a massive increase of MOCVD installations in China. China is rapidly becoming the largest owner of MOCVD systems in the world and is expected to have over a thousand sets of MOCVD tools installed by the end of 2012. However, the rapid influx of MOCVD installations has resulted in concerns about excess capacity, artificially low costs, unfair competition and less concentration on the efficiency of the LED produced. It is estimated that China's current LED fab tool utilization rate is around 35-40%, with 60% of all the MOCVD reactors shipped to China being turned on, with approximately 60% utilization on those tools, implying an overall utilization of between 35%–40%.

In May 2012, China's Ministry of Science and Technology released the 12th Five-Year Plan for Semiconductor Lighting Development, which was designed to address the concerns cited

above, while facilitating continued growth for the LED industry. Increasing the productivity of its LED industry and stimulating LED demand continues to be important to the Chinese government because of LED's potential for positive environmental and economic impact. The Plan calls for an acceleration of LED technology and industrial development with the objective of making China's LED makers more competitive on a global scale and placing China among the world's top three global LED producers.

Industry by sector

The distribution of China's semiconductor industry changed rather significantly in 2011 as a result of the more than double average growth of the IC design (fabless) sector and minimum growth of the IC packaging and testing sector. The IC design sector has been the fastest growing sector over the past ten years, with a dollar revenue CAGR of 45%. It has now grown from less than US$200m in 2001 to more than US$7bn in 2011. It had represented almost 11% of China's semiconductor industry for each of the three years 2006, 2007 and 2008, grew to represent 13.5% in 2009, 14.1% in 2010 and now 16.8% in 2011. The sector's growth rate has slowed from 54% in 2006 to 27% in 2007 and 14% in 2008 before increasing to 17% in 2009 and 36% in each of 2010 and 2011. For the first time ever, China's IC design sector revenue growth has contributed more than 20% to the total semiconductor industry revenue growth. China's IC design sector revenue growth in 2011 represented 46% of China's total semiconductor industry revenue growth.

The distribution of China's semiconductor industry changed rather significantly in 2011 as a result of the more than double average growth of the IC design (fabless) sector and minimum growth of the IC packaging and testing sector.

IC manufacturing, which includes the IC wafer foundries, has been the second fastest growing and most variable sector over the past ten years. It has been noticeably affected by the additions and utilization changes of a relatively few very large wafer fabrication facilities. During the past ten years it has experienced annual dollar revenue growth ranging from a 2004 peak of 190%, down to an almost 12% decrease in 2009, before recovering with a 32% increase in 2010 and a further 14% increase in 2011. The IC manufacturing sector dollar revenue had grown from less than US$400m in 2001 to US$7.5bn in 2011, for a ten-year CAGR of 35%. It continued to represent slightly more than 17% of China's semiconductor industry revenue in 2011 as it had in 2009 and 2010, down from 18% in 2008 and 19% in 2007.

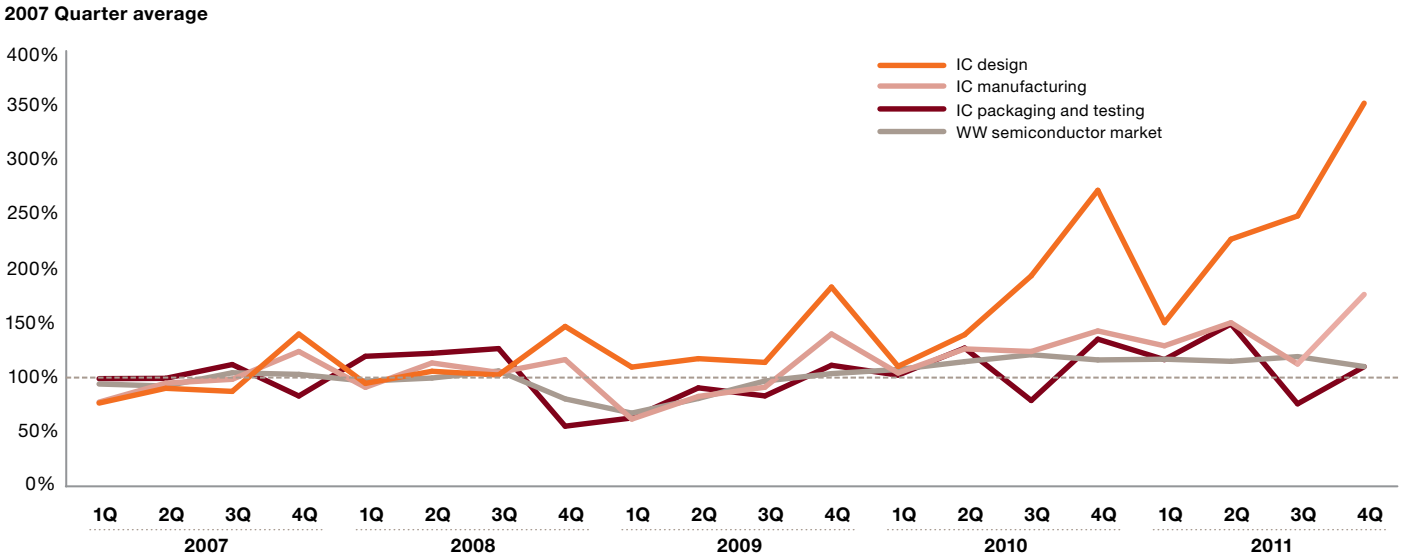
IC packaging and testing, which includes multinational and Chinese SATS (semiconductor assembly and test services) as well as multinational captive facilities, continued to remain the second largest sector of China's semiconductor industry in 2011. Over the past ten years, its dollar revenue has grown at an 18.6% CAGR from less than US$2bn in 2001 to more than US$9bn in both 2010 and 2011. However, those past ten years includes the largest annual decrease of any sector, a more than 18% drop in 2009 and a nominal 1.8% dollar increase (but 2.8% RMB decrease) in 2011. As a result, the IC packaging and testing share of China's semiconductor industry revenue has further declined to 21.7% in 2011, down from 24% in 2010, 25% in 2009, 28% in 2008 and 30% in 2007, but holding on to the second largest share.

Although it continues to be somewhat less celebrated or promoted and has often had below-average growth, the O-S-D sector has remained the largest sector of China's semiconductor industry for at least the last ten years since 2001. China's reported O-S-D industry sector revenue consists of just discrete and LED devices and because of CSIA reporting protocols may not include other optoelectronic or sensor devices. As a result, it may be understated. During this ten-year period, the reported O-S-D sector grew from US$2.8bn in 2001 to more than US$19bn in 2011 for a CAGR of just over 21%. Measured in dollars, the reported O-S-D sector achieved 14.6% overall growth in 2011 slightly above China's industry average. The LED segment's record 2011 growth of 26.4% was somewhat offset by the larger discrete segment's below-average 3.4% growth. China's O-S-D sector revenue growth in 2011 represented 45% of China's total semiconductor industry revenue growth. As a result, the O-S-D sector remained the largest sector of China's semiconductor industry with slightly more than a 44% share in 2011.

Figure 13 shows the relative performance of the three sectors of China's IC industry during the past five years from 1Q/2007 through 4Q/2011. It compares revenues for each quarter as a percent of 2007 annual average quarter revenue against a similar measure of the worldwide semiconductor market. The dashed reference line is set at 100%. For example, in 1Q/2009 China's IC design sector revenue was 111%, while IC manufacturing dropped to 63%, IC packaging and testing to 64% and the worldwide market to 68% of their 2007 quarter averages.

This figure illustrates the relative strength of China's IC design sector, with all quarters (except 1Q/2008) greater than 100%, and all quarters greater—some quite significantly—than the worldwide semiconductor market. The 4Q/2011 IC design performance was 358% compared to the worldwide semiconductor market's 112%.

Figure 13: Comparison of China IC industry sector growth by quarters, 2007–2011



Note: Comparison of China's IC industry sectors versus worldwide semiconductor market growth by quarter 2007–2011 indexed against 2007 average quarter.

Source: CSIA, SIA quarterly reports

China's IC manufacturing sector, which includes both foundries and IDM wafer fabs, was impacted one quarter later than the worldwide market by the global recession and not quite as extensively. Its relative performance has exceeded that of the worldwide market for 8 of the 12 quarters since 1Q/2009.

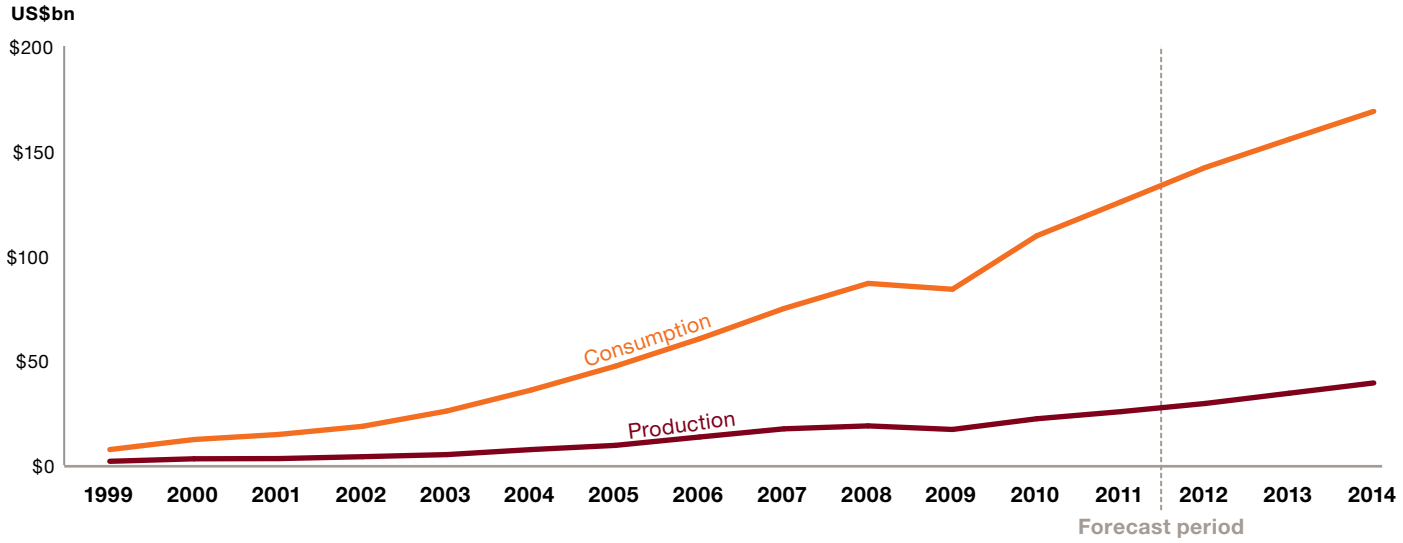
China's IC packaging and testing sector was the most severely impacted by the global recession and has had a weaker and more volatile recovery. It was the first sector to be impacted, with its index dropping more sharply than the worldwide market in 4Q/2008 and had four successive quarters of less than 100%, and three falling below the worldwide market. Its recovery since 1Q/2010 has been variable, with four of the eight quarters through 4Q/2011 being less than the worldwide market, including two, 3Q/2010 and 3Q/2011, when it fell below 100%. It finished 2011 with a 4Q/2011 IC index performance that was fractionally less than the worldwide semiconductor market.

Integrated circuit consumption/production gap

China's exceptional relative semiconductor performance in 2011 was also evident in the continued growth of China's IC consumption/production gap. This gap is the difference between IC consumption and IC industry revenues. Both China's IC market consumption and China's IC industry production increased to new record levels in 2011. As a result, China's IC consumption/production gap also increased to a new record level in 2011. China's IC consumption/production gap increased by more than US$13bn in 2011 to a new record of US$100.5bn. Reported in RMB, China's IC indutry revenue (production) grew 9.2% in 2011, an increase of 13.2 billion RMB, while China's IC market grew by 9.7%, an increase of 71.6 billion RMB.

Measured in dollars, China's annual IC consumption increased 14.9%, by US$16.2bn, while IC production increased 14.3%, which was an in-

Figure 14: Comparison of China's integrated circuit consumption and production, 1999–2014



Actual annual average FX rates used for 1999–2011, and 2011 year-end FX rate used for forecast 2012–2014.

Source: CCID, CISA, PwC 2004–2012

crease of only US$3bn, Consequently, China's IC consumption/production gap increased by US$13.2bn to reach US$100.5bn for 2011. From a Chinese perspective, about one third, 31.5%, of this dollar increase was due to continued revaluation of the RMB. Regardless of the currency, this annual gap had grown dramatically, from US$5.7bn in 1999 to a record US$100.5bn in 2011—or from 47 billion RMB in 1999 to 649 billion RMB in 2011—despite all the Chinese government's plans and efforts to contain it. Chinese authorities now expect that it will continue to increase through at least the next three years. According to the China Semiconductor Association (CSIA) 2012 report, China's IC market is forecast to grow to US$168bn by 2014, with IC industry revenues expected to reach US$38bn. This forecast implies a further widening of China's IC consumption/production gap to US$130bn. It is our belief that this gap continues to contribute to the Chinese government's ongoing initiatives to increase indigenous production.

Measured in dollars, China's annual IC consumption increased 14.9%, to US$16.2bn, while IC production increased 14.3% which was an increase of only US$3bn, Consequently, China's IC consumption/production gap increased by US$13.2bn to reach US$100.5bn for 2011.

At the same time, the ratio of China's IC production revenue to IC consumption value has shown some further degradation. It had grown with some yearly variability from 16% in 2001 to a peak of 22% in 2007 before declining slightly to 20% in 2009 and 2010 and to 19% in 2011. According to CSIA, this ratio is now expected to increase to 23% by 2014, which is down from the 24% they had forecast for 2013 a year ago. We consider this ratio as more of a measure of parity than one of IC self-sufficiency since China's reported IC industry revenue includes significant production activities, such as foundry wafer fabrication or packaging and testing for IC devices, that are only partially completed in China. As noted in our 2011 Update, one of the stated Ministry of Industry and Information Technology (MIIT) objectives of China's 12th Five-Year Plan is to improve this ratio to 27.5% by 2015.

China's IC consumption/production gap is also reflected in their import/export statistics. In 2011, China's reported imports of ICs increased 8.4% to US$170bn, while their reported export of ICs increased 11.4% to US$33bn. China's IC imports in 2011 accounted for more than 22% of all mechanical and electronic imports and were the second largest amount of all imported products, just 13% less than crude oil imports. In China's foreign trade of mechanical and electrical products, only ICs and LCD panels reported a trade deficit for 2011. The reported deficit for LCD panels was US$18bn, while that for ICs was US$138bn. China's reported import/export trade deficit for ICs has more than doubled since 2005. This large and growing deficit reflects China's lack of IC self-sufficiency and its need to rely on imports for core chip and high-end chip products.

China's IC consumption/production gap represents both an opportunity and a challenge for the established multinational semiconductor industry. Over the near term, it continues to represent an unparalleled market opportunity, but over the longer term, it represents a domestic industry void that will inevitably be filled. The question is how will it be filled: will it be a combination transfer and expansion of multinational companies or the emergence and growth of significant Chinese companies?

O-S-D consumption/ production gap and surplus

This is the first update in which we have tried to evaluate China's O-S-D consumption versus production. Actually, it can only be an evaluation of what the CSIA defines as their discrete industry sector since China's reported O-S-D industry sector revenue consists of just discrete and LED devices because the CSIA reporting protocols do not include other optoelectronic or sensor devices. As incomplete as that makes it, we believe that this evaluation may be significant because it is so notably different from the IC consumption/production gap. Since 2005, there has not been a significant difference between China's reported discrete (including LED) production revenues and consumption value. That difference has gone from a moderate US$374m (5%) gap in 2005 to a modest surplus in 2008 and 2010 and then a notable surplus in 2011.

Both China's O-S-D market consumption and industry production increased to new record levels in 2011. As a result, China's discrete (including LED) production versus consumption surplus also increased to a new record level in 2011. Reported in RMB, China's discrete industry revenue (production) increased 9.6% in 2011, up 10.7 billion RMB, while China's discrete market increased by just 4.1%, up 4.6 billion RMB. Measured in dollars, during 2011 China's annual discrete production increased 14.6%, a rise of US$2.4bn, to US$19.2bn, while discrete consumption increased 9.0%, up US$1.5bn, to US$18.2bn. Consequently, China's discrete (including LED) production/consumption surplus increased by US$900m, reaching US$1bn in 2011. Chinese authorities now expect that this discrete surplus will continue to increase through at least the next three years. According to the China Semiconductor Association (CSIA) 2012 report, China's discrete (including LED) industry revenues are forecast to grow to US$31bn by 2014, while the discrete market is expected to reach US$24bn. This forecast implies a continuing growth of China' discrete production/consumption surplus to US$7bn by 2014.

Over the near term, China's IC consumption/production gap continues to represent an unparalleled market opportunity, but over the longer term, it represents a domestic industry void that will inevitably be filled. The question is how will it be filled: will it be a combination transfer and expansion of multinational companies or the emergence and growth of significant Chinese companies?

China's discrete production/consumption surplus was also reflected in their import/export statistics. In 2011 China's reported imports of discrete (including LED) devices increased 8.3%, to US$17.4bn, while their exports of discrete devices increased by 11%, to US$33.6bn. This resulted in a first time ever trade surplus of US$16.2bn. This implies that China's discrete industry has developed to be of worldwide significance and, although it still needs further improvement in advanced manufacturing technology, is approaching self-sufficiency.

Regional structure

The Yangtze River Delta or East China region has grown to have the heaviest concentration of China's semiconductor industry. It accounted for 56% of China's IC industry revenues in 2011. Of the 160 semiconductor wafer fabrication facilities in operation in China at the end of 2011, 79 are located in the East China region, representing 64% of China's total wafer fabrication capacity. Similarly, East China had 65 of China's 109 semiconductor packaging, assembly and test (SPAT) facilities in operation during 2011, representing 62% of China's total SPAT capacity. The majority of these plants are located in Shanghai, Suzhou and Wuxi. Five of China's top ten IC design firms are also located in this region.

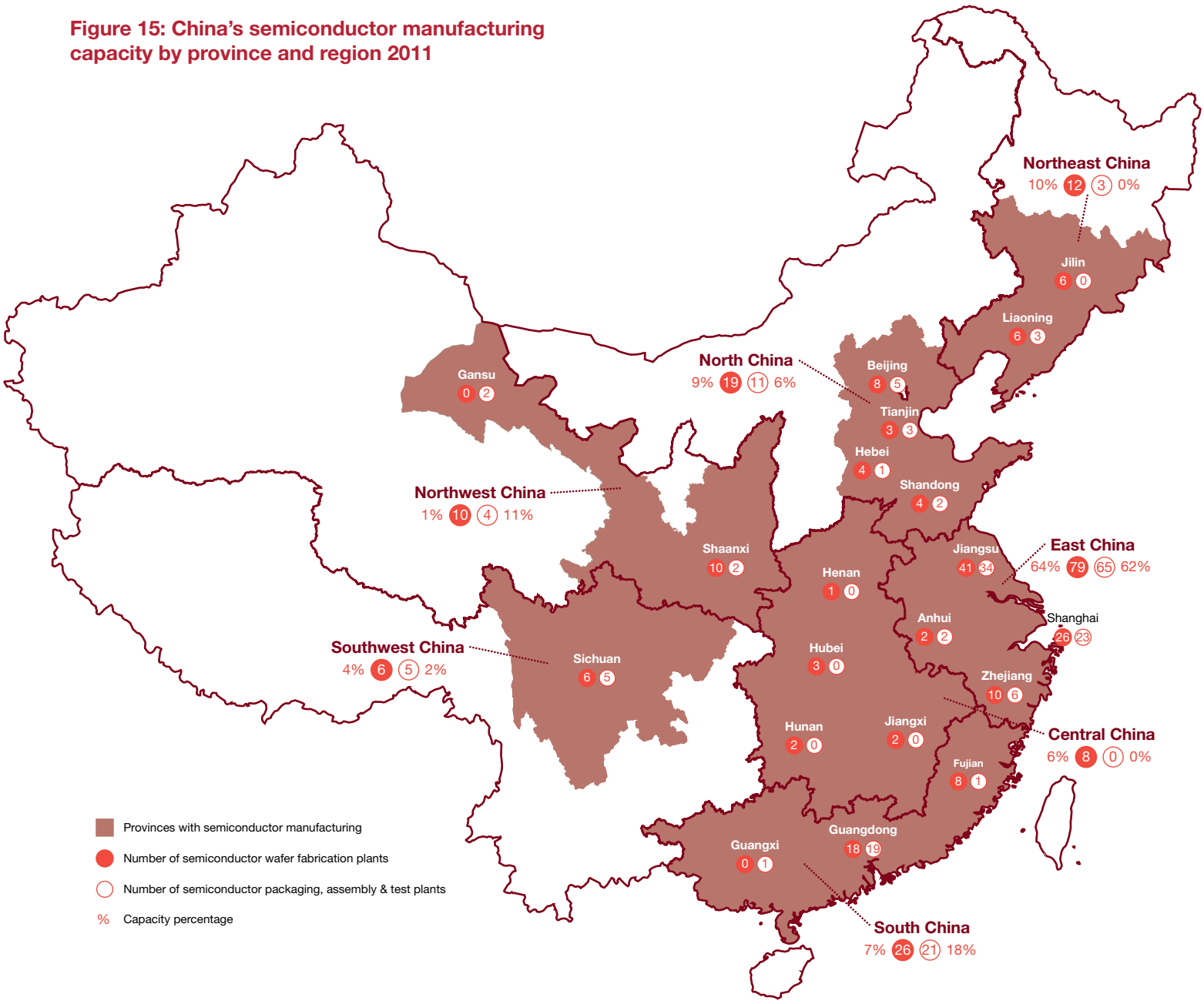
The Bohai Ring or North China region, which is mainly constituted by Beijing, Tianjin, Hebi, Shangdong and Liaoning, accounted for 23% of China's IC industry revenues in 2011. Nineteen of China's wafer fabrication and eleven of China's SPAT facilities are located in this region, representing 9% and 6% of China's total wafer fabrication and SPAT capacity. Three of China's top ten IC design firms are also located in this region.

As a result of the continuing strong growth of Chinese IC design firms, the Pearl River Delta or South China region, accounted for 9% of China's IC industry revenue in 2011. The two of China's top ten IC design firms that are located in this area accounted for 41% of the top ten revenue for 2011. The 21 SPAT facilities that are located in this region accounted for 17% of China's SPAT capacity, while the 26 wafer fabrication facilities in the region only represented 7% of China's total wafer fabrication capacity. The majority of the region's semiconductor manufacturing plants are located in Shenzhen, Dongguan and Zhuhai.

The four other regions accounted for the remaining 13% of China's IC industry revenues in 2011. Of China's 160 semiconductor wafer fabrication facilities, twelve are located in Northeast China, including Dalian and Jilin, representing 10% of China's capacity; eight in Central China for 6% of capacity; six in Southwest China including Chengdu, Chongquing and Leshan for 2% of capacity and ten in Northwest China for 1% of capacity. Four of China's 109 SPAT facilities are located in Northwest China for 11% of China's capacity; five in Southwest China for 4% of capacity and three in Northeast China for 0.1% of capacity.

Of the 160 semiconductor wafer fabrication facilities in operation in China at the end of 2011, 79 are located in the East China region, representing 64% of China's total wafer fabrication capacity.

Figure 15: China's semiconductor manufacturing capacity by province and region 2011



China's IC industry revenue from the four other regions of Central, Southwest, Northeast and Northwest China, increased by more than 500% in the last two years.

During the past couple of years, there has been a modest shift in the regional location of China's IC industry with South China and the four other regions gaining share and the East China region losing share. China's IC industry revenue from the four other regions of Central, Southwest, Northeast and Northwest China, increased by more than 500% in the last two years. It has grown from 3% of China's total IC industry revenues in 2009 to 13% in 2011. East China's IC industry revenue only grew 15% during those two years and, as a result, has decreased from 69% to 56% of China's total IC industry revenue.

The above summary is based upon CCID's current definition of the seven regional ICT (information and communications technology) markets in China which is slightly different from the six "traditional regions" grouping of China's 31 provincial-level divisions by its former administrative areas from 1949 to 1952. The CCID definition includes the same 31 provincial-level divisions with the earlier South Central China traditional region divided into two regions, South China and Central China and three provinces reassigned from the East China traditional region to South China, Central China and North China.

