

# *Continuing to grow* China's impact on the semiconductor industry 2013 update

*Technology Institute*

*September 2013*



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*Welcome*



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In 2004 when we published our first report on China's impact on the semiconductor industry, we were responding to our clients' concerns that China's growing semiconductor production would cause over-capacity in the global market. Interestingly, it is not China's semiconductor production but its semiconductor consumption which is creating headlines. In 2012, China's semiconductor consumption market grew by 8.7% (in contrast to a 3% decline in the worldwide market) to reach a new record of 52.5% of the global market. Continued strong global demand for smartphones and tablets—the lion's share of which are produced in China—is the main reason for this continued strong growth in semiconductor consumption and will continue to be a factor in the coming years.

And while the growth of semiconductor production in China has fallen short of some expectations, it is nevertheless remarkable, rising 9.6% in 2012 and representing about 12% of the worldwide industry. But the production/consumption gap continues to grow and represents an unparalleled market opportunity. What remains to be seen, however, is whether local Chinese companies will rise to meet this challenge.

Broadening our look, we see economic ties strengthening between China and Taiwan which serves to expand and deepen the impact of Greater China on the global semiconductor industry. Further, as the industry continues to grow and mature, we see China increasing its share of basic patents and becoming a leading territory for semiconductor IPOs.

Taking all these factors into consideration, we expect that China will continue to strengthen its position in the global semiconductor industry for the foreseeable future. If you would like to start a conversation on how these findings might impact your business, please contact me or any of the technology industry leaders listed at the back of this report.

Sincerely,

A handwritten signature in black ink that reads "Raman". The signature is written in a cursive style and is positioned above a short horizontal line.

## *A note to our readers*

In the last few years, as the semiconductor industry has matured, we have re-evaluated both the timing and depth of this report to ensure that we continue to provide needed information in a timely manner.

For this year's 2013 Update we have elected to release a condensed report in order to provide the information earlier than past reports. Included are versions of 26 of the 29 figures and 10 of the 12 tables found in the 2012 Update. All of the considerations described in the 2012 Update appendix, "Interpreting Chinese semiconductor statistics" and the "About this report" section remain relevant to this condensed 2013 Update and should be referred to as needed.

If you are interested in reading any of the previously issued full reports, please visit our website at [www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon).

# Executive summary

*The major global semiconductor companies continue to dominate the Chinese market.*

Both China's semiconductor consumption market and semiconductor industry production grew to new record levels in 2012 despite a 3% decrease in the worldwide semiconductor market. China's semiconductor consumption market grew by 8.7% in 2012 to reach a new record of 52.5% of the global market while China's semiconductor industry revenues grew by 9.6% to reach a record US\$56.3bn. For the first time ever during 2012 China consumed more than half of all the worldwide semiconductor market. However, almost three percentage points of these increases were the result of China's continuing revaluation of the Renminbi (RMB).

This exceptional performance was the result of the continuing transfer of both worldwide electronic equipment production and worldwide semiconductor production to China. China's share of worldwide electronic equipment production increased by two percentage points to 34.2% in 2012 and is forecast to increase to more than 40% by 2017. By our most conservative comparison, China's share of worldwide semiconductor production value increased by three percentage points to at least 12% in 2012 and is forecast to increase to at least 14% by 2015. As a result, China

has continued to increase its share of the worldwide semiconductor market by displacing all other regions.

The major global semiconductor companies continue to dominate the Chinese market. There have only been fourteen different companies that have been among the top ten suppliers to the Chinese market over the past ten years. Seven companies have been among the top ten suppliers for every year from 2003 through 2012: Intel, Samsung, TI, Toshiba, SK Hynix, ST and Freescale. It still appears that there was no Chinese company within the top 30 suppliers to the Chinese semiconductor market in 2012. Even if the largest Chinese semiconductor company sold all of their 2012 output within China, they would have not been within the top 30 suppliers to that market.

There is now some uncertainty about the size and growth history of China's semiconductor industry. In October 2012, the China Semiconductor Industry Association (CSIA) revised China's IC industry statistics for 2011 and 2012 year-to-date without providing a detailed explanation for the cause and its implications. We believe the reported ten-year compound annual growth rate (CAGR) for China's semiconductor

*China's exceptional relative semiconductor performance in 2011 and 2012 remains evident in the continuing growth of China's IC consumption/production gap.*

industry from 2002 through 2012 remains reasonably representative. However, there are unanswered questions associated with the yearly and quarterly growth rates for the most recent half decade.

The overall performance of China's IC industry (the sum of IC design, IC wafer manufacturing and IC packaging and testing) was the major contributor to China's overall semiconductor industry growth in 2012. IC industry revenues, measured in dollars, increased by 14.5% to more than US\$34bn in 2012. All three sectors of China's IC industry reported double-digit growth in 2012. Benefiting from the continuing growth of the smartphone and IC card markets, China's IC design sector grew by 21% in 2012 to a new record US\$9.9bn. Despite a 4% decline in the worldwide IC market, China's IC wafer manufacturing and IC packaging and testing sectors benefited from a continuing industry shift to outsourced manufacturing and grew by 13% and 11% in 2012 to new records of US\$9.4bn and US\$15bn respectively.

China's optoelectronics-sensor-discrete (O-S-D) industry sector performance in 2012 was only slightly better than worldwide O-S-D performance. Measured in dollars, China's O-S-D industry sector revenues increased 2.7% in 2012 to a record US\$22bn while the value of China's O-S-D exports exceeded the value of O-S-D imports for the third year in a row.

China's exceptional relative semiconductor performance in 2011 and 2012 remains evident in the continuing growth of China's IC consumption/production gap. This gap is the difference between IC consumption and IC industry revenues. Based upon the revised CSIA industry statistics, this annual gap had grown by US\$7.6bn, (8.7%) in 2011 to reach US\$94.9bn and grew a further US\$6.7bn (7.1%) in 2012 to reach a

record US\$101.6bn. It is our belief that this gap continues to contribute to the Chinese government's ongoing initiatives to increase indigenous IC production.

Measured in dollars, during the last two years China's IC industry has reported a 26.9% CAGR; China's IC design sector reported a 35.5% CAGR; IC packaging and testing 27.1% and IC manufacturing 19.2%. Based upon these revised results, it is now deemed reasonably possible, if not completely probable, that China's IC industry may follow the aggressive production growth scenario through 2015 and achieve the Ministry of Industry and Information Technology (MIIT) revenue goals of over US\$52bn, with IC design over US\$11bn. During the same two-year period, more than US\$10bn of additional fixed-asset investments were made in China's IC industry. While this investment rate clearly supports the moderate scenario, it may have to be increased to support the aggressive scenario requirements.

Greater Chinese companies have grown to dominate worldwide semiconductor outsourced manufacturing. With the merger of China's HHNEC and GSMC (Grace Semiconductor Manufacturing Company) six of the top 10 (4 Taiwanese + 2 Chinese) and 10 of the top 20 (6 Taiwanese + 4 Chinese) pure-play semiconductor wafer foundries were Greater China companies, accounting for 77% of total worldwide 2012 foundry revenues. By the end of 2012, Greater China also represented 71% of worldwide pure-play wafer foundry capacity. Similarly, six of the top 10 (4 Taiwanese + 2 Chinese) and 11 of the top 20 (8 Taiwanese + 3 Chinese) SATS (semiconductor assembly and test services) suppliers were Greater China companies, accounting for 48% of total worldwide 2012 SATS revenue. Also by the end of 2012 Greater China represented 64% of worldwide SATS manufacturing floor space capacity.



# Overview of China's impact in 2013

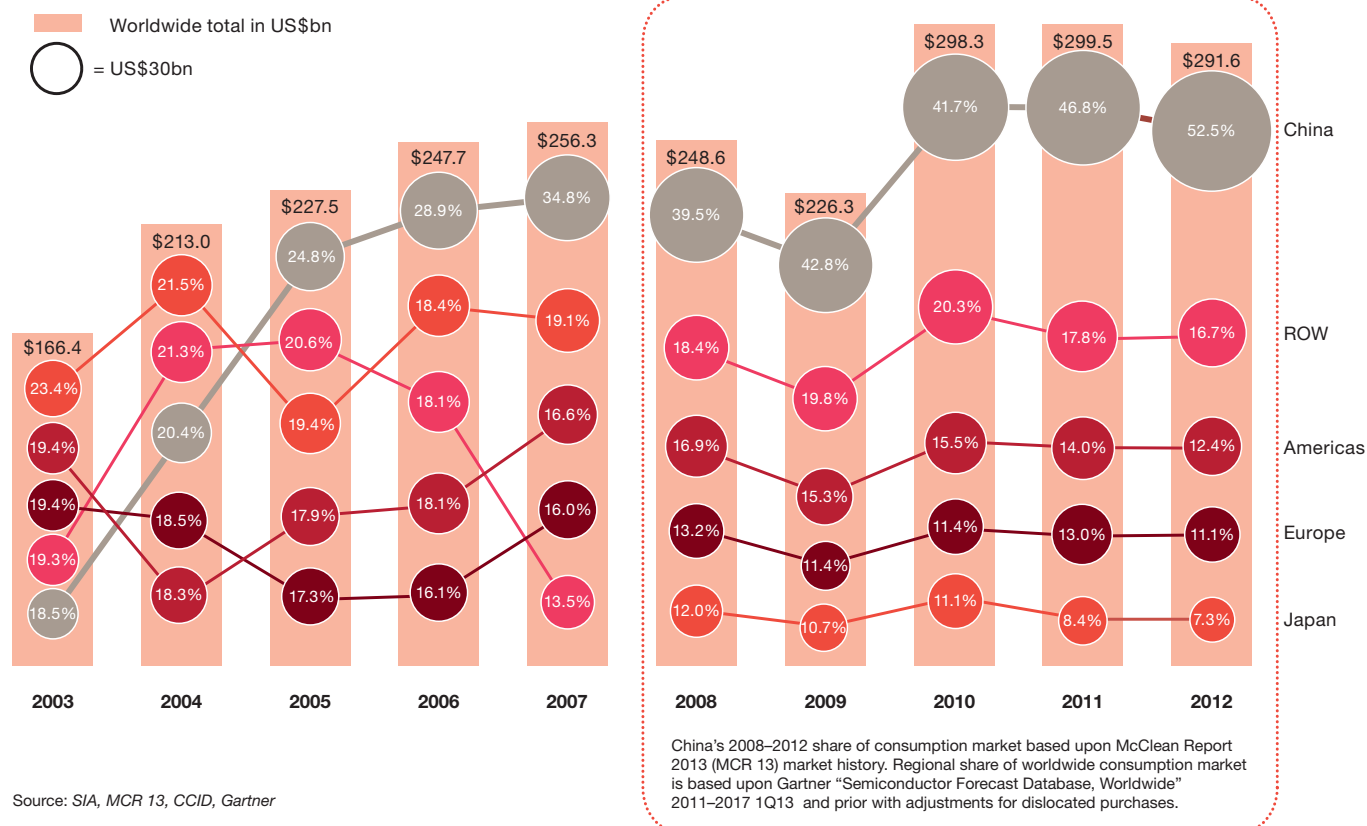
## China's semiconductor market

China's semiconductor consumption growth continued unabated in 2012. Despite a 2.6% worldwide semiconductor market contraction, China's semiconductor consumption market grew by 8.7% in 2012 to reach a new record of 52.5% of the global

market. Much of this exceptional growth continued to be the result of China's dominant position in the production of smartphones and media tablets. Almost three percentage points of this increase was the result of China's continuing revaluation of the Renminbi (RMB). Measured

**Figure 1: Worldwide semiconductor consumption market by region, 2003–2012**

(Total worldwide in US\$bn)



Source: SIA, MCR 13, CCID, Gartner

in local (RMB) currency, China's semiconductor consumption market grew by 5.9% in 2012. Although noticeably less than Chinese officials had forecast, that 5.9% local currency growth far exceeded all other regions and may be understated since most of the semiconductors consumed in China were sourced from multinational suppliers and priced in dollars, euros or yen.

For the first time ever during 2012 China consumed more than half of all the worldwide semiconductor market. As a result of growing consumption during a year of worldwide contraction, China's

share of worldwide semiconductor consumption grew to exceed 52% in 2012 while most other regions' shares decreased. Since 2001, the bottom of the prior semiconductor business cycle, China's semiconductor consumption has grown at a 22.9% compounded annual growth rate (CAGR), while total worldwide consumption has only grown at a 6.9% CAGR.

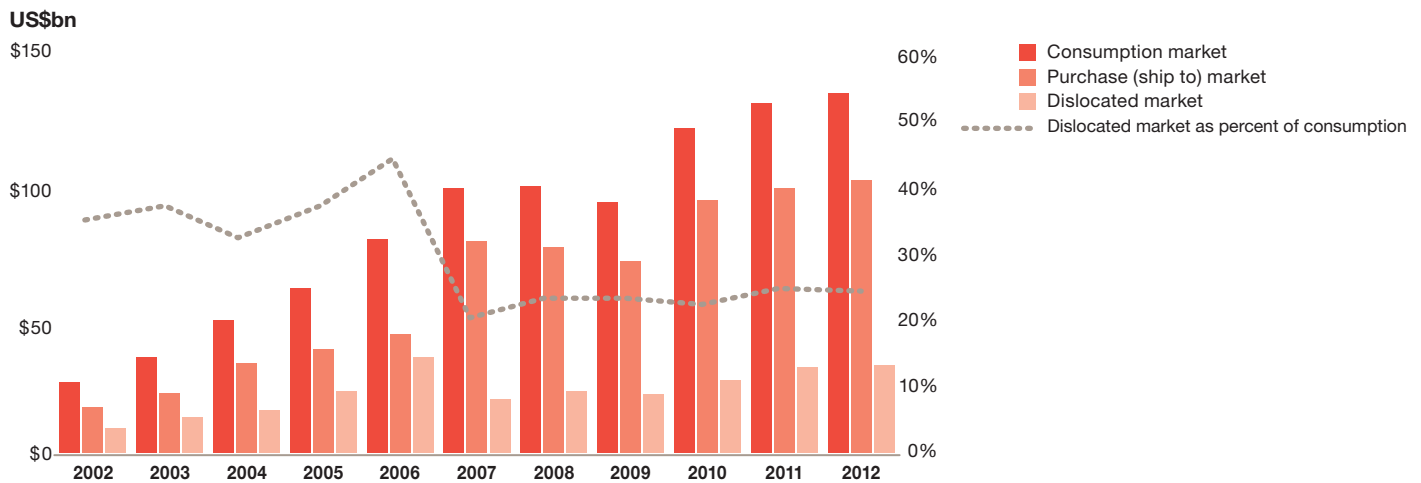
China's reported semiconductor consumption market is greater than most market analysts' Chinese market share reports because a significant portion of the semiconductor devices consumed in China continue to be purchased outside of China. This

**Table 1: China's production and worldwide share of main electronic products, 2008–2012**

	Production in 1000s					% CAGR	Worldwide market share %				
	2008	2009	2010	2011	2012		2008	2009	2010	2011	2012
Main products											
Mobile phone	559,640	619,520	998,000	1,133,000	1,182,000	20.6%	44.7%	49.9%	71.3%	70.6%	74.7%
Computer/PC	136,666	182,150	246,000	320,000	354,000	26.9%	47.0%	60.9%	73.4%	90.6%	86.6%
Color TV	90,331	98,990	118,000	122,000	128,000	9.1%	43.9%	48.3%	47.8%	48.6%	52.3%
Digital camera	81,883	80,260	90,000	82,900				62.3%	64.9%		

Source: CSIA, MIIT, Digitimes Research 2010–2013

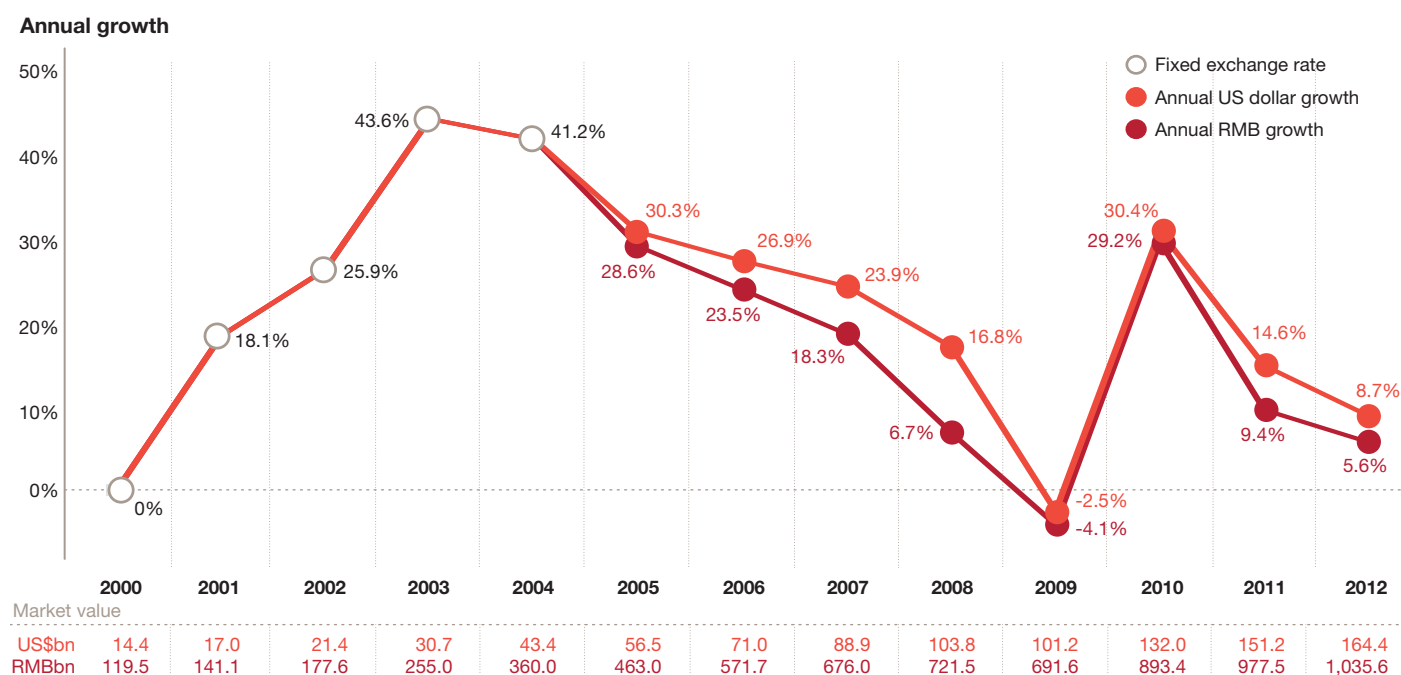
**Figure 2: Analysis of China/Hong Kong consumption versus purchasing TAM semiconductor market history**



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



**Figure 3: China's semiconductor market growth, 2000–2012**



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 make up the total semiconductor market.