The above summary is not intended to simplify or dismiss the challenging geographic diversity and dispersion of China's semiconductor industry that suppliers and customers need to address for success. There are at least 270 semiconductor wafer fabrication or packaging and testing plants currently in production spread across 20 different provinces in China. They span from Jilin in the North to Guangdong in the South and from Zhejiang in the East to Sichuan in the West across an area of about 1,700,000 square miles (4,400,000 square kilometers).

Noticeable growth

China's IC design industry even grew during the 2008/2009 downturn thanks to booming domestic demand.

Integrated circuit design

Integrated circuit (IC) design is the only segment of China's semiconductor industry that achieved positive year-over-year (YoY) revenue growth for every year since 2000. Its revenue comes primarily from China's indigenous fabless semiconductor companies, and it has been the fastest growing segment of China's semiconductor industry since 2000. In fact, China's IC design industry even grew during the 2008/2009 downturn thanks to booming domestic demand. During 2009, a series of domestic stimulus policies introduced by the government were implemented, driving up demand. China's fabless semiconductor industry further benefitted from the seemingly endless demand for semiconductors used in cell phones as shipments of mobile handsets designed in China surged by nearly 60% in 2011.

IC design revenues grew from US$178m in 2001 to US$7.3bn in 2011—experiencing a compounded annual growth rate (CAGR) of 45%. As this sector has grown larger, its YoY growth rate had decreased from a peak of 108% in 2003 to a plateau of about 55% in 2005 and 2006, followed by decreases to 14% in 2008 before improving to 17% in 2009 and 36% in 2010 and 2011. Notably, China's IC design sector dollar revenues did grow by 14.1% and 16.8% in 2008 and 2009 despite a 2.8% and 9.0% decline in the worldwide semiconductor market for those years; by 36% in 2010 exceeding the worldwide market growth of 32%; and by a further 36% in 2011 far exceeding the worldwide market growth of 0.4%.

China's IC design revenue growth of 36% in 2011 exceeded that of China's IC manufacturing, IC packag-

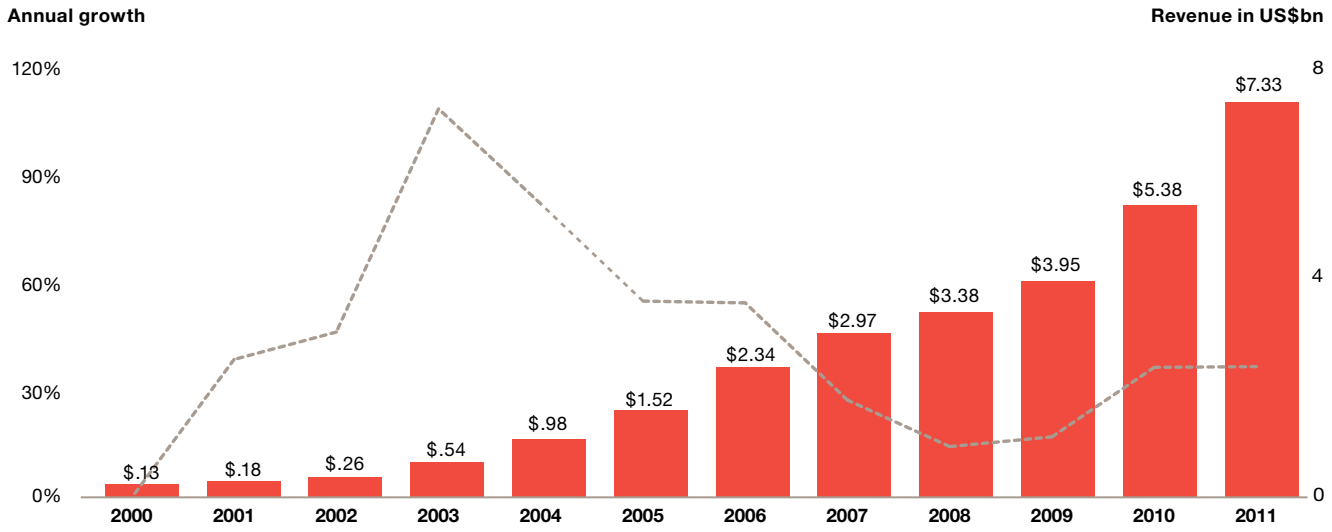
ing and testing, and even the much larger O-S-D sectors. Consequently, the IC design sector's share of China's semiconductor industry increased to 16.8% in 2011, as compared to 14.1% in 2010, after having remained flat at 10.8% for three consecutive years through 2008 before increasing to 13.5% in 2009. Most of the revenue in this sector can be attributed to China's fabless semiconductor companies, which in 2011 has increased to constitute about 10% of the US$74bn worldwide fabless IC industry up from a 1% share in 2001, 4% share in 2004 and a 7% share in 2010.

Design enterprises

According to China Center of Information Industry Development (CCID) Consulting, China had 503 IC design enterprises at the close of 2011, an increase from the 485 reported at the close of 2010. Although this number of IC design enterprises is based upon a list maintained by the China Semiconductor Industry Association (CSIA), there has been considerable skepticism by many foreign industry associations and analysts about its size and makeup. CCID advises that "CSIA has the list of 503 companies, but CCID did not get this list" and that the list includes foreign joint venture (JV) and multinational company (MNC) subsidiary company design and research and development (R&D) activities. There is a great diversity among this group of enterprises. It includes: state-owned, OEM-owned subsidiaries and spin-offs; IC design teams affiliated with university research departments; start-ups founded by returning Chinese engineers and local entrepreneurs; and the Chinese staffed development centers of multinational companies.

While the 2008/2009 financial crises had less effect in China than elsewhere, it still hindered many Chinese companies, including some IC design (fabless) companies. With a significant slowdown in the Chinese market and a decline in the worldwide semiconductor market growth in 2008, competition between Chinese IC design companies intensified. Many of these companies' products had concentrated on low-end consumer applications and the differentiation between enterprises and products became blurred as the applications became more homogeneous. Price wars became the common mode of competition and the slowdown in the start-up of new markets further restricted the operations of some IC design companies focusing on those markets. This environment

Figure 16: China's integrated circuit design industry revenue and growth, 2000–2011



Source: CCID, CSIA

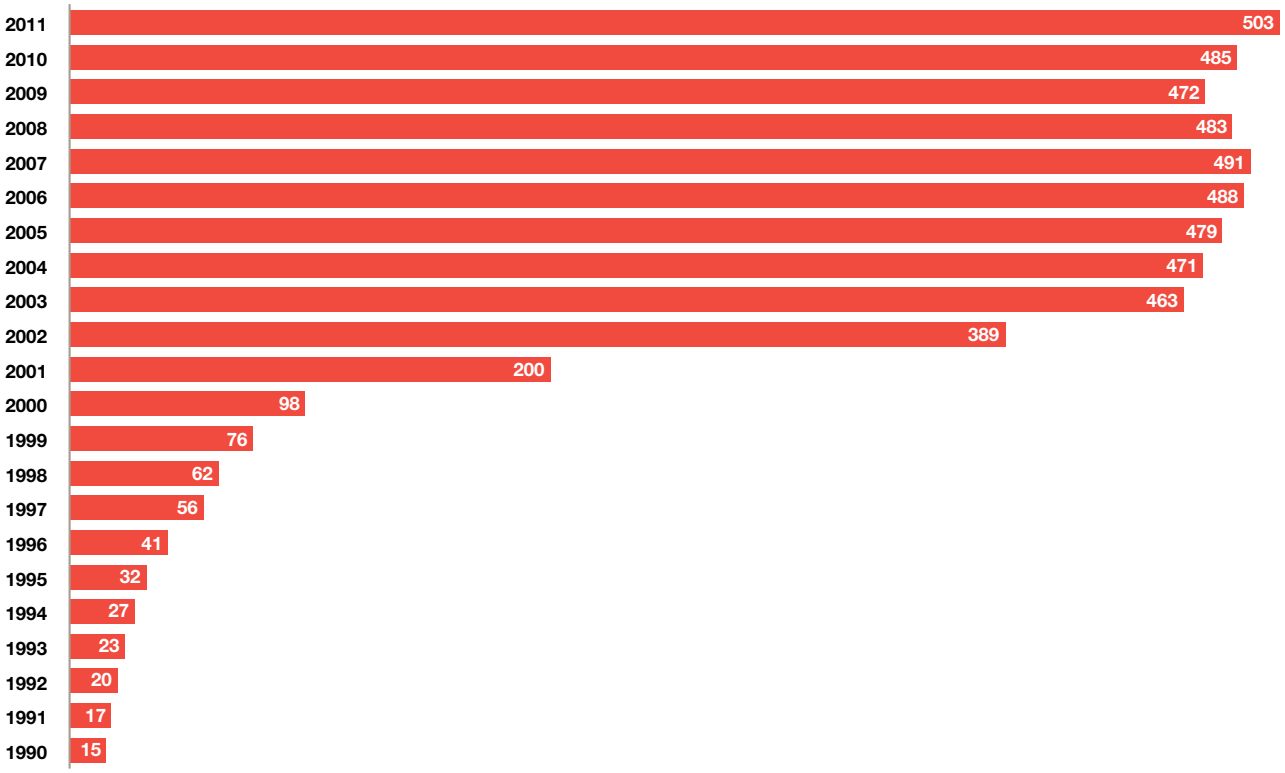
put a severe strain on many of China's IC design companies and several had difficulty surviving. Several companies went bankrupt in 2008 and more did so in 2009. Last year, many of the survivors grew stronger, but the fundamental issue remains that there are just too many local fabless companies with similar products competing purely on price. Therefore, it is still estimated that there are currently no more than 100, possibly less, of the local indigenous IC design enterprises that are truly viable fabless semiconductor companies.

Of the 503 IC design enterprises reported at the end of 2011 as many as 240 could be the design or research & development (R&D) units or activities of foreign-invested or subsidiary multinational companies (MNC). Of this group, PwC analysis has identified over 238 participants. This group is now spread across the more than 280 multinational semiconductor companies and the 100 largest semiconductor-consuming OEM/ODMs identified in the Gartner market share databases. Over the last five years this group has become a bit more concentrated among the smaller companies. It includes the Chinese design activities of 16 of the top 25 multinational semiconductor companies and 17 of the top 25 semiconductor-consuming OEM/ODMs. Thirty-four of the 100 largest, eleven of the middle 100 and forty of the remaining 95 smaller multinational semiconductor companies have design activities in China.

According to an analysis PwC did of the top 280 multinational (MNC) semiconductor companies (not including any Chinese companies) we identified:

- 85 MNC semiconductor companies that have design facilities in China;

Figure 17: Number of IC design enterprises in China, 1990–2011



Source: CCID

- 84 MNC semiconductor companies that have R&D facilities in China (of which 14 have design facilities in China as well) and
- 155 MNC semiconductor companies that have either/or design and/or R&D facilities in China.

In addition PwC did a similar analysis of the top 100 semiconductor consuming OEM/ODM companies and identified:

- 74 MNC OEM/ODM companies that have design facilities in China;
- 45 MNC OEM/ODM companies that have R&D in China (of which 36 have design facilities in China as well) and
- 83 MNC OEM/ODM companies that have either/or design and/or R&D facilities in China.

Companies in the communications sector, particularly smart phones, achieved rapid growth in revenue and size while those in the IC card sector experienced a relative decline.

Combining the two analyses of MNC semiconductor companies and OEM/ODM companies we could conclude that:

- 238 MNC semiconductor or OEM/ODM companies that have either/or Design and/or R&D facilities in China.

The reasons for these multinational design and R&D activities in China are many and include:

- Protecting long-term local market share by demonstrating participation in the country's technology growth initiatives;
- Servicing large Chinese OEMs that are addressing the worldwide market;
- Developing products for the unique and specific standards and requirements of the Chinese market;
- Developing and utilizing China's large pool of lower cost talent;
- Participating in the government's economic stimulus and other long-term infrastructure development initiatives and
- Qualifying for NHTE (new and high tech enterprise) status tax incentives.

Many MNC semiconductor companies are investing heavily in their design activities in China which will inevitably provide designs and services in the local market and will compete directly with the local indigenous IC design companies for market and resources. They are viewed by some authorities as posing a challenge to proprietary IC IPR (intellectual property rights) in the country.

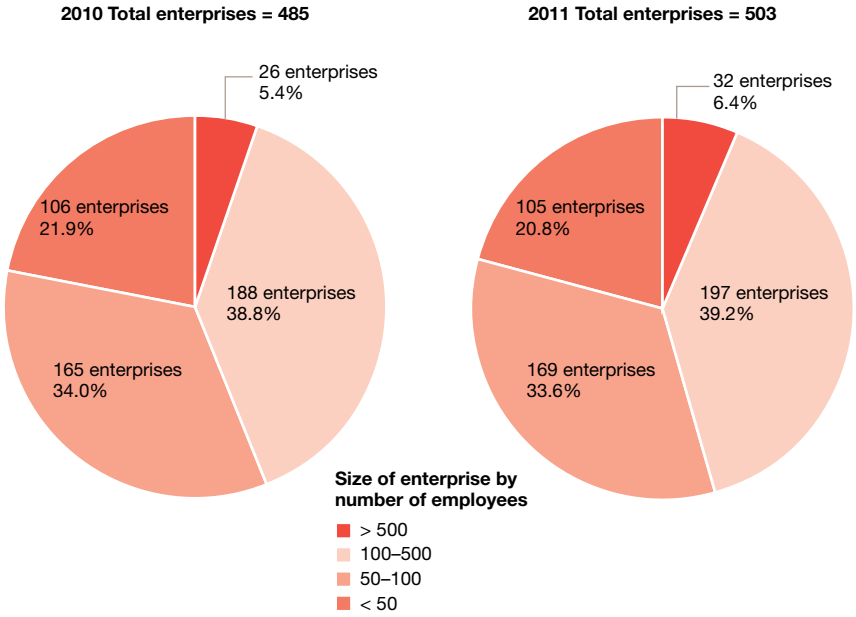
Mobile devices have become the major products for China's IC design industry during the last two years. Companies in the communications sector, particularly smart phones, achieved rapid growth in revenue and size while those in the IC card sector experienced a relative decline. As a result, there has been a significant change in the make-up of China's top 10 IC design companies. Companies involved in mobile device design—Spreadtrum, RDA, Galaxycore, ZTE Microelectronics and Leadcore—made the top 10 list, while IC chip companies including CEC Huada, Wuxi China Resources Semico, Datang Microelectronics and Beijing Tongfang Microelectronics fell in rank or dropped off the list.

Design employees

Employment growth in China's IC design sector moderated in 2011. As previously noted, during the past year, the number of reported IC design enterprises in China increased by 4%, to 503. The total number of employees in the IC design sector increased by 9%, to about 110,000. As a result, the increase in the employee density among China's IC design enterprises continued in 2011. The number of IC design enterprises with more than 500 employees increased by 23% to 32. The number of enterprises with more than 100 employees increased by 7% or 15 enterprises, while the number with less than 100 employees increased by just 1% or three enterprises. Similarly, by the end of 2011, less than 21% of China's IC design enterprises had less than 50 employees, which is a further reduction from the more than 40% that had been reported at the end of 2009.

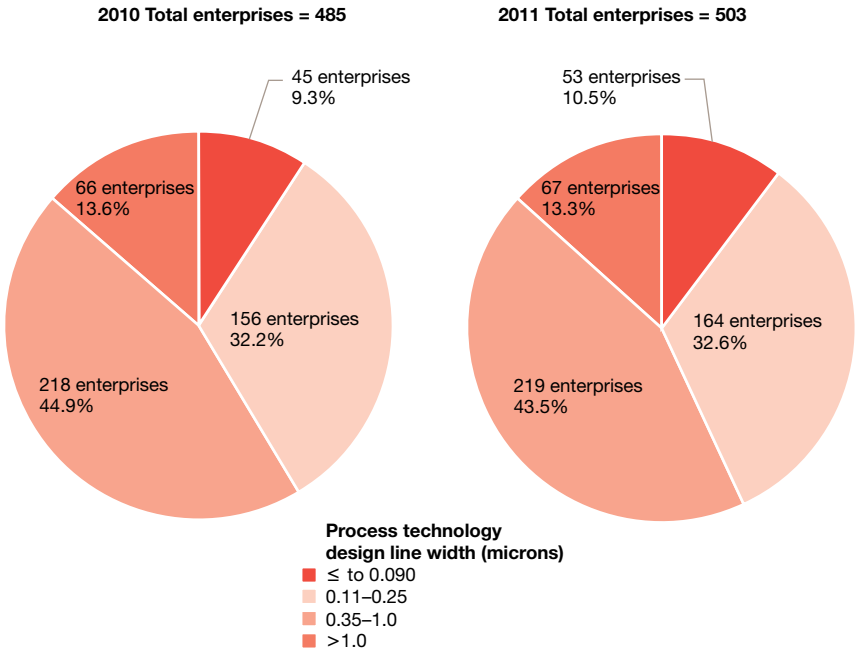
This moderate increase in employee density, coupled with a much greater increase in revenues, resulted in improved sales per employee productivity for the IC design sector. During 2011, the average sales per employee for China's IC design sector increased by almost 25%, from US$55,000 in 2010 to US$69,000. By comparison, although it decreased by 3%, the average sales per employee of the 168 worldwide fabless semiconductor companies reported in the Global Semiconductor Alliance (GSA) Global Financials Report for 2011 was US$525,000. Part of the large difference between these two productivity measures may be the result of the different population of companies being reported upon. The GSA report covers only public fabless companies, which are relatively larger, established and profitable companies. It does not include any of the other thousand start-up and pre-IPO fabless companies. By contrast, the vast majority of China's reported

Figure 18: China's IC design enterprises by employee count, 2010 & 2011



Source: CCID

Figure 19 : China's IC design industry by process technology, 2010 & 2011



Source: CCID

The average 2011 sales per employee of those nine Chinese fabless companies was US$418,000, which is about 80% of the GSA report worldwide average.

503 IC design companies are other than public fabless companies, including many start-up and pre-IPO fabless companies as well as the 238 design and R&D units or activities of foreign-invested or subsidiary multinational (MNC) companies.

A more relevant comparison may be made with just the nine Chinese fabless companies that are included in the GSA report. The average 2011 sales per employee of those nine Chinese fabless companies was US$418,000, which is about 80% of the GSA report worldwide average. Of the nine Chinese IC design companies that were reported in the GSA's Global Financials Report, only two—Spreadtrum Communications with 670 employees and RDA Microelectronics with 350 employees—exceeded the worldwide average, reporting 2011 sales per employee of US$1,006,000 and US$825,000 respectively. One other, Hangzhou Silan Microelectronics, with 560 employees, improved their sales per employee to US$435,000 in 2011, up from US$331,000 in 2010. The other six were lower and diverse: Shanghai Fudan Microelectronics with 300 employees (US$320,000); Vimicro with 324 employees (US$228,000); Beijing Fuxing Xiaocheng Electronic Technology Stock Co., Ltd. with 307 employees (US$154,000); Nationz Technologies Inc. with 612 employees (US$148,000); Ingenic Semiconductors with 192 employees (US$135,000) and Actions Semiconductor with 480 employees (US$99,000).

Design focus

China's IC design industry continued to achieve some reportable qualitative improvements during 2011. There was a modest migration of design capabilities to finer design line widths. According to CSIA and CCID, the number of design enterprises with design capabili-

ties of equal to or less than 0.25 micron has increased to more than 43% of all enterprises, up from 41% in 2010. In particular, 53 of these enterprises had design capabilities for equal to or less than 90 nanometers, eight more than in 2010. At the same time, the percentage of IC design enterprises with legacy technologies greater than 1.0 micron has decreased, although their number increased by one.

Another change is that more Chinese ID design companies are licensing intellectual property cores and software developed by foreign IP providers. In a late 2011 report, EE Times noted that ARM has reached licensing deals with more than 34 Chinese companies for its Cortex processor and Mali graphics processor cores and that MIPS has more than 20 licensing agreements in China. That same report stated that 9% of the companies responding to their EE Times China 10th annual IC Design House Survey were mass producing digital ICs using 45nm or below process technologies. Similarly, 23% and 28% of respondent companies were using 0.13µm process technologies to make analog and mixed signal ICs. Also, Chinese IC design companies now have access to finer process technology nodes at foundries outside of Mainland China such as TSMC in Taiwan. EE Times also reported that 63% of respondent companies used foundries in Taiwan in 2011 compared with 57% in 2010, while 19% and 15% indicated that SMIC and CSMC were their best suited foundries. It is believed that the Chinese stimulus package has helped Chinese IC design companies compete globally at more advanced process nodes using available IP. As the technical capabilities of China's IC design sector have improved, several local companies have achieved notable results. Among the 33 projects recognized by the annual "China semiconductor innovative products and technology" awards for 2011 were nine projects from China's IC design sector. At least one included ICs designed for 40nm processes, while at least two included ICs designed for 65nm processes.

Further, in 2011 China reported its first billion dollar IC design company, HiSilicon Technologies, and two of the worldwide top five fastest growing IC design companies, Spreadtrum Communications and RDA Microelectronics.

Design industry outlook

We may have to wait for history to validate whether 2011 did in fact represent the expected turning point in the development of the Chinese semiconductor industry and of its IC design industry in particular. Although the absolute RMB growth achieved by the IC design industry in 2011 was slightly less than that forecast by CCID at the start of the year, the absolute dollar growth and growth rate of 36.3% were both greater than that attained in the 2010 recovery year. Further, in 2011 China reported its first billion dollar IC design company, HiSilicon Technologies, and two of the worldwide top five fastest growing IC design companies, Spreadtrum Communications and RDA Microelectronics. In addition to economic stimulus packages funded by state and provincial governments in response to the global financial crises, this transition has been driven by the following factors:

- China's push for the adoption of a TD-LTE wireless specification plus other domestic standards;
- China's IC design companies leveraging a range of intellectual property cores from foreign suppliers;

- Chinese system and IC design companies success in aggressively capturing the market for the flood of Android-based products sweeping the global mobile and consumer markets; and
- TSMC's provision of advanced semiconductor processes previously unavailable to companies headquartered in Mainland China.

c. the continuing improvement of cost and performance from growing design skill experience and the adoption of advanced process technologies;

d. an ability to respond to the consumer market's need for very short cycle time and volume flexibility;

e. an ability to survive on lower gross margins; and

By the end of 2011, 29 Chinese semiconductor companies had become publicly listed companies for a combined IPO funding of more than US$4.8bn, including 11 IC design companies for a combined IPO funding of US$1.2bn.

Furthermore, the wealth effect created by listing on the GEM (Global Enterprise Board) or other local financial markets has attracted more and more start-up funds and talent into China's IC design industry. By the end of 2011, 29 Chinese semiconductor companies had become publicly listed companies for a combined IPO funding of more than US$4.8bn, including 11 IC design companies for a combined IPO funding of US$1.2bn.

There are several factors that support the continuing realization of this transition for China's IC design sector into a significant worldwide fabless semiconductor participant including:

a. the growth of China's local electronic equipment manufacturers in both the domestic and worldwide (especially developing countries) market place, creating more opportunities for local fabless semiconductor suppliers;

b. the increasing need for IT infrastructure from government and state-owned enterprises, creating more demand for state-owned fabless semiconductor suppliers;

f. a favorable government industrial policy environment.

There are also some factors that could hinder this transition including:

a. the pressing local and international economic environment with appreciation of the RMB, rising costs in raw materials and labor, changing domestic credit policy and uncertain international economic situation;

b. the increasingly fierce competition from the international industry as overseas-funded enterprises have occupied a dominant position in China's IC industry with a share of more than 80% which affects the development of local enterprises;

c. a domestic IC industry supply chain that is severely disconnected, with more than 80% of products for domestic consumption relying on imports, while nearly 80% of domestic products are for export, a situation encouraged by the export refund of the 17% value-added tax that is imposed on domestic sales;

d. narrow or limited product offerings in leading technologies as most companies have focused on the low-end and low average selling price (ASP) market with just a follower strategy;

e. a limited design service and business engagement with MNC tier 1 electronic equipment manufacturers due to limitations in technology and operations; and

f. a narrow business vision and market scope that increases vulnerability to sustainable developmental risk.