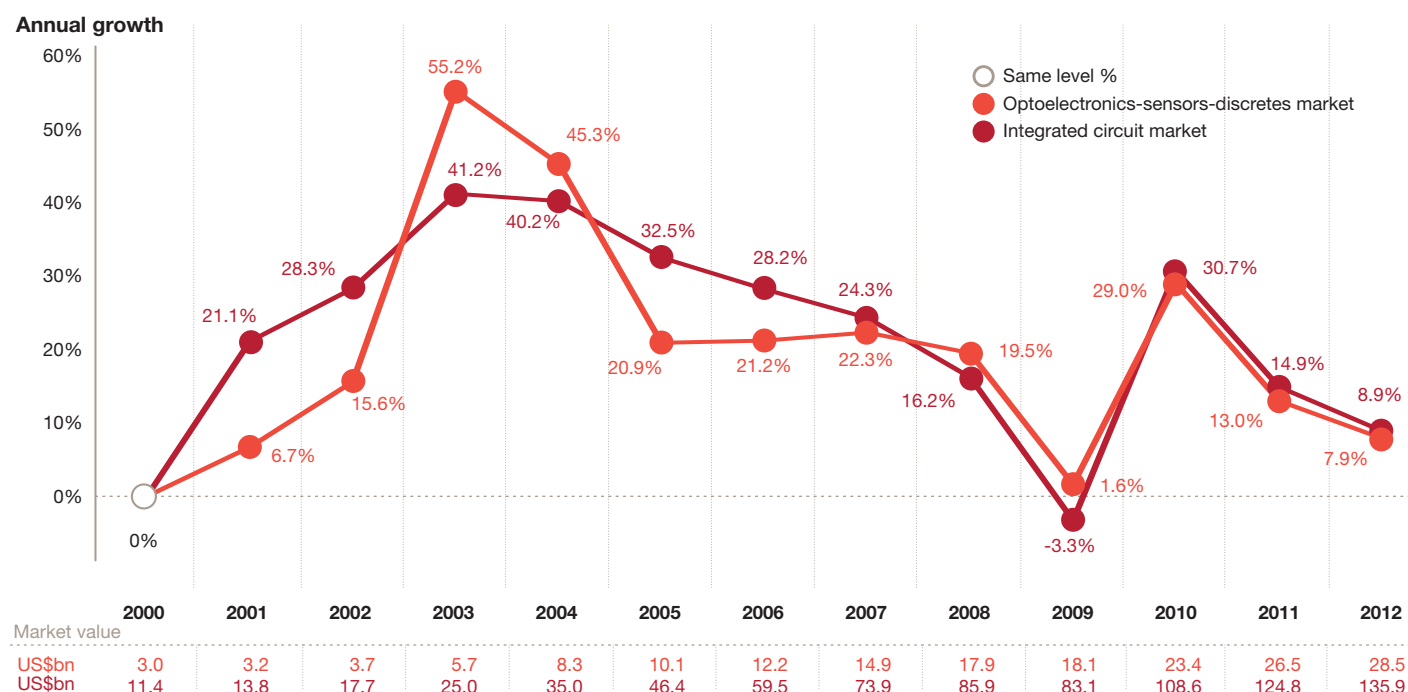
Source: CCID, CSIA

“dislocated purchasing” occurs because some customers—due to supply chain considerations such as control of key inventory items, intellectual property protection and/or toll processing business models—will buy semiconductor devices outside of China and transship them to China for use and consumption. Since 2007 we have been identifying this “dislocated purchasing” for the Chinese consumption market by a comparison of consumption to purchasing TAM (total available market). Using a recently revised measure of purchasing TAM, we have found this “dislocated purchasing” to have only increased slightly since 2007 to just over 24% for the last two years. The largest share of this “dislocated purchasing” has occurred in Taiwan, Korea, the Americas and Japan.

China’s semiconductor consumption market continues to grow many times faster than the worldwide market as a result of two driving

factors—the continuing transfer of worldwide electronic equipment production to China and the above-average semiconductor content of that equipment. During 2012 electronic equipment production in China increased by US\$42bn while it decreased marginally in the rest of the world. As a result, China’s share of worldwide electronic equipment production increased by two percentage points to 34.2% in 2012. At the same time, the semiconductor content of China’s electronic equipment production remained well above the 20% worldwide average at 26% in 2012. Whether the Chinese semiconductor consumption market will continue to gain global market share will be primarily determined by the future transfer of electronic equipment production. Most industry analysts predict that the trend of an increasing share of electronic equipment production in China will continue over the next several years. According to Gartner,

**Figure 4: China's IC and O-S-D market growth, 2000–2012**



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

Source: CCID, CSIA

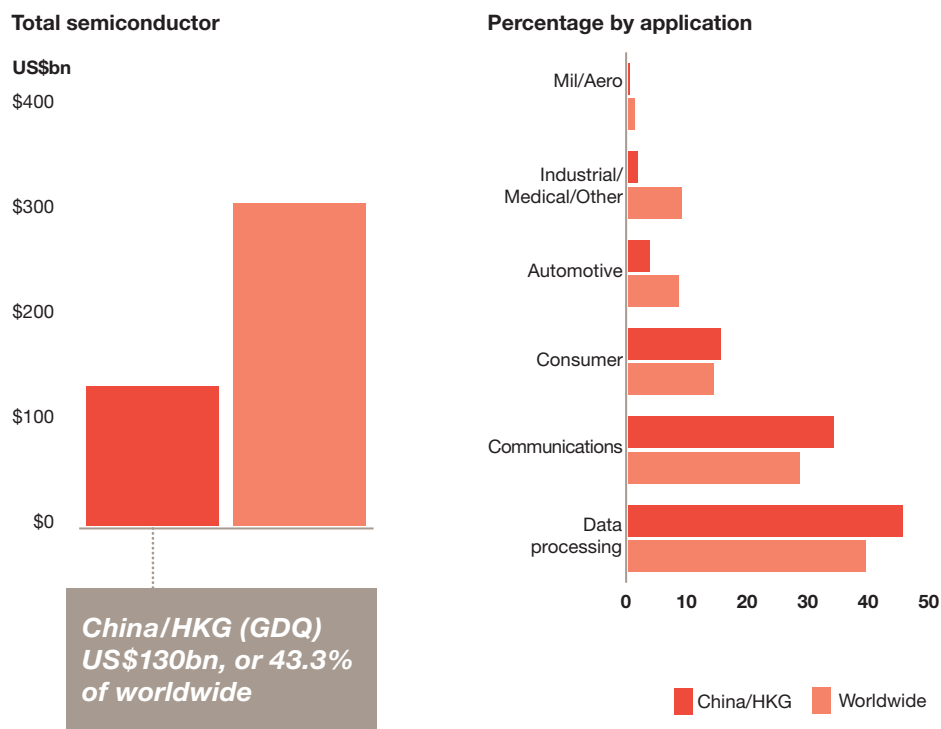
China's share of electronic equipment production is forecast to increase to more than 40% by 2017 and China's share of worldwide semiconductor consumption to increase by a further 7%.

The integrated circuit (IC) consumption market in China increased 8.9% to US\$135.9bn in 2012. This increase was realized while the worldwide IC market decreased 4%. As a consequence, China's IC consumption grew to represent more than 53% of worldwide consumption in 2012. During 2012 China's IC consumption increased by about US\$11bn while the worldwide market decreased by almost US\$9bn. This is the fifth time in the past six years that China's IC consumption grew faster than the rest of the world's IC market and China's IC consumption grew at

the expense of displacing IC markets in other regions. This confirms the resumption in the dynamics of China's impact on the industry.

In 2012 China's O-S-D (optoelectronics-sensor-discrete) consumption market grew 7.9% to reach a new peak of US\$28.5bn. This increase was much greater than the worldwide O-S-D market increase of 1% and, as a result, China's share of that market grew to 49% in 2012 (from a revised 46% in 2011). While sensors remained the smallest segment of China's O-S-D market (at US\$3.7bn), it was once again the fastest growing in 2012 at 10%. Discrete devices remained the largest segment at US\$14.6bn while growing at 9%. Optoelectronics continued as the middle segment at US\$10.2bn while growing 6% in 2012.

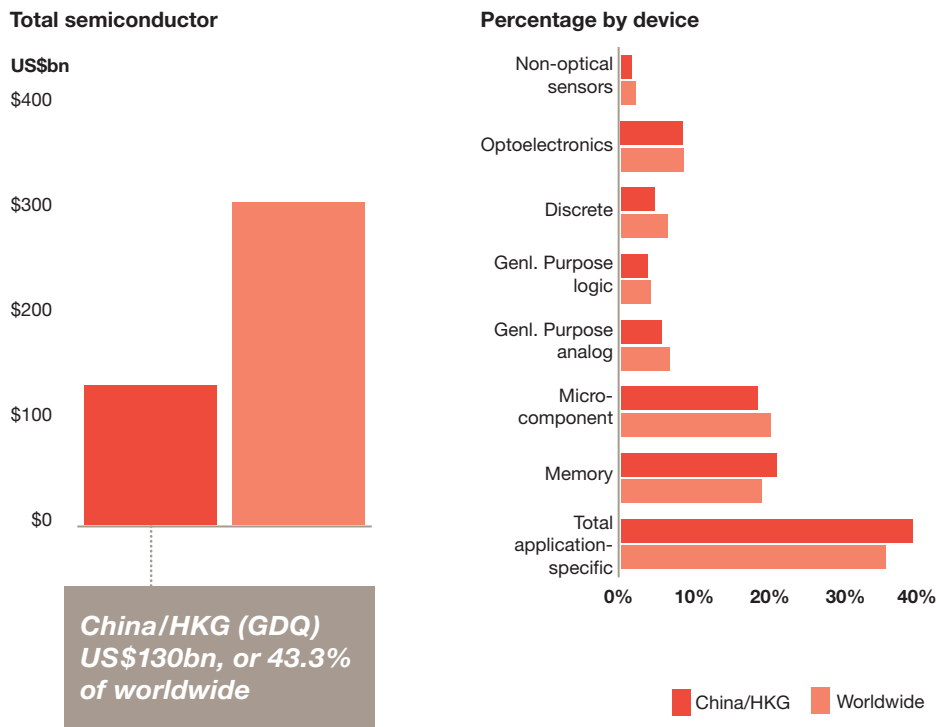
**Figure 5: China compared with worldwide semiconductor market by application, 2012**



Source: Gartner Dataquest

During 2012 China's semiconductor consumption continued to be somewhat more concentrated in the data processing (computing) and communications applications sectors than the worldwide market while remaining slightly more concentrated in the consumer, less concentrated in the automotive and noticeably less concentrated in the industrial/medical/other and military/aerospace sectors. China's share of 2012 worldwide semiconductor consumption was largest for the data processing (computing) sector and increased for all the application sectors except the industrial/medical/other sector where it declined slightly. Since 2003 China's consumption of semiconductors for the data processing (computing) applications has grown at a 19% CAGR, while consumption for communications and consumer applications has grown at 20% and 12% respectively. China's consumption for automotive, industrial, medical, military and other applications is smaller, but has grown at a faster rate of 22%.

**Figure 6: China compared with worldwide semiconductor market by device 2012**



Source: Gartner Dataquest

China's semiconductor consumption also remained a bit more concentrated in the application-specific and memory device sectors than the worldwide market in 2012. China's share of 2012 worldwide semiconductor consumption decreased slightly for the general purpose analog, application-specific and discrete sectors, while it increased for all the other device sectors. The memory and application sectors continue to be the largest. Although it remained the smallest, non-optical sensors continued to be

**Table 2: Chinese Top OEMs by revenue and semiconductor consumption 2010–2012 (US\$bn)**

	Rank (per MIIT)		Revenue			Semiconductor consumption (Design TAM)			Purchase TAM		
Name of company	2011	2012	2011	2012	Change %	2011	2012	Change %	2011	2012	Change %
Huawei	1	1	32.0	34.9	9.0%	3.8	4.3	12.9%	3.0	3.4	13.6%
Lenovo	2	2	29.6	33.9	14.6%	7.8	8.1	4.1%	5.9	5.8	-1.8%
China Electronics Corp.		3	26.4	29.0	9.8%						
Haier Group Company	3	4	23.7	25.8	8.9%	0.6	0.5	-9.2%	0.5	0.5	-4.6%
ZTE	4	5	13.5	13.3	-1.8%	2.8	3.1	13.1%	2.5	2.6	6.1%
Hisense Group	6	6	11.2	12.8	13.9%	0.4	0.5	36.0%	0.4	0.5	33.0%
Changhong Electric Co.	7	7	8.2	8.3	1.7%	0.3			0.4		
TCL	8	8	9.6	11.0	15.2%	1.2	1.5	26.8%	1.4	1.7	22.6%
Founder Group Co.	9	9	9.1	9.8	8.1%						
BYD Company Ltd.	10	10	7.7	7.4	-3.9%	0.3			0.3		
Total			170.9	186.2	8.9%	17.2	18.1		14.4	14.6	
% Semi penetration						12.7%	13.7%		10.6%	11.1%	
Semiconductor consuming subsidiaries											
Great Wall Technology	5	3	15.1	15.4	2.0%	0.1			0.1		
Haier Electronics Group	3	4	8.0	8.9	12.2%						
Hisense Electric Co.	6	6	3.7	4.1	9.7%						
Companies tracked from previous years											
Skyworth	14	13	3.6	4.5	25.7%	0.3	0.5	35.5%	0.4	0.6	30.3%
Konka Group	19	17	2.5	2.9	13.9%	0.3	0.4	26.2%	0.3	0.4	26.2%

Source: MIIT, Gartner, Thomson Reuters, Company reports

the fastest growing device sector of China's semiconductor consumption, increasing at a 52% CAGR from 2003. The microcomponent, optoelectronics and memory sectors have all grown at a 20% or slightly higher CAGR since 2003.

Table 2 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 2013". Their combined reported revenues increased by almost 9% in 2012 and at China's average 24% semiconductor content, these 10 Chinese OEMs could have

been responsible for semiconductor consumption of US\$35bn or 21% of China's total semiconductor market. These Chinese OEMs influence and/or purchase a significant and increasing number of semiconductor devices and could be important customers for the international semiconductor companies intending to participate in the continuing growth of the Chinese semiconductor market.

The major global semiconductor companies continue to dominate the Chinese market. Table 3 lists the top 10 suppliers with the largest value of semiconductors consumed in China during 2012. There have only been fourteen different companies among

**Table 3: Semiconductor suppliers to the Chinese market 2011–2012**

Company	Rank		Revenue in US\$m						Market share
	2011	2012	2011 IC	2012 IC	% change	2011 Semi	2012 Semi	% change	
Intel	1	1	23,777	25,076	5.5%	23,777	25,076	5.5%	15.3%
Samsung	2	2	9,388	10,759	14.6%	9,612	11,450	19.1%	7.0%
TI	4	3	4,920	5,062	2.9%	5,210	5,398	3.6%	3.3%
Toshiba	3	4	4,385	4,235	-3.4%	5,322	5,152	-3.2%	3.1%
SK Hynix	5	5	5,087	5,108	0.4%	5,087	5,108	0.4%	3.1%
ST	6	6	3,616	3,351	-7.3%	4,742	4,359	-8.1%	2.7%
AMD	7	7	4,406	4,219	-4.2%	4,406	4,219	-4.2%	2.6%
Freescale	9	8	2,913	3,043	4.5%	3,426	3,561	3.9%	2.2%
Renesas	8	9	2,681	2,646	-1.3%	3,452	3,260	-5.6%	2.0%
Qualcomm	13	10	2,270	3,171	39.7%	2,270	3,171	39.7%	1.9%
<b>Total Top 10</b>			<b>63,443</b>	<b>66,670</b>	<b>5.1%</b>	<b>67,304</b>	<b>70,754</b>	<b>5.1%</b>	<b>43.0%</b>
<b>Total Top 10 share of</b>									
Chinese integrated circuit market			50.8%	49.1%	-1.8%				
Chinese semiconductor market						44.5%	43.0%	-1.5%	

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

Source: CCID IC Market China 2012 & 2013 Conferences—March 2012 & March 2013

these top ten suppliers over the past ten years (since our initial report). Seven companies have been among the top ten suppliers to China every year from 2003 through 2012: Intel, Samsung, TI, Toshiba, SK Hynix, ST and Freescale. Qualcomm joined this list for the first time in 2012, moving up from number 13 and displacing NXP which had been among the top ten suppliers to China for every year from 2003 through 2011. During 2012 China's consumption of semiconductor products from these ten largest suppliers increased by 5.1%. Although almost four percentage points less than the growth of the overall semiconductor market in China, it is

still noticeably better than the decline in the worldwide semiconductor market. The Chinese semiconductor consumption market continued a trend of becoming less concentrated than the worldwide market. The top 10 suppliers' share of China's consumption declined to 43% in 2012, down from 45% in 2011 and less than the 51% share the top 10 suppliers to the worldwide market held. However, it still appears that there were no Chinese companies within the top 30 suppliers to the Chinese semiconductor market in 2012. Even if the largest Chinese semiconductor company sold all of its 2012 output within China, it would have not been within the top 30 suppliers to that market. This is an improvement from 2011 when it would have not been among the top 35 suppliers.

*The Chinese semiconductor consumption market continued a trend of becoming less concentrated than the worldwide market.*

### China's semiconductor industry

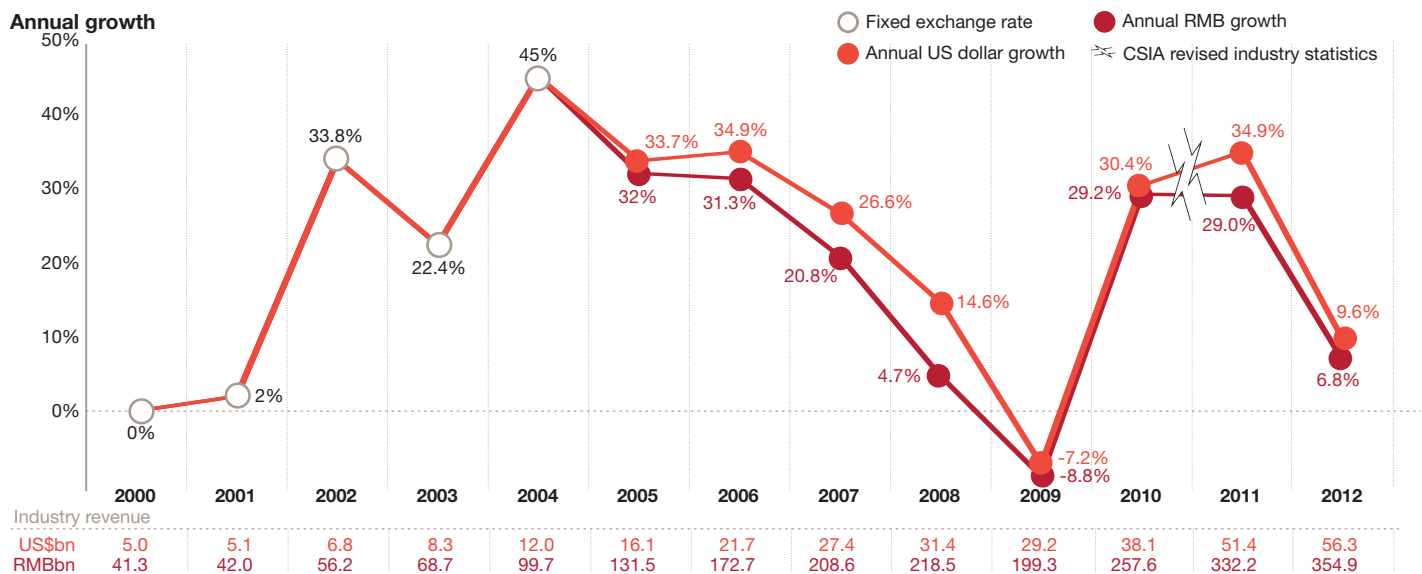
In October 2012, the China Semiconductor Industry Association (CSIA) revised China's IC industry statistics for 2011 and 2012 year-to-date without providing a detailed explanation for the cause and implications. This revision amounted to a 23% increase in China's 2011 IC industry revenues with almost all of the increase attributed to the IC packaging and testing sector and smaller offsetting increases and decreases attributed to the IC design and manufacturing sectors. Since there were no complementary revisions to the prior years' industry statistics, there is now an apparent inexplicable dislocation in the growth history of China's IC industry and one or more of its sectors. Further, there is a unique and noticeable difference between how China's two industry reporting agencies, CSIA and CCID, reported the 2011 and 2012 sector mix (IC manufacturing versus IC packaging and testing) of the same IC industry revenue. We believe the reported ten-year compound annual growth rate

(CAGR) for China's semiconductor industry 2002 through 2012 remains reasonably representative. However, there are unanswered questions associated with the yearly and quarterly growth rates for the most recent half decade.