As noted above, at the end of 2011 there were reported to be more than 500 IC design enterprises in China. International and local venture capitalists and private equity have been injecting funding through IPPs and M&A deals. The new State Council Document No. 4 issued in January 2011 has made it clear that encouragement will be given for financing activities in a number of ways, including investment from within the central government budget, industrial investment funds, bank loans and enterprise self-raised funds. With the encouragement given to newly established IC design companies by the No. 4 document, authorities expect China will have another wave of start-up IC design companies in the next couple of years and a rapid increase in the total number of IC design enterprises. For this reason, CCID's current forecast is for China's IC design sector industry to grow by a 22.4% CAGR over the next three years to reach US$14bn by 2014. If this forecast is realized, China's IC design sector would represent almost 14% of worldwide fabless semiconductor revenues and about 4.2% of the worldwide IC market.

Chinese semiconductor companies

Table 5 lists the top 50 Chinese semiconductor companies that had the largest revenues in 2011. 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. Therefore, neither foundries nor packaging and testing companies are included on the list. They, along with foreign semiconductor companies manufacturing in China, are included in Table 10.

The threshold for inclusion in this 2011 listing has increased to US$44m up from the US$30m threshold used since the 2007 list. The number of companies qualifying in 2011 increased to the maximum of 50 from 43 on the 2010 list. Thirty-nine of the same companies qualified, although many changed their relative ranking in 2011. Two companies were dropped from the list due to declining revenues: Ingenic Semiconductor Co. Ltd., which reported a 22% reduction and Beijing Sigma Jinghua Microelectronics which reported a 6% reduction in revenues in 2011. Two other companies, Beijing Huahong IC Design Co. and Jinan Jingheng Co., Ltd., failed to meet the higher revenue threshold for inclusion despite reporting revenue increases of 8% and 6% and were also dropped from the list. Eleven new companies, including

The new State Council Document No. 4 issued in January 2011 has made it clear that encouragement will be given for financing activities in a number of ways, including investment from within the central government budget, industrial investment funds, bank loans and enterprise self-raised funds.

Table 5: Major Chinese semiconductor companies by revenue, 2011

Name of company	Rank 2010	Rank 2011	Sales revenue (RMB:100M) 2010	Sales revenue (RMB:100M) 2011	Change	Sector	Sales revenue (US$m) 2010	Sales revenue (US$m) 2011	Change
HiSilicon Technologies Co., Ltd.	1	1	44.16	66.68	51.0%	●	652	1032	58.1%
Spreadtrum Communications Inc.	2	2	25.00	42.88	71.5%	●	369	663	79.6%
RDA Microelectronics, Inc.	4	3	12.81	18.19	42.0%	●	189	281	48.7%
Sanan Optoelectronics		4	8.63	17.47	102.4%	▼	128	270	112.0%
No. 55 Research Institute of China Electronics Technology Group Corporation	11	5	8.11	16.24	100.3%	■	120	251	109.7%
Hangzhou Silan Microelectronics Co., Ltd.	7	6	10.03	13.30	32.6%	●	123	206	67.3%
TianJIn ZhongHuan Semiconductor Co., Ltd.	3	7	7.70	12.60	63.6%	▲	114	195	71.4%
Galaxycore Inc.	9	8	8.40	11.68	39.0%	●	124	181	45.6%
Shenzhen State Microelectronics Co. Ltd. (SSMEC)	29	9	4.13	11.20	171.3%	●	61	173	184.1%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	8	10	10.00	11.00	10.0%	●	148	170	15.2%
MLS Co., Ltd.		11	7.82	10.40	33.0%	▼	116	161	39.3%
Foshan Nationstar Optoelectronics		12	8.15	10.20	25.2%	▼	120	158	31.1%
Leadcore Technology Co., Ltd.	13	13	7.90	9.44	19.5%	●	117	146	25.1%
Elec-Tech International Co., Ltd.		14	3.70	9.10	145.9%	▼	55	141	157.6%
BCD Semiconductor Manufacturing Ltd.	12	15	8.04	8.81	9.6%	■	119	136	14.8%
Wuxi China Resources Huajian Microelectronics Co., Ltd.	5	16	11.39	8.67	-23.8%	■▲	168	134	-20.2%
Jilin Sino Microelectronics Co., Ltd.	6	17	11.00	8.45	-23.2%	▲	163	131	-19.5%
Suzhou Good-Ark Electronics Co.,Ltd.	10	18	8.33	8.36	0.4%	▲	123	129	5.2%
CEC Huada Electronics Design Co., Ltd. (HED)	25	19	5.01	8.24	64.5%	●	74	127	72.3%
Wuxi China Resources Semico Co., Ltd.	18	20	6.17	8.04	30.2%	●	91	124	36.3%
Changzhou Galaxy Electrical Co., Ltd.	20	21	8.00	7.50	-6.3%	▲	118	116	-1.8%
ShenZhen Si Semiconductor Co. Ltd.	15	22	7.00	7.37	5.3%	▲	103	114	10.3%
Shandong Inspur Huaguang Optoelectronics Co., Ltd.		23		6.55		▼		101	
Fuzhou Rockchip Electronics Co. Ltd.	22	24	5.55	6.33	14.1%	●	82	98	19.5%
Datang Microelectronics Technology Co., Ltd.	19	25	6.14	6.24	1.6%	●	91	97	6.4%
Shanghai Huahong IC Co. Ltd.	16	26	6.87	6.10	-11.2%	●	101	94	-7.0%
Shanghai Fudan Microelectronics Co., Ltd.	23	27	5.11	6.10	19.4%	●	75	94	25.0%
Shenzhen Netcom Electronic Co., Lte.	27	28	4.66	6.07	30.2%	●	69	94	36.3%
Shanghai Belling	21	29	5.86	6.02	2.7%	■⬣	87	93	7.6%
Nationz Technologies Inc.	14	30	7.02	5.69	-19.0%	●	104	88	-15.2%
Guangzhou Hongli Optoelectronics		31	4.38	5.50	25.6%	▼	65	85	31.5%
Fosham Blue Rocket Electronics Co., Ltd.	28	32	4.51	5.38	19.3%	▲	67	83	24.9%
NingBo Hualong Electronics Co.,Ltd.	24	33	5.03	5.20	3.3%	▲	74	80	8.2%
Beijing Huadazhibao Electronic Systems Co., Ltd.	32	34	3.72	4.84	30.2%	●	55	75	36.3%
Beijing Vimicro Co., Ltd.	17	35	6.69	4.78	-28.5%	●	99	74	-25.1%
Jiangsu Wenrun Optoelectronics		36		4.20		▼		65	
Xi'an Microelectronics Technology Institute	31	37	3.86	4.20	8.9%	■	57	65	14.0%

● IC Design ▲ Discrete ▼ Discrete (LED) ⬣ Foundry ■ IDM

Name of company	Rank 2010	Rank 2011	Sales revenue (RMB:100M) 2010	2011	Change	Sector	Sales revenue (US$m) 2010	2011	Change
Wuhan HC SemiTek Co., Ltd.		38	3.51	3.98	13.4%	▼	52	62	18.7%
Changelight Co., Ltd		39	2.97	3.77	26.8%	▼	44	58	32.8%
Shantou Huashan Electronic Device Co.,Ltd.	26	40	4.83	3.73	-22.9%	▲	71	58	-19.2%
Forward Semiconductor Company	35	41	3.31	3.49	5.4%	▲	49	54	10.4%
Tongfang Microelectronics Company	33	42	3.44	3.42	-0.7%	●	51	53	4.0%
Hangzhou Silan Azure Co. Ltd.	30	43	3.93	3.41	-13.2%	▲	58	53	-9.1%
Yangzhou JingLai Semiconductor (Group) Co. Ltd.	36	44	3.23	3.40	5.3%	▲	48	53	10.2%
Chendu Sino Microelectronics Systems Co., Ltd.	34	45	3.32	3.17	-4.5%	●	49	49	0.0%
China Electronics Technology Group Corporation No. 58 Institute	37	46	2.92	3.07	5.2%	▲	43	47	10.2%
Beijing Fuxing Xiaocheng Electronics Technology Stock Co.		47	2.36	3.04	28.8%	●	35	47	34.9%
Hangzhou Youwang Electronics Co.,Ltd.	38	48	2.85	2.99	5.0%	●	42	46	9.9%
Actions Semiconductor Co., Ltd	40	49	2.45	2.96	20.6%	●	36	46	26.3%
Shanghai Epilight Technology Co., Ltd		50	2.31	2.85	23.6%	▼	34	44	29.4%

**Note 9 companies estimated based upon sectors' average 2011 growth including 5 previously estimated based upon 2010 sector growth.*
Source: CSIA, CCID, GSA, GDQ, PwC

ten discrete/LED plus one IC design company, were added to the list: Sanan Optoelectronics; MLS Co., Ltd.; Foshan Nationstar Optoelectronics; Elec-Tech International Co., Ltd.; Shandong Inspur Huaguang Optoelectronics Co. Ltd.; Guangzhou Hongli Optoelectronics; Jiangsu Wenrun Optoelectronics; Wuhan HC SemiTek Co. Ltd.; Changelight Co., Ltd.; Epilight Technology Co., Ltd.; and Beijing Fuxing Xiaocheng Electronics Technology Stock Co. At least nine of these eleven new companies, eight discrete/LED plus the one IC design company, are companies that had qualified for listing in 2010 but were overlooked.

The top two of the five largest companies—HiSilicon Technologies, and Spreadtrum Communications—retained their first and second rankings and the third company, RDA Microelectronics, moved from number 4 in 2010 to number 3. Five other companies improved their rankings, one other company retained its rank and 30 companies lost rank position. One company, Tianjin ZhongHuan Semiconductor Co., Ltd., had been previously incorrectly ranked based upon reported revenues that included other than semiconductor device revenues.

Together these top 50 companies constituted 55% of China's IC design sector, 12% of China's discrete sector and 9% of China's IC chip manufacturing sector.

This group of major Chinese semiconductor companies continues to report superior performance. Overall, these 50 companies reported an average 39% increase in dollar revenues during 2011, which is better than the 14% increase reported for China's overall semiconductor industry and notably better than the 0.4% increase reported for the worldwide semiconductor industry. As a result, these 50 companies accounted for 36% of China's semiconductor industry growth and for 16% of China's semiconductor industry revenues in 2011, up from 12% in 2010. There were four of these Chinese companies whose revenues more than doubled in

Five of the eleven new companies on the list are from a group of 15 Chinese companies with LED wafer fabrication facilities that were in production by 2011, each with total investments of US$50m or greater. The five are:

Elec-Tech International Co., Ltd. (Elec-Tech) was established in 1996 and is based in Zhuhai. It is mainly engaged in the design, production and sale of opto-electronics, including LED epitaxy, LED chips, encapsulation, LED lighting and LED display, SDA (Small Home Appliances), Mini & Particular Motor, and Wind Power Equipment in the People's Republic of China and internationally. The company offers LED lighting products, which include commercial lighting products, such as panel, par, spot, down, table and retrofit lights, as well as fluorescent tubes and bulbs, outdoor lighting products comprising LED street and tunnel lights and decorative strip lighting products. The company exports its products primarily to North America, Europe, Australia, New Zealand, South America, Asia and Africa. The company was listed on the Shenzhen Stock Exchange in 2004, with the share code being 002005 and was one of the first eight enterprises listed out of the Small and Medium-sized Enterprise Board.

Sanan Optoelectronics Co. Ltd. engages in the research, development, production and sale of light emitting diode (LED) products primarily in central China. It is based in Xiamen, China. The company provides products in the categories of LED wafers, including aluminum-gallium-indium-phosphide (AlGaInP) series and gallium nitride series; LED chips, such as AlGaInP series, nickel-gold chips, indium tin oxide chips, and high power chips, as well as personal identification number photodiode chips, including high linearity incept chips and general incept chips. It also sells its products in the United States, the United Kingdom, Korea, Japan, India, Turkey, Malaysia, Singapore, Austria and Russia. The company was formerly known as Tianyi Science & Technology Co., Ltd.

Xiamen Changelight Co., Ltd was established in February 2006 as a high-tech enterprise specializing in research, development, production and sales of high-quality quaternary alloy AlGaInP of red, orange, yellow LED wafers, chips and high-performance GaAs solar cells. The company is located at the national level Torch Industrial Park (Xiang'an District, Xiamen) with high standard clean room facilities. It has introduced world-class, high-end equipment for manufacturing and testing from USA, Germany, Japan, UK, etc. It employs an efficient team composed of domestic and foreign experts with extensive industrial experience, and operates in strict compliance with the ISO9001 and ISO14000 Quality System Standards for the purpose of providing stable quality and high performance of the products. Changelight claims that its quaternary alloy AlGaInP LED epitaxial wafers and chips are leading-edge by virtue of their uniformity, consistency and reliability and have achieved the leading domestic level in scale, output and sales. They are widely applied in digital, dot matrix, full-color screen and traffic lights, etc. Furthermore, Changelight reports that its high-performance GaAs solar cell has reached the international advanced level. Changelight has obtained many patents and undertaken a number of R&D projects sponsored by the state and ministries. The company has always been devoted to researching, developing and producing green products with high quality; to providing customers with the most satisfactory products and services; and to moving forward to become an outstanding corporation in the opto-electrical industry.

Epilight Technology Co., Ltd was founded in April 2000 and was the first domestic Chinese enterprise to pioneer the research and manufacturing of gallium nitride-based blue light epitaxial wafers and chips. Located in Shanghai Zhangjiang National Hi-tech Park, Epilight was one of the technology transfer receivers to commercialize the achievements from China's Optoelectronics Project of National High Technology Program (863 Plan). Their technology is based on the major technology achievements undertaken by Peking University as part of the 863 Plan. Epilight's commercialization of the technology for gallium nitride-based high-brightness luminescent materials was identified as one of the national engineering demonstration projects for new materials by the National Development and Reform Commission as well as the Shanghai high-tech Transformation Project. Epilight has recruited many professional staff from the US and Taiwan. With first-class equipment, technologies and professional staff, and the company claims that it has advanced its technology and product quality to the international level. Their main products are gallium nitride-based high-brightness blue and green EPI wafers and LED chips.

Shandong Huaguang Optoelectronics Co., Ltd. is a hi-tech enterprise engaged in research, production and sale of compound semiconductor epitaxy material and optoelectronic devices. It was jointly established in November 1999 by Weifang Investment Co., Ltd. and Shandong University. Factories are set up in Jinan and Weifang, covering an area more than 200 mu (30 acres). The company offers products such as epitaxial wafers, optoelectronic devices, semiconductor light-emitting diodes (LEDs), commercial laser diode (LD) wafer, chips, devices and applications. Shandong Inspur Huaguang Optoelectronics Co., Ltd. is based in Weifang, China.

The one new IC Design company on the list is as follows:

Beijing Fuxing Xiaocheng Electronic Technology Stock Company Limited was established in 2000 as a high-tech enterprise specializing in integrated circuit research and design. The company specializes in comprehensive and highly accurate automatic metering and monitoring solutions, including the automatic meter reading system, smart card prepayment systems, general packet radio service (multifunction meter monitoring systems) and data collection units, all based on pioneering technology. They manufacturer a series of super scale integrated circuits developed with independent intellectual property rights, such as the PL2000 series, PL3000 series etc. Most of their products supply a gap in the Chinese market, and some products keep ahead in the overseas market. Currently the company has been the biggest supplier for PLCC (Power Line Carrier Communication) modulation/demodulation special purpose ICs in China, with more than 70% of the domestic market in the PLCC meter reading field and has also sold products to Asian, African and European countries. They claim to supply good-performance integrated circuits for clients from electric power, water supply, gas supply and other industries as well as supplying intelligent system solutions with PLCC technology and accumulated practice for relevant industries. Their chips are used by nearly 50% of the Smart Grid in China and they have contributed much to China's Smart Grid with the support of the Ministry of Industry and Information Technology, China Electric Power Research Institute and the National and State Electrical Grids Service. The company is "driven by the need to produce and supply long-lasting, quality, cost-effective products on demand; products that honor intellectual property rights and meld human innovation and creativity with cutting-edge, government-approved technology."

2011: Shenzhen State Microelectronics Co. Ltd.; Elec-Tech International Co. Ltd.; Sanan Optoelectronics; and No. 55 Research Institute of China Electronics Technology Group Corp. An additional five companies reported revenue growth of between 50% and 100%: Spreadtrum Communications; CEC Huada Electronics Design; Tianjin ZhongHuan Semiconductor; Hangzhou Silan Microelectronics; and HiSilicon Technologies. A total of 32 of these 50 companies had 2011 revenue growth that was greater than China's overall industry growth of 14.4% and a total of 39 had revenue growth greater than the worldwide industry average. Of the remaining 11 companies, one reported no change in revenue in 2011; eight, four IC design and four discrete companies, reported revenue decreases ranging from 2% to 25%; and two companies, Shandong Inspur Huaguang Optoelectronics, Co., Ltd., and Jiangsu Wenrun Optoelectronics, reported first-year production revenues for 2011 that were considerably greater than the qualification criteria. The largest absolute dollar revenue increases for 2011 were reported by HiSilicon Technologies, Spreadtrum Communications, Sanan Optoelectronics, No. 55 Research Institute and Shenzhen State Microelectronics, with increases ranging from US$110m to US$380m. These top five revenue gainers accounted for 19% of China's semiconductor industry revenue growth in 2011.

Although they still only represent a very modest portion of worldwide semiconductor revenues, the top Chinese semiconductor companies as a group have consistently increased their presence and significance in the industry over the past five years. In our 2006 Update report the list of top Chinese semiconductor companies consisted of 29 companies with 2005 revenues of US$20m or more, with only 14 companies with revenues of US$30m or more. The 29 compa-

Industry awareness of Chinese semiconductor companies is now also being hindered by what appears to be an increasing opacity on the part of the local Chinese industry associations and authorities.

nies had an average 2005 revenue of US$47m and together only accounted for 0.6% of the 2005 worldwide semiconductor industry revenues. Over the next six years, 32 more Chinese companies grew to be qualified with revenues of US$30m or more and were added to the list, while 11 companies were dropped from the list. The 50 companies on this year's list had average 2011 revenues of US$140m and together accounted for 2.3% of worldwide semiconductor revenues, up from US$108m and 1.6% in 2010. During the last six years, the number of Chinese semiconductor companies with revenues of US$30m or greater has almost quadrupled from 14 to 55, their average revenue has nearly tripled from US$47m to US$140m and the revenue of the largest company on the list increased by more than 660%, from US$155m to US$1,032m.

Industry awareness of Chinese semiconductor companies continues to be slowly increasing. By definition, all 50 of these largest Chinese semiconductor companies should be included in the semiconductor market share reports compiled by industry analysts. However, only 22 of these companies were included in third-party research firm Gartner's database entitled "Top Companies (ALL) Revenue from Shipments of Total Semiconductors—Worldwide (Millions of $US)" which ranked 295 companies by their 2011 revenues. Six of the top 10 were included, with the Chinese company with the largest 2011 revenue, HiSilicon Technologies, ranked 67th among worldwide semiconductor companies. According to Gartner, HiSilicon's ranking among worldwide semiconductor companies has improved from 156 in 2007 to 108 in 2008 to 82 in 2010 and now to 67 in 2011. More than half of the largest Chinese semiconductor companies missing from the Gartner database continue to be discrete companies, including all five of the new LED wafer fabrication facilities, which is an indication of the industry's general lack of awareness of the significance of China's discrete semiconductor industry sector. The Gartner database did include three additional Chinese semiconductor companies with 2011 revenues less than US$30m, for a total of 25 Chinese companies, which is six more than they included in their 2009, 2008 and 2007 databases of 270+ worldwide companies and an notable increase from the 15 out of 227 in their 2005 database.

Industry awareness of Chinese semiconductor companies is now also being hindered by what appears to be an increasing opacity on the part of the local Chinese industry associations and authorities. Individual company data for a number of previously reported companies is now missing from CSIA reports and their and other listings of top companies by industry sectors contain obvious omissions. As a result, the 2011 revenues for nine of the private companies included in our Table 5 had to be estimated based upon sector average growth rates. This is an increase from five companies for 2010 revenues and three companies for 2009 revenues. In addition, the new LED wafer fabrication segment seems to have been completely missed or ignored and as a result there could be some companies missing from our Table 5.

Undergoing a structural shift

Greater China accounted for more than half of the worldwide semiconductor consumption market in 2011, while it produced less than a third of the worldwide semiconductor industry revenues.

Greater China's consumption and production of semiconductors both grew to record levels in 2011. Measured in US dollars, Greater China, which includes mainland China, Hong Kong and Taiwan, accounted for more than half of the worldwide semiconductor consumption market in 2011, while it produced less than a third of the worldwide semiconductor industry revenues.

Taiwan is one of the world's largest suppliers of semiconductors and a key pillar of the Greater China semiconductor industry. Its growing economic relationship with China and progressive easing of cross-Strait investment restrictions have helped accelerate the integration of the Taiwanese and Chinese semiconductor industries, largely through the infusion of talent, technology and capital from Taiwan. This chapter highlights the latest market developments in Taiwan's semiconductor industry and its interactions with China.

Mixed outlook for 2012

Taiwan's IC industry revenues as a whole (including design, manufacturing, assembly and testing) fell 11.7% to NT$1,562bn (US$53bn) in 2011, according to the Taiwan Semiconductor Industry Association (TSIA). Between the natural disasters in Japan and Thailand and the overall impact of a weak global economy, last year presented a number of major challenges for the semiconductor industry in Taiwan and worldwide.

Chapter 4: Greater China

For the time being, Taiwan's market domination of the global semiconductor foundry and assembly and testing sectors is assured. Taiwan currently has an estimated two-thirds global market share of the IC chip contract manufacturing sector, and its IC packaging and testing industry ranks first in the world, with over 50% market share. However, Taiwanese fabless IC designers face increasing competition in the Chinese market from mainland rivals, while local DRAM chip manufacturers are struggling to stay afloat.

The latest TSIA forecasts, made in August 2012, project a 6.9% annual increase in Taiwan's IC industry revenues for 2012. Microsoft's release of Windows 8, along with still-strong demand for smartphones, tablet PCs and other mobile devices, will help drive industry growth this year. Offsetting some of these positives is the continued weakness in the global economy, which could potentially dampen demand for IC chips through to the year-end and into 2013. Still, semiconductor capital investment is projected to continue apace this year and to be directed towards advanced technologies in wafer processing and packaging assembly.

Foundries aggressively investing in new generation capacity

Taiwan's dedicated IC foundry sector is expected to enjoy healthy growth in 2012, boosted by strong demand for smart mobile devices. Taiwan's two largest chip makers, Taiwan Semiconductor Manufacturing Co. (TSMC) and United Microelectronics Corp. (UMC), are aggressively expanding production capacity to safeguard their market positions. Both companies embarked on new multi-billion 12-inch fab construction in the second quarter of 2012 in southern Taiwan, aiming to provide sufficient 28-nanometer and below capacity in the years to come to meet consumer demand for high-end chips.

The unexpected strength of demand for smartphones and tablets in early 2012 prompted TSMC to raise its capital expenditure budget for the year to between US$8bn and US$8.5bn from the original US$6bn, and exceeding the record-high of US$7.3bn it spent in 2011. The proposed investment is intended to meet growing customer demands for its 28-nanometer technology process and expedite development of the more advanced 20-nanometer node. TSMC is also ramping up its capital investment and spending on R&D in an effort to fend off growing competition from new rivals as they vie for a bigger share of the booming mobile market.

Taiwan currently has an estimated two-thirds global market share of the IC chip contract manufacturing sector, and its IC packaging and testing industry ranks first in the world, with over 50% market share.

TSMC has dominated the global chip foundry sector since the middle of the last decade, but competition in the market is on the rise. US-based GlobalFoundries is emerging as a rival in the IC foundry business, while Intel and Samsung Electronics, which mainly make chips for their own brands, are pushing into the market for chips used in mobile devices. Samsung, already the world's largest memory chip maker, is planning large investments in its own capacity to expand into non-memory chip and foundry chip making, including the building of a US$7bn NAND flash memory plant in China, its biggest overseas chip investment.

Taiwan's contract chip makers are also benefitting from the current shake-out in Japan's semiconductor industry as it grapples with costly restructuring.

In an effort to gain leverage in a highly competitive market, TSMC announced in early August 2012 that it would invest €838m (US$1bn) to acquire a 5% equity stake in Dutch firm ASML, the world's top chip equipment maker. (The announcement came within weeks of both Intel and Samsung signing similar investment agreements with ASML.) Under the deal, TSMC will also invest €276m (US$400m) over the next five years in ASML's R&D programs, including extreme ultraviolet (EUV) lithography technology and 450mm lithography tools, which are aimed at accelerating the development of faster, smaller and more energy-efficient chips. TSMC said it also expects the co-investment program will help control escalating wafer manufacturing costs.

As for UMC, Taiwan's second-largest pure-play foundry has set its capital expenditure budget at US$2 billion for 2012, which is 25% higher than the US$1.6bn it spent in 2011. In May 2012, UMC announced plans to spend US$8bn over the next few years to expand its advanced chipmaking capacity, with the aim of boosting its 28-nanometer chip production and establishing a solid foundation for 20-nanometer chips and beyond. One month earlier, it had also unveiled plans to raise its investment stake in Chinese wafer foundry Hejian Technology to 80–90%, up from its current holding of 35%, subject to approval of the Taiwanese authorities.

The expansion plans of TSMC and UMC have also attracted the investment support of several foreign IC designers and packagers. Last November, UK chip designer ARM Holdings opened an R&D center in the Hsinchu Science Park and, in July 2012, signed a multi-year agreement with TSMC to co-develop technology beyond the 20-nanometer process. (The month before UMC said it had licensed process technology from IBM to expedite the development of 20-nanometer chips). Also, Singaporean chip packaging and testing firm STATS ChipPAC has expanded its wafer bump and wafer level chip scale packaging facilities in Hsinchu, which can now provide wafer bumping and associated leading-edge packaging services for 12-inch wafers.

Taiwan's contract chip makers are also benefitting from the current shake-out in Japan's semiconductor industry as it grapples with costly restructuring. In May 2012, Renesas Electronics, the world's largest supplier of automotive microcontroller chips, announced

that it was broadening its outsourcing agreement with TSMC. The Taiwanese foundry manufacturer is to make 40-nanometer microchips for Renesas, in addition to the 90-nanometer units that it already produces for the embattled Japanese chip maker. Taiwan's contract chip assemblers can also expect to benefit from increased outsourcing from Japanese IDMs.

Ambitious assembly and testing expansion plans

Several of Taiwan's leading independent providers of semiconductor assembly and testing services also plan to increase their capital spending this year and beyond to meet growing demand. Kaohsiung-based Advanced Semiconductor Engineering (ASE), the world's largest IC packaging and testing company, continues to expand its capital investments in both Taiwan and China to keep up with the brisk consumption of smartphones, tablet PCs, smart TVs and game consoles, as well as the increase in outsourcing by IDMs.

The merger of MediaTek and Mstar, Taiwan's largest and second-largest IC design houses, respectively, will create the world's fourth-biggest chip designer.

In October 2011, ASE completed construction of its new K12 manufacturing plant in the Nantze Export Processing Zone in southern Taiwan. The facility cost between US$500m and US$600m to build, and will focus on the production of ASE's advanced packaging technologies and copper wire IC packages. The company reportedly plans to spend a further US$1.9bn in Taiwanese capacity expansion over the next four years.

A month earlier, ASE broke ground on its China headquarters and an R&D center in Shanghai's Zhangjiang Industrial Park. The new facilities are aimed at attracting more orders from local fabless IC firms and IDMs, and establishing a firm foothold in China. At the same time, ASE also unveiled plans to invest another US$3.7bn in China over the next eight to 10 years, where it currently runs production plants in Kunshan, Shanghai, Shenzhen, Suzhou and Weihai. The company has been migrating its capacity for entry- and mid-level IC backend services to China since 2010, leaving its Taiwan plants to focus on higher-end services.

Taiwan's two largest IC design houses to merge

Taiwan's IC design sector, in which over 80% of companies reported declining revenues and profits for 2011, faces growing competition in China from local rivals like Spreadtrum Communications. MediaTek, the world's second biggest mobile chipset maker, has been particularly hit by the intensifying competition in its core feature-phone chip market and its slow progress in designing chips for high-end smartphones. In response, MediaTek has stepped up efforts to broaden its product portfolio, primarily through acquisitions that aim to build up its technological capabilities in communications and digital home entertainment.

In June 2012, MediaTek announced plans to acquire long-standing Taiwanese rival Mstar Semiconductor in a deal that values the latter at about US$3.8bn. The merger of Taiwan's largest and second-largest IC design houses, respectively, would create the world's fourth-biggest chip designer, with annual revenue of about US$4.2bn last year. For MediaTek, the MStar buy puts it into the smart TV business, which will be one of the main growth drivers in the future. MStar currently accounts for about 50% of the world's digital TV chip market and has rapidly expanded into the mobile-phone chip and set-top box chip markets in recent years.

DRAM industry shake-up underway

Taiwan's memory chip makers are struggling to keep afloat in the face of stagnant demand for PC DRAM chips, an increased consumer focus on mobility and a darkening global economic outlook. Coupled with over-capacity and growing inventories, these factors are depressing DRAM prices and undermining the ability of Taiwan's DRAM sector to remain profitable. Moreover, this comes at a time of significant pressure from industry leader Samsung Electronics, which now commands over 40% of the global DRAM market.

Taiwan's memory chip makers are struggling to keep afloat in the face of stagnant demand for PC DRAM chips, an increased consumer focus on mobility and a darkening global economic outlook.

Local DRAM manufacturers are taking action to reduce their over-dependence on PC DRAM. Winbond Electronics, Powerchip Semiconductor and ProMOS Technologies have all largely left the PC DRAM market to become either contract manufacturers or producers of other, niche DRAM products used in hot-selling devices such as smartphones and tablets. Nanya Technology, Taiwan's largest DRAM chip maker by sales and part of the conglomerate Formosa Plastics Group, and its Inotera Memories joint venture with US firm Micron Technology are also expanding their share of non-standard DRAM products. Nanya also has a 10-year partnership agreement with Micron (through 2018) to co-develop new DRAM chip technology.

Besides Micron, Japan's Elpida Memory had also formed key partnerships with several Taiwanese DRAM companies. However, the embattled Japanese DRAM chip maker filed for bankruptcy protection in late February 2012. Five months later, Micron agreed to buy Elpida in a deal worth US$2.5bn. Separately, Micron also took ownership of Elpida's 65% stake in Rexchip Electronics, its Taiwanese joint venture with Powerchip Technology, and, in addition, purchased the latter's shares in Rexchip. Once completed, these deals will bring significant changes to the DRAM industry landscape and supply chain relationships, and may even help correct the current oversupply situation.

In the meantime, Taiwan's DRAM sector remains plagued by financial problems. But the government is unlikely to step in as it tried during the steep downturn in 2008–2009. Its original plan to restructure the industry by building a stronger DRAM entity—Taiwan Memory Co.—was finally scrapped in March 2010 in the face of strong resistance. This time around, while the government has voiced concern over the DRAM sector's woes, it is trying a different approach, looking to raise R&D capability in the industry.

In December 2011, the government-backed Industrial Technology Research Institute (ITRI) and US chipmaker Intel announced a five-year partnership to develop next-generation memory chips. The project will focus on developing 3D IC technology for memory chips, which would be mostly used in ultra-mobile devices, such as smartphones and tablets.

Taiwan allows higher Chinese investment in tech sector

In a bid to shore up Chinese investment interest in Taiwan's technology industry, in March 2012 the Taiwan government raised investment ceilings for Chinese investors in five key sectors: liquid crystal displays (LCDs); semiconductors; IC assembly and testing; microelectronics production equipment and metal tool manufacturing. Chinese investors are no longer limited to a 10% stake in local companies, or 50% in joint ventures. However, they are still barred from taking controlling stakes or appointing managers in their investments, and all investments must be approved by Taiwan regulators. The relaxation also covers makers of light-emitting diodes (LEDs) and solar cells, which were opened to Chinese investors for the first time.

In March 2012, the Taiwan government raised investment ceilings for Chinese investors in the LCD, semiconductor, IC assembly and testing, microelectronics production equipment and metal tool manufacturing sectors.

ITRI expects the project to bear fruit within three years at the earliest, and it would then transfer the memory technologies to private firms. This development suggests that, in the longer run, the memory sector will still likely play a key role in Taiwan's semiconductor industry.

Since the signing of the Economic Cooperation Framework Agreement in June 2010, Taiwan has accelerated the process of opening its market to investment from China. To date, however, accumulated Chinese investment in Taiwan is less than three-thousandths of the money going in the other direction. As of June 2012, Chinese enterprises had invested a total of almost US$300m in Taiwan since it first opened its market to them in 2009, while Taiwanese businesses have officially invested about US$120bn in China since 1991, according to statistics from

Taiwan's Investment Commission. The paucity of Chinese investment has been partially attributed to the lack of a bilateral investment protection agreement. Such a pact was finally signed in early August 2012 at the eighth round of high-level talks between Taiwan and China. This should help encourage more Chinese investment to come to Taiwan.

China removed from Taiwan's SHTC watch list

In a further sign of normalization of cross-Strait trade ties, Taiwan eased its ban on the export of strategic high-tech commodities (SHTC) to China in June 2012. The ban was introduced in 2006 amid concerns that Iran and North Korea might use Taiwan as a transhipment point for goods and materials that could be used to produce weapons of mass destruction. The relaxation measure now brings Taiwan's rules into line with export control regimes in most countries, including the US, the European Union and Japan.

The removal of China from the list of restricted areas will benefit companies whose trade activities involve exporting SHTC items to China from Taiwan. While administrative fines may still be triggered by non-compliance with export permit requirements, criminal liabilities will no longer apply to SHTC exports to China, except where the item is one of 12 categories of semiconductor manufacturing equipment.

Export restrictions to China are now limited to chemical mechanical polishers, photo-resist strippers, photo-resist developers, rapid thermal processors, deposition apparatuses, cleaning equipment, dryers, electron microscopes, etching machines, ion implanters, photo-resist coaters and lithography equipment.

Greater China's impact on the semiconductor industry

Driven by the Chinese market, Greater China's semiconductor consumption increased to a record level of US$162bn in 2011, growing by 14%, or US$29.9bn, in the year. This growth was more than fifteen times the US$1.2bn increase in the 2011 worldwide semiconductor market reported by SIA/WSTS (Semiconductor Industry Association/ World SemiconductorTrade Statistics). As a result, Greater China's share

We gauge semiconductor market share by region including Greater China to be:

	2007	2008	2009	2010	2011	Change
Greater China	42%	45%	48%	47%	54%	+12%
Japan	19%	19%	17%	16%	14%	-5%
Americas	16%	15%	17%	18%	17%	+1%
Europe	16%	15%	13%	13%	11%	-5%
Rest of world	7%	6%	5%	6%	4%	-3%

of the worldwide semiconductor consumption market increased significantly to 54% in 2011, accounting for more than half of all the semiconductors consumed in the world for the first time ever. In the latest business cycle, Greater China has fared much better than the total industry. Over the last four years, since 2007, Greater China's semiconductor consumption market has increased 51%, while the worldwide market only increased 17%. This is because China's consumption market has increased 70%, while Taiwan's has decreased 6%. The difference between the two markets reflects the continued and sustained transfer (or off-shoring) of worldwide electronics equipment production to China from other locations including Taiwan.

As a result, China's consumption of semiconductors has grown to be almost fifteen times that of Taiwan's in 2011. A conspicuous portion of that market consumption in China continues to be created by Taiwanese electronic manufacturing service (EMS) and original design manufacturer (ODM) companies.

Greater China's semiconductor industry (production) also increased to a new record level in 2011, as China's industry growth more than offset Taiwan's decreases. Although Taiwan's semiconductor industry continues to be larger, uses more advanced technology and features more renowned companies, it was also more affected by global natural disasters, economic weakness and the challenges of the DRAM market.

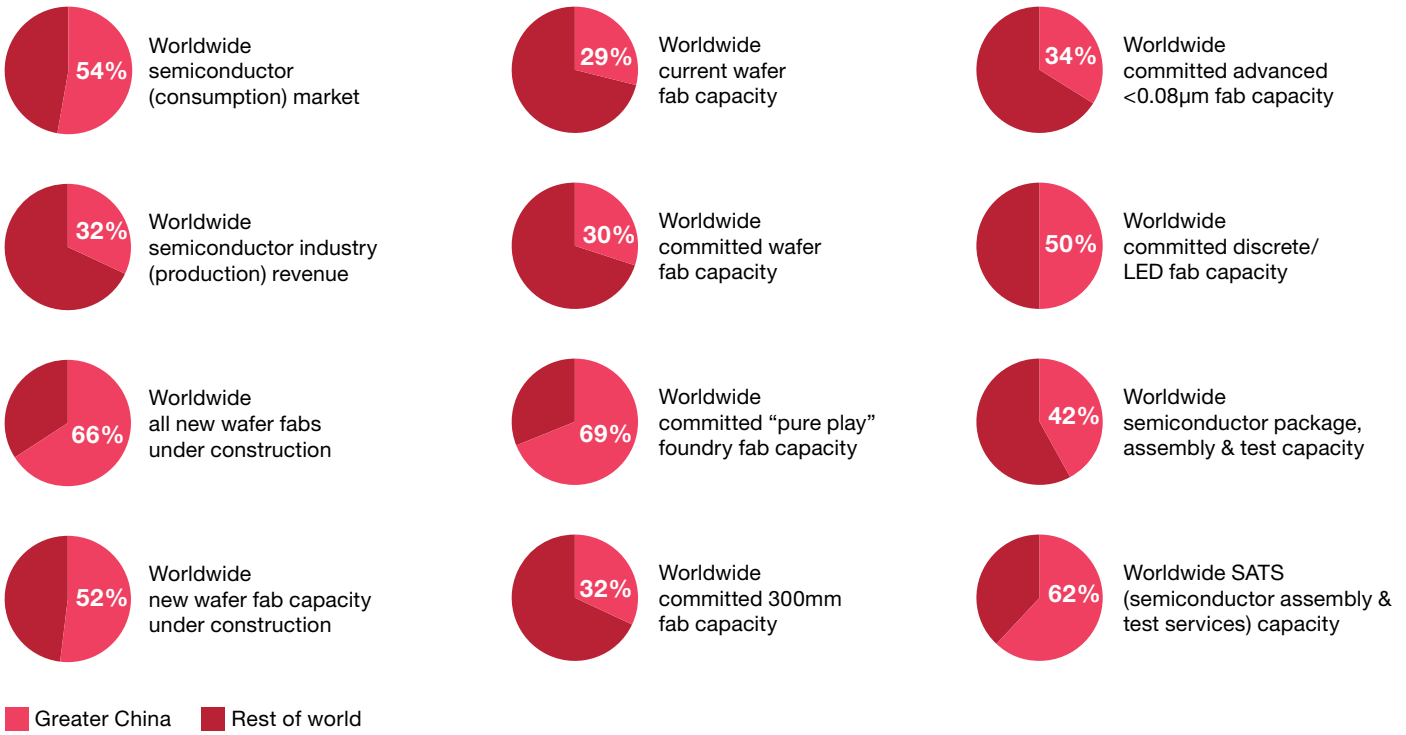
Figure 20: Greater China share of the worldwide semiconductor industry, 2000–2012

Source: CCID, CSIA, Gartner Dataquest, ICI, TSIA, WSTS, PwC 2004–2012

Measured in US dollars, Taiwan's IC industry revenue decreased by more than 4% (almost 12% in local currency terms) in 2011, an annual drop of more than US$2bn, while China's semiconductor industry revenue increased by more than 14% in the year, for a gain of more than US$5bn. As a result, Greater China's semiconductor industry (production) revenues increased by a net US$3bn in 2011, growing 3.2% to a new record of almost US$98bn.

During the past four years of this business cycle both China's and Taiwan's IC industry revenues have increased: China by 59% and Taiwan by 19%. As result, the Greater China semiconductor industry has performed better than the worldwide industry, growing 34% compared to a worldwide 17% growth over the last four years. During that period, Taiwan's industry performance was much more volatile than that of China. Much of that volatility came from Taiwan's IDM/IC sector, reflecting the crash of the worldwide DRAM market in 2008 and 2009, its dramatic recovery in 2010 and subsequent relapse in 2011. After a two-year run of declines (-27% in 2008, and -19% in 2009) the sector abruptly grew 86% in 2010 and then dropped by -34% in 2011. Taiwan's foundry and packaging and testing sectors also contributed to the volatility, declining by -2% in 2008 and -9% in 2009 before growing +36% in 2010 and declining a moderate -2% in 2011. Taiwan's IC design sector, which had a more stabilizing performance, declined -6% in 2008, but grew +3% in 2009 and +18% in 2010, before declining -15% in 2011. As a result, Taiwan's IC industry relative revenue performance ended up being slightly less than two and a quarter times as large as China's in 2011.

Figure 21: Greater China share in 2011



Source: CCID, Gartner Dataquest, ICI Insights, SEMI World Fab Watch, TSIA, WSTS, PwC 2012

Greater China's IC consumption far exceeds its IC production. The difference, which we describe as Greater China's annual IC consumption/production gap, has grown steadily since 2000 to reach a record US$58bn in 2011. This is a 43% increase from the US$40bn annual gap reported for 2010 and is the consequence of China's IC consumption growth greatly exceeding Taiwan's IC production growth. China's annual IC consumption/production gap (i.e., the value of its IC consumption less production), which had been growing steadily since 2000, with only a slight decrease in 2009, increased by 15% in 2011 to a new record US$100.5bn. At the same time, Taiwan's annual production/consumption surplus, which had reached a record US$46.9bn in 2010 after four consecutive years in the US$30bn to US$34bn range, decreased by 9%, or US$4.1bn, to US$42.8bn in 2011. Therefore, Greater China had an annual IC consumption/production gap of US$57.7bn in 2011, a further increase from US$40bn in 2010, US$36bn in 2009 and US$35bn in 2008. While the gap is still significantly less than that of China alone, it now accounts for more than 19% of the total worldwide semiconductor market.

Since the end of the 2008/09 semiconductor downturn 49 new wafer fabs have started production in Greater China, representing 60% of all the new fabs starting production worldwide and 35% of their capacity.

Since the end of the 2008/09 semiconductor downturn, 49 new wafer fabs have started production in Greater China, representing 60% of all the new fabs starting production worldwide and 35% of their capacity. Of these new fabs, 40 were discrete/LED fabs, giving Greater China a significant 78% share of new discrete/LED fabs starting production since 2009. In addition, there are currently (as of May 2012) 29 additional wafer fab facilities under construction in Greater China, representing 66% of all fabs under construction worldwide and 52% of their capacity. Twenty of these fabs under construction in Greater China are discrete/LED fabs, representing 91% of all discrete/LED fabs under construction. If and when all these fabs are completed, put into production, fully equipped and ramped to full capacity, Greater China will have 30% of total worldwide wafer fab capacity, including 69% of pure-play foundry capacity, 50% of discrete/LED capacity, 32% of 300mm capacity and 34% of advanced ≤ 80nm capacity.

Eight of the twelve new semiconductor package, assembly and test facilities that have been added worldwide since 2009 are located in Greater China. As a result, Greater China has increased to 42% its share of total worldwide semiconductor package, assembly and test capacity.

Greater China's impact on semiconductor demand

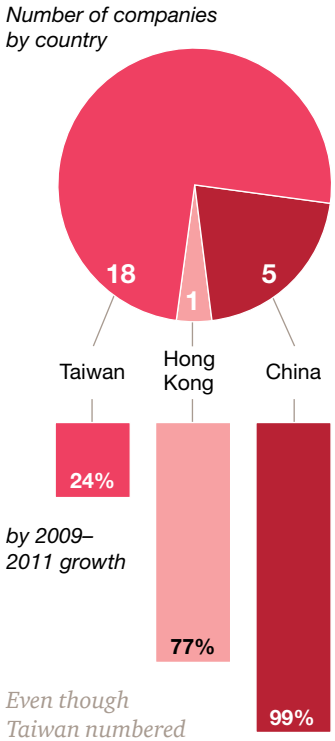
There were 24 Greater China OEM and ODM companies among the worldwide top 100 semiconductor consumers in 2011 based upon Design TAM (total available market). Design TAM is the total value of the semiconductor content in all products designed by electronic equipment manufacturers, regardless whether the design is for the manufacturer itself or for a third party. Of these 24 companies 18 are in Taiwan, 5 in China, and 1 in Hong Kong. Their combined total Design TAM accounted for slightly more than 14% of worldwide in 2011, an increase from 13% in 2009. Their combined Design TAM in 2011 had increased 46% from 2009 compared to the worldwide Design TAM which increased 34%. The top four of these Greater China companies with Design TAM's of more than US$4bn in 2011 are: Lenovo (US$8bn), Huawei

Table 6: Greater China's top 100 OEM/ODM companies by Design TAM
(Greater China companies among worldwide top 100 OEM/ODM companies by Design TAM)

Company	Country	Design TAM (US$m) 2009	2010	2011	% change 2009–2011
Ability	TWN	420	622	737	75.5%
Acer	TWN	4,162	5,410	4,286	3.0%
A-Data	TWN	663	794	570	-14.1%
ASUSTeK	TWN	2,976	2,341	2,455	-17.5%
BenQ	TWN	1,151	1,302	1,164	1.1%
Compal	TWN	2,360	1,952	1,617	-31.5%
Delta Electronics	TWN	298	396	399	33.9%
ECS	TWN	509	620	513	0.7%
Gigabyte	TWN	507	607	567	11.8%
Haier	CN	297	437	590	98.8%
Hon Hai	TWN	2,628	3,854	4,086	55.4%
HTC	TWN	748	1,631	2,456	228.2%
Huawei	CN	2,278	3,408	4,255	86.8%
Inventec	TWN	810	770	868	7.1%
Lenovo	CN	3,729	6,083	7,779	108.6%
Lite-On	TWN	369	424	473	28.2%
MSI	TWN	916	1,187	857	-6.4%
Pegatron	TWN	0	1,845	1,666	NA
Quanta	TWN	996	1,245	1,253	25.7%
TCL	CN	557	945	1,183	112.5%
TPV	HKG	1,005	2,000	1,776	76.6%
Transcend	TWN	622	617	726	16.8%
Wistron	TWN	882	1,084	1,381	56.6%
ZTE	CN	1,473	2,088	2,790	89.4%
Grand total		**30,358**	**41,663**	**44,446**	**46.4%**

Source: Gartner

Greater China's total OEM/ODM companies by Design TAM



Even though Taiwan numbered the most companies, it experienced the lowest Design TAM growth from 2009–2011.

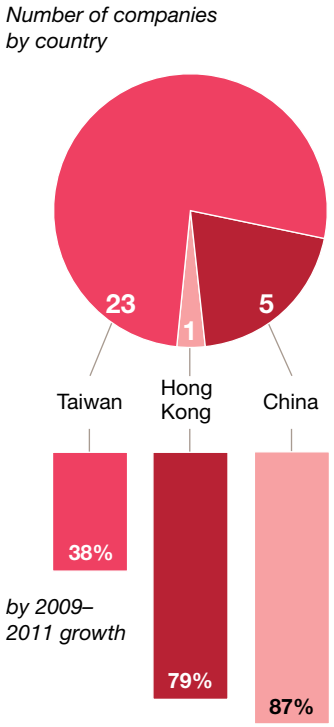
Table 7: Greater China's top 100 OEM, ODM & EMS companies by Purchasing TAM

(Greater China companies among worldwide top 100 OEM, ODM & EMS companies by Purchasing TAM)

Company	Country	Purchasing TAM (US$m) 2009	2010	2011	% change 2009–2011
Ability	TWN	432	710	843	95.0%
Acer	TWN	2,091	2,846	2,256	7.9%
A-Data	TWN	663	794	570	-14.1%
Arima	TWN	375	422	422	12.7%
ASUSTeK	TWN	5,648	1,600	1,643	-70.9%
BenQ	TWN	728	778	696	-4.5%
Cal-comp	TWN	725	864	772	6.5%
Compal	TWN	4,896	5,532	5,198	6.2%
ECS	TWN	994	1,192	1,016	2.2%
Gigabyte	TWN	949	1,145	1,097	15.6%
Haier	CN	285	410	536	88.1%
Hon Hai	TWN	10,573	15,438	18,429	74.3%
HTC	TWN	1,068	2,032	2,675	150.6%
Huawei	CN	1,825	2,760	3,246	77.8%
Inventec	TWN	2,519	2,280	2,652	5.3%
Largan Precision	TWN	317	365	445	40.4%
Lenovo	CN	2,846	4,738	5,919	108.0%
Lite-On	TWN	471	545	599	27.3%
Mitac	TWN	780	730	646	-17.2%
MSI	TWN	1,461	1,817	1,440	-1.5%
Pegatron	TWN	0	5,888	5,690	NA
Quanta	TWN	4,289	6,091	6,214	44.9%
Skyworth	CN	346	308	426	23.2%
TCL	CN	784	1,230	1,459	86.0%
TPV	HKG	1,008	2,000	1,808	79.5%
Transcend	TWN	622	617	726	16.8%
TSMT	TWN	368	589	653	77.7%
USI	TWN	587	822	916	56.1%
Wistron	TWN	2,452	2,949	3,520	43.5%
ZTE	CN	1,458	2,069	2,491	70.8%
Grand total		**51,561**	**69,560**	**75,004**	**45.5%**

Source: Gartner

Greater China's total OEM, ODM & EMS companies by Purchasing TAM



Hong Kong, with its single company, experienced almost 80% Purchasing TAM growth from 2009–2011.