As now reported, China's semiconductor industry growth continued in 2012 to exceed both its consumption growth and the worldwide market decline. During 2012 China's semiconductor industry grew by 9.6% to reach a record US\$56.3bn. From 2002 through 2012, China's semiconductor industry has achieved a ten-year compounded annual growth rate (CAGR) of 23.6% measured in US dollars (or 20.2% measured in local RMB currency). During 2012, US\$8.4bn of additional fixed-asset investments were made in China's semiconductor industry, up almost 6% from the nearly US\$8bn in investments made in 2011. Of that amount, US\$5.5bn was invested in the integrated circuits (IC) industry, 16% more than in 2011. The remaining

*During 2012 China's semiconductor industry grew by 9.6% to reach a record US\$56.3bn.*

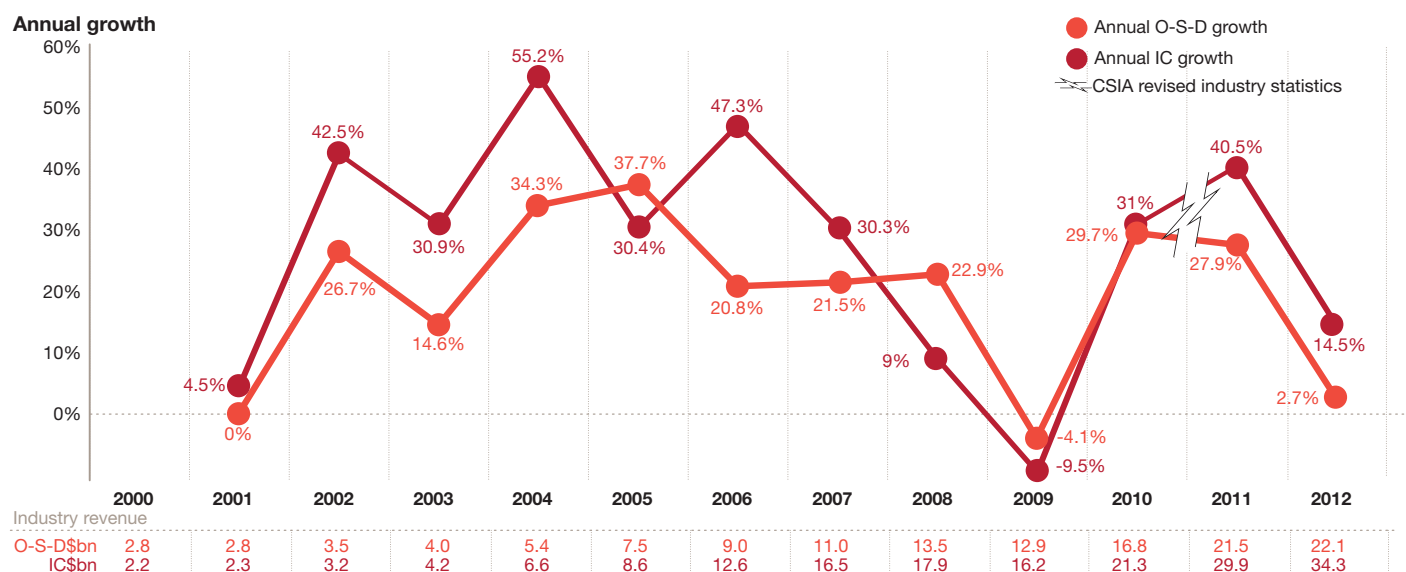
**Figure 7: China's semiconductor industry revenue and growth, 2000–2012**



Source: CCID, CSIA



**Figure 8: China's O-S-D and IC industry revenue and growth, 2000–2012**



Source: CCID, CSIA

US\$2.9bn was invested in the optoelectronics-sensors-discretes (O-S-D) sector, 9.5% less than in 2011. This US\$8.4bn investment represented 14.2% of the 2012 total worldwide semiconductor capital expenditures.

Our original comparison between China's reported semiconductor industry revenue and the sum of worldwide semiconductor device sales plus foundry and assembly and test services (SATS) revenues would measure China as accounting for 16% of the worldwide industry in 2012. Our more conservative alternate 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 12% of the worldwide semiconductor industry in 2012. Both comparisons confirm that China's share of the worldwide semiconductor industry is continuing to grow, becoming both noticeable and significant. Looking forward, the Chinese authorities currently forecast that China's semiconductor industry revenues will grow to reach

US\$75bn by 2015. When compared to the sum of the SIA/WSTS forecast for worldwide device sales—plus all wafer fabrication and packaging, assembly and test values—that forecast projects that China's semiconductor industry will account for at least 14% of the worldwide semiconductor industry by 2015. This seems compatible with China's recent 14% share of worldwide semiconductor capital expenditures.

The overall performance of China's IC industry (the sum of IC design, IC wafer manufacturing and IC packaging and testing) was the major contributor to China's overall semiconductor industry growth in 2012. IC industry revenues, measured in dollars, increased by 14.5% to more than US\$34bn in 2012. The same IC industry revenues measured in local RMB currency increased by 11.6% to 216 billion RMB. Measured in dollars, all three sectors of China's IC industry reported double-digit growth in 2012. Benefiting from the continuing growth of the smartphone and IC card markets, China's IC design sector grew by 21% in 2012 to a new record US\$9.9bn. Despite a 4% decline in



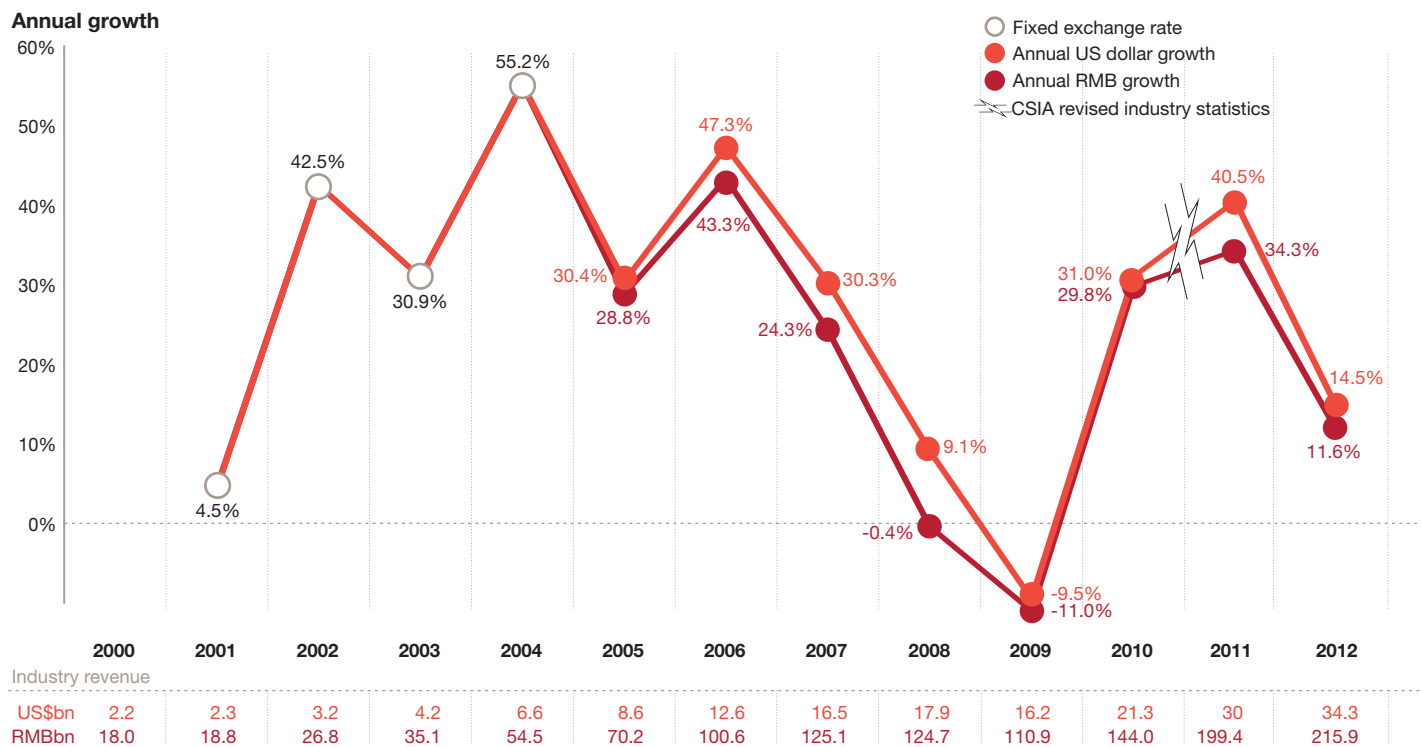
the worldwide IC market, China's IC wafer manufacturing and IC packaging and testing sectors benefited from a continuing industry shift to outsourced manufacturing and grew by 13% and 11% in 2012 to new records of US\$9.4bn and US\$15bn respectively.

According to the China Semiconductor Industry Association (CSIA) China's IC industry unit production increased by 12% in 2012, while dollar unit average selling price (ASP) remained unchanged. Based upon the current reported revenue values, China's IC industry achieved an overall self-sufficiency ratio of about 25% (ratio of production versus consumption values) in 2012, which is noticeably higher than the 20% previously reported for 2011. As noted in prior updates, based upon the CSIA's reported unit volumes, China's IC industry unit self-sufficiency ratio for 2012 might have been

much greater.

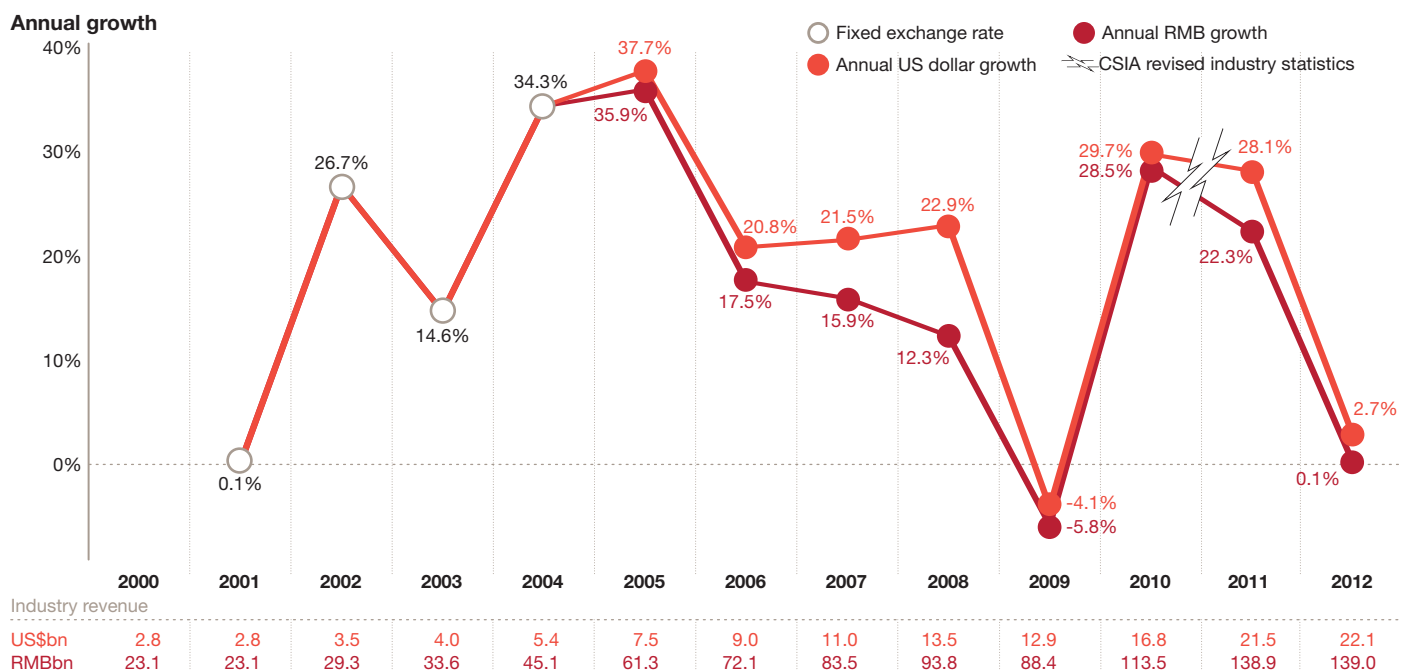
China's O-S-D sector performance in 2012 was only slightly better than worldwide O-S-D performance. Measured in dollars, China's O-S-D sector revenues increased 2.7% in 2012 to a record US\$22bn. However when measured in local RMB currency, China's O-S-D sector revenues only increased by 0.1% and contributed less than 1% to China's total semiconductor industry growth in 2012. Within the sector, China's LED revenues grew by 23% to US\$6.8bn, while discrete device revenues declined by -4% to US\$15.3bn. China's reported O-S-D production unit output and ASPs remained relatively unchanged during 2012. Based upon revenue values, China's reported O-S-D industry achieved an overall self-sufficiency ratio of about 110% (ratio of production versus consumption

**Figure 9: China's IC industry revenue and growth**

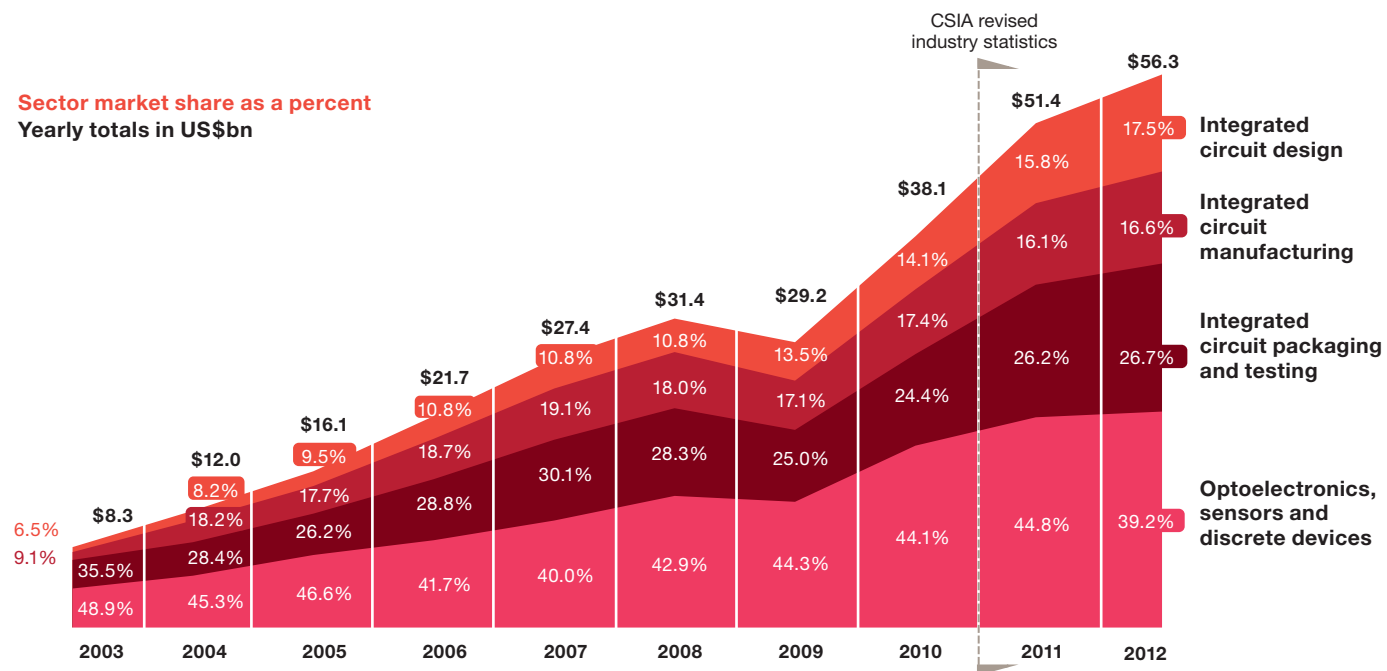


Source: CCID, CSIA

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



**Figure 11: China's semiconductor industry by sector 2003–2012**



value) in 2012, which was about nine percentage points lower than the revised record reported for 2011. Correspondingly, while the value of China's O-S-D exports exceeded the value of O-S-D imports for the third year in a row, that net export value declined sharply in 2012.

The distribution of China's industry has noticeably changed over the last few years as a result of the almost double average growth rate of the IC design sector and the below-average growth rate of the O-S-D and IC packaging and testing sectors. Over the past ten years, from 2002 through 2012, the once very small IC design sector has grown at a 43.4% CAGR, the slightly larger IC manufacturing sector at a 32.3% CAGR, while the much larger O-S-D and IC packaging and testing sectors have only grown at a 20.1% CAGR.

As a result, IC design sector revenues grew to exceed those of the IC manufacturing sector for the first time during 2012, reorganizing the sector distribution from largest to smallest share of total industry revenue to:

1.	O-S-D devices	39.2%
2.	IC packaging and testing	26.7%
3.	IC design	17.5%
4.	IC manufacturing	16.6%

In fact, 2012 is the first year that China's three IC industry sectors have grown to represent more than 60% of China's total semiconductor industry.