(US$4bn), Acer (US$4bn) and Hon Hai (US$4bn). Apple, at US$18.8bn, is reported to have the largest semiconductor Design TAM worldwide in 2011, slightly greater than Samsung Electronics at US$18.4bn and greater than HP at US$16.0bn.

There were 30 Greater China OEM, ODM and EMS companies among the worldwide top 100 semiconductor consumers in 2011 based upon Purchasing TAM. Purchasing TAM is the total value of the semiconductor content in all products purchased by an electronic equipment manufacturer regardless of whether the purchase is for the manufacturer itself or for a third party. Since EMS companies only manufacturer electronic equipment designed by other parties, they create Purchasing TAM but not Design TAM. Of these 30 companies 23 are in Taiwan, 6 in China and 1 in Hong Kong. Their combined total Purchasing TAM accounted for slightly more than 24% of worldwide in 2011, an increase from 22% in 2009. Their combined Purchasing TAM in 2011 had increased 45% from 2009 compared to the worldwide Purchasing TAM, which increased 34%. The top five of these Greater China companies all with Purchasing TAM's of more than US$5bn in 2011 are: Hon Hai (US$18bn), Quanta (US$6bn), Lenovo (US$6bn), Pegatron (US$6bn) and Compal (US$5bn). ODM and EMS companies such as Hon Hai, Quanta, Pegatron and Compal can have Purchasing TAMs that are larger than their Design TAMs since they manufacturer electronic equipment designed by others, while OEM companies such as Lenovo can have a Design TAM larger than its Purchasing TAM because it outsources some of its manufacturing, including purchasing, to others. Hon Hai is reported to have the largest Purchasing TAM worldwide in 2011 at US$18.4bn, slightly greater than Samsung Electronics at US$17.7bn.

Growing capabilities

During the past year, China increased the net number of fabs in production by 13, or 9%—and increased its net capacity by 9%—while the worldwide industry only increased the net number of fabs in production by 25, or 2%, for a 4% increase in net capacity.

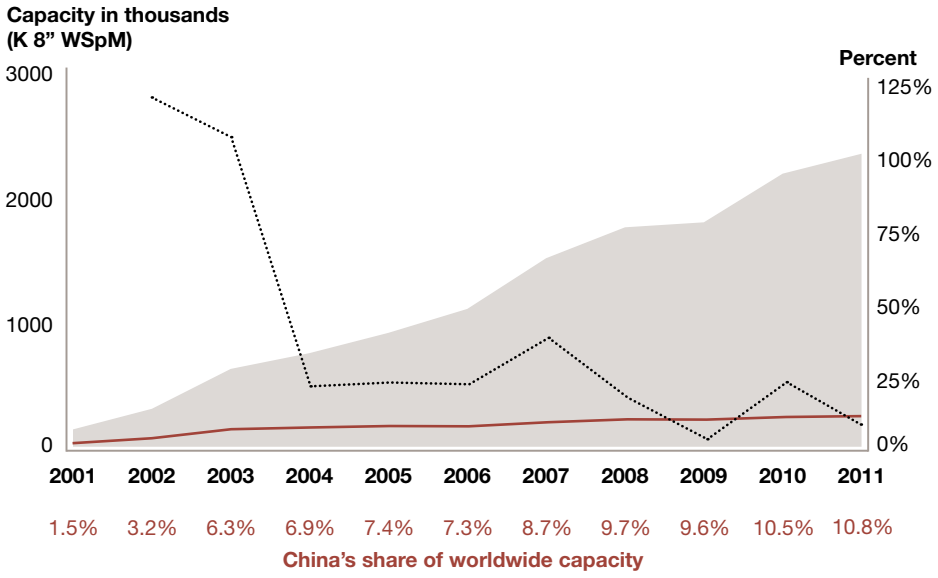
Wafer fab capacity

During 2011 China increased wafer fab capacity faster than the worldwide average for the second year in a row and for nine out of the past eleven years. During the past year, China increased the net number of fabs in production by 13, or 9%—and increased its net capacity by 9%—while the worldwide industry only increased the net number of fabs in production by 25, or 2%, for a 4% increase in net capacity.

Based upon their current capabilities (rather than intentions, i.e. World Fab Watch, WFW, Probability ≥1.0), China will now be able to increase its share of total worldwide semiconductor wafer production from the ≤ 2% realized in 2003 to ≥ 10.8% by 2014 by just fully equipping and ramping to full capacity at mature yields all of their existing wafer fabrication modules. This would more than quintuple their share of worldwide wafer production compared to 2003 and represents a further increase in China's relative capacity during the past year from 10.5% to 10.8% of worldwide capacity.

As a result of the increased awareness of the significance and impact of China's local O-S-D (optoelectronics–sensors–discrete) sector, a further four existing Chinese wafer fabs were added to the WFW database. All four were discrete wafer fabs. Their inclusion was in addition to the 10 existing wafer fabs added in 2010, 26 added in 2009 and 13 added in 2008. These continuing revisions have provided a more comprehensive understanding of China's local O-S-D sector. Because of the 2011 additions, China's 2010 current wafer fab capacity has been revised to 2,170.4K Wafer Starts per Month (a 2% correction) which represented 10.5% of 2010 worldwide capacity.

Figure 22: China's wafer fab capacity and share of worldwide capacity, 2002–2011



Source: World Fab Watch 2002-2012

China currently has 22 additional wafer fabs committed and under construction. This is half the total of the 44 additional committed fabs under construction worldwide, but only represents slightly more than 9% of the total capacity of the 44 fabs. China is getting less capacity per new wafer fab plant because it is adding a greater proportion of 4-inch(100mm) or smaller O-S-D fabs than other regions and has a lower proportion of 12-inch (300mm) plants. Twenty-four (24) of the 28 fabs that started production during 2011 and 19 of the 22 fabs that are committed and under construction are all LED wafer fabs and most are 2-inch (50mm) wafer fabs. During the past five years, the number of wafer fabrication modules committed and under construction in China has varied widely. It decreased from 20 in 2006 to 8 in 2008 before growing to 12 in 2009 and 22 in both 2010 and 2011. These 22 modules under construction have the potential to further increase China's wafer fabrication capacity by 5.5%, which is less than the 6.6% increase in potential worldwide capacity from the total of 44 modules under construction worldwide. At that point, China will no longer be increasing wafer fab capacity faster than other regions.

Based upon their current plus committed capabilities—plants in production plus plans under construction (i.e., WFA Probability ≥ 0.8)—China could increase and maintain its share of total worldwide semiconductor wafer production from the ≤ 2% realized in 2003 to ≥ 10.7% through 2015. This would require financing, completing the 22 wafer fabrication plants currently under construction and full equipping and ramping to full capacity at mature yields those new plants plus all of China's existing wafer fabrication modules. If this were to come to pass, it would increase China's share of worldwide wafer production by slightly more than five times and have a moderate impact on the semiconductor industry.

China currently has 22 additional wafer fabs committed and under construction. This is half the total of the 44 additional committed fabs under construction worldwide, but only represents slightly more than 9% of the total capacity of the 44 fabs.

Table 8: Comparison of current wafer fab capacity, 2011

	China		China's % of Worldwide	Worldwide	
	Capacity	%		Capacity	%
Geometry					
≥ 0.7µm	621.4	27%	20%	3,089.2	14%
< 0.7 to ≥ 0.4µm	159.6	7%	14%	1,175.0	5%
< 0.4 to ≥ 0.2µm	202.9	9%	10%	2,073.6	10%
< 0.2 to ≥ 0.12µm	315.0	14%	14%	2,269.2	11%
< 0.12 to ≥ 0.06µm	467.3	20%	16%	2,888.6	13%
< 0.06 to ≥ 0.028µm	562.5	24%	11%	5,333.7	25%
< 0.028 µm	0.0	0%	0%	4,086.8	19%
N/A		0%		611.0	3%
Total	**2,328.7**	**100%***	**11%**	**21,527.1**	**100%**
Wafer size					
≥ 4″	345.7	15%	34%	1,019.8	5%
5″	186.9	8%	26%	724.6	3%
6″	396.3	17%	13%	3,093.9	14%
8″	619.0	27%	11%	5,814.1	27%
12″	780.8	34%	7%	10,874.8	51%
Total	**2,328.7**	**100%***	**11%**	**21,527.2**	**100%**

Capacity = 1000s 8" Equivalent Wafer Starts per month (KWSpM)
Current capacity = World Fab Watch Probability ≥ 1.0
**Total % may differ from 100% due to rounding.*

Source: SEMI World Fab Watch, May 2012

Capacity by process node and wafer size

From a geometry/technology node distribution standpoint, China's current wafer fabrication capabilities continue to lag the worldwide industry in moving to leading-edge capabilities. When fully equipped and ramped, China will only have 24% of its capacity at the advanced <0.06µm node compared to a worldwide industry distribution of 44%. None of China's advanced capacity will be at the leading edge ≤ 0.028µm node versus 19% of current worldwide industry capacity. By contrast, China will have 20% at the less advanced <0.12 to ≥0.06µm nodes versus 13% worldwide and 23% at the mid-range <0.4 to ≥0.12µm nodes versus 21% worldwide. Probably because of its heavier focus on O-S-D—and especially LED production—China will also have 34% of its capacity at the mature >0.4µm nodes versus worldwide 19%.

Also because of its heavier focus on LED production and mature technologies, China's current capabilities in terms of wafer size continue to be more concentrated in the smaller size ranges. To illustrate, China has:

- 15% of its capacity in 4-inch or smaller wafers versus the worldwide mix of 5%;

Table 9: Comparison of committed future wafer fab capacity, 2011

	China			China's % of Worldwide	Worldwide		
	# Fabs	Capacity	%		# Fabs	Capacity	%
Geometry							
≥ 0.7µm	19	94.7	74%	62.3%	23	152.1	11%
< 0.7 to ≥ 0.4µm	1	4.0	3%	83.3%	2	4.8	0%
< 0.4 to ≥ 0.2µm	1	10.0	8%	80.0%	4	12.5	1%
< 0. to ≥ 0.12µm	0	0.0	0%	0.0%	1	45.0	3%
< 0.12 to ≥ 0.06µm	1	20.0	15%	16.7%	2	120.0	8%
< 0.06 to ≥ 0.028µm	0		0%	0.0%	3	360.0	25%
< 0.028µm	0		0%	0.0%	9	726.8	51%
N/A	0		0%		0		
Total	**22**	**128.7**	**100%**	**9.1%**	**44**	**1,421.2**	**100%***
Wafer size							
≥ 4″	19	94.7	74%	100.0%	19	94.7	7%
5″	0		0%		0		0%
6″	0		0%	0.0%	8	60.8	4%
8″	3	34.0	26%	25.4%	4	134.0	9%
12″	0	0.0	0%	0.0%	12	1,127.8	79%
18″	0	0.0	0%	0.0%	1	4.6	0%
Total	**22**	**128.7**	**100%**	**9.1%**	**44**	**1,421.9**	**100%***

Capacity = 1000s 8" Equivalent Wafer Starts per month (KWSpM)
Committed future capacity = Wafer Fab Watch WFW Probability ≥ 0.8 to <1.0
**Total % may differ from 100% due to rounding.*

Source: SEMI World Fab Watch, May 2012

- 25% of its capacity in 5-inch or 6-inch wafers versus the worldwide mix of 17%;
- 27% of its capacity in 8-inch wafers equal to the worldwide mix of 27% and
- 34% of its capacity in 12-inch wafers compared to the worldwide mix of 51%.

During 2011, the production startup of SMIC's Mega Fab 5 in Beijing and Hua Li's Fab 3 in Shanghai, plus the ramp up of Intel's Fab 68 in Dalian, improved China's 12-inch (300mm) fab capability somewhat.

Of the 103 12-inch (300mm) wafer fabrication plants currently in production worldwide, eight are now in China, constituting 7.2% of worldwide 300mm capacity. However, China did not have any of the 12 additional 12-inch (300mm) wafer plant committed and under construction worldwide during 2011. When they are completed, fully equipped and ramped to full capacity—which could be three years from now—China's share of worldwide 300mm capacity will be decreased to 6.5%. As a result, 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 NAND Flash) wafer manufacturing cost leadership.

For the future, China does have three 12-inch (300mm) wafer fabs that are announced and planned, including the Samsung Xi'an NAND Flash memory fab which broke ground in September 2012. If and when these three planned fabs are completed, equipped and ramped into production, China's share of worldwide 12-inch capacity will increase to 9.8%. The Samsung Xi'an fab is the most significant of these three planned 12-inch fabs. It represents 70% of their added capacity and, when brought into full production, will become China's largest and most advanced technology wafer fab surpassing the Hynix Wuxi fab.

From a business model standpoint, China's wafer fabrication capabilities remain noticeably different from worldwide capabilities. Foundry capacity continues to dominate both China's current and committed capabilities.

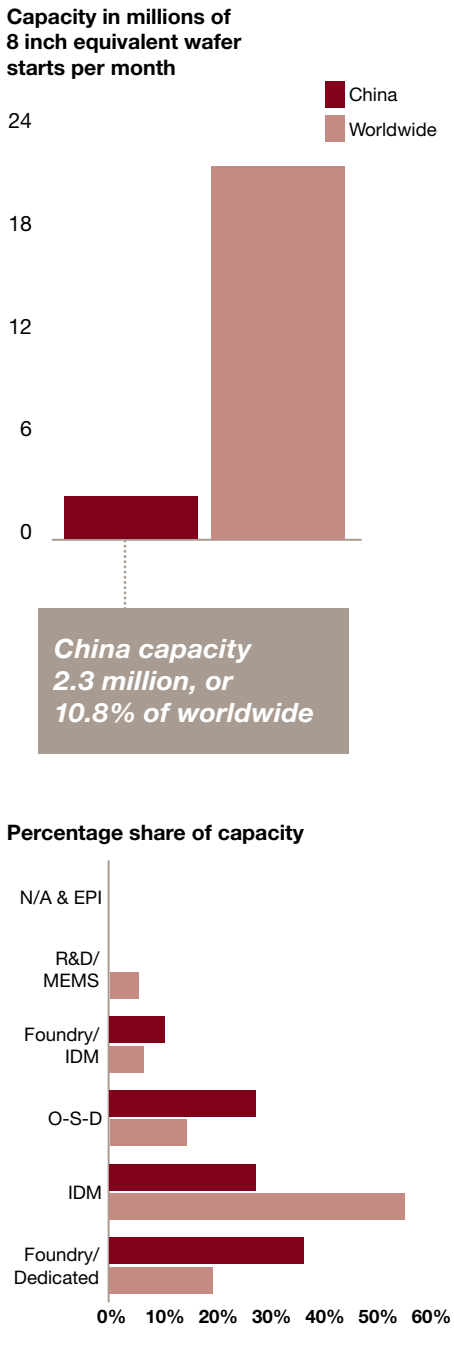
Offsetting this relative lack of 12-inch (300mm) wafer fab capacity, China continues to maintain a greater than worldwide average concentration of 6-inch and smaller fab capacity. China currently has 138 6-inch or smaller wafer fabs in production, constituting 40% of total capacity compared to a worldwide average of 22%. To a considerable extent, this mix is the result of China's concentration in the O-S-D sector and recent growth of its LED capabilities. One hundred and five (105) of these smaller fabs are O-S-D, including 63 LED wafer fabs, and 41 discrete fabs.

Overall, China continues to have newer wafer fabrication plants with older technology. More of China's current wafer fab capacity has been brought into production within the last five years. Seventy-six (76) of China's current 163 wafer fab plants started production after 2006 and represent 37% of China's current capacity. By contrast, worldwide wafer fab plants starting production after 2006 only represent 27% of total current capacity. At the same time, China lags the worldwide average in technology node and wafer size. Previously this apparent anomaly had been the result of many of China's wafer fab plants being established with transferred used equipment and technology. Currently it also reflects China's recent concentration in the establishment of new LED wafer fabs.

Capacity by business model

From a business model standpoint, China's wafer fabrication capabilities remain noticeably different from worldwide capabilities. Foundry capacity continues to dominate both China's current and committed capabilities. For example, when fully equipped and ramped to volume, foundry production will occupy 46% of China's current capacity compared to just under 26% worldwide. In the future, if all the committed wafer fab plants under construction are fully equipped and ramped to volume worldwide, foundry production will continue to account for 44% of China's capacity versus 26% worldwide. China also has a greater share of its current wafer fab capabilities dedicated to discrete at 20% and optoelectronics/LED at 7% compared to worldwide discrete at 10% and optoelectronics/LED at 4%. China's share of wafer fab capabilities dedicated to optoelectronics/LED will increase further to 11% versus a worldwide

Figure 23: Current wafer fab capacity comparison, China and Worldwide, 2011



Source: World Fab Watch 2012

share of 4% in the future when all the committed wafer fab plants under construction are fully equipped and ramped to volume worldwide.

China's wafer foundry revenues decreased by nearly 3% in 2011, while worldwide foundry revenues increased by 6%. As a result, China's share of worldwide foundry revenues decreased to about 10% in 2011, down from 11% in 2010. The most significant revenue decreases in 2011 were recorded by SMIC, Shougang NEC and He Jian. This drop in share is likely the continuation of the trend that started four years ago, when China's share of worldwide foundry revenues decreased from a peak of 12.5% in 2007 to 11.5% in 2008.

Since 2007, China's wafer foundry revenue growth of 2% CAGR has been significantly less than the worldwide average growth of 8% CAGR. Based upon its current capabilities, China should be able to increase its share of worldwide foundry production to slightly more than 19% by 2013 by fully equipping and ramping to full capacity at mature yields all of their existing wafer fabrication modules. This could have a significant impact on the semiconductor industry. However, its relative revenue growth will lag significantly if its foundries continue to compete on price rather than leading-edge technology.

Based upon SMIC's relative peer performance, China's foundries have only been earning 75.7% of the worldwide average revenue per wafer start over the past five years. Further, even if all of the worldwide committed wafer fabs under construction are completed and ramped to full production, China's potential share of foundry production would be reduced to about 18% by 2015. This would equate to China reaching no more than a 14% potential share of worldwide foundry revenues by 2015, given their continuing below worldwide average revenue per wafer start.

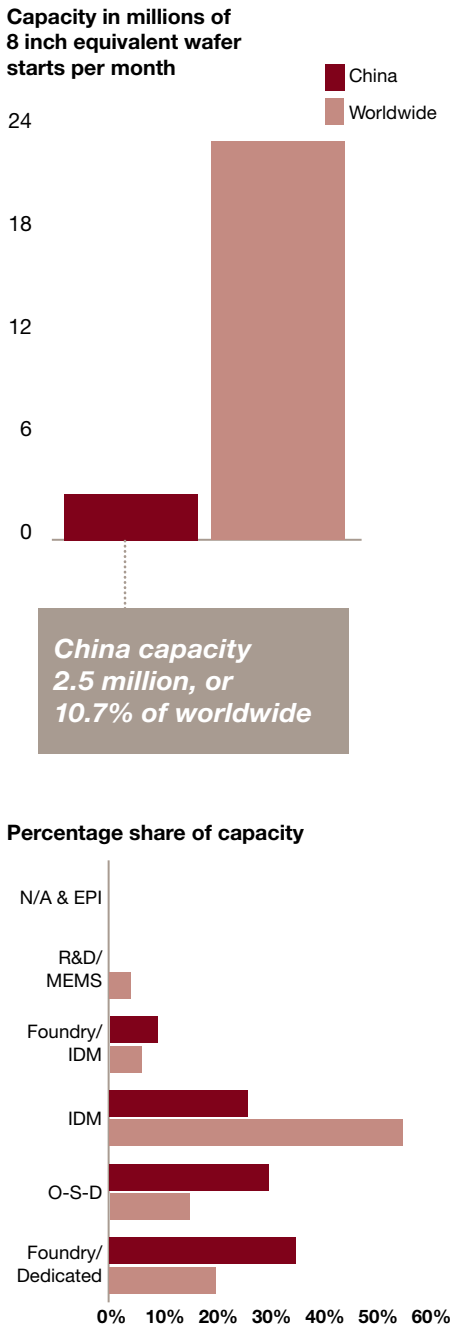
During the past year, China's share of current wafer fab capacity allocated to IC IDMs decreased slightly to 27% and remained notably less than the worldwide average of 56%. This is because there were no IC IDM fabs among the 29 fabs that started production in China last year. Three of China's 29 fabs that started production last year were foundry fabs, accounting for 56%; 25 were discrete LED fabs, accounting for 36%; and 1 was a discrete power fab, accounting for 6% of the added capacity. As a result, China continues to only represent about 5% of worldwide IC IDM capacity.

This low IC IDM participation was probably the result of the timing of the opening of China's semiconductor sector to foreign investments, an election to mimic the Taiwan foundry model and the very weak market position of China's state-owned semiconductor companies. It has been continued by China's focus on developing the IC design (fabless) and O-S-D (LED) sectors. Currently, there are only five foreign IDMs with some form of invested IC wafer fabrication capacity in China: Hynix, Intel, NEC, (Hua Hong & SG JVs), NXP (JaLin JVs) and TI.

China's IC IDM participation will improve somewhat after 2014 when Samsung's planned Xi'an NAND Flash fab starts production. At that time, China's share of wafer fab capacity allocated to IC IDM's will have been increased to 34% and its share of worldwide IC IDM capacity to 9%.

One hundred and six (106) of China's 163 current wafer fabs are dedicated to the O-S-D sector. Over the last three years, China's share of wafer fab capacity allocated to the O-S-D sector has been increasing. O-S-D capacity now represents 27% of China's current wafer fab capabilities versus 14% of worldwide. It could increase to 30% for China versus 15% worldwide by 2015 if all of the committed wafer fabs

Figure 24: Current and committed wafer fab capacity comparison, China and Worldwide, 2011



Source: World Fab Watch 2012

under construction are completed and ramped to full production. China currently accounts for 20% of worldwide O-S-D capacity and that could increase to 22% by 2015 if all of the committed wafer fabs under construction are completed and ramped to full production. Currently there are fourteen foreign companies with some form of invested O-S-D wafer fabrication capacity in China. Seven are from Taiwan: Arima Optoelectronics, Epistar, FOREPI, Liteon, SemiLEDs, United LED and Walsin Lihwa. Three are from the US: Cree, InvenLux and Littlefuse. Two are from Korea: AUK and KEC. There is one each from Europe, NXP and Japan, Toppan.

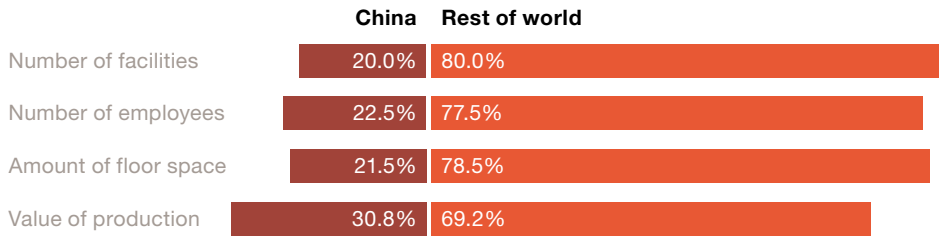
As of the May 2012 WFW, there were nine additional new wafer fabs announced and/or planned (i.e. WFW probability of ≥0.45 <0.80) for China that had not been committed to start construction. This is five less than a year ago, but it represents 32% of the 28 new fabs announced and/or planned worldwide, and 29% of their equivalent capacity. The number of such announced and/or planned but not committed new fabs worldwide has decreased noticeably from 54 in 2008 and 41 in 2011. 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 ≤2% realized in 2003 to 12.4% by 2017. This is a notable increase in share from the plans of a year ago, and certainly from those of three or four years ago before the economic downturn, and could have moderate impact on the semiconductor industry.

While it remains uncertain whether all of these announced and/or planned wafer fab plants will be realized, they do provide a measure of the evolving prospects for China's semiconductors. Four of the nine are planned to be 12-inch (300mm) fabs which would account for 86% of the potential additional capacity. One of those four is the Samsung Xi'an NAND Flash fab, which accounts for more than 50% of the potential additional capacity. The other three are foundry fabs. There are two planned 8-inch (200mm) analog/ mixed signal fabs that account for 12% of the potential additional capacity. The remaining three are two 2-inch (50mm) and one 4-inch (100mm) specialty LED fabs. Chinese companies are responsible for five of these possible additional wafer fabs. Taiwan-based UMC (He Jian Technology) and Tekcore are involved with two, Korea-based Samsung and US-based TI are each related to one of these nine total possible additional wafer fabs.

Packaging, assembly and test production

Packaging assembly and test is probably the largest of China's semiconductor manufacturing activities when measured in terms of value added, production revenue, employees and manufacturing floor space. This relationship is often missed because a significant portion of China's semiconductor packaging assembly and test (SPA&T) production is allocated to the O-S-D industry sector which is reported as a separate sector from the IC packaging and testing industry sector. China has continued to gain share of worldwide SPA&T production value during 2011. The composite weighted average of China's 2011 SPA&T production is estimated to be about 31% of worldwide, up from 28% in 2010. The value of China's IC SPA&T production increased by 5% to represent more than 19% of the value of worldwide production in 2011, which is about

Figure 25: Comparison of China and all remaining countries' SPA&T resources, 2011



Source: Gartner Dataquest 2012

During 2011, China's reported IC packaging, assembly and test (ICPA&T) quarterly revenues fluctuated dramatically, from a record peak in 2Q, to a 50% drop in 3Q, followed by a 40% recovery in 4Q. As a result, China's ICPA&T revenues, measured in local RMB currency, reported a 2.8% drop in 2011. However, because of the continuing strengthening of the RMB exchange rate, China did report a modest 1.8% increase in 2011 ICPA&T revenues (measured in dollars) to US$9.5bn. China achieved these slightly higher dollar revenues with about the same share of worldwide SPA&T facilities, but a greater share of manufacturing floor space than a year ago.

2011 saw the first expansion of overall semiconductor packaging, assembly and test (SPA&T) facilities in three years. Although 10 existing worldwide SPA&T facilities were closed in 2011, several new facilities started production, for a net increase of 12 facilities and an overall manufacturing floor space increase of more than 6%. As part of these changes, China reported the closure of four old facilities, the addition of six existing but previously not reported facilities, the opening of one new facility, and the expansion of several others. As of the end of 2011, China had 109 SPA&T facilities, an increase from 106 in 2010. These 109 facilities represent 20% of the total number of worldwide SPA&T facilities, more than 21% of worldwide SPA&T manufacturing floor space and 23% of reported worldwide. SPA&T employees. During 2011, China's a one percent more share than it represented in 2009 and 2010. At the same time, the value of China's O-S-D SPA&T production increased by 18%, to represent more than 33% of the value of worldwide production value in 2011, an increase from the 32% it had represented in 2008 and 2009. As a result, the composite of China's SPA&T production value increased by a weighted average of almost 11% in 2011 to represent slightly less than 31% of the worldwide production value. China's increased share of worldwide SPA&T value during 2011 was the result of its increased share of worldwide production volume, especially for LED devices, with a corresponding increase in O-S-D ASPs (average selling prices). China's SPA&T production continues to be more heavily utilized for higher volume and lower cost packages and products, with their ICs accounting for 37% of worldwide unit volume and their OSDs for 70%, compared to 34% of ICs and 66% of OSDs in 2010.

China's increased share of worldwide SPA&T value during 2011 was the result of its increased share of worldwide production volume, especially for LED devices, with a corresponding increase in O-S-D ASPs (average selling prices).

SPA&T manufacturing floor space, a proxy for potential manufacturing capacity, increased to represent almost 21.5% of worldwide SPA&T manufacturing floor space. As a result, China's SPA&T facilities continued to rank first in share of worldwide SPA&T manufacturing floor space for the third year, ahead of Taiwan (at slightly more than 20%) and Japan (at 17%). China's SPA&T facilities also ranked first in number of reported employees, with 23% of worldwide SPA&T employees at the end of 2011, ahead of Taiwan (17%) and Malaysia (16%).

While China has the second largest share of planned future SPA&T facilities, it may have the largest share of planned capacity. Of the 19 SPA&T facilities planned worldwide at the end of 2011, five were located in China compared to eight in Taiwan and one each in six other countries. These five represent 26% of the planned facilities and more than 85% of the announced planned manufacturing space.

At the end of 2011, 74 SATS facilities were in production in China. Of these, 40 were owned by Chinese companies and 34 by foreign companies. Each of the seven largest and eight of the ten largest multinational (MNC) SATS companies had one or more facilities in China.

In terms of the ownership of China's SPA&T facilities, very little has changed since 2008. Of the total 109 SPA&T existing facilities, about 37% belong to Chinese companies and 14% belong to companies from Taiwan (12%) and Hong Kong (2%). The largest foreign ownership is that of companies from the US which represent more than 18% of China's SPA&T facilities.

Semiconductor assembly and test services (SATS)

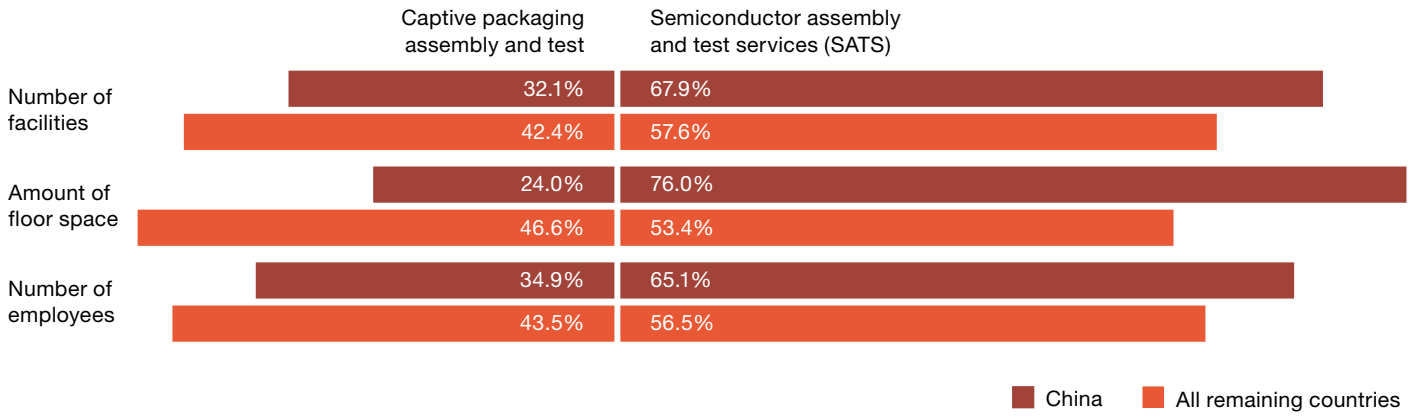
Figure 26 shows China's share of its SPA&T capacity that is dedicated to SATS (semiconductor assembly and test services) suppliers compared with all other regions. China's share remains somewhat more concentrated than that of other regions. SATS resources represent 76% of China's SPA&T manufacturing floor space and 65% of China's SPA&T facilities versus 53% and 56% for all other countries.

At the end of 2011, 74 SATS facilities were in production in China. Of these, 40 were owned by Chinese companies and 34 by foreign companies. Each of the seven largest and eight of the ten largest multinational (MNC) SATS companies had one or more facilities in China. The eight included ASE, Amkor Technology, SPIL, STATS ChipPac, Powerchip Technology, UTAC, ChipMOS Technologies and STS Semiconductor. These eight largest MNC SATS companies with facilities in China averaged 22% of their manufacturing capacity in China. By comparison, all 35 of the IDM SPA&T facilities in production in China by the end of 2011 were owned by foreign companies that had an average of 18.5% of their SPA&T capacity in China.

China's SATS facilities represent a mix of three-way competition between wholly foreign-funded enterprises, China-foreign joint ventures and domestic-funded enterprises. Among these, the SATS plants set up by large international enterprises have been leading in terms of scale and technology. However, a trio of domestic-funded SATS enterprises consisting of Xinchao Group, Nantong Fujitsu Microelectronics Co., Ltd. and Tian Shui Hua Tian Microelectronics

(TSHT) are growing rapidly. Two of these Chinese SATS companies are ranked among the 20 largest SATS suppliers on a worldwide basis. They are Xinchao Group (including JCET and JCAP) and Nantong Fujitsu (NFME). During 2011, the Xinchao Group improved its worldwide market share from 2.3% in 2010 to 2.5% and its ranking from ninth in 2010 to eighth in 2011. However, NFME's market share decreased in 2011 from 1.1% in 2010 to 1.0% and, as a result, its ranking dropped from eighteenth in 2010 to nineteenth in 2011. All three companies have grown to reach a sizeable scale in the leadframe segment of the SATS sector, while moving into the substrate and more advanced package sectors, and they have the ability to make an impact on pricing. They also have received support from China's National Major Science and Technology Project 02 (Project 02), which enabled JCET to successfully move into advanced QFN (quad flat no-lead) package technology and BGA (ball grid array) package technology. Similarly, Project 02 support enabled NFME to successfully move into BGA, QFN and copper wire bonding package technologies. TSHT also receives government support through the Chinese government's Western Area Development Plan. All three are expected to develop even more advanced, smaller volume package technologies, including FC (flip chip), SIP (system in package) and TSV (through silicon via), with JCET recently announcing its patented MIS (Molded Interconnected System) packaging technology. TSHT, the former state-owned Yonghong Appliance Factory, is the core of Tian Shui Huatian Technology Company, and is the main IC packaging enterprise in China's western region. All three of these leading Chinese SATS companies expanded their capacity during 2011 and are now working to expand their share of markets outside of China.

Figure 26: Comparison of China and all remaining countries' SATS share of SPA&T capacity, 2011



Source: Gartner Dataquest 2012

The top Chinese semiconductor manufacturers

Table 10 lists the 50 largest semiconductor manufacturers in China—those reporting 2011 revenues of US$131m or more. This revenue threshold is up from both the US$89m threshold of the top 50 in our 2011 report and the US$72m threshold of the top 50 in our 2009 report. It is the highest revenue threshold to date and reflects the growing number and size of Chinese semiconductor manufacturers, especially the new LED manufacturers.

This table includes seven groups that each own one or more companies in the various sectors of China's semiconductor industry. These groups are listed in place of listing their several individual

Seven groups with their most significant companies

	Revenue (US$m)			
	2008	2009	2010	2011
China Resources Microelectronics (Holdings) Ltd.	654	540	669	631
Wuxi China Resources Microelectronics Co., Ltd. (CR Micro) (former CSMC)—Foundry	154	144	179	169
Wuxi China Resources Huajing Microelectronics Co., Ltd.—Discrete	134	121	168	134
Wuxi China Resources Semico Microelectronics Co., Ltd.—IC Design	90	84	91	124
XINCHAO Group	574	618	944	969
JECT (Jinangsu Changjiang Electronics Technology Co., Ltd.)—Pkg & Test	342	347	531	611
Nantong Huada Microelectronics Group Co., Ltd.	383	398	618	620
Nantong Fujitsu Microelectronics—Pkg & Test	173	181	254	251
Shanghai Huahong (Group) Co., Ltd.	431	411	555	671
HHNEC (Shanghai Huahong NEC Electronics Co., Ltd.)—Foundry	279	240	367	389
Shanghai Hongli Semiconductor Co., Ltd.—Foundry				231
Shanghai Huahong IC Co., Ltd.—IC Design	88	95	96	94
China Huada Integrated Circuits Design (Group) Co., Ltd. (CIDC Group)	208	211	215	246
CEC Huada Electronics Design Co., Ltd.—IC Design	84	68	74	127
Beijing Huada Zhaibao Electronic Systems Co., Ltd.—IC Design	32	40	55	75
Nationz Technologies Inc.	31	68	104	88
Shenzhen National Holdings Co., Ltd.			163	173
Shenzhen State Microelectronics—IC Design	27	46	61	73
Shenzhen Sunmoon Microelectronics—IC design				
Shenzhen State Micro Technology—OEM				
Hangzhou Silan Microelectronics Co., Ltd.	134	140	224	206
Hangzhou Silan Microelectronics Co., Ltd.—Design	76	86	96	
Hangzhou Silan Integrated Circuit Co., Ltd.—IDM/Foundry	56	59	96	
Hangzhou Silan Azure Co., Ltd.—LED	26	29	58	53

companies in order to better reflect their increasing significance in the growth and concentration of China's semiconductor industry. This approach also corresponds to the CSIA's (China Semiconductor Industry Association's) current reporting practice, which reports the group totals (by industry sector) in response to requests by the groups.

In addition to these seven groups, Table 10 also lists a single entry for each of several multinational semiconductor companies that have more than one manufacturing facility in China though each facility may be legally organized as a separate company in China. These companies include ASE, Diodes, Freescale, Hynex, Intel, Renesas, RFMD, Samsung Electronics, ST Microelectronics and UTAC. Each listing reflects the combined revenues of all the companies' manufacturing facilities in China.

There are eight companies that are new to the top 50 Chinese semiconductor manufacturers list for 2011. They are all LED companies and reflect the growing awareness and importance of this segment of China's semiconductor industry. Several should have been included in prior years' top 50 lists, but were overlooked due to a lack of information about China's LED segment. These newly included eight LED companies (listed by 2011 ranking) are described below.

Hiuizhou Cree was established in 2007 by Cree's acquisition of Hong Kong-based Cotco and expanded in 2010 to become Cree Huizhou Solid State Lighting Col, Ltd. by the acquisition and development of a 529,000 square foot factory to become Cree's first overseas chip manufacturing facility. Cree is a US multinational manufacturer of semiconductor materials and devices; and a market-leading innovator of lighting-class LEDs, LED lighting and semiconductor solutions for wireless and power applications. Cree's product families include LED fixtures and bulbs, blue and green LED chips, high-brightness LEDs, lighting-class power LEDs, power-switching devices and radio-frequency/wireless devices.

The combined 2011 revenues reported for these top 50 enterprises is US$26.2bn, representing 60% of China's total 2011 semiconductor industry revenue of US$44bn.

The combined 2011 revenues reported for these top 50 enterprises is US$26.2bn, representing 60% of China's total 2011 semiconductor industry revenue of US$44bn. Although this year's top 50 share is up from 55% in 2010, China's industry still remains less concentrated than the worldwide industry in which the top 50 companies represent 82% and the top 16 companies 60% of the total market. The combined reported RMB revenues of the continuing 46 of these top 50 manufacturers increased more than 15% in 2011, while their dollar revenues increased by 21%, which in both cases was significantly (6%) more than the increase reported by China's total semiconductor industry.

Liteon Technology (China) Co., Ltd. manufactures LED related products. It reports to be one of the best optoelectronics manufacturers globally, mainly producing a series of SMT LEDs, infrared communication modules, digital tube, infrared LEDs, phototransistors, optocouplers, photoelectric switches, etc. Its plant in Tianjin was founded in 1995. The

Table 10: Major Chinese semiconductor manufacturers (including groups) in 2011

Name of company	Rank 2010	Rank 2011	Sales revenue (RMB: 100M) 2010	2011	Change	Sector	Sales revenue (US$m) 2010	2011	Change
Intel Products/Semiconductor (Chengdu/Dalian) Co., Ltd.	1	1	186.13	308.00	65.5%	◆■	2,750	4,765	73.3%
SK Hynix Semiconductor (China) (incl Hytech JV)	2	2	137.86	158.51	15.0%	■◆	2,037	2,452	20.4%
SMIC (Semiconductor Manufacturing International Corp.)	3	3	104.60	85.00	-18.7%	⬣	1,545	1,315	-14.9%
Freescale Semiconductor (China) & (Suzhou) Co.,Ltd.	4	4	85.29	72.32	-15.2%	◆●	1,260	1,119	-11.2%
HiSilicon Technologies Co., Ltd.	8	5	44.16	66.68	51.0%	●	652	1,032	58.1%
XINCHAO Group	6	6	63.89	62.61	-2.0%	◆	944	969	2.6%
Samsung Electronics (Suzhou Semi & LED) Co.,Ltd.	18	7	21.86	54.19	147.9%	◆▼	323	838	159.6%
Spreadtrum Communications Inc.	15	8	25.00	44.20	76.8%	●	369	684	85.1%
Shanghai Huahong (Group) Company Ltd.	12	9	37.56	43.40	15.5%	●⬣	555	671	21.0%
ASE Assembly & Test (Shanghai+ Khunshan+WeiHai +Suzhou) Ltd.	14	10	40.00	42.46	6.1%	◆	591	657	11.2%
China Resources Microelectronics (Holdings) Ltd.	7	11	45.30	40.80	-9.9%	■▲●	669	631	-5.7%
Hiuizhou Cree		12		40.80		▼		631	
Nantong Huada Microelectronics Group Co., Ltd.	9	13	41.81	40.08	-4.1%	◆	618	620	0.4%
Shanghai Panasonic Semiconductor Co., Ltd.	11	14	39.43	38.89	-1.4%	◆	583	602	3.3%
Renesas Semiconductor (Beijing & Suzhou) Co.,Ltd.	10	15	39.83	41.58	4.4%	◆●	588	643	9.3%
RFMD (RF Micro Devices (Beijing) Co.,Ltd.	5	16	64.37	37.84	-41.2%	◆	951	585	-38.4%
Diodes Shanghai Co., Ltd.	19	17	20.98	28.53	36.0%	◆	310	441	42.4%
ST Microelectronics	13	18	32.15	27.20	-15.4%	◆	475	421	-11.4%
Leshan Radio Co., Ltd. (incl ON Semiconductor JV)	16	19	24.19	26.88	11.1%	▲	357	416	16.4%
TSMC (Shanghai) Co., Ltd.	21	20	17.80	23.66	32.9%	⬣	263	366	39.2%
Liteon Technology		21		23.60		▼		365	
Infineon Technologies (Wuxi) Co.,Ltd.	17	22	22.20	21.93	-1.2%	◆	328	339	3.4%
STATS ChipPAC	20	23	20.63	20.53	-0.5%	◆	305	318	4.2%
Everlight Electronics		24		19.90		▲	0	308	
RDA Microelectronics, Inc.	31	25	12.81	18.19	42.0%	●	189	281	48.7%
Tianshui Huatian Microelectronics Co., Ltd.	29	26	14.60	17.75	21.6%	◆	216	275	27.3%
Sanan Optoelectronics		27	8.63	17.47	102.4%	▼	128	270	112.0%
No. 50 Research Institute of China Electronics Technology Group Corporation	42	28	8.11	16.24	100.2%	■	120	251	109.7%
China Huada Integrated Circuits Design (Group) Co., Ltd.	30	29	14.58	15.90	9.1%	●	215	246	14.2%
Shanghai Grace Semiconductor Manufacturing Co., Ltd	23	30	15.46	14.90	-3.6%	⬣	228	231	0.9%
UTAC Dongguan, Shanghai, Chengdu, Ltd.	37	31	13.94	14.54	4.3%	◆	206	225	9.2%
HeJian Technology (Suzhou) Co., Ltd.	25	32	15.06	13.45	-10.7%	⬣	223	208	-6.5%
Amkor Technology China Ltd.	27	33	14.84	13.40	-9.7%	◆	219	207	-5.4%
SanDisk Semiconductor (Shanghai) Co. Ltd.	28	34	12.12	13.31	9.8%	◆	179	206	15.0%
Hangzhou Silan Microelectronics Co., Ltd.	24	35	15.16	13.30	-12.3%	●▲⬣	224	206	-8.1%
TianJin ZhongHuan Semiconductor Co., Ltd.	26	36	7.66	12.62	64.8%	▲	113	195	72.5%
Galaxycore Inc.	40	37	8.40	11.68	39.0%	●	124	181	45.6%
Fairchild Semiconductor (Suzhou) Co., Ltd.	38	38	8.88	11.41	28.5%	◆	131	176	34.5%

● IC Design ▲ Discrete ▼ Discrete (LED) ⬣ Foundry ■ IDM ◆ Packaging & Testing

Name of company	Rank 2010	Rank 2011	Sales revenue (RMB: 100M) 2010	2011	Change	Sector	Sales revenue (US$m) 2010	2011	Change
Shenzhen National Holdings Co., Ltd.	34	39	11.00	11.20	1.8%	●	163	173	6.6%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	35	40	10.00	11.00	10.0%	●	148	170	15.2%
Shougang NEC Electronics	32	41	12.10	10.61	-12.3%	⬣	179	164	-8.2%
MLS Co., Ltd.		42	7.82	10.40	33.0%	▼	116	161	39.3%
Siliconware Technology (Suzhou) Co., Ltd.	39	43	8.70	10.35	19.0%	◆	129	160	24.6%
Foshan Nationstar Optoelectronics		44	8.15	10.20	25.2%	▼	120	158	31.1%
Unity Opto Technology		45		9.90		▼		153	
ASMC (Advanced Semiconductor Manufacturing Co., Ltd.)	36	46	9.56	9.50	-0.6%	⬣	141	147	4.1%
Leadcore Technology Co., Ltd.	45	47	7.90	9.44	19.5%	●	117	146	25.1%
Elec-Tech International Co., Ltd.		48	3.70	9.10	145.9%	▼	55	141	157.6%
BCD Semiconductor Manufacturing Ltd.	43	49	8.04	8.81	9.6%	■	119	136	14.7%
Jilin Sino Microelectronics Co., Ltd.	33	50	11.00	8.45	-23.2%	▲	163	131	-19.6%

Source: CCID, CSIA, GDQ, PwC 2009–2012

first phase of construction of its East China Regional Headquarters in Wujin, Changzhou, was completed in July 2009. By September, there were 14 production lines running and that figure was projected to increase to 40 production lines by the end of the year, with a monthly capacity of six million units and 4,500 employees in the plant. In China, the Lite-On Group has established comprehensive sales and production facilities with more than 50,000 employees in 30 locations.

Everlight Electronics Co., Ltd. was founded in 1983 in Taipei, Taiwan. Playing a critical role in the formation of the global LED industry, the company is rapidly ascending to become a leading supplier due to its dedication to certification, R&D, production, quality, marketing and global customer service. It has had manufacturing facilities in China since 1991, with its current facilities located in Suzhou; Guangzhou. It is ISO 9001, ISO 14001 and TS 16949 qualified.

San'an Optoelectronics is China's earliest-established and largest production base for full-color ultra-high brightness LED epitaxial products and chips with optimum quality. It was established in 2000 and produced its first epitaxial wafers in 2002. San'an is mainly engaged in the R&D, production and marketing of full-color, ultra-high brightness LED epitaxial products, chips, compound solar cells and high-power concentrating solar products with internationally leading performance. It is ISO 9001, ISO 14001 and ISO/TS 16949 qualified.

MLS Co., Ltd. is one of the leading companies of LED encapsulation and LED application products. It was founded in 1997 and, after years of development, has grown to more than 180,000 square meters of manufacturing floor space and 10,000 employees. MLS's main products include LED displays, LED lights, DIP LEDs, SMT LEDs and high-power LEDs. It is ISO 9001 and 14001 certified.

Foshan Nationstar Optoelectronics Co., Ltd. was registered in 1970 and is a high-tech enterprise of the Nation Torch Project that specializes in manufacturing semiconductor optoelectronics devices and LED applied products. It has 64,000 square

meters of manufacturing floor space and more than 1500 employees. Its products include LEDs (LAMP LED, CHIP LED, TOP LED, POWER LED), LED traffic signals, LED display modules, LED backlights, LED light modules, LED displays, LED illuminating and decoration serial products, IR. LED, IR. Receiver, numeric displays, clock displays, photodiodes, LED clusters, LED linear light sources and tuners. It is ISO 9001, ISO 14001, ISO/TS 16949, and OHSAS18001 certified.

Unity Opto Technology has designed and manufactured optoelectronics since 1993. Today, Unity is a world leader in high bright visible LEDs, IR devices and various lighting modules. It was founded in Taiwan in 1991 and started mass production in its China factory in 1997. It now has facilities in Suzhou, Jiangsu; Long Gang District, Shenzhen and Yangzhou, China.