### **Integrated circuit and O-S-D consumption/production gap and surplus**

China's exceptional relative semiconductor performance in 2011 and 2012 remains evident in the continuing growth of China's IC consumption/production gap. This gap is the difference between IC consumption and IC industry revenues. Based upon the revised CSIA industry statics, this annual gap had grown by US\$7.6bn, (8.7%) in 2011 to reach US\$94.9bn and grew a further US\$6.7bn (7.1%) in 2012 to reach a record US\$101.6bn. At the same time, the ratio of China's IC production revenue to IC consumption has now shown some improvement. It had grown with yearly variability from 16% in 2001 to a peak of 22% in 2007 before declining slightly to 20% in 2008 and 2010. It is now reported to have grown to 24% in 2011 and further

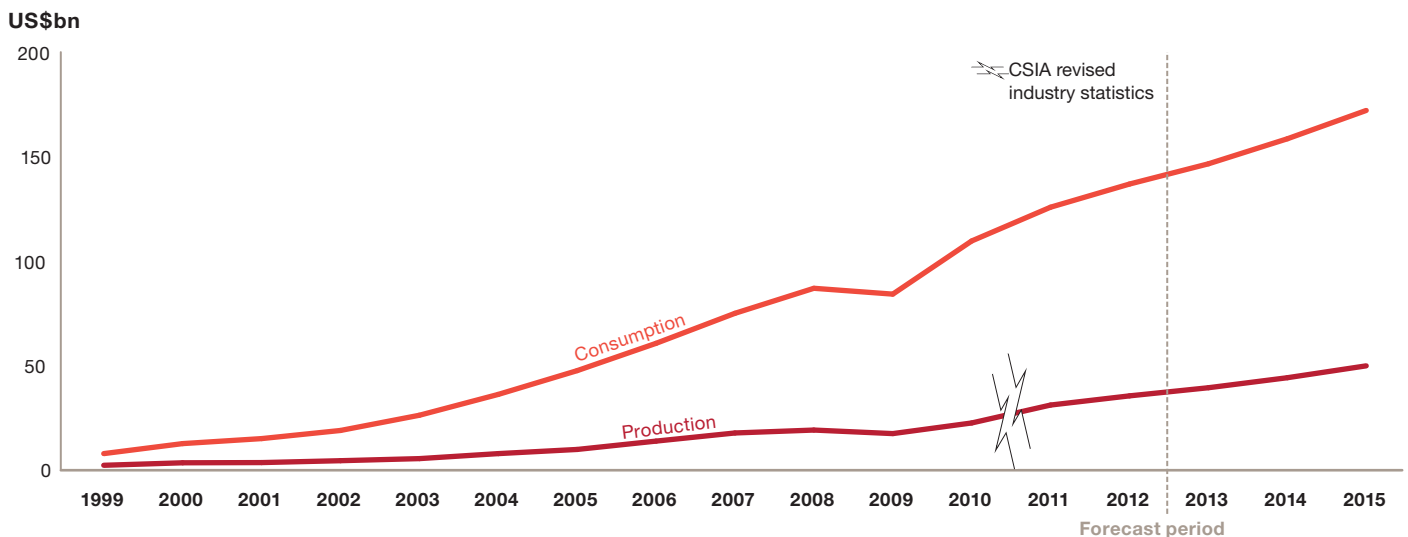
to 25% in 2012. According to CSIA, this ratio is now expected to increase to 28% by 2015, which is up from the 23% they had forecast for 2014 a year ago. However, this will still result in a further increase in China's IC consumption/production gap.

According to the CSIA 2013 report, China's IC market is forecast to grow to US\$171bn by 2015, with IC industry revenue expected to reach US\$49bn. This forecast implies a further widening of China's IC consumption/production gap to US\$122bn despite all the Chinese government's plans and efforts to contain it. It is our belief that this gap continues to contribute to the Chinese government's ongoing initiatives to increase indigenous IC production.

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 inevitability be filled. The question remains how will it be filled: will it be a

*China's exceptional relative semiconductor performance in 2011 and 2012 remains evident in the continuing growth of China's IC consumption/production gap.*

**Figure 12: Comparison of China's integrated circuit consumption and production, 1999–2015**



Actual annual average FX rates used for 1999–2012, & 2012 average FX rate used for forecast 2013–2015.  
Source: CCID, CISA, PwC 2004–2012.

combination of transfer and expansion of multinational companies or the emergence and growth of significant Chinese companies?

As discussed in our prior update, the only measure we have of China's O-S-D consumption versus production is an evaluation of what China's defines as their discrete sector which consists of discrete plus LED devices but not other optoelectronic or sensor devices. 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 deficiency between

China's reported discrete (including LED) production and consumption values. That difference has gone from a moderate US\$374m (5%) gap in 2005 to a modest surplus in 2008 and 2010 and now to significant surpluses of US\$3.3bn (15%) and US\$1.9bn (9%) in 2011 and 2012. Although China's reported O-S-D sector revenues could be understated by as much as 6% since their reporting protocols do not include optoelectronics other than LEDs and sensors in the sector, that does not significantly change the relative sector growth measurements.

### IC design in China

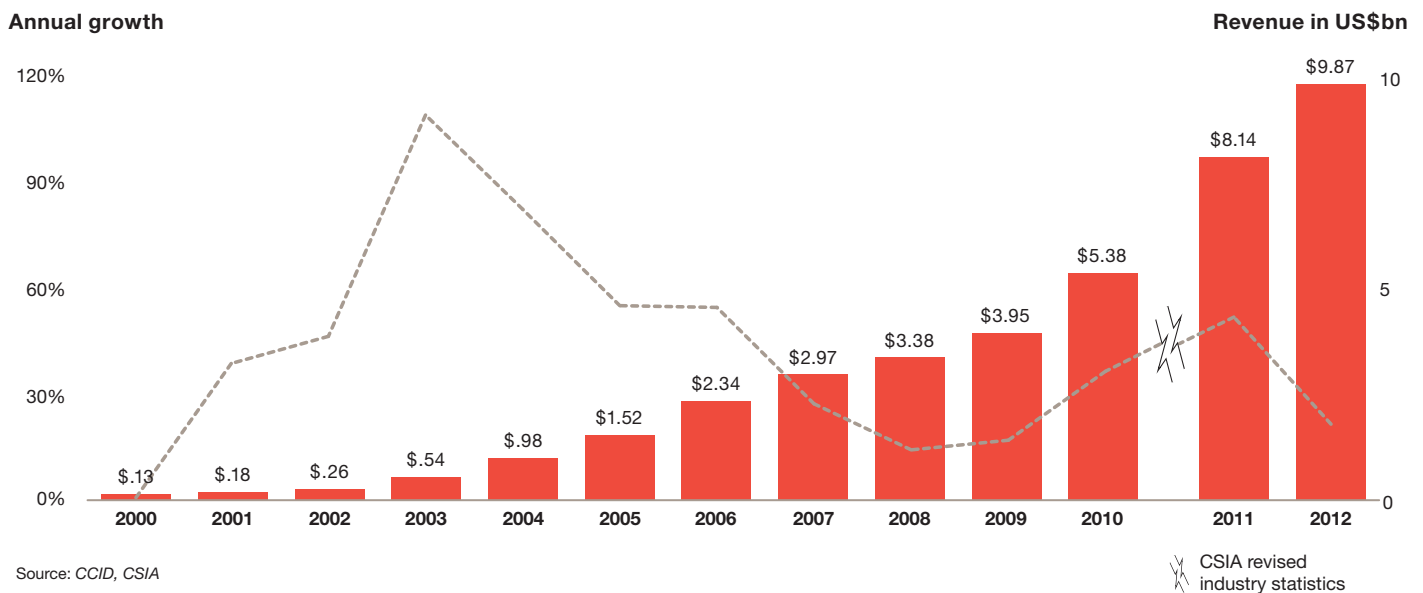
Integrated circuit (IC) design continues to be the fastest growing segment of China's semiconductor industry. It grew by 21% in 2012 to reach record revenues of US\$9.9bn. During the ten years from 2002 through 2012 China's IC design (fabless) industry has grown at a 43.8% CAGR from US\$260m to almost US\$10bn. Measured in US dollars, IC design sector revenue contributed more than 40% to China's semiconductor industry revenue growth in 2012 and has grown to represent 17.5% of China's total semiconductor industry. In addition, China's IC design sector was responsible for about 34% of the output of China's IC manufacturing (wafer foundry) sector and 10% of the output of China's IC packaging and testing sector. In total, China's IC design sector was responsible for about 26% of China's semiconductor industry revenue in 2012.

According to China Center of Information Industry Development (CCID) Consulting, China had

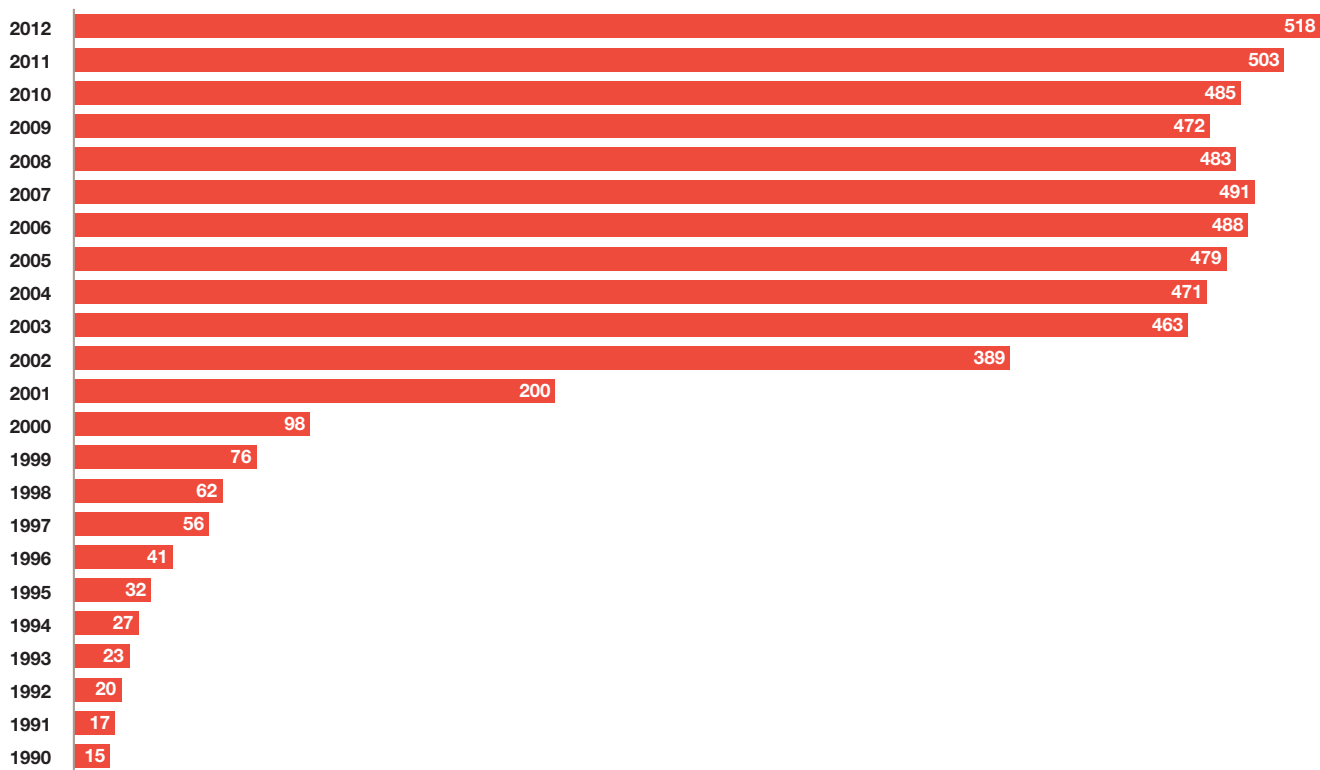
518 design enterprises at the end of 2012. As we discussed in the 2012 update, there has been considerable scepticism about the size and make-up of this group of enterprises as well as a great diversity among this group of enterprises. It is still estimated that there are no more than 100, possibly less, local indigenous IC design enterprises that are truly viable fabless semiconductor companies.

Employment growth in China's IC design sector moderated even further in 2012. The total number of employees in the IC design sector increased by 6% in 2012 to about 112,500, with the distribution shifting somewhat to the larger companies with more than 100 employees. This moderate increase in employee density, coupled with a smaller 3% increase in the number of enterprises and a much greater, 21%, increase in revenue, resulted in a modest 2.4% increase in the average number of employees per enterprise and a significant 15% increase in average sales per employee productivity to US\$88,000.

**Figure 13: China's integrated circuit design industry revenue and growth, 2000–2012**



**Figure 14: Number of IC design enterprises in China, 1990–2012**



Source: CCID

As discussed in the 2012 update, the only relevant comparison of company employee productivity we have been able to make is of the nine Chinese fabless companies that are included in the Global Semiconductor Alliance (GSA) Global Financials Report for 2012. The average 2012 sales per employee productivity of those nine Chinese fabless companies was US\$306,000, which was a surprising 27% lower than a similar 2011 average and only 54% of the GSA report's average of US\$564,000 for 163 worldwide fabless companies. Only two of those nine Chinese fabless companies had an increase in employee productivity in 2012.

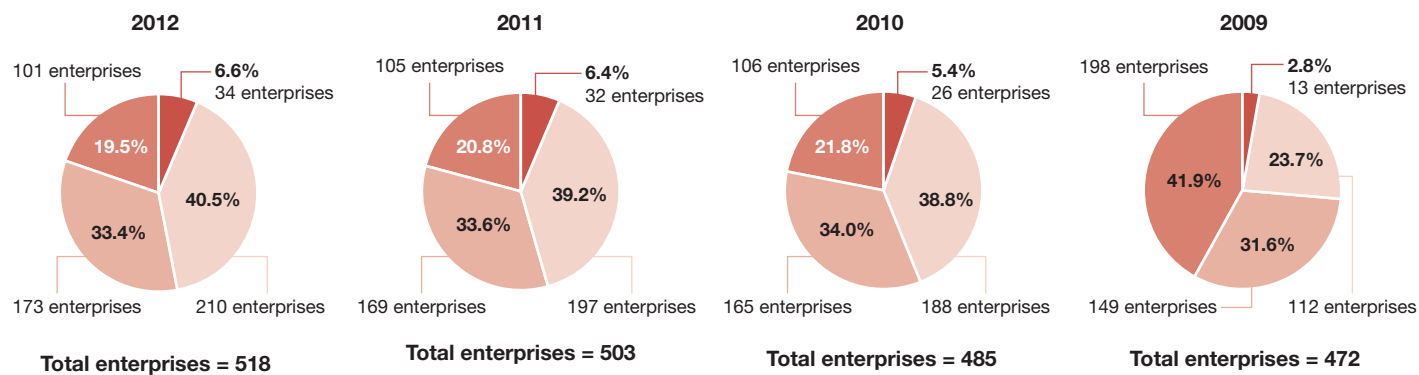
China's IC design industry continued to make some reportable qualitative improvements during 2012, including a modest further migration to finer design line widths. According to

CCID and CSIA, the number of design enterprises with design capabilities equal or less than 0.25 microns increased by 7% in 2012 to represent 45% of IC design enterprises, up from 43% in 2011. Sixty-one (61) of these enterprises had design capabilities for equal to or less than 90 nanometers, eight more than in 2011, and several have developed 40 nanometer phone chips.

For most of the same reasons discussed in the 2012 update, CCID's latest forecast is for China's IC design sector industry to grow by an 18.8% CAGR over the next three years to reach US\$16.5bn by 2015. If this forecast is realized, China's IC design sector would represent almost 17% of worldwide fabless semiconductor revenues and slightly more than 5% of the worldwide IC market.



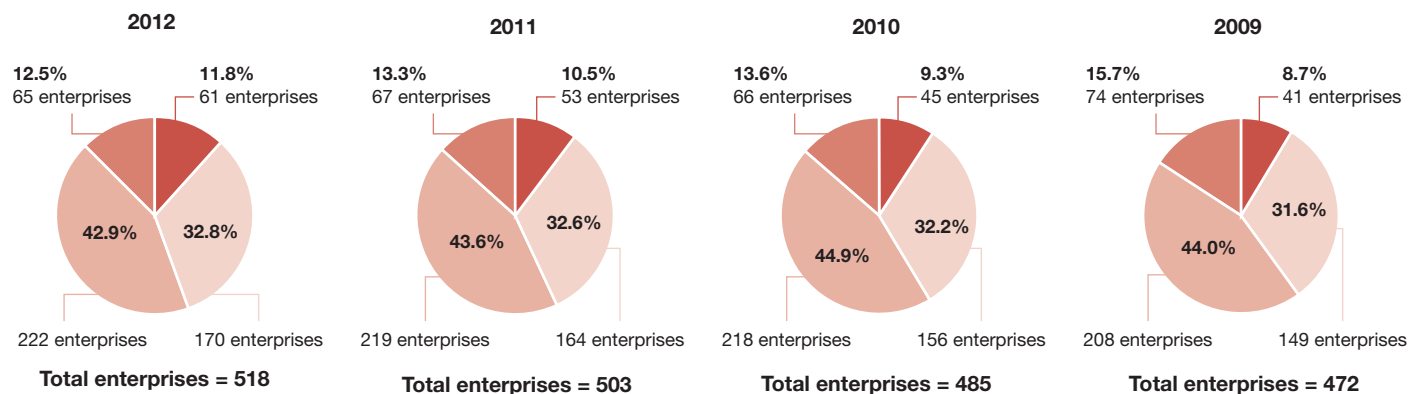
**Figure 15: China's IC design enterprises by employee count, 2009–2012**



Source: CCID

Size of enterprise by number of employees ■ Greater than 500 ■ 100–500 ■ 50–100 ■ Less than 50

**Figure 16 : China's IC design industry by process technology, 2009–2012**



Source: CCID

Process technology design line width (microns) ■ Less than or equal to 0.090 ■ Greater than 1.0 ■ 0.35–1.0 ■ 0.11–0.25

### Chinese semiconductor companies

Table 4 lists the top 50 Chinese semiconductor companies that had the largest revenues in 2012. 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 7.

The threshold for inclusion in this 2012 listing has increased to US\$52m, up 18% from the US\$44m used for the 2011 listing. Six companies qualified for inclusion on the 2012 listing for the first time, including three IC design and three discrete companies. The combined reported dollar revenues of the continuing 46 of these top 50 Chinese semiconductor companies increased by 13.6% in 2012, which is higher than the 9.6% increase reported by China's total semiconductor industry. During 2012 these top 50 companies accounted for 48% of China's IC design (fabless) revenues, but only 12% of discrete revenues and 7% of IDM and foundry revenues.