Correspondingly, there were eight 2010 top 50 manufacturers that did not qualify for the 2011 list, although three of the companies reported revenue increases.

Elec-Tech International Co., Ltd was established in May 1996 and is mainly engaged in the design, production and sale of optoelectronics, SDA (Small Home Appliances), mini & particular motor and wind power equipment. Its main optoelectronics products include LED epitaxy, LED chips, encapsulation, LED lighting and LED displays. Elec-Tech Group has 12 subsidiary companies located in Zhuhai, Zhongshan, Shenzhen, Yangzhou, Wuhu and Dalian with 20,000 employees, including more than 2000 professional and technical personnel. It is ISO 9001 certified and has 145 patented technologies and designs, including 14 patents certificated in foreign countries. In 2008, Elec-Tech Group made a large investment in the optoelectronics industry, including 100 sets of MOCVD devices, with the target of becoming a leading company in the field in two to three years, and to be the most competitive optoelectronics manufacturer in the world.

Correspondingly, there were eight 2010 top 50 manufacturers that did not qualify for the 2011 list, although three of the companies reported revenue increases. However, each of the other five reported double-digit declines in dollar revenues, so that these combined eight companies experienced a 20% decline in 2011 dollar revenue. They are described below in 2010 ranking order.

Chipmore Technology Corporation, Ltd. is a China-based LCD driver IC backend service provider, providing gold bumping, tape carrier packaging (TCP), chip on film (COF) and chip on glass (COG) packaging services whose majority shareholder is Chipbond Technology Corporation, Taiwan's leading packaging service provider for LCD driver ICs, providing turkey solution for driver IC design houses. It reported a 117% decline in dollar revenue for 2011, due to the Japan earthquake and Euro Crisis putting the terminal consumer market in recession, and thus failed to meet the qualifying revenue threshold.

Suzhou Good-Ark Electronics Co., Ltd. is a discrete device manufacturer which had returned to the top 50 list in 2010 with a reported 72% two-year increase in dollar revenue, but fell short of the higher 2011 qualifying criteria with a reported 5% increase in dollar revenue for 2011.

EEMS (Suzhou) Co., Ltd. and **EEMS Tech** are WFE (Wholly Foreign Invested) subsidiaries of the EMS Group, the result of the spin-off of an operating unit of Texas Instruments, that is a worldwide leader in assembling and testing semiconductor modules and DRAM memories. They were the first independent A/T service provider in China to offer state-of-the-art 300mm assembly line packaging with a wide array of packages in single and stacked die configuration. However, they reported a 17% decrease in dollar revenue for 2011 and thus failed to meet the qualifying threshold.

GEM Electronics (Shanghai) Co., Ltd. is a WFE subsidiary of GEM Services, a multinational semiconductor assembly and test contractor that specializes in small-outline surface-mount packages for power management semiconductors. GEM operates two factories in Jiading (Shanghai) and Hefei, China, producing high volume, high quality, industry standard and advanced discrete, IC and MCM packages. Although reporting a 15% increase in 2011 dollar revenues, it just missed the qualifying criteria for the 2011 list.

Nationz Technologies Inc. Founded in 2000 as a part of China's Project 909 (national efforts to encourage domestic IC design and production capabilities), Nationz Technologies is the leading provider of security processors and RF chips in China. However, the company reported a 15% decline in dollar revenues for 2011 and failed to meet the qualifying threshold.

Measured in dollars, China's reported semiconductor industry revenues increased by 14.4% or US$5.5bn during 2011.

Beijing Vimicro Co., Ltd. was founded in 1999 by several entrepreneurs from Silicon Valley, with initial support from the Ministry of Information Industry (MII). Dedicated to the development of advanced mixed-signal multimedia chips, Vimicro successfully launched a series of products into domestic and international markets, targeting fast-growing application fields such as computer, broadband, mobile communication and consumer electronics and, in 2005, became the first fabless chip company from China listed on NASDAQ. However, it has reported declining revenues for four of the last five years, including in 2011, and failed to meet the qualifying threshold.

Datang Microelectronics Technology Co., Ltd. (DMT), formerly the IC center of China Academy of Telecommunications Technology (CATTIC), is a subsidiary of Datang Telecom Technology Co., Ltd (DTT). As one of the larger IC design companies in China, DMT has led the stable and rapid growth of the mobile communications smart card market in China for the last several years. Although reporting a 7% increase in 2011 dollar revenues, the company missed the higher qualifying criteria for the 2011 list.

China Wafer Level CSP Ltd. (Suzhou) (WLCSP) is a leading global supplier of wafer-level chip size packaging and test services for the growing digital imaging and small form factor such as RFID markets. It reported a 42% decline in dollar revenue for 2011, due to the Japan earthquake and Euro Crisis putting the terminal consumer market in recession, and thus failed to meet the qualifying threshold.

Measured in dollars, China's reported semiconductor industry revenues increased by 14.4% or US$5.5bn during 2011. The 46 continuing companies in China's top 50 manufacturers accounted for a bit more than one-third of that increase. Five of China's top 50 semiconductor manufacturers each reported revenue growth of more than US$250m in 2011: Intel, Hynix, HiSilicon Technologies, Samsung Electronics and Spreadtrum. Another five manufacturers reported 2011 revenue increases of between US$100 and US$250m and a further six manufacturers between US$50 and US$100m. Similarly, four of China's top 50 semiconductor manufacturers each reported revenue growth of more than 100% in 2011: Samsung Electronics, San'an Optoelectronics, No. 50 Research Institute and Leadcore Technology. An additional four manufacturers reported 2011 revenue growth of between 50% and 100% and a further 12 manufacturers between the industry average 14.4% and 50%. In total, 20 of China's top 50 semiconductor manufacturers reported above industry average revenue growth for 2011.

However, 10 of China's top 50 semiconductor manufacturers reported revenue decreases in 2011, an increase from the two reporting revenue decreases in 2010.

Supporting growth and measuring progress

The 12th FYP makes it clear that China, which became the world's number two economy in 2010, has now turned its attention from the pursuit of national strength to increasing it people's prosperity.

China's 12th Five-Year Plan

During 2011 China entered its 12th Five-Year Plan (12th FYP) period which will run from 2011 through 2015. Our 2011 Update report included a meaningful discussion of China's Five-Year plans and their broad implications for the semiconductor industry in China. We noted: "While China's 12th FYP is more a message to the Party ranks and government hierarchies parameterizing "acceptable" behaviors than a roadmap for a new development path for China, it will result in new implementation policies affecting the semiconductor industry."

The earlier 10th and 11th FYPs (2001–2010) had furthered policies pursuing stable economic growth with the objectives of doubling GDP between 2001 and 2010 and increasing the capacity for independent innovation, enabling firms to obtain key technologies by investing in R&D and raising their level of competitiveness with major international players. Those FYPs shared a focus on opening up markets, increasing the capacity for innovation and adjusting the industrial structure to achieve sustained economic growth, with the 10th FYP including phased targets to increase individual disposable income and the 11th FYP concentrated on building a market-led, private business-centered economy. That policy direction also became the main motivation for promoting the growth of China's semiconductor industry. The semiconductor industry was listed as one of the key industries for state support and was therefore the beneficiary of a series of tax incentive policies and measures. China notably exceeded the overall economic targets set during the 10th and 11th FYP periods and China's semiconductor industry revenues grew more than seven times from US$5bn (42 billion RMB) in 2001 to US$38bn (258 billion RMB) in 2010.

The 12th FYP makes it clear that China, which became the world's number two economy in 2010, has now turned its attention from the pursuit of national strength to increasing it people's prosperity. The 12th FYP marks a shift away from output growth to R&D and overall industry competitiveness. It places far greater emphasis on internal markets and domestic demand than prior FYPs and includes industrial structures that emphasize added value.

China reoriented its semiconductor industry policy for the 12th FYP period, moving away from the pursuit of growth in capacity and output value in favor of pursuing advanced technology and advanced R&D capabilities. China's policy objectives for the semiconductor industry during the 12th FYP period are to transform the industry into one of the world's major development and manufacturing bases with sufficient capacity to satisfy the majority of China's domestic demand, while achieving a certain level of exports, and to reduce the manufacturing process technology gap between China and the advanced nations. The focus is on fostering a group of globally competitive semiconductor firms that will develop into global leaders in terms of both technological standards and market share.

The 12th FYP continues to support the industry through methods including expanding domestic demand, promoting the seven new major strategic industries, funding and subsidies for major scientific and technological projects and intensifying reform of the financial markets. The semiconductor industry is included as one link in the infrastructure for next-generation IT, one of the seven strategic industries, and thereby relevant semiconductor businesses will be able to receive government support providing they meet the proper criteria. The policy goals set for the seven new strategic industries is to reach 8% of China's GDP by 2015, increasing to 15% by 2020. To achieve these targets, the policy also calls for three government-supported measures in the form of tax incentives, strengthening government purchasing of relevant businesses and establishing specialized funds for the development of strategic new industries; and four measures aimed at private funding, specifically encouraging financial organizations to expand credit support for businesses, promoting the development of venture capital and equity investment funds, encouraging the development of capital markets, such as securities and bonds, and diversifying financing channels for businesses.

Earlier, the Executive Meeting of the State Council of January 12, 2011 determined that the software and semiconductor industries were new national strategic industries, as well as vital foundations for the creation of an information-based society in China, confirming that these two industries retain an important strategic role in

China's policy objectives for the semiconductor industry during the 12th FYP period are to transform the industry into one of the world's major development and manufacturing bases with sufficient capacity to satisfy the majority of China's domestic demand, while achieving a certain level of exports, and to reduce the manufacturing process technology gap between China and the advanced nations.

China's national and economic development outside the framework of the seven new industries. The State Council has therefore set out six policies to further the development of the software and semiconductor industries:

- Strengthen investment and financing
- Expand support for research and development
- Implement tax incentives
- Improve measures to retain and attract talent
- Strictly enforce IP rights protection
- Strengthen regulations to maintain market order

State Council Rule 4 (2011) issued January 28, 2011, is the most important core government policy for the development of China's semiconductor industry during the 12th FYP period. China's Ministry of Industry and Information Technology (MIIT) 12th Five-Year Plan for the Development of the Integrated Circuits Industry incorporates Rule 4 (2011) as "implementation of new policies creates more favorable environment for the development of industry". Rule 4 (2011) sets out specific encouragement and incentive measures for China-based semiconductor firms. It could be regarded as the successor to the policies of State Council Rule 18 (2000), which applied during the 10th and 11th FYP periods. Of all the policies set out in Rule 4 (2011), those relating to tax incentives will be the most critical to the development of China's semiconductor industry and most likely to affect investment in the industry. They incorporate many changes from the prior policies of Rule 18 (2000). Rule 4 rescinds VAT incentives for semiconductor firms in favor of business tax breaks; expands corporate income tax incentives and extends them to include semiconductor package, testing, specialist materials and equipment firms. More importantly, instituting tax incentives through corporate income tax means that only profit-making businesses are eligible to benefit from them.

The shift in tax incentives seen in Rule 4 reflect the 12th FYP policy objectives of improving R&D and technology to create companies with strong technical capabilities and large output, a change in direction from 10th and 11th FYPs, which were focused on expanding capacity and output when companies were subsidized through tax incentives whether they were profitable or not. Henceforth, semiconductor firms will receive the support of national tax incentives as long as they are capable of making a profit, while firms that are unable to do so will find that the resulting lack of government support will make it difficult to invest in advanced process R&D or capacity expansion. This change in tax incentive policy may increase the degree of concentration in China's semiconductor industry and indirectly work to accelerate mergers between companies in the industry.

Of all the policies set out in Rule 4 (2011), those relating to tax incentives will be the most critical to the development of China's semiconductor industry and most likely to affect investment in the industry.

Besides tax incentives, Rule 4 (2011) also includes several investment fundraising-related measures as another focal point for the development of the semiconductor industry. There are three government investment and policy measures that provide for government subsidies for semiconductor firms on the basis of individual projects

As part of the 12th FYP cycle, China's Ministry of Industry and Information Technology (MIIT) published the 12th Five-Year Plan for the Development of the Integrated Circuits Industry in December of 2011. The following is a synopsis of the most significant main tasks, priorities, policy measures and goals that were included in the MIIT plan.

Main tasks

- *Concentrate force, pool resources and make breakthroughs in R&D for a number of generic critical technologies and key products.*
- *Grow key enterprises to be strong and exemplary and boost enterprises' core competitiveness.*
- *Build a large industrial chain for chips and end products.*

Priorities

- *Concentrate efforts to develop the chip design sector and develop high-performance IC products.*
- *Expand the size of the chip manufacturing sector and enhance advanced and specialty process capabilities.*
- *Boost levels and capabilities of the packaging and testing sectors and develop advanced packaging and testing technologies and products.*
- *Make breakthroughs in R&D of critical special equipment, instruments and materials.*

Policy measures

- *Improve the efficiency in use of financial funds and expand channels of investment and financing.*
- *Push forward integration of resources and foster large enterprises with international competitiveness.*
- *Continue to expand opening to the outside world and improve the benefit of utilizing foreign investments*
- *Strengthen talent training efforts and introduce overseas talents vigorously.*

Goals

- *By the end of the 12th FYP period, the size of the industry will more than double. IC output will exceed 150 billion units. Sales will reach RMB 330 billion (US$51bn).The industry will achieve an average 18% growth, accounting for about 15% of the world IC market, and satisfying nearly 30% of domestic market demand (infers China's consumption market will be 50% of the worldwide market).*
- *Cultivate 5–10 key design firms posting sales of over RMB 2 billion each (US$310M), with one firm ranking among the global top ten design firms (infers sales =/> US$2.6bn).*
- *Cultivate 1–2 key chip manufacturers posting sales of over RMB 20 billion (US$3.1bn).*
- *Cultivate 2–3 packaging & testing firms posting sales of over RMB 7 billion (US$1.1bn) ranking among the global top ten in the packaging & testing sector.*
- *Advanced design capabilities will reach 22nm, with over 30% of IC products developed by Chinese enterprises independently used in domestic key end-product applications.*
- *Large-scale chip manufacturing production technology will improve to 12-inch, 32nm process, gradually introducing 29nm process and mastering such specialty process technology as advanced high voltage, MEMS and SiGe processes.*

As another part of the 12th FYP cycle, China's Ministry of Science and Technology (MOST) first released the 12th Five-Year Plan for Semiconductor Lighting Development in May 2012. Previously the Chinese government had in 2011 instituted a subsidy of 8–10 million RMB on each metal-organic chemical vapor deposition (MOCVD) system installed in China.

MOCVD systems are responsible for the chemical processes used to manufacture LED chips and these subsidies had led to a massive increase of MOCVD installations and resulting concerns about excess LED capacity, artificially low costs, unfair competition and less concentration on the efficiency of the LED produced.

This five-year plan for the LED industry was largely constructed to combat those concerns, while also facilitating continued growth for the LED industry. The following is a synopsis of the most significant goals that were included in the MOST plan.

Research and development

- *A number of specific goals related to improving the efficiency of LED light bulbs and the effectiveness of the production process.*
- *Increasing LED efficiency and luminosity to impact their effectiveness for use in general lighting.*

Economy

- *Raise the value of the domestic LED industry to RMB 500 billion (US$77bn) by 2015.*
- *Place China among the world's top three global LED producers.*
- *Create two million new jobs through increased LED production.*
- *Form 20 to 30 new LED enterprises in China in the next five years.*

Environment

- *Grow LED lighting to account for over 30% of China's lighting market by 2015.*
- *Thereby saving 100 bn kWh of energy, using 35 million less tons of coal and reducing harmful emissions by 100 million tons.*

Planning and implementation

- *Subsidies, introducing talented workers, international cooperation, support for research and development.*
- *Focus subsidies on several of the bigger firms with the most potential for technological advances.*

that will be selective in nature. Only firms that have advanced technology and R&D capabilities should expect to receive subsidies from the government. There are five measures aimed at fundraising on the financial market that provide for diversifying financing channels that will enable the government to reduce its share of investment in companies by increasing the proportion of funds coming from private financing. The long-term goal of these measures extends from the 11th FYP objective to "create a semiconductor industry centered on private companies and possessing independently developed advanced technologies".

For the 12th FYP period, China has launched ambitious policy initiatives to develop large domestic markets for specific next-generation technologies including mobile Internet, information-based household appliances, 3C (computing, communications and consumer applications) convergence, Internet of Things, smart grid and cloud computing. The government is also increasingly emphasizing indigenous innovation in government procurement programs in order to reduce dependence on foreign technology.

Among others, the following tax incentives clearly reflect the Chinese government's focus on encouraging technological developments:

1. Reduced Corporate Income Tax (CIT) of 15% for new/high technology enterprises (NHTEs)
2. Super deduction of R&D expenses for CIT purposes
3. CIT exemption or reduction on income derived from qualified technology transfer
4. Different CIT holidays for software and integrated circuit (IC) enterprises
5. Immediate Levy, Immediate Refund VAT policy for software and IC enterprises

The effects of the relevant policies of China's 12th FYP are projected to move China's IC manufacturing industry in two key directions: increasing and accelerating concentration within the sector and increasing the number of firms funded from security market listings. The following trends are expected to result from those effects:

- Increasing number of Chinese IC design firms
- Increasing concentration of China's IC design industry
- Increasing IC design share of China's semiconductor industry revenue
- Mobile communications becoming central to China's semiconductor industry technology and development
- Advanced packaging becoming a key technology for next-generation IT within the 12th FYP's seven new strategic industries
- Increasing concentration of China's IC wafer foundry industry
- Increasing Chinese government stake in IC wafer foundry firms
- Decreasing IC wafer foundry share of China's semiconductor industry revenue

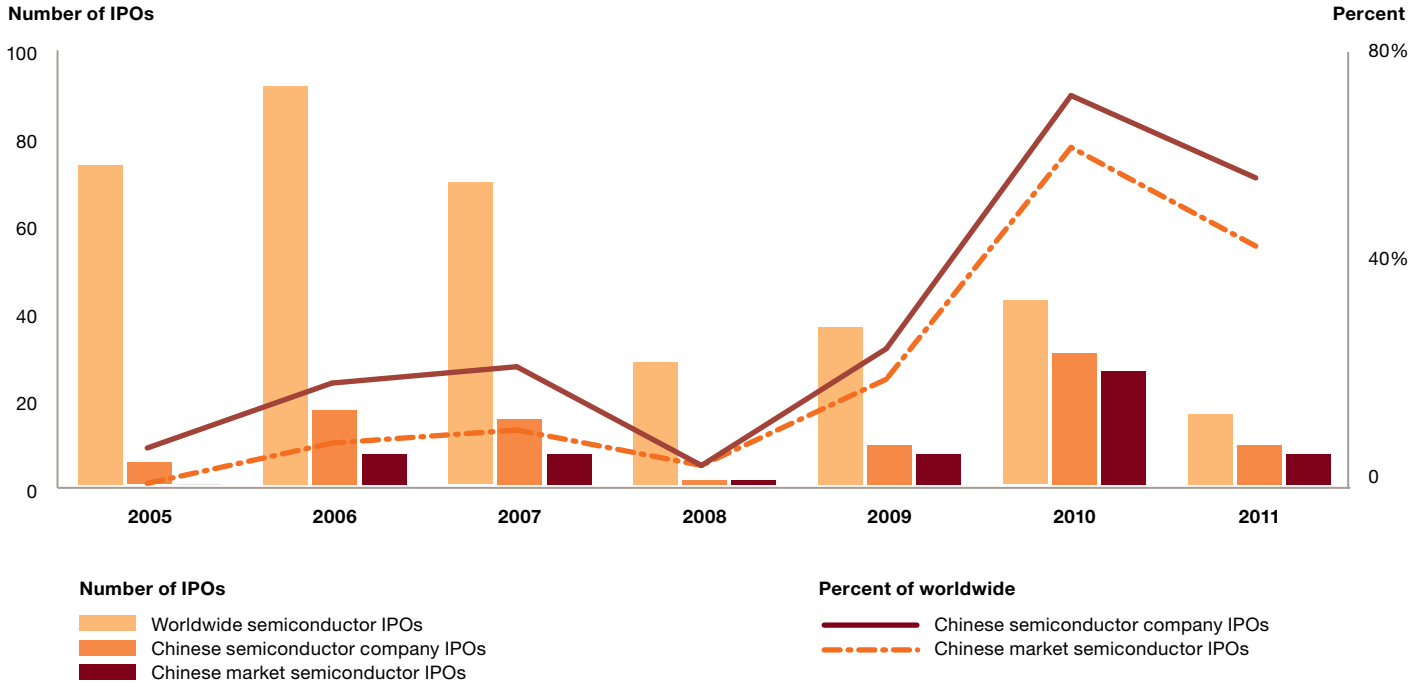
For the 12th FYP period, China has launched ambitious policy initiatives to develop large domestic markets for specific next-generation technologies including mobile Internet, information-based household appliances, 3C convergence, Internet of Things, smart grid and cloud computing.

We have not found a similar 12th FYP published for China's discrete semiconductor industry. We have been informed that "neither MIIT nor any other government department has published a 12th FYP for China's Discrete semiconductor industry because officers and scholars consider this industry as 'low tech'" and it "may be kind of included in the IC 12th 5YP". This seems to reflect an unusual oversight or significant change in strategic priority. China's discrete semiconductor industry (without LEDs) had 2011 revenues of more than US$13bn, accounting for 30% of China's semiconductor industry, 58% of the worldwide discrete market, and has grown at a greater than 20% CAGR for the last 10 years. It accounted for 20% of China's current wafer fab capacity, and for more than 40% of China's semiconductor packaging, assembly and testing facilities and capacity. It also has greater indigenous Chinese participation than China's IC industry. How can it be ignored?

Financial markets and IPO funding

As noted in our recent Updates, China has emerged as a significant source of new companies and financial funding for semiconductor start-ups. According to Thomson Financial, Chinese domiciled companies represented the second largest group of semiconductor IPOs (initial public offerings) completed between 2005 and 2011. During that period, there were a total of 355 semiconductor IPOs completed worldwide, including 54 by South Korean, 86 by Chinese and 100 by Taiwanese companies. The 86 Chinese IPOs represented 24% of the number of IPOs and 44% of the proceeds realized. Prior to 2009, less than half of the Chinese IPOs were completed in China's financial markets. That trend changed very significantly in 2009 with the opening of the Shenzhen Stock Exchange Small and Medium Enterprise (SME) Board and ChiNext Board

Figure 27: China versus worldwide semiconductor IPOs, 2005–2011



Source: Thomson Financial 2010, 2011, 2012

to facilitate fund-raising of small and medium-sized enterprises and growing venture enterprises. The ChiNext was launched in 2009 and offered a new capital platform for Chinese enterprises engaged in innovation and other growing industries. Even while other worldwide capital markets were still suffering from the global recession and contracting economy, there was a significant rebound of IPO activities in the Greater China capital markets in the second half of 2009. As a result, nine Chinese companies represented 25% of the 36 semiconductor IPOs completed in 2009 and 77% of the funds raised. Seven of those nine IPOs were completed in China's financial markets, accounting for 75% of all worldwide semiconductor IPO funding raised during 2009.

That momentum continued through 2010, with 30 Chinese companies completing more than 70% of the 42 semiconductor IPOs completed in 2010, 26 in China's financial markets and raising 72% of the funding realized. During 2010, China overshadowed the US and the rest of the world with the most technology IPOs—67 Chinese companies completed their IPOs in 2010 as compared to 19 US companies. China's Shenzhen exchange displaced NASDAQ as the leading exchange for technology IPOs, accounting for 49% (53) of total deals and 40% (US$7.2bn) of total funds raised. China's strong showing in 2010 was largely a result of its focus on technology manufacturing and the semiconductor and alternative energy subsectors.

While China's predominance in technology IPOs continued through 2011, the global market for technology IPOs declined by 21% that year. The high volatility of capital markets during the summer of 2011—due primarily to the US debt and the Euro Zone

Table 11: China versus worldwide semiconductor IPOs 2005–3Q 2012

	2005	2006	2007	2008	2009	2010	2011	1Q/12	2Q/12	3Q/12	Total 7.75 yrs 2005–3Q 12
Worldwide semiconductor IPOs											
Number of IPOs	73	91	69	28	36	42	16	10	4	1	355
Proceeds (US$m)	3,006.0	3,663.8	3,727.1	678.2	1,693.6	6,202.6	2,645.0	997.0	372.0	77.0	21616.3
Chinese semiconductor company IPOs											
Number of IPOs	5	17	15	1	9	30	9	7	3	0	86
% of worldwide	6.8%	18.7%	21.7%	3.6%	25.0%	71.4%	56.3%	70.0%	75.0%	0.0%	24.2%
Proceeds (US$m)	407.9	743.6	1,109.5	37.4	1,308.9	4,493.6	1,323.0	738.0	282.0	0.0	9423.9
% of worldwide	13.6%	20.3%	29.8%	5.5%	77.3%	72.4%	50.0%	74.0%	75.8%	0.0%	43.6%
Chinese market semiconductor IPOs											
Number of IPOs	0	7	7	1	7	26	7	7	3	0	55
% of worldwide	0.0%	7.7%	10.1%	3.6%	19.4%	61.9%	43.8%	70.0%	75.0%	0.0%	15.5%
Proceeds (US$m)	0.0	285.5	351.6	37.4	1,270.7	4,062.5	1,220.0	738.0	282.0	0.0	7227.7
US$ of worldwide	0.0%	7.8%	9.4%	5.5%	75.0%	65.5%	46.1%	74.0%	75.8%	0.0%	33.4%

Chinese semiconductor company = domiciled in China

Source: Thomson Reuters 2010-2012

crises—significantly slowed the IPO market during the third quarter of 2011. China continued its dominance over the worldwide technology IPO market, with the most technology IPOs—49 Chinese technology companies completed their IPOs in 2011 out of a worldwide total of 86. However, the proceeds raised by Chinese technology companies declined by almost 30% in 2011 compared to 2010, while US companies posted healthy growth in 2011. Although China's Shenzhen exchange remained as one of the top exchanges for technology IPOs, with a total of 35 IPOs (41%) in 2011, it declined in number of deals year over year by 30% and in proceeds raised by over 50% compared to 2010. China's strong showing continued to be largely a result of its focus on both the internet software & services and the semiconductor and alternative energy subsectors. Correspondingly, nine Chinese companies represented more than 56% of the 16 semiconductor IPOs completed in 2011, seven in China's financial markets, raising 50% of the funding realized.

After demonstrating healthy growth in 1Q12, with 30 IPOs, the worldwide technology IPO market declined sharply to 20 IPOs in 2Q12 and 11 IPOs in 3Q12, reflecting a lack of liquidity in the market and dampening investor confidence due to ongoing global economic uncertainty. China's Shenzhen exchange, which had led the IPO market with the highest number of technology IPOs in each of the last several quarters, dropped to second place with only four IPOs in 3Q12 yielding proceeds that declined 77% quarter over quarter, reflecting decelerating economic growth. Similarly, worldwide semiconductor IPOs have dropped from ten in 1Q12 to four in 2Q12 and to only one in 3Q12. Although China had no semiconductor IPOs in 3Q12, they have had a total of ten semiconductor IPOs in 1Q and 2Q 2012, representing 67% of the worldwide total and 70% of the worldwide funding through 3Q12. At this point, it remains to be seen whether the technology IPO market will pick up steam in 4Q12 or wait until the beginning of 2013, at which time uncertainties in global leadership will be settled.

Over the longer term, it is still expected that China's 12th FYP's policies aimed at promoting different levels of market stock transfer mechanisms will help businesses to expand financial channels in phases as their operations grow in scale and provide more reasons to entice Chinese semiconductor companies to list themselves on the markets.

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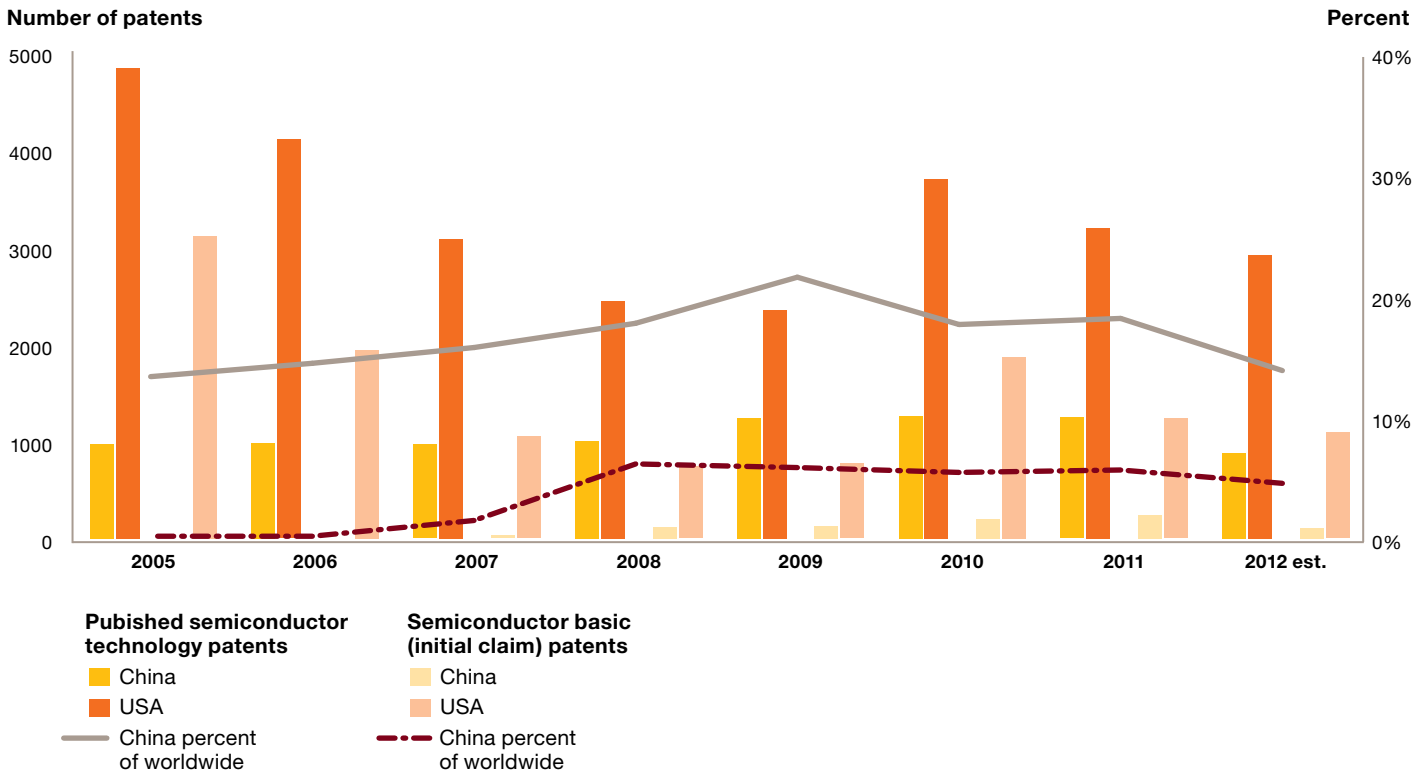
Semiconductor patents

Intellectual property and intellectual property protection is an area of specific focus of China's 12th FYP. One of the policy objectives of the 12th FYP for the semiconductor industry is to foster a group of semiconductor firms that will develop into global leaders in terms of both technology standards and market share. Rule 4 (2011) aims to create globally competitive Chinese semiconductor firms through seven policy areas that include one for IP protection policy. Further, Rule 4 (2011) reinforces the focus of the Chinese government to promote and support

the software and IC industries. In addition to continuing existing tax incentives, including the reduced corporate income tax (CIT) rate of 15% for new/high technology enterprises (NHTEs), Rule 4 (2011) covers many new incentives including providing intellectual property protection.

One of the criteria for qualification for NHTE status is core proprietary intellectual property (IP) rights. Since 2005, China's share of worldwide semiconductor technology-focused patents published by year has increased from 13.4% in 2005 to a peak of 21.6% in 2009 before declining to 17.7% and 18.2% in 2010 and 2011 according to data from the Derwent Worldwide Patent Database. China's share declined further during the first three quarters of 2012, and is forecast to be about 14% for all of 2012. Perhaps more important is the gradual growth of China's share in the first instance of a semiconductor patents publication, referred to as the patent basic statistic. China, which had no semiconductor patents basic issued in 2005 or 2006, started to grow its share of worldwide semiconductor patents basic issued from 1.3% in 2007 to 9.1% in 2011. China is forecast to account for about 5% of semiconductor patents basic issued during 2012. This means that for the past five years, from 2007 through 2011, 5% to 6% of patents on semiconductor inventions have been first issued in China.

Figure 28: China versus worldwide semiconductor patents 2005–2012



Source: Derwent 2012

Further research with the Derwent patent data base reveals that most of these Chinese semiconductor patents are being issued to companies registered outside of China. The top 10 assignees, accounting for 20% of the 1,244 semiconductor technology patents issued in China in 2011, were the following multinational companies:

Company	# of patents
TSMC (Taiwan Semiconductor Manufacturing Co. Ltd.)	42
SEME (Semiconductor Energy Laboratory Co. , Ltd.)	38
SMSU (Samsung Electronics Co., Ltd.)	30
IBMC (IBM Corp.)	21
SHAF (Sharp KK)	21
DUPO (Du Pont De Nemours & Co..)	18
PHIG (Konink Philips Electronics NV)	18
SONY (Sony Corp.)	16
SUMO (Sumitomo Chemical Co., Ltd.)	16
GLDS (LG Innotek Co., Ltd.)	15

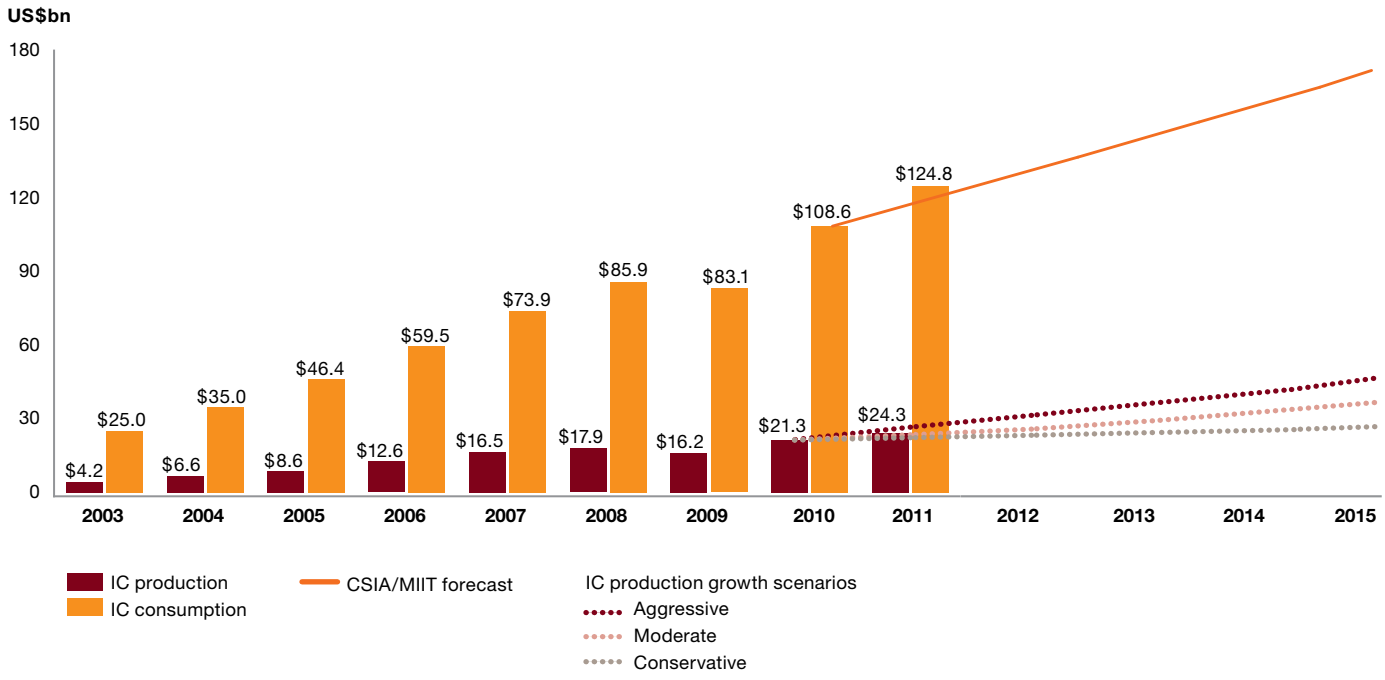
Likewise, the top 10 assignees accounting for 24% of the 238 semiconductor patents basic (initial claim) issued in China in 2011 were the following mix of multinational and Chinese companies and institutions:

Company	# of patents
Au Optoelectronics Corp. (Taiwan)	9
SMIC (Semiconductor Mfg. International Corp.)	9
Enraytek Optoelectronics Co. Ltd.	6
Suzhou Instutite Nano-Tech & Nano-Bionics	6
ITRI (Ind. Technology Res. Inst. Taiwan)	5
University Fudan	5
University Peking	5
University Qinghua	5
Chinese Acad Sci Changchun Inst. Appl. Che.	4
University Nankai	4

Production growth scenarios

PricewaterhouseCoopers' original 2004 report examined the effects that different levels of growth in the Chinese integrated circuit (IC) semiconductor industry would have on the greater industry. We used scenarios that spanned 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 period. Finally, we predicted the likelihood that China would achieve each level of growth—conservative, moderate or aggressive—based upon then-current market conditions.

Figure 29: China's integrated circuit production and consumption—12th FYP scenarios compared with actual



Source: CSIA CCID, World Fab Watch, PricewaterhouseCoopers

Since then, China has progressed through the last of its 10th and all of its 11th Five-Year Plan periods and the semiconductor industry progressed through more than one complete business cycle. Therefore, based upon those experiences and in conjunction with the start of China's 12th Five-Year Plan, PwC revised the basic assumptions and business models used for our further scenario analysis of China's IC industry.

The following is a concise summary of our analysis of new conservative, moderate and aggressive growth scenarios developed last year for China's IC industry over the period from 2010 through 2015. The conservative and moderate scenarios reflect China's capabilities, while the aggressive scenario reflects its stated intentions. The analysis covers the assumptions, business models, developments, investments and milestones for each scenario over that five-year period.

The conservative and moderate scenarios reflect China's capabilities, while the aggressive scenario reflects its stated intentions.

The moderate scenario is based upon an assumption that China completes and fully equips all the current and the two committed IC wafer fab facilities that were under construction at the end of 2010, ramps them into full production and operates them at a utilization and effectiveness that averages 90% of their WFW nominal capacity and earns an average of US$600 per 8-inch equivalent wafer. It further assumes that all of the resulting wafer fab output is packaged and tested in China in addition to the 2010 volume of imported wafer devices packaged and tested in China, and that China's IC design sector grows at a moderately higher CAGR than the IC manufacturing sector to meet the MIIT's 12th FYP objectives. This scenario would result in China's IC industry growing at a slightly greater than 10% rate for the five years to reach revenue of US$34.5bn by 2015. It would require an additional investment of about US$13bn. We believe this to be the most likely scenario, with about a 65% probability. If, under this scenario, the IC design sector were to grow at CCID's current forecasted 22.4% CAGR, China's IC industry revenue would have increased at more than a 14% CAGR to reach US$42bn by 2015 for about the same capital investment.

The conservative scenario is based upon an assumption that China completes and equips all current and the two committed IC wafer fab facilities that were under construction at the end of 2010 to 70% of their nominal capacity, ramps them into full production and operates them at a utilization and effectiveness that averages 90% of their 70% WFW nominal capacity. We estimate that 70% of nominal capacity is slightly more than the highest level equipped in China to date. That level was first achieved in 2009 and again in 2011 after declining to about 61% in 2010. This scenario further assumes that all of the resulting wafer fab output is packaged and tested in China in addition to the 2010 volume of imported wafer devices packaged and tested in China, and that China's IC design sector grows at a 10% CAGR, slightly higher than China's forecast GDP growth. This scenario would result in China's IC industry growing at a CAGR slightly less than 5%, to reach revenue of US$27bn by 2015. It would require an additional investment of about US$4bn. The results of this scenario are almost the same as would result if China's IC manufacturing sector grew at the same rate as the worldwide GDP, while China's IC design sector grew at the same rate as China's GDP. We believe this to be a less likely scenario, with about a 20% probability.

The aggressive scenario assumes that China's IC industry and IC design sector achieves the goals established by MIIT as part of China's 12th FYP. Those goals were for China's IC industry to achieve revenue of 330 billion RMB and China's IC design sector to have revenues of 70 billion RMB by 2015. Based upon the same fully equipped, 90% utilization and effectiveness, and US$600 per wafer assumptions as used for the moderate scenario, these goals would require the addition of more than 10 large wafer fab facilities—as large as the Intel Fab 68 in Dalian—and an additional investment of US$21bn beyond the US$13bn required for the moderate scenario, for a total investment of almost US$34bn. Achievement of the MIIT 12th FYP goals will require China's IC industry to achieve an 18% CAGR for the five-year period through 2015. We believe this to be the least likely scenario, with a 15% probability.

The IC consumption scenario is based upon China MIIT's 12th Five-Year Plan expectations for 2015 coordinated with the CSIA forecast for the earlier years.

Performance versus scenarios

China's 2011 IC consumption market grew much faster than the worldwide market, but, when measured in local RMB currency, missed the CSIA forecast by almost 3%. However that miss was more than offset by a 5% gain in the RBM exchange rate, so that when measured in US dollars, China's actual 2011 IC consumption market grew almost 2% faster than the CSIA/MIIT scenario forecast.

China's 2011 IC production dollar revenues exceeded the moderate scenario by more than 3%, but with significant diversity among its three sectors. IC design, which grew at 36%, far exceeded even the aggressive scenario, while IC manufacturing, which grew at 14%, exceeded the moderate but not the aggressive scenario and IC packaging and testing, which grew by less than 2%, missed even the conservative scenario as well as the moderate and aggressive scenarios.

During 2011, almost US$8bn of additional fixed-asset investments were made in China's semiconductor industry. Of that amount, almost US$5bn was invested in the integrated circuit (IC) industry, which will clearly support the moderate scenario, but could be short of the aggressive scenario requirements.

At this point, we continue to believe that the moderate scenario remains the most likely, with at least a 65% probability of realization. There could be a upside if the new Samsung NAND wafer fab is completed and ramped into full and integrated production faster than projected as it could positively affect both production volume and technology-driven wafer average selling price.

Appendix: Interpreting Chinese semiconductor statistics

Despite increasing international interest and press coverage, market reports and statistics of the Chinese semiconductor industry remain difficult to obtain and are 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 policymakers.

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 (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.

When CCID and CSIA measure and report on the China semiconductor market their data is based upon a consumption model. They obtain data on the output of China's electronic systems production, calculate the consumption of semiconductors in every electronic product, value at current local average selling prices and add all the consumption to get the total of China's semiconductor market size. CCID collects output data on electronic system production from MIIT, National Bureau of Statistics of China, General Administration of Customs of PRC, CCID's Electronic Products Research Database and other industry associations and organizations. This is different from

World Semiconductor Trade Statistics (WSTS) and most international market research firms that measure and report on the worldwide semiconductor market based upon a sales model. The WSTS and others compile their reports of semiconductor market size based upon sales revenue data collected from semiconductor companies. As a consequence, there can be significant differences and discrepancies resulting from the use of these two different models and from major inventory changes, dislocated purchasing, WSTS' lack of Chinese company participants and the difference between worldwide and Chinese local average selling prices.

In addition, CCID has had to make some noticeable adjustments to their historical Product Structure of China Semiconductor Market database to bring it into complete and inclusive alignment with the international definitions of the O-S-D (optoelectronics, sensors and discretes) market segments. It appears that prior to 2008 CCID included LEDs in their discrete market segment and only reported photo electrics rather than all optoelectronic devices.

Further, both the CCID and CSIA compile and analyze their industry or production data based upon a 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.

IC 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. Nor does it include LED plants since the CSIA continues to include LEDs within the discrete industry. 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 semiconductor companies in China. It also includes LEDs, which CSIA continues to include within the discrete industry sector. 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 CCID and CSIA compile their industry 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 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.

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 two and a quarter times as large as they would be if reported using the conventional consigned wafer/die (cost less die) basis. This reporting difference is significant and could account for an overstatement of 15% in the 2011 revenues for the IC packaging and testing sector, 6% in the 2011 revenues of the Chinese IC industry and 3% in the 2011 revenues of the overall Chinese semiconductor industry.

Probable double-counting: A hypothetical example

Because of the way 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 using 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$650 per wafer, for a total of US$650,000
- Average consigns the 1,000 wafers to XSE for assembly and testing in plastic QFN or PLCC packages with 1,250 net die per wafer and a die-free package cost of US$0.17 per package, for a total of 1,250,000 finished units and value of US$212,500
- Average sells the 1,250,000 finished units to Solectron for an average selling price of US$1.00 per device, for a total of US$1,250,000

Using CCID and CSIA reporting practices, these transactions would be classified and recorded as shown in the table below.

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 70% and the unit shipments by 100% relative to conventional industry standards.

Revenue comparison

	Pieces	**Revenue**	**Revenue** using industry standards
IC manufacturing sector	1,000	$650,000	Not reported
Packaging and testing sector	1,250,000	$212,500	Not reported
IC design sector	1,250,000	$1,250,000	$1,250,000
Total	2,501,000	$2,122,500	$1,250,000

(All revenues are in US$)

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 62-162 RMB, depending on the scenario:

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

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

162 RMB 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.

For the future, increasing international interest and visibility may encourage 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 is a member of the World Semiconductor Council (WSC). They should be encouraged to participate in the World Semiconductor Trade Statistics (WSTS) 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 each company, and because Chinese policymakers themselves rely upon these results. Although the tendency is for these sources to overstate the size of the industry, understatement is far less likely. 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.

About this report

This 2012 update assesses the current status of the semiconductor industry in China and how it has changed since our previous update. As with our earlier reports on this issue, we conducted a second-order analysis for the 2012 update. To accomplish this, first we reconciled data from different, incomplete and often contradictory reports from various sources. These sources included industry associations and third-party research firms located in Asia as well as the West. Then we analyzed the reconciled data with an eye towards 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 parts of the value chain.

This year we found reasonable consistency between various sources about the direction and relative magnitude of the changes in China's semiconductor market and industry. However, there was still a noticeable variation between sources about the absolute size of the market.

For our top level reporting of China's semiconductor consumption market and production industry, we have continued to utilize the values reported by CCID Consulting. They provide the most comprehensive detail about China's market and industry available and their reports are the principal source of information for Chinese policymakers.

For some of our detail analysis we have utilized alternate sources that provide information not available elsewhere and have wherever possible tried to base each such analysis on a homogeneous data source. For example, for our analysis of China compared with the worldwide semiconductor market by application and by device and of semiconductor consumption versus purchases China versus worldwide by region, we have continued to utilize the values reported by Gartner (GDQ) as they provide database information for each of those markets that is reconciled on a worldwide basis. As a consequence, the value of some metrics may vary slightly between different figures and tables. We acknowledge these differences and trust that they will not divert our readers' attention from the value and significance of the findings of the report.

Our intent with using this method remains to construct a more comprehensive, meaningful and yet quantitatively based picture of the industry than is otherwise available. Using this method, we surfaced additional findings and considered the ramifications of those findings for multinational semiconductor industry companies. Then, finally, based on this newly developed information, we formulated a current set of recommendations for industry companies.

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

There are a couple of further points we should note on the data sources. The metrics we use or developed 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 although several other market research firms have reported 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. 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.

Because the report relies on a number of data sources, we were unable to complete it in full until late in the fourth quarter of 2012. Therefore, in an effort to publish as much of this vital information as possible in a more timely fashion, we chose to release the report in a tiered fashion. The first chapter was released in July and the final sixth chapter in early December 2012. During that time we made one significant addendum to Chapter 1 and a revision to Chapter 3, both of which have been incorporated into this final complete report.

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PwC can help

If your company is facing challenges doing business in China, or you just want to have a deeper discussion about what's happening in the market and how we can help, please reach out to one of the technology industry leaders listed below.

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About PwC's Technology Institute

The Technology Institute is PwC's global research network that studies the business of technology and the technology of business with the purpose of creating thought leadership that offers both fact-based analysis and experience-based perspectives. Technology Institute insights and viewpoints originate from active collaboration between our professionals across the globe and their first-hand experiences working in and with the technology industry. For more information please contact Raman Chitkara, Global Technology Industry Leader.

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