**Table 4: Major Chinese semiconductor companies by revenue, 2012**

Name of company	Rank		Sales revenue (RMB:100M)				Revenue (US\$m)		
	2011	2012	2011	2012	Change	Sector	2011	2012	Change
HiSilicon Technologies Co., Ltd.	1	1	66.68	74.19	11.3%	●	1,032	1,178	14.2%
Spreadtrum Communications Inc.	2	2	42.88	43.83	2.2%	●	663	696	4.9%
Tianjin Zhonghuan Semiconductor Co., Ltd.	7	3	12.60	11.78	-6.5%	▲	195	187	-4.1%
RDA Microelectronics, Inc.	3	4	18.19	24.69	35.7%	●	281	392	39.3%
No. 55 Research Institute of China Electronics Technology Group Corporation	5	5	16.24	19.70	21.3%	■	251	313	24.5%
Sanan Optoelectronics	4	6	17.47	16.40	-6.1%	▼	270	260	-3.7%
Hangzhou Silan Microelectronics Co., Ltd.	6	7	13.30	12.64	-5.0%	●	206	201	-2.5%
Galaxycore Inc.	8	8	11.68	11.80	1.0%	●	181	187	3.6%
Shenzhen State Micro Technology Co., Ltd. (SMIT)	9	9	11.20	11.20	0.0%	●	173	178	2.6%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	10	10	11.00	11.50	4.5%	●	170	183	7.3%
Leadcore Technology Co., Ltd.	13	11	9.44	11.07	17.2%	●	146	176	20.3%
Beijing Vimicro Co., Ltd.	35	12	4.78	11.00	130.0%	●	74	175	136.0%
Allwinner Technology		13	3.23	10.58	227.5%	●	50	168	236.0%
Jilin Sino Microelectronics Co., Ltd.	17	14	8.45	10.55	24.9%	▲	131	168	28.1%
Elec-Tech International Co., Ltd.	14	15	9.10	10.27	12.8%	▼	141	163	15.8%
MLS Co., Ltd.	11	16	10.40	9.40	-9.6%	▼	161	149	-7.3%
Shenzhen Netcom Electronic Co., Ltd.	28	17	7.59	9.37	23.5%	●	117	149	26.7%
CEC Huada Electronics Design Co., Ltd. (HED)	19	18	8.24	9.36	13.6%	●	127	149	16.6%

● IC design    ▲ Discrete    ▼ Discrete (LED)    ● Foundry    ■ IDM

Name of company	Rank		Sales revenue (RMB:100M)				Revenue (US\$m)		
	2011	2012	2011	2012	Change	Sector	2011	2012	Change
Wuxi China Resources Huajian Microelectronics Co., Ltd.	16	19	8.67	8.68	0.1%	■▲	134	138	2.7%
Datang Microelectronics Technology Co., Ltd.	25	20	6.24	7.86	25.9%	●	97	125	29.2%
Changzhou Galaxy Electrical Co., Ltd.	21	21	7.50	7.51	0.1%	▲	116	119	2.7%
Shenzhen SI Semiconductor Co., Ltd.	22	22	7.37	7.38	0.1%	▲	114	117	2.7%
Foshan Nationstar Optoelectronics	12	23	10.20	7.10	-30.4%	▼	158	113	-28.6%
Shanghai Huahong IC Co., Ltd.	26	24	6.10	6.81	11.6%	●	94	108	14.5%
Fuzhou Rockchip Electronics Co., Ltd.	24	25	5.30	6.80	28.3%	●	82	108	31.6%
Shanghai Belling	29	26	6.02	6.77	12.4%	■●	93	107	15.3%
Xiamen Hualian Electronics Co., Ltd.		27		6.60		▼		105	
Shanghai Fudan Microelectronics Co., Ltd.	27	28	6.10	6.30	3.3%	●	94	100	6.0%
Wuxi China Resources Semico Co., Ltd.	20	29	8.04	6.30	-21.6%	●	124	100	-19.6%
BCD Semiconductor Manufacturing Ltd.	15	30	8.81	6.14	-30.3%	■	136	98	-28.4%
GigaDevice Semiconductor		31	4.85	6.11	26.1%	●	75	97	29.3%
Suzhou Good-Ark Electronics Co.,Ltd.	18	32	8.36	6.05	-27.6%	▲	129	96	-25.8%
Shandong Inspur Huaguang Optoelectronics Co., Ltd.	23	33	6.55	6.00	-8.4%	▼	101	95	-6.0%
Fosham Blue Rocket Electronics Co., Ltd.	32	34	5.38	5.38	0.1%	▲	83	85	2.7%
NingBo Hualong Electronics Co.,Ltd.	33	35	5.20	5.21	0.1%	▲	80	83	2.7%
Shenzhen Refond Optoelectronics Co., Ltd.		36		5.00		▼		79	
Shanghai Epilight Technology Co., Ltd.	50	37	2.85	4.70	64.9%	▼	44	75	69.2%
Chengdu Yaguan Electronic Co., Ltd.		38		4.22		▲		67	
Beijing MXTronics Co., Ltd.		39		4.21		●		67	
Jiangsu Wenrun Optoelectronics	36	40	4.20	4.20	0.1%	▼	65	67	2.7%
Shantou Huashan Electronic Device Co.,Ltd.	40	41	3.73	4.17	11.7%	▲	58	66	14.6%
Guangzhou Hongli Opto-Electronics	31	42	4.14	4.10	-1.1%	▼	64	65	1.5%
Beijing Huadazhibao Electronic Systems Co., Ltd.	34	43	4.84	4.00	-17.4%	●	75	63	-15.3%
China Electronics Science & Technology Group Company No. 58 Institute	46	44	3.07	3.98	29.6%	▲	47	63	33.0%
Nationz Technologies Inc.	30	45	5.69	3.78	-33.5%	●	88	60	-31.8%
Changelight Co., Ltd.	39	46	3.77	3.70	-1.8%	▼	58	59	0.7%
Forward Semiconductor Company	41	47	3.49	3.49	0.1%	▲	54	55	2.7%
Yangzhou JingLai Semiconductor (Group) Co., Ltd.	44	48	3.40	3.40	0.1%	▲	53	54	2.7%
Actions Semiconductor Co., Ltd.	49	49	3.04	3.40	11.8%	●	47	54	14.7%
Tongfang Microelectronics Company	42	50	3.42	3.32	-2.8%	●	53	53	-0.3%

Source: CSIA, CCID, GSA, Gartner, PwC

● IC design    ▲ Discrete    ▼ Discrete (LED)    ● Foundry    ■ IDM

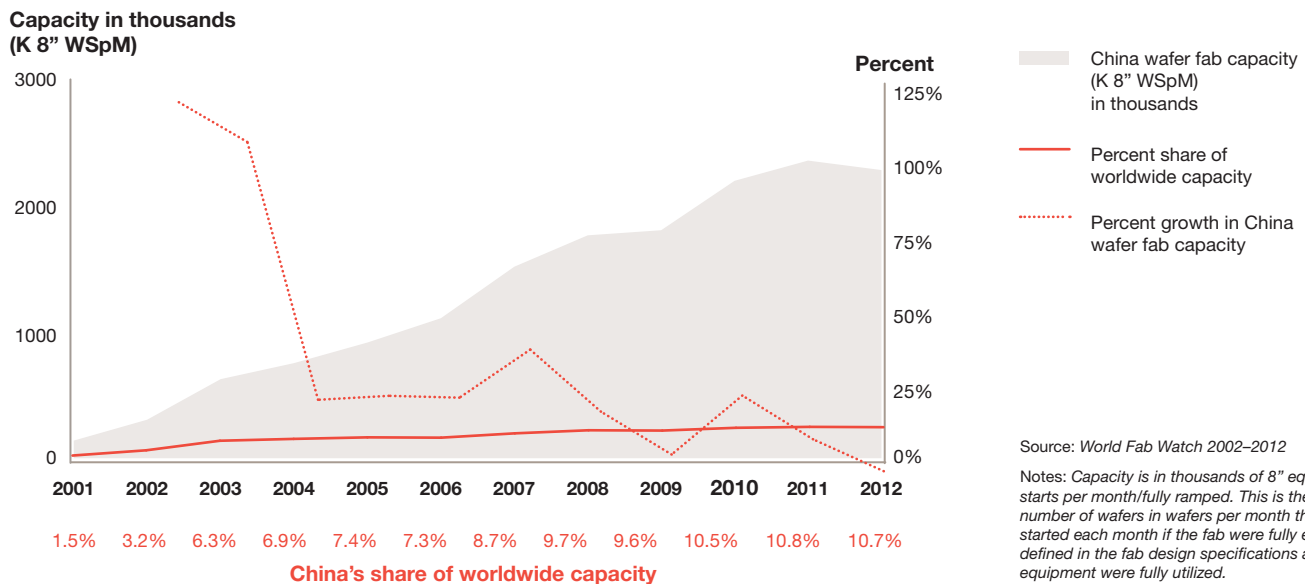
### Wafer fabrication capacity

Overall, 2012 was a year of wafer fab capacity rationalization rather than growth for both China and the worldwide industry. During the past year, nine new LED fabs started production in China with a combined nominal capacity of 28K 8" equivalent wafer starts per month (WSpM), while four existing discrete/optoelectronic, three IDM and two dedicated foundry fabs, with a combined nominal capacity of 100K WSpM were decommissioned. The net result was that the number of fabs in production in China during 2012 remained unchanged at 163, while their net nominal capacity decreased by about 3%. By comparison, the number of fabs in production worldwide decreased by four, for a net decrease in nominal capacity of about 2%. Consequently, China's share of worldwide fab capacity in 2012 decreased slightly to 10.7%.

However, China was able to increase the effective utilization of its wafer fab capacity during the past year by more than 15% by further equipping and ramping production at existing fabs as well as improving their overall utilization while worldwide effective fab utilization decreased by about 1%.

The overall relative composition of China's wafer fab capacity did not change much during 2012. Because China has a disproportionately large share (21%) of worldwide discrete and LED fab capacity, it continues to have a much higher mix of smaller wafer size (125mm or less) and mature technology node (0.7µm or greater) fab capacity than worldwide. Conversely, its mix of larger, 200 and 300 mm wafer size and leading-edge technology node fab capacity remained less than worldwide. Not one of the three new 300mm fabs that

**Figure 17: China's wafer fabrication capacity and share of worldwide capacity, 2002–2012**



**Table 5: Comparison of current wafer fab capacity, 2012**

	China			China's % of Worldwide	Worldwide		
	# Fabs	Capacity	%		# Fabs	Capacity	%
Geometry							
≥ 0.7μm	117	628.2	28%	21%	510	3,046.2	14%
< 0.7 to ≥ 0.4μm	12	151.2	7%	14%	139	1,080.0	5%
< 0.4 to ≥ 0.2μm	13	202.9	9%	10%	129	2,029.8	10%
< 0.2 to ≥ 0.12μm	8	315.0	14%	14%	86	2,202.9	10%
< 0.12 to ≥ 0.06μm	8	417.2	19%	17%	69	2,464.4	12%
< 0.06 to ≥ 0.028μm	5	540.0	24%	11%	66	4,769.7	23%
< 0.028μm	0	0.0	0%	0%	46	4,942.4	23%
N/A	0		0%		30	611.6	3%
Total	163	2,254.5	100%	11%	1075	21,147.0	100%
Wafer size							
≥ 4"	103	356.7	16%	34%	416	1,036.0	5%
5"	12	186.9	8%	29%	59	636.7	3%
6"	25	383.7	17%	13%	276	3,009.9	14%
8"	15	569.0	25%	10%	213	5,804.9	27%
12"	8	758.2	34%	7%	106	10,659.4	50%
N/A	0				5		
Total	163	2,254.5	100%	11%	1075	21,146.9	100%

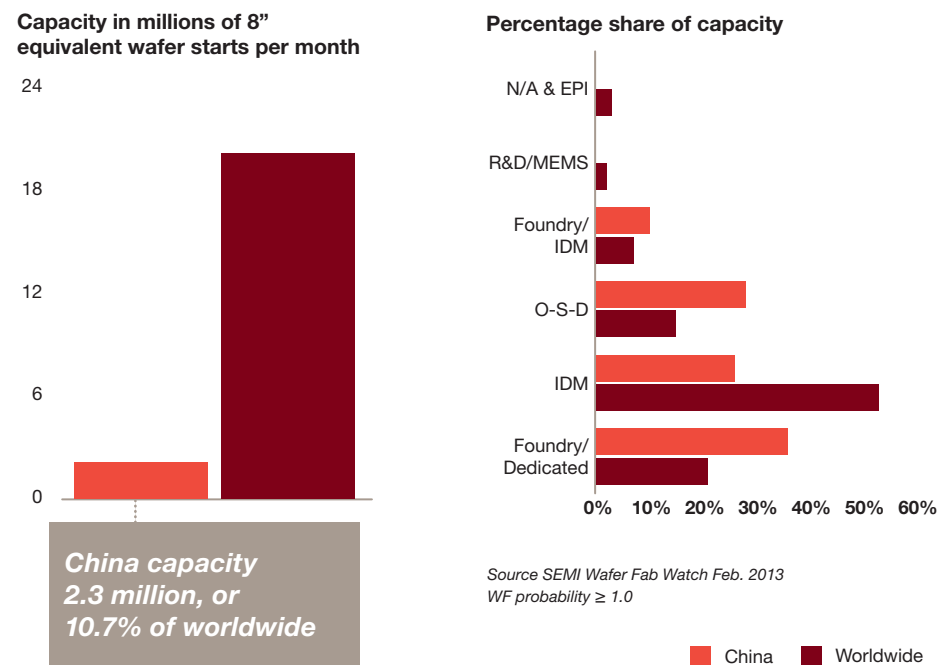
Capacity = 1000s 8" equivalent wafer starts per month (KWSpm)

Current capacity = world fab watch probability ≥1.0

Total % may differ from 100% due to rounding.

Source: SEMI World Fab Watch, Feb. 2013

**Figure 18: Current wafer fab capacity comparison, China and Worldwide**



started production during 2012 were in China. Also, China had no wafer fabs with leading-edge (28nm or less) technology in production during 2012.

That relative composition is expected to change somewhat during the next couple of years as 15 of the 40 new wafer fabs under construction worldwide are in China, representing 28% of new committed capacity. The 15 include the Samsung Xi'an 300mm NAND Flash fab which, when it enters production in 2014, will become China's largest and most advanced technology wafer fab. When all are in full production, China will have moved somewhat closer to having a representative mix of larger wafer size and advanced technology wafer fab capacity.

**Table 6: Comparison of committed future wafer fab capacity, 2012**

	China			China's % of Worldwide	Worldwide		
	# Fabs	Capacity	%		# Fabs	Capacity	%
Geometry							
≥ 0.7μm	11	55.7	12%	56.4%	14	98.7	6%
< 0.7 to ≥ 0.4μm	1	4.0	1%	61.5%	2	6.5	0%
< 0.4 to ≥ 0.2μm	1	10.0	2%	85.5%	3	11.7	1%
< 0.2 to ≥ 0.12μm	0		0%	0.0%	4	161.0	10%
< 0.12 to ≥ 0.06μm	1	20.0	4%	44.7%	3	44.7	3%
< 0.06 to ≥ 0.028μm	0		0%	0.0%	1	67.5	4%
< 0.028μm	1	360.0	80%	30.3%	13	1,186.9	75%
N/A	0		0%	0.0%	0		0%
Total	15	449.7	100%	28.5%	40	1,577.0	100%
Wafer size							
≥ 4"	11	55.7	12%	94.7%	12	58.8	4%
5"	0		0%	0.0%	0		0%
6"	0		0%	0.0%	5	44.2	3%
8"	3	34.0	8%	19.5%	7	174.0	11%
12"	1	360.0	80%	27.8%	15	1,295.6	82%
18"	0		0%	0.0%	1	4.6	0%
Total	15	449.7	100%	28.5%	40	1,577.2	100%

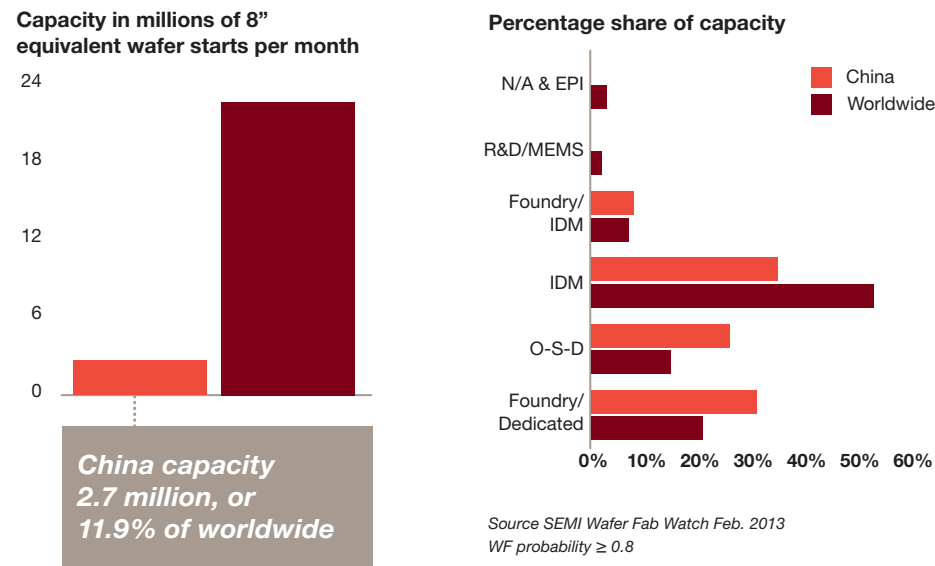
Capacity = 1000s 8" equivalent wafer starts per month (KWSpM)

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, Feb 2013

**Figure 19: Current and committed wafer fab capacity comparison, China and Worldwide**



Foundry production continued to constitute the largest share of China's wafer fab capacity in 2012 at 46% of the total compared to the worldwide average of 28%. IDM production only constituted 26% of China's wafer fab capacity, compared to 53% worldwide. That mix will only change moderately when all the committed fabs currently under construction are brought into production with China's foundry production decreasing to 37% and IDM production increasing to 35% of total compared to 28% and 53% worldwide.

### **Packaging, assembly and test capacity**

Semiconductor packaging, assembly and test (SPA&T) capacity grew in China during 2012 while it contracted in the rest of the world. During the past year, China reported the closure of 11 old SPA&T facilities, the addition of 16 existing but previously not reported facilities, the opening of three new facilities and the expansion of several others, resulting in a 5% increase in net manufacturing floor space with no change in number of employees. During the same time, the number of SPA&T facilities in the rest of the world decreased by two, their total manufacturing floor space fell by 8.9% and employees by 1.3%. As of the end of 2012, China had 117 SPA&T facilities in operation, an increase from an adjusted total of 114 in 2011. These 117 facilities represent 21% of the total number of worldwide SPA&T facilities, more than 27% of worldwide SPA&T manufacturing floor space and 23% of reported worldwide SPA&T employees.

During 2012 China's manufacturing floor space—a proxy for potential manufacturing capacity—grew to represent almost 28% of worldwide

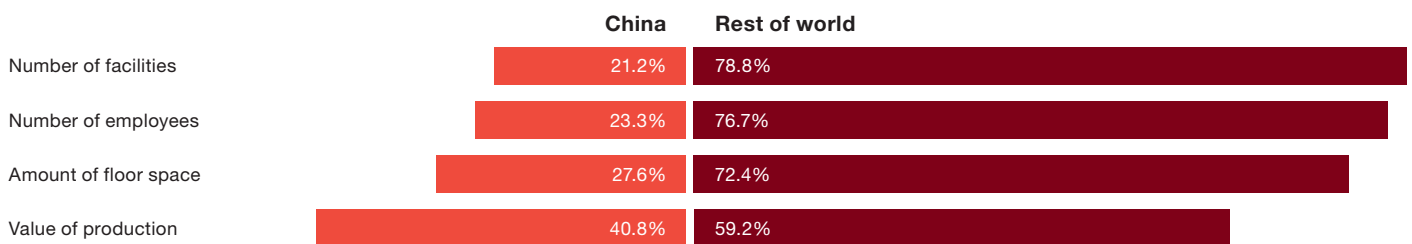
SPA&T manufacturing floor space. As a result, China's SPA&T facilities continued to rank first in share of SPA&T manufacturing floor space for the fourth year, noticeably ahead of Taiwan (at slightly more than 19%) and Japan (at 13%). China's SPA&T facilities also ranked first in number of reported employees, with 23% of worldwide employees at the end of 2012, ahead of Taiwan (18%) and Malaysia (15%).

At the end of 2012 China had five of the 17 planned new worldwide SPA&T facilities which represented more than 90% of the planned manufacturing floor space.

The ownership of China's SPA&T facilities changed moderately during the past year, with the share of facilities owned by Chinese companies decreasing from 37% to 32%, offset by increases in the share belonging to companies from the US (19%), Japan (15%), Taiwan (14%) and Korea (6%).

Most of the growth in China's SPA&T capacity during 2012 was realized in the semiconductor assembly test services (SATS) sector as JCET

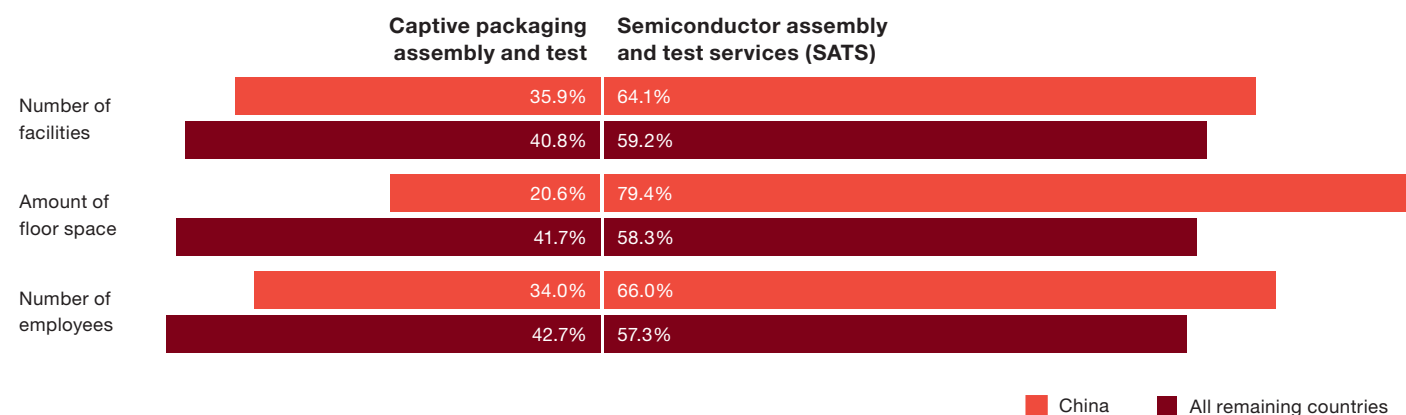
**Figure 20: Comparison of China and all remaining countries' SPA&T resources, 2012**



Source: Gartner



**Figure 21: Comparison of China and all remaining countries' SATS share of SPA&T capacity, 2012**



Source: Gartner

started production in a very large new facility in Chuzhou, Anhui that added almost 9% to China's total SPA&T manufacturing floor space. More of China's SPA&T capacity remains dedicated to the SATS sector than that of other regions. SATS resources represent 79% of China's SPA&T manufacturing floor space and 64% of China's SPA&T facilities versus 58% and 59% for all other countries. Eight of the ten largest SATS companies had one or more facilities in China for a total of 19 out of the 85 top ten SATS facilities worldwide. These 19 facilities accounted for 32% of the top ten SATS manufacturing floor space worldwide.

Packaging assembly and test remains the largest of China's semiconductor manufacturing activities when measured in terms of value added, production revenue, employees and manufacturing floor space, although this relationship is often missed because it is allocated between two separate industry sectors: IC packaging and testing and O-S-D. The composite weighted average of China's 2012 SPA&T production is now estimated to be about 39% of worldwide, up from a revised 36% in 2011.

### Top Chinese semiconductor manufacturers

Table 7 lists the 50 largest semiconductor manufacturers in China— those reporting 2012 revenues of US\$137m or more. This revenue threshold is up 4% from the US\$131m threshold in our 2012 update, which reflects the continuing growth in number and size of Chinese semiconductor manufacturers.

The combined 2012 revenues reported for these top 50 enterprises is US\$29.2bn representing 52% of China's total 2012 semiconductor industry revenue of US\$56.3bn.

This is an increase from the revised 50% of US\$51.4bn now reported for 2011. China's industry continues to be less concentrated than the worldwide industry where the top 10 companies accounted for 51% of the total market.

### The eight groups with their most significant companies are:

	Revenue (US\$m)			
	2009	2010	2011	2012
<b>China Resources Microelectronics (Holdings) Ltd.</b>	540	669	631	558
Wuxi China Resources Microelectronics Co., Ltd. (CR Micro) (former CSMC)—Foundry	144	179	169	
Wuxi China Resources Huajing Microelectronics Co., Ltd.—Discrete	121	168	134	
Wuxi China Resources Semico Microelectronics Co., Ltd.—IC design	84	91	124	100
<b>XINCHAO Group</b>	618	944	969	1,055
JECT (Jinangsu Changjiang Electronics Technology Co., Ltd.)—Pkg & Test	347	531	611	714
<b>Natong Huada Microelectronics Group Co., Ltd.</b>	398	618	620	656
Natong Fujitsu Microelectronics (NFME)—Pkg & Test	181	254	251	252
<b>Shanghai Huahong (Group) Co., Ltd.</b>	411	555	671	730
HHNEC (Shanghai Huahong NEC Electronics Co., Ltd.)—Foundry	240	367	389	372
GSMC (Grace Semiconductor Manufacturing Co.)—Foundry		231	233	
Shanghai Huahong IC Co., Ltd.—IC design	95	96	94	108
<b>China Huada Integrated Circuits Design (Group) Co., Ltd. (CIDC Group)</b>	211	215	246	256
CEC Huada Electronics Design Co., Ltd.—IC design	68	74	127	149
Beijing Huada Zhaibao Electronic Systems Co., Ltd.—IC design	40	55	75	63
Nationz Technologies Inc.	68	104	88	60
<b>Shenzhen National Holdings Co., Ltd.</b>		163	173	183
Shenzhen State Microelectronics—IC design	46	61	73	71
Shenzhen Sunmoon Microelectronics—IC design				
Shenzhen State Micro Technology—OEM				
<b>Hangzhou Silan Microelectronics Co., Ltd.</b>	140	224	206	201
Hangzhou Silan Microelectronics Co., Ltd.—Design	86	96		
Hangzhou Silan Integrated Circuit Co., Ltd.—IDM/Foundry	59	96		
Hangzhou Silan Azure Co., Ltd.—LED	29	58	53	29
<b>Tian Shui Hua Tian Technology Co., Ltd. (TSHT)</b>		216	275	291
Tianshui Huatian Technology Co., Ltd.—Pkg & Test			203	257
Tianshui Huatian Microelectronics Co., Ltd.—Pkg & Test				

**Table 7: Major Chinese semiconductor manufacturers (including groups) in 2012**

Name of company	Rank		Sales revenue (RMB: 100M)				Sales revenue (US\$m)		
	2011	2012	2011	2012	Change	Sector	2011	2012	Change
Intel Products/Semiconductor (Chengdu/Dalian) Co., Ltd.	1	1	308.00	314.00	1.9%	■◆	4,765	4,984	4.6%
SK Hynix Semiconductor (China) (incl Hytech JV)	2	2	158.51	171.15	8.0%	■◆	2,452	2,717	10.8%
SMIC (Semiconductor Manufacturing International Corp.)	3	3	85.00	106.76	25.6%	●	1,315	1,695	28.9%
HiSilicon Technologies Co., Ltd.	5	4	66.68	74.19	11.3%	●	1,032	1,178	14.2%
XINCHAO Group	6	5	62.61	66.49	6.2%	◆	969	1,055	9.0%
Micron Semiconductor (Xi'an) Co., Ltd.		6	59.59	66.23	11.1%	◆	922	1,051	14.0%
Freescale Semiconductor (China) & (Tianjin) Co., Ltd.	4	7	72.32	65.05	-10.0%	◆●	1,119	1,033	-7.7%
Samsung Electronics (Suzhou Semi & LED) Co., Ltd.	7	8	54.19	55.41	2.2%	▼◆●	838	880	4.9%
Shanghai Huahong (Group) Company Ltd.	9	9	43.40	46.01	6.0%	●●	671	730	8.8%
Huizhou Cree	12	10	40.80	45.70	12.0%	▼	631	725	14.9%
RF Micro Devices (RFMD) (Beijing) Co., Ltd.	16	11	37.84	45.00	18.9%	◆	585	714	22.0%
Spreadtrum Communications Inc.	8	12	42.88	44.00	2.6%	●	663	698	5.3%
ASE Assembly & Test (Shanghai+Khunshan+WeiHai+Suzhou) Ltd.	10	13	42.46	42.84	0.9%	◆	657	680	3.5%
Nantong Huada Microelectronics Group Co., Ltd.	13	14	40.08	41.33	3.1%	◆	620	656	5.8%
China Resources Microelectronics (Holdings), Ltd.	11	15	40.80	35.20	-13.7%	■▲●	631	559	-11.5%
TSMC (Shanghai) Co., Ltd.	20	16	23.66	34.17	44.4%	●	366	542	48.2%
Shanghai Panasonic Semiconductor Co., Ltd.	14	17	38.89	33.70	-13.3%	◆	602	535	-11.1%
Renesas Semiconductor (Beijing & Suzhou) Co., Ltd.	15	18	35.58	32.63	-8.3%	◆●	550	518	-5.9%
Diodes Shanghai Co., Ltd.	17	19	28.53	28.90	1.3%	◆	441	459	3.9%
Tianjin ZhongHuan Semiconductor Co., Ltd.	36	20	12.62	11.78	-6.7%	▲	195	187	-4.2%
Lite-On Technology	21	21	23.60	24.80	5.1%	▼	365	394	7.8%
RDA Microelectronics, Inc.	25	22	18.19	24.69	35.7%	●	281	392	39.3%
Infineon Technologies (Wuxi) Co., Ltd.	22	23	21.93	23.00	4.9%	◆	339	365	7.6%
STATS ChipPAC	23	24	20.53	22.66	10.4%	◆	318	360	13.2%
SanDisk Semiconductor (Shanghai) Co., Ltd.	34	25	13.31	22.50	69.0%	◆	206	357	73.4%
Leshan Radio Co., Ltd. (incl ON Semiconductor JV)	19	26	26.88	22.01	-18.1%	▲	416	349	-16.1%
Everlight Electronics	24	27	19.90	21.90	10.1%	▼	308	348	12.9%
No. 55 Research Institute of China Electronics Technology Group Corporation	28	28	16.24	19.70	21.3%	■	251	313	24.5%
Amkor Technology China, Ltd.	33	29	13.40	19.56	46.0%	◆	207	310	49.8%
ST	18	30	27.20	19.23	-29.3%	◆	421	305	-27.5%
Tianshui Huatian Technology Co., Ltd.	26	31	17.75	18.32	3.2%	◆	275	291	5.9%
Shanghai Huali Microelectronics Corporation		32	14.93	16.45	10.2%	●	231	261	13.0%
Sanan Optoelectronics	27	33	17.47	16.40	-6.1%	▼	270	260	-3.7%
China Huada Integrated Circuits Design (Group) Co., Ltd.	29	34	15.90	16.12	1.4%	●	246	256	4.0%
UTAC Dongguan, Shanghai, Chengdu, Ltd.	31	35	14.54	14.11	-3.0%	◆	225	224	-0.4%
Siliconware Technology (Suzhou) Co., Ltd.	43	36	10.35	13.81	33.5%	◆	160	219	36.9%

● IC design    ▲ Discrete    ▼ Discrete (LED)    ● Foundry    ■ IDM    ◆ Packaging and testing

Name of company	Rank		Sales revenue (RMB: 100M)				Sales revenue (US\$m)		
	2011	2012	2011	2012	Change	Sector	2011	2012	Change
HeJian Technology (Suzhou) Co., Ltd.	32	37	13.45	13.48	0.3%	●	208	214	2.9%
Hangzhou Silan Microelectronics Co., Ltd.	35	38	13.30	12.64	-5.0%	●▲●	206	201	-2.5%
Galaxycore Inc.	37	39	11.68	11.80	1.0%	●	181	187	3.6%
Shenzhen National Holdings Co., Ltd.	39	40	11.20	11.50	2.7%	●	173	183	5.3%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	40	41	11.00	11.50	4.5%	●	170	183	7.3%
Leadcore Technology Co., Ltd.	47	42	9.44	11.07	17.2%	●	146	176	20.3%
Beijing Vimicro Co., Ltd.	60	43	9.48	11.00	16.0%	●	147	175	19.0%
Allwinner Technology		44	3.23	10.58	227.6%	●	50	168	236.0%
Jilin Sino Microelectronics Co., Ltd.	50	45	8.45	10.55	24.9%	▲	131	168	28.1%
Fairchild Semiconductor (Suzhou) Co., Ltd.	38	36	11.41	10.27	-10.0%	◆	176	163	-7.6%
Elec-Tech International Co., Ltd.	48	47	9.10	10.27	12.8%	▼	141	163	15.8%
TI Semiconductor Manufacturing (Chengdu) Co., Ltd.		48	5.05	10.25	103.0%	■	78	163	108.3%
Shenzhen Netcom Electronics Co., Ltd.		49	6.07	9.37	54.4%	●	94	149	58.4%
ASMC (Advanced Semiconductor Manufacturing Co., Ltd.)	46	50	9.50	8.60	-9.5%	●	147	137	-7.1%

Source: CSIA, CCID, GSA, Gartner, Company reports, PwC

● IC design    ▲ Discrete    ▼ Discrete (LED)    ● Foundry    ■ IDM    ◆ Packaging and testing

The combined reported revenues of the continuing 49 of these top 50 manufacturers increased by 8.6% in 2012, which is slightly (1%) less than the increase reported by China's total semiconductor industry. During 2012 these top 50 enterprises accounted for 92% of China's chip manufacturing (foundry and IDM) revenues; 82% of IC packaging and testing revenues; 47% of IC design (fabless) revenues; but only 17% of O-S-D revenues.

This table includes eight 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 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 eight groups, Table 7 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. These companies include ASE, Diodes, Freescale, Hynex, Intel, Renesas, RFMD, Samsung Electronics, ST and UTAC. Each listing reflects the combined revenues of all the companies' manufacturing facilities in China.

### Greater China

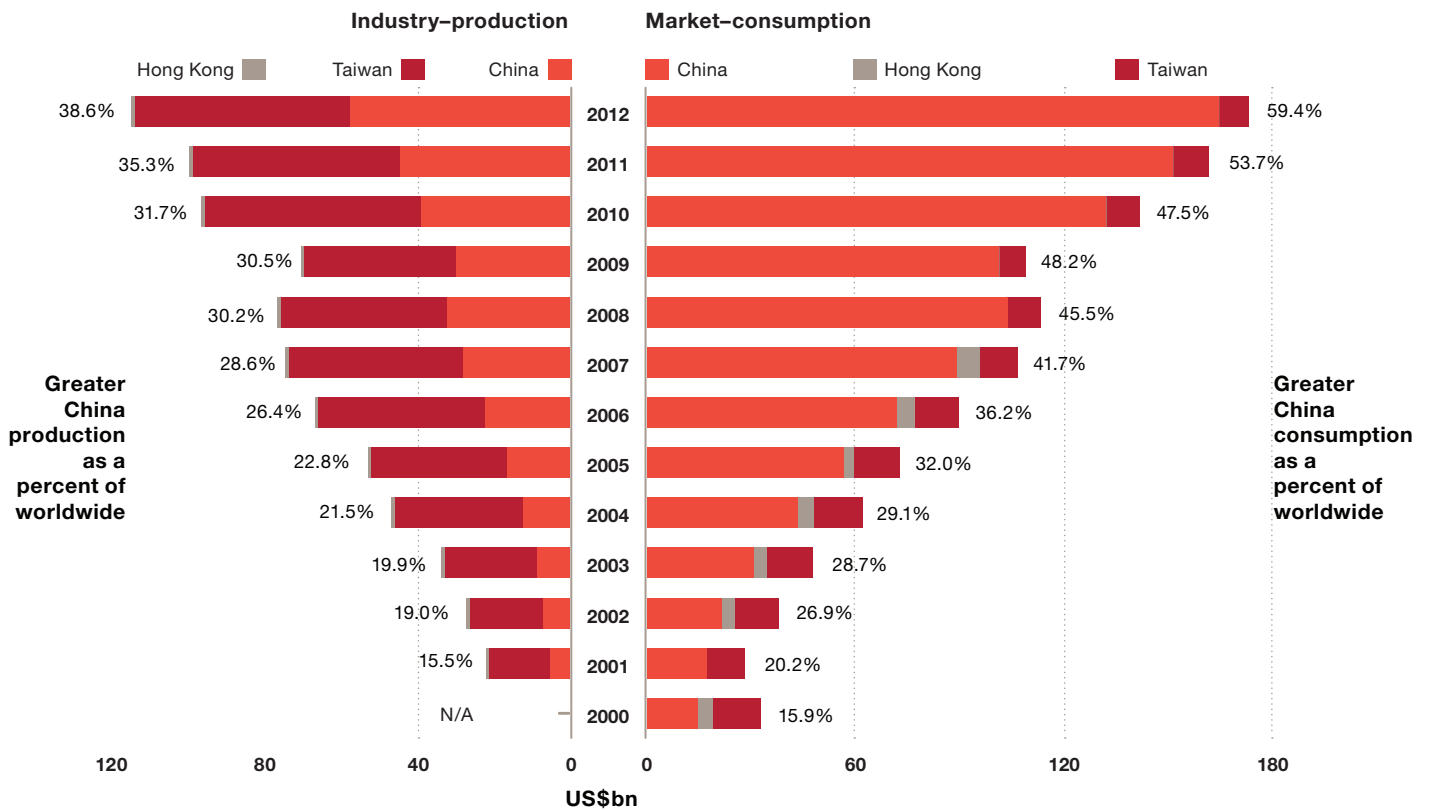
Greater China's consumption and production of semiconductors continued to grow to new record levels during 2012 despite the overall decrease in the worldwide semiconductor market. Measured in US dollars, Greater China, which includes China, Hong Kong and Taiwan, accounted for more than 55% of the worldwide semiconductor consumption market in 2012, while it produced slightly less than a quarter of worldwide industry revenues.

Taiwan is one of the world's largest suppliers of semiconductors and a key pillar of the Greater China semiconductor industry. According to the Taiwan Semiconductor Industry Association (TSIA), Taiwan's IC

industry revenues as a whole rose 4.6% to NT\$1,634bn (US\$55bn) in 2012. TSIA forecasts 9.3% growth in 2013 on the back of robust demand for chips used in smartphones, tablet computers and other smart mobile devices.

Taiwan's leading IC contract foundries continue to aggressively expand production capacity, boosting their capital expenditures to record levels in 2012-2013 to ensure sufficient 28nm and below capacity in future years to meet growing demand for high-end chips. Local IC packaging and testing service providers are also increasing capital spending to meet higher demand, focusing on packaging technologies for 28nm manufacturing processes.

Figure 22: Greater China share of the worldwide semiconductor industry, 2000–2012



Source: CCID, CSIA, Gartner Dataquest, ICI, TSIA, WSTS, PwC 2004–2013

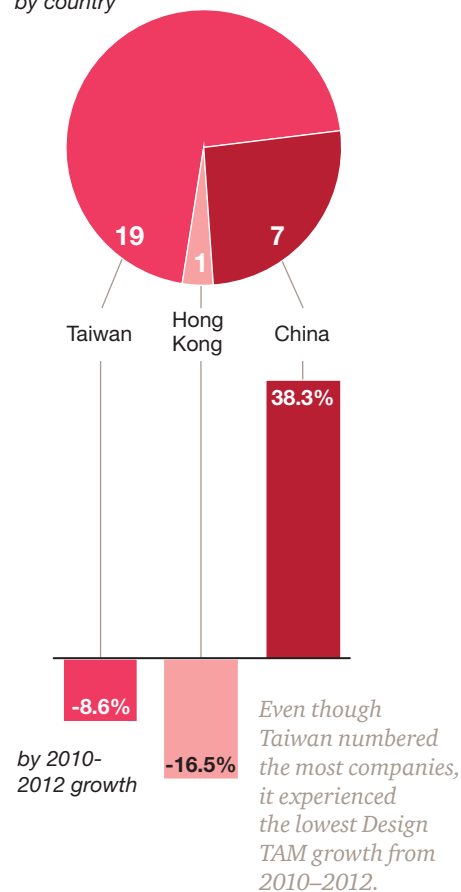
**Table 8: Greater China companies among worldwide top 100 OEM/ODM companies by Semiconductor Design TAM**

Company	Country	Design TAM (US\$m)			
		2010	2011	2012	% change 2010–2012
Ability	TWN	622	715	661	6.3%
Acer	TWN	5,410	4,287	3,448	-36.3%
A-Data	TWN	794	491	447	-43.7%
ASUSTeK	TWN	2,774	2,731	3,302	19.0%
Compal	TWN	1,952	1,609	1,474	-24.5%
Delta Electronics	TWN	396	396	388	-2.0%
ECS	TWN	620	509	459	-26.0%
Gigabyte	TWN	607	564	533	-12.2%
Haier	CN	428	573	520	21.5%
Hisense	CN	259	372	506	95.4%
Hon Hai	TWN	3,855	3,982	3,499	-9.2%
HTC	TWN	1,631	2,472	1,913	17.3%
Huawei	CN	3,391	3,833	4,327	27.6%
Inventec	TWN	770	863	726	-5.7%
Lenovo	CN	6,083	7,782	8,098	33.1%
Lite-On	TWN	424	472	573	35.1%
MSI	TWN	1,187	854	696	-41.4%
Pegatron	TWN	1,413	1,381	1,193	-15.6%
Qisda	TWN	1,335	1,179	1,168	-12.5%
Quanta	TWN	1,245	1,331	1,784	43.3%
Skyworth	CN	230	346	473	105.7%
TCL	CN	945	1,178	1,494	58.1%
TPV	HKG	2,000	1,752	1,670	-16.5%
Transcend	TWN	617	724	616	-0.1%
Wistron	TWN	1,084	1,372	1,064	-1.8%
Yulong	TWN	71	192	556	683.1%
ZTE	CN	2,081	2,776	3,140	50.9%
<b>Grand total — 27</b>		<b>42,224</b>	<b>44,736</b>	<b>44,728</b>	<b>5.9%</b>

Source: Gartner

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

Number of companies by country



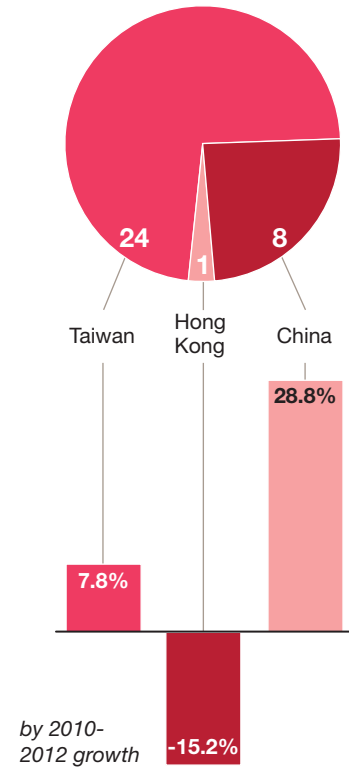
**Table 9: Greater China companies among worldwide top 100 OEM, ODM and EMS companies by Semiconductor Purchasing TAM**

Company	Country	Purchasing TAM (US\$m)			
		2010	2011	2012	% change 2010–2012
Ability	TWN	710	819	756	6.4%
Acer	TWN	2,846	2,258	1,783	-37.3%
A-Data	TWN	794	491	447	-43.7%
ASUSTeK	TWN	1,600	1,643	2,045	27.8%
Cal-comp	TWN	864	773	853	-1.3%
Changhong	CN	295	396	408	38.3%
Compal	TWN	5,532	5,191	4,834	-12.6%
Delta Electronics	TWN	406	404	396	-2.5%
ECS	TWN	1,192	1,013	922	-22.6%
Gigabyte	TWN	1,145	1,093	1,059	-7.5%
Haier	CN	401	520	494	23.2%
Hisense	CN	296	409	544	83.8%
Hon Hai	TWN	15,441	18,557	21,824	41.3%
HTC	TWN	2,032	2,693	2,011	-1.0%
Huawei	CN	2,748	2,965	3,369	22.6%
Inventec	TWN	2,280	2,627	2,144	-6.0%
Largan Precision	TWN	365	445	405	11.0%
Lenovo	CN	4,738	5,922	5,815	22.7%
Lite-On	TWN	545	598	692	26.9%
Mitac	TWN	730	611	591	-19.1%
MSI	TWN	1,817	1,435	1,241	-31.7%
Pegatron	TWN	5,894	5,445	5,634	-4.4%
Qisda	TWN	843	759	821	-2.6%
Quanta	TWN	6,091	6,247	6,362	4.5%
Skyworth	CN	308	422	550	78.6%
TCL	CN	1,230	1,427	1,749	42.2%
TPV	HKG	2,000	1,783	1,697	-15.1%
Transcend	TWN	617	724	616	-0.1%
TSMT	TWN	589	662	672	14.2%
USI	TWN	822	916	966	17.5%
Wistron	TWN	2,949	3,511	2,944	-0.2%
Yulong	TWN	71	192	556	683.1%
ZTE	CN	2,062	2,477	2,627	27.4%
<b>Grand total — 33</b>		<b>70,253</b>	<b>75,428</b>	<b>77,827</b>	<b>10.8%</b>

Source: Gartner

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

Number of companies by country



*Hong Kong, with its single company, experienced almost 80% Purchasing TAM growth from 2010–2012.*



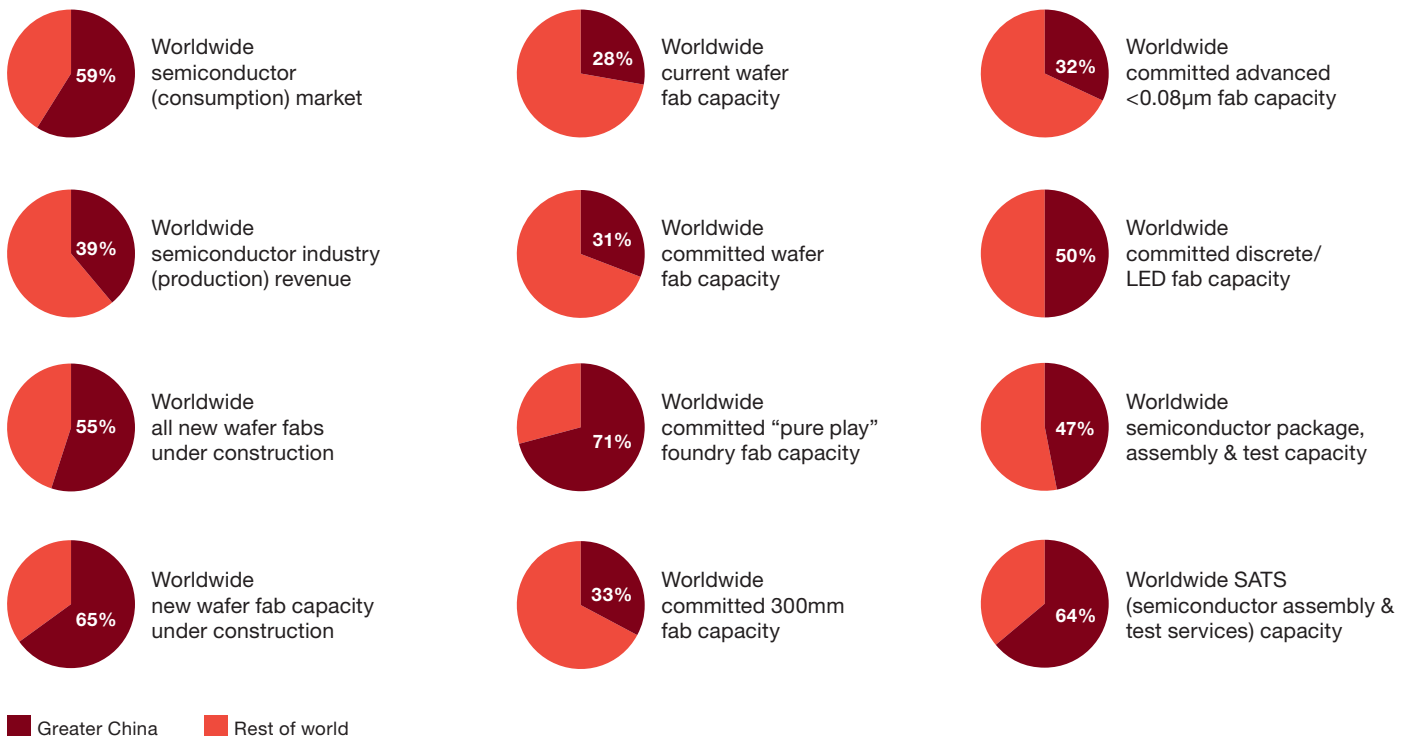
Elsewhere, Taiwan's fabless IC designers face mounting competition in the Chinese market from mainland rivals, particularly in the mobile-phone chip segment. Also, Taiwan's DRAM manufacturers are struggling to stay afloat in the face of intense competitive pressure and an increased consumer focus on mobility. Local memory chipmakers have largely left the PC DRAM market and have each found a niche in which to survive or revive their businesses.

Taiwan has been relaxing its restrictions on investment from Mainland China as cross-strait relations have markedly improved in recent years. Since 2009, Taiwan has carried out three rounds of opening up its markets to Chinese capital. The government is expected to conduct a fourth round of market opening in 2013, as well as a wider

relaxation of regulations for Chinese investors, which may further raise the ceilings for investment in Taiwan's semiconductor sector.

Greater Chinese companies have grown to dominate worldwide semiconductor outsourced manufacturing. With the merger of China's HHNEC and GSMC (Grace Semiconductor Manufacturing Company) six of the top 10 (4 Taiwanese + 2 Chinese) and 10 of the top 20 (6 Taiwanese + 4 Chinese) pure-play semiconductor wafer foundries were Greater China companies, accounting for US\$25bn, 77%, of total worldwide 2012 foundry revenues. By the end of 2012, Greater China also represented 71% of worldwide pure play wafer foundry capacity. Similarly, 6 of the top 10 (4 Taiwan + 2 China) and 11 of the top 20 (8 Taiwan + 3 China) SATS (semiconductor assembly and test

**Figure 23: Greater China represents, 2012**



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

services) suppliers were Greater China companies accounting for US\$12bn or 48% of total worldwide 2012 SATS revenue. Also by the end of 2012 Greater China represented 64% of worldwide SATS manufacturing floor space capacity.

Driven by the Chinese market, Greater China's semiconductor consumption increased to a record level of US\$173bn in 2012, growing by 7% or US\$12bn during the year. China's consumption of semiconductors grew to be more than eighteen times that of Taiwan's in 2012, with a significant portion of that consumption created by

Greater China's IC consumption continues to exceed its IC production because China's IC consumption growth continues to exceed Taiwan's IC production growth. As a result, Greater China's annual IC consumption/production gap has grown steadily since 2000 to reach a record US\$55bn in 2012, up from a revised US\$51bn in 2011.

While this gap is still significantly less than that of China alone, it now accounts for more than 21% of the total worldwide IC market.

There were 27 Greater China OEM and ODM companies among the worldwide top 100 semiconductor consumers in 2012 based upon Design TAM (total available market), up from 24 such companies in 2011. Of these 27 companies 19 are in Taiwan, seven in China and one in Hong Kong. Their combined total Design TAM accounted for 15% of worldwide in 2012, an increase from 14% in 2011. Samsung Electronics, at US\$25.5bn, is reported to have the largest Design TAM worldwide in 2012, up a significant 37% from 2011 and slightly greater than Apple, last year's leader, with US\$21.2bn.

There were 33 Greater Chinese OEM, ODM and EMS companies among the worldwide top 100 semiconductor consumers in 2012 based upon Purchasing TAM. This is an increase from 30 such companies in 2011. Of these 33 companies, 24 are in Taiwan, eight in China and only one in Hong Kong. Their combined total Purchasing TAM accounted for 26% of worldwide in 2012, an increase from 24% in 2011. Samsung Electronics is also reported to have the largest Purchasing TAM worldwide in 2012 at US\$25.0bn, up a dramatic 40% from 2011 and 15% greater than last year's leader, Hon Hai at US\$21.8bn.

*Driven by the Chinese market, Greater China's semiconductor consumption increased to a record level of US\$173bn in 2012, growing by 7% or US\$12bn during the year.*

Taiwanese electronic manufacturing services (EMS) and original design manufacturers (ODM) companies operating in China.

Greater China's semiconductor industry (production) revenue also increased to a new record level of US\$113bn in 2012 as both China's and Taiwan's industry sectors grew by 10% and 4% respectively despite the worldwide semiconductor industry's -3% decline. During the past ten years, from 2002 through 2012, China's IC industry has grown at a 26.6% CAGR, while Taiwan's industry has only grown at an 11.4% CAGR. As a result, Taiwan's IC industry revenues were only 1.6 times as large as China's reported IC industry revenues in 2012, down from being almost six times as large in 2002.

### **Government support and tax incentives**

As previously reported, China's 12th Five-Year Plan (12th FYP) has shown the government's firm determination to further promote the development of the semiconductor industry.

Tax incentives are an important part of the government support. The unification of Corporate Income Tax ("CIT") in China, effective from 1 January 2008, features a noteworthy change in the focus of tax incentives, from "geographic-oriented" to "industry-oriented". Apart from the CIT incentives, incentives in the form of other taxes such as turnover tax and customs, are also found to be aimed at directing investments into those industry sectors and projects encouraged and supported by the government. Among others, the following tax incentives stipulated in Caishui [2008] No. 1 and Caishui [2012] No. 27 (Circular 27) reflect the Chinese government's focus on encouraging the IC industry:

- A "2+3 CIT holiday" (i.e., two-year exemption plus a three-year 50% reduction) for newly established IC design enterprises;
- A "2+3 CIT holiday" for qualified IC manufacturing enterprises (IC with line width less than 0.8 microns); or
- A "5+5 CIT holiday" for qualified IC manufacturing enterprises (IC with line width less than 0.8 microns) and total investment more than 8 billion RMB, each commencing from the first profit-making year (prior to the end of 2017);
- A lower CIT rate of 10% for qualified "key IC design enterprises", provided that those enterprises are not entitled to CIT exemption for that year;

- Full CIT deduction of employee training expenses for qualified IC design companies; and
- Accelerated depreciation of intangible assets and fixed assets for qualified IC enterprises.

In addition, IC and semiconductor enterprises may also enjoy some other tax incentives such as an R&D expenses super-deduction for CIT purpose; CIT exemption or reduction on income derived from qualified technology transfer, Business Tax/Value-added Tax exemption on qualified services (e.g., development, design, consultation) and qualified exported services, etc.

### **Uncertainties**

According to the State Administration of Taxation ("SAT") and Ministry of Finance ("MOF") jointly issued Circular 27, qualified IC and semiconductor enterprises can enjoy various CIT incentives beginning 1 January 2011. However, the detailed assessment measures of "qualified IC manufacturing and design enterprises" and the relevant implementation rules have not yet been released.

Based on Public Notice [2012] No. 19 issued by SAT in 2012, before the new measures are released, companies that fulfill the criteria provided by Circular 27 can apply for qualified IC enterprise status following the previous rules in order to enjoy the relevant CIT incentives. However that company will have to re-apply for qualified IC enterprise status according to the new measures once they are available. If it fails to obtain the status under these new measures, the tax incentives enjoyed under Circular 27 will be clawed back.

It is anticipated that a higher threshold for obtaining the qualified IC enterprise status, as well as more stringent administration of qualified IC and semiconductor enterprises, may be introduced in the near future.

As one of China's strategic fast developing industries, the IC industry has greatly benefited from the government's supporting policies. However, in order to avail themselves of such support, semiconductor

companies may face new challenges in meeting the qualification criteria. Some uncertainties regarding the current policies also remain in respect to the assessment of qualified IC enterprises and the relevant tax treatment. We believe SAT and other relevant government bodies will clarify them in due course to ensure the thorough implementation of such incentives.

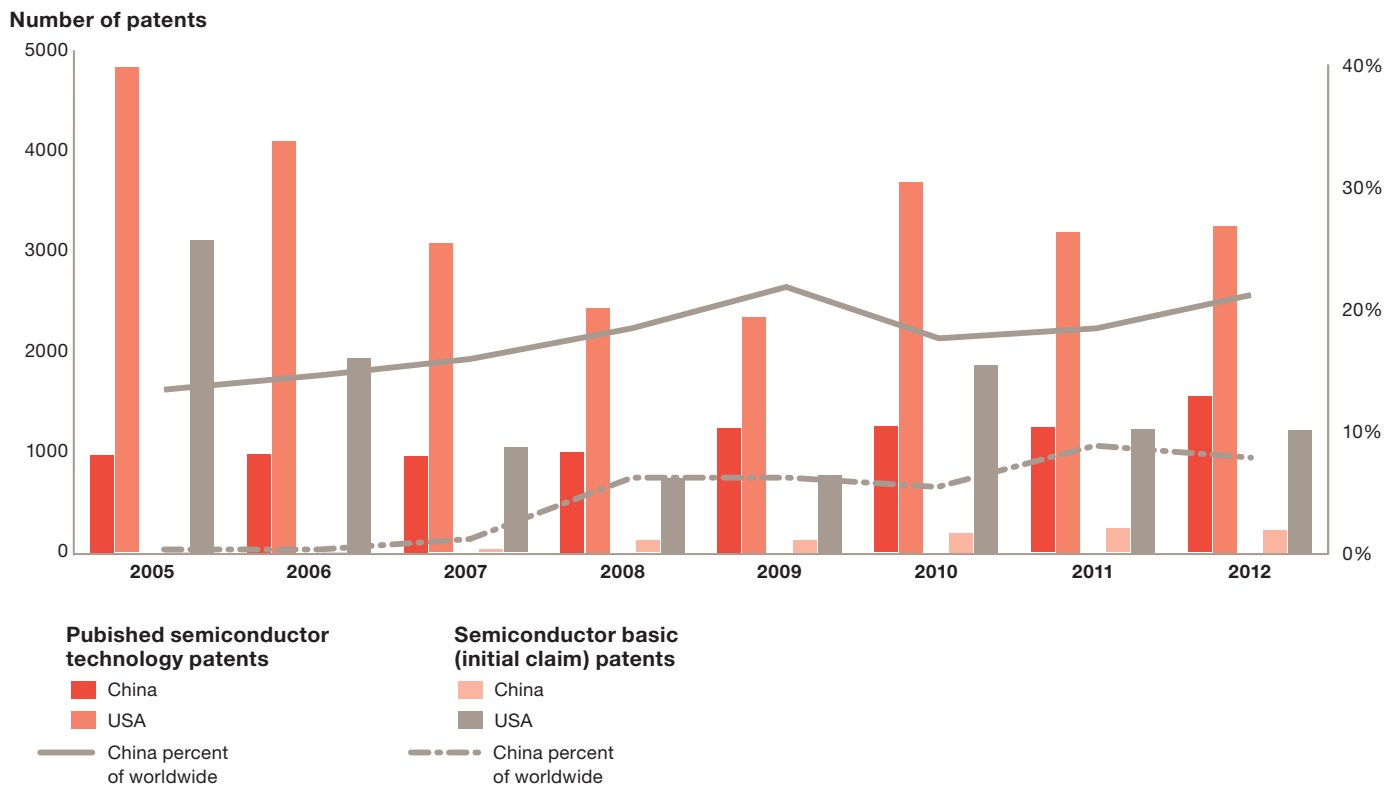
### Semiconductor patents

Intellectual property (IP) and its protection continues to be an area of specific focus of China's 12th Five Year Plan (FYP). One of the policy objectives of the 12th FYP for the semiconductor industry remains to foster a group of semiconductor firms that will develop into global leaders in terms of both technology standards and market share. The government has implemented various tax and other incentives to support this objective for new/high technology enterprises (NHTEs).

One of the qualification criteria for NHTE status is core proprietary IP rights. Since 2005, China's share of worldwide semiconductor patents published by year has increased from

13.5% in 2005 to a peak of 21.6% in 2009 before declining to 17.7% and 18.2% in 2010 and 2011 and then growing to 20.9% in 2012. What may be more significant is the gradual growth of China's share of the first instance of a semiconductor patent's publication, referred to as the basic patent statistic. According to data from the Derwent Worldwide Patent Database, China, which had no semiconductor basic patents issued in 2005 or 2006, started to grow its share of worldwide semiconductor basic patents issued from 1.3% in 2007 to 9.1% in 2011 and 8.1% in 2012. During the past five years, from 2008 through 2012, 7% of patents on semiconductor inventions have been first issued in China compared to 45% in the US. While the US has maintained its lead

**Figure 24: China versus worldwide semiconductor patents 2005–2012**



Source: Derwent 2013

*The top 10 assignees, accounting for 21% of the 1,553 semiconductor technology patents issued in China in 2012, were the following multinational companies:*

Company	# of patents
Semiconductor Energy Laboratory Co. (SEME)	76
Taiwan Semiconductor Manufacturing Co., Ltd. (TSMC)	51
Sony Corp. (SONY)	36
Sharp KK (SHAF)	31
Samsung Electronics Co., Ltd. (SMSU)	30
Matsushita Electrical Industries Co., Ltd.	23
Panasonic Corp.	23
IBM Corp. (IBM)	20
Samsung Mobile Display Co., Ltd.	20
Sumitomo Chemical Co., Ltd.	19

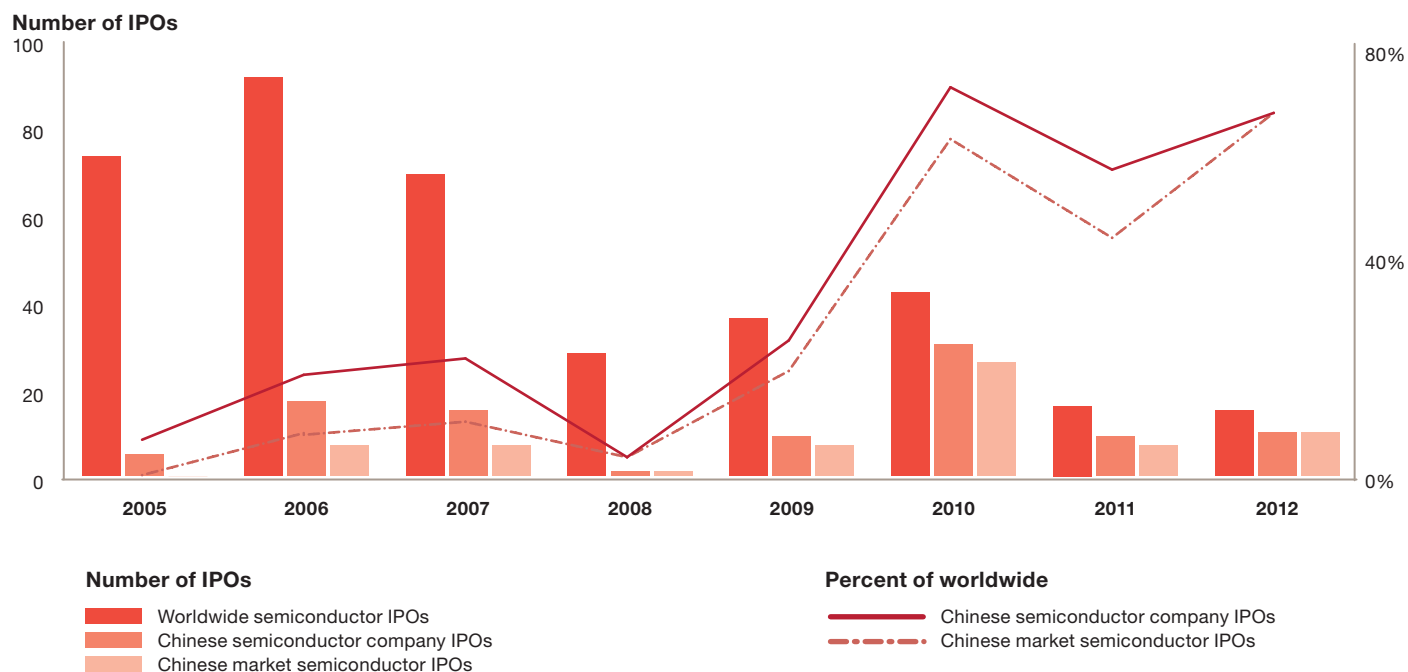
*Correspondingly, the top 10 assignees accounting for 27% of the 222 semiconductor basic (initial claim) patents issued in China in 2012 were the following Chinese companies and institutions:*

Institute of Microelectronics Chinese Academy of Science	11
Haiyangwang Lighting Technology Co., Ltd.	8
Oceans King Lighting Science & Technology Co.	8
BOE Technology Group Co., Ltd.	6
Semiconductor Manufacturing International Corp. (SMIC)	5
University of Beijing Science and Technology	5
Tsinghua University	5
Southeast University	5
Beijing Institute of Technology	4
Hefei Institutes of Physical Science, Chinese Academy of Sciences	4

in share of worldwide semiconductor basic patents issued, China has taken a lead in share of total worldwide basic patents issued, increasing from 8% in 2006 to 53% 2012.

Further research with the Derwent patent database reveals that most of these Chinese semiconductor patents are still being issued to companies outside of China. There were no Chinese companies or institutions among the top 10 and only one among the top 20 assignees.

**Figure 25: China versus worldwide semiconductor IPOs, 2005–2012**



Source: Thomson Financial 2010, 2011, 2012, 2013  
Chinese semiconductor company=domiciled in China

### **Financial markets and IPO funding**

As reported in our prior updates, China had emerged in 2009 as a significant source of new companies and financial funding for semiconductor start-ups. That momentum continued through 2010 as China overshadowed the US and the rest of the world with the most technology IPOs and China's Shenzhen exchange displaced NASDAQ as the leading exchange for those technology IPOs. However as China's predominance in technology IPOs continued through 2011, the global market for technology IPOs started to decline.

Chinese technology IPOs and money raised experienced a steady decline during 2012. By 4Q 2012 China has only one technology IPO during the

quarter and has had no semiconductor IPO since 2Q 2012. After three years of growth in IPOs, the decline in economic growth led to lower numbers of technology companies listing in both China and Greater China.

China saw technology IPO activity decline throughout 2012 due to slowing growth and change in posture by the Chinese Security and Regulatory commission relative to new filings. No technology IPOs were recorded in China in Q1 and Q2 2013.

Also of interest, as noted in our 2011 update, recent changes in China's tax incentives for semiconductor NHTEs may increase the degree of concentration in China's semiconductor industry and indirectly work to accelerate mergers between



**Table 10: China versus worldwide semiconductor IPOs 2005–2Q 2013**

	2005	2006	2007	2008	2009	2010	2011	2012	1Q/13	2Q/13	Total 8.5 Yrs 2005–2Q/13
<b>Worldwide semiconductor IPOs</b>											
Number of IPOs	73	91	69	28	36	42	16	15	1	0	371
Proceeds (US\$m)	3,006.0	3,663.8	3,727.1	678.2	1,693.6	6,202.6	2,645.0	1,445.4	42.0	0	23,103.7
<b>Chinese semiconductor company IPOs</b>											
Number of IPOs	5	17	15	1	9	30	9	10	0	0	96
% of worldwide	6.8%	18.7%	21.7%	3.6%	25.0%	71.4%	56.3%	66.7%	0.0%	0.0%	25.9%
Proceeds (US\$m)	407.9	743.6	1,109.5	37.4	1,308.9	4,493.6	1,323.0	1,020.0	0.0	0	10,443.9
% of worldwide	13.6%	20.3%	29.8%	5.5%	77.3%	72.4%	50.0%	70.6%	0.0%	0.0%	45.2%
<b>Chinese market semiconductor IPOs</b>											
Number of IPOs	0	7	7	1	7	26	7	10	0	0	65
% of worldwide	0.0%	7.7%	10.1%	3.6%	19.4%	61.9%	43.8%	66.7%	0.0%	0.0%	17.5%
Proceeds (US\$m)	0.0	285.5	351.6	37.4	1,270.7	4,062.5	1,220.0	1,020.0	0.0	0.0	8,247.7
% of worldwide	0.0%	7.8%	9.4%	5.5%	75.0%	65.5%	46.1%	70.6%	0.0%	0.0%	35.7%

Chinese semiconductor company = domiciled in China  
Source: Thomson Reuters 2010–2012

companies in the industry. According to Thomson Financial, Chinese companies have completed 115 semiconductor industry related M&A (merger and acquisition) deals since 2010. There were 45 deals completed in 2011, 43 completed in 2012 and eight completed during Q1 2013. Of these 115 Chinese semiconductor M&A deals, 83 involved the acquisition of other Chinese assets and 32 of foreign assets, including nine from the US, six from Germany and three from Hong Kong.

### Production growth scenarios

Since our original 2004 report, PwC has examined the effects that different levels of growth in the Chinese integrated circuit (IC) semiconductor industry would have on the greater industry. We initially used scenarios that spanned the time period from 2003 through 2010, analysing the developments, investments and milestones that would have to be accomplished for China to achieve each level of growth during the forecast period. With the start of China's 12th Five Year Plan we revised the basic assumptions and business models used for our further scenario analysis of China's IC industry.

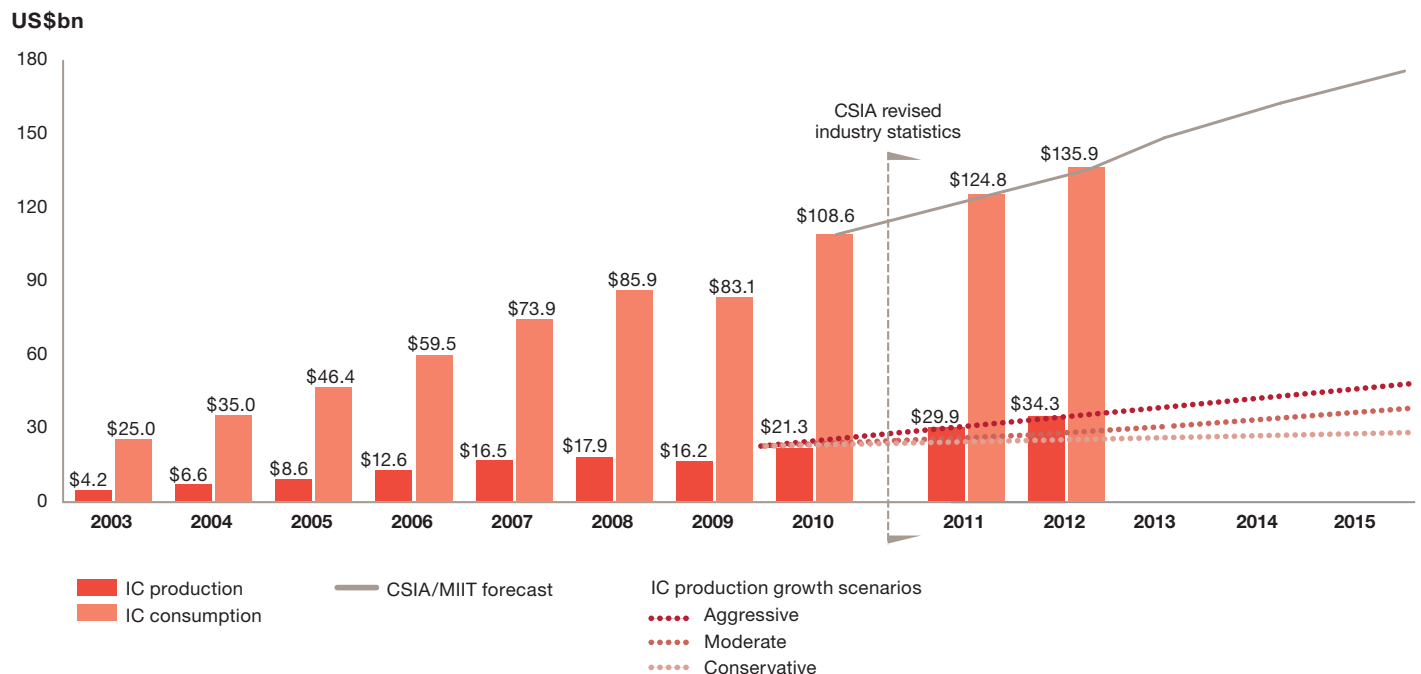
The following is a concise summary of our analysis of the revised conservative, moderate and aggressive growth scenarios developed for China's IC industry over the period from 2010 through 2015. The conservative and moderate scenarios reflect China's capabilities, while the aggressive scenario reflects its stated intentions. The analysis covers the assumptions,

business models, developments, investments and milestones for each scenario over that five-year period. These scenarios are described in considerable detail in our 2011 update.

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" 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 to meet the MIIT's 12th FYP objectives.

The conservative scenario is based upon similar wafer fab completion assumptions reduced to 70% of nominal WFW capacity, with all of the

**Figure 26: China's integrated circuit production and consumption—12th FYP scenarios compared with actual**



Source: CSIA CCID, World Fab Watch, PwC

resulting wafer fab output packaged and tested in China in addition to the 2010 volume of imported wafer devices packaged and tested in China. It also assumes that China's IC design grows at a 10% CAGR, slightly higher than China's forecast GDP growth.

The aggressive scenario assumes that China's IC industry and IC design sectors achieve 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 revenue of 70 billion RMB by 2015. At the 2012 average FX rate, these goals equate to US\$52.3bn and US\$11.1bn.

*Although China's IC consumption market achieved exceptional growth in 2012 during a worldwide market decline, it missed the CSIA forecast growth by more than 4.5%.*

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

Figure 26 illustrates these three scenarios along with China's reported IC industry performance. Although China's IC consumption market achieved exceptional growth in 2012 during a worldwide market decline, it missed the CSIA forecast growth by more than 4.5%. However, based upon the current CSIA reports, China's IC industry production revenues exceeded the aggressive scenarios in both 2011 and 2012. During the last two years, China's IC industry has reported a 22.4% RMB and 26.9% dollar CAGR. During this period, China's IC design sector reported a 35.5% dollar CAGR, IC packaging and testing 27.1% and IC manufacturing 19.2%. Based upon these revised results, it now seems reasonably possible, if not completely probable, that China's IC industry may follow the aggressive scenario through 2015 and achieve the MIIT revenue goals of 330 billion RMB with IC design reaching 70 billion RMB. During the same two-year period, more than US\$10bn of additional fixed asset investments were made in China's IC industry. While this investment rate clearly supports the moderate scenario, it may have to be increased to support the aggressive scenario requirements.

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# Conclusion

During 2012 both China's semiconductor consumption market and industry production were able to grow to new record levels despite a 3% decrease in the worldwide semiconductor market. China confirmed its role as the dominant consumer of semiconductor devices. Measured in dollars, more than half of all the semiconductors consumed worldwide during 2012 were used in the production of electronic equipment and devices in China. Since more than 90% of the semiconductors consumed in China continue to be supplied by the major global semiconductor companies, China's impact extends across the entire semiconductor industry.

At the same time, China's share of worldwide semiconductor production value increased to at least 12% in 2012 with the majority of that production value being contributed by the major global semiconductor companies. Most industry analysts predict that the trend of China's increasing share of worldwide semiconductor consumption will continue over the next several years, possibly increasing by a further 7% by 2017 and it now seems reasonably possible that China's IC industry production will achieve the MIIT 12th Five-Year Plan revenue goals of 300 billion RMB (US\$52.3bn) with IC design reaching 70 billion RMB (US\$11.1bn).

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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 here.***

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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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