

# *China's impact on the semiconductor industry: 2015 update*

*Technology Institute  
Full Report  
March 2016*

---

# ***Table of contents***

---

Overview

Part I – China's semiconductor market

Part II – China's semiconductor industry

Part III – China's design industry

Part IV – China's semiconductor manufacturing

Part V – Top Chinese semiconductor companies and manufacturers

About this report

Interpreting Chinese semiconductor statistics

---

---

# *Overview*

---

# Overview

During the eleven years that PwC has reported on China's impact on the semiconductor industry, China has moved rapidly from being the smallest of the regional semiconductor consumption markets in 2003, to the largest by 2005, and then expanded its consumption leadership position and increased its market share every subsequent year but one. During four of those years China's consumption grew by commanding the majority of worldwide market growth, while during the other six years, including the past four, China's consumption has grown at the expense of decreases in other regions. While the worldwide semiconductor market has grown by US\$169 billion from 2003 through 2014, China's semiconductor consumption has grown by US\$173 billion, and 2014 was the third year that China consumed more than half of the worldwide semiconductor market.

From 2004 through 2014 China's semiconductor consumption grew at a ten-year compound annual growth rate (CAGR) of 16.7% while the worldwide semiconductor market grew at a 4.7% CAGR. During that same period China's much smaller semiconductor industry revenue grew at a 20.5% CAGR. A conservative comparison indicates that China's semiconductor industry accounted for 13.4% of the world- wide semiconductor industry in 2014, up from 12.0% in 2013 and 11.6% in 2012.

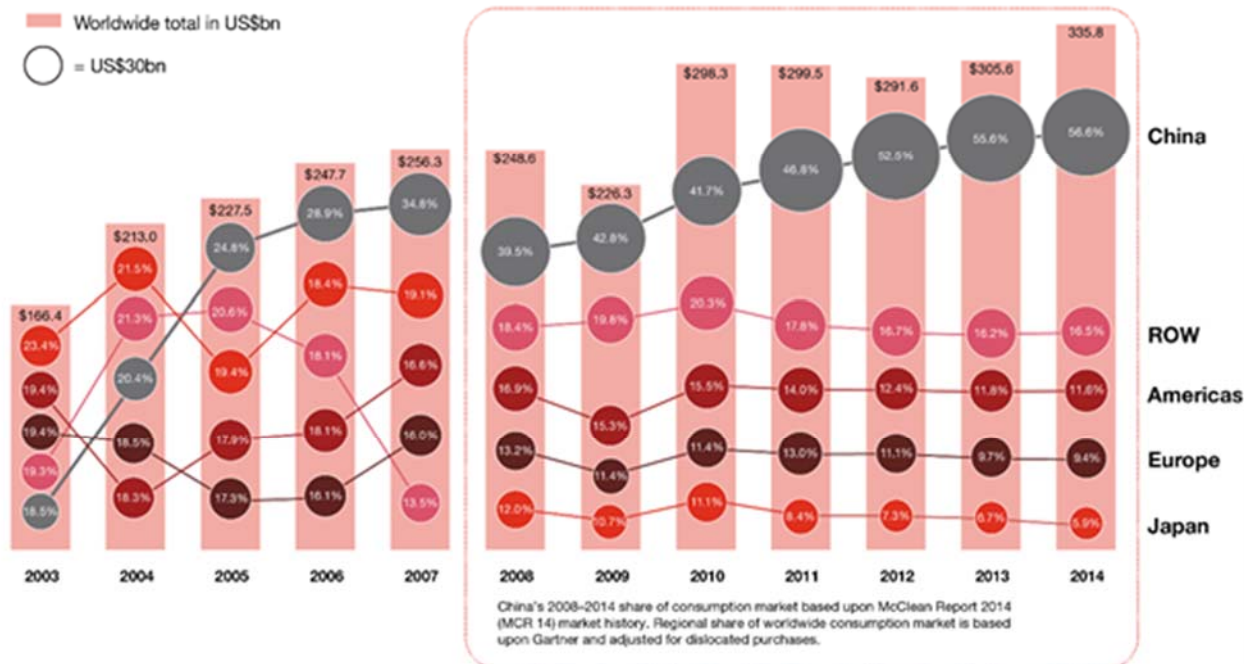
Updates to many of our annual graphics as well as a brief explanation of the significant changes for the year can be found at [www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon).

If you have any questions or would like to discuss any of the findings in this report and how they may impact your business, please reach out to [Raman Chitkara](mailto:raman.chitkara@us.pwc.com) (raman.chitkara@us.pwc.com), our global technology industry leader, [Jianbin Gao](mailto:gao.jianbin@cn.pwc.com) (gao.jianbin@cn.pwc.com), the technology industry leader in China or [Clements E. Pausa](mailto:clements.e.pausa@us.pwc.com) (clements.e.pausa@us.pwc.com), the report author.

---

# ***Part I – China's semiconductor market***

## Worldwide semiconductor consumption market by region, 2003–2014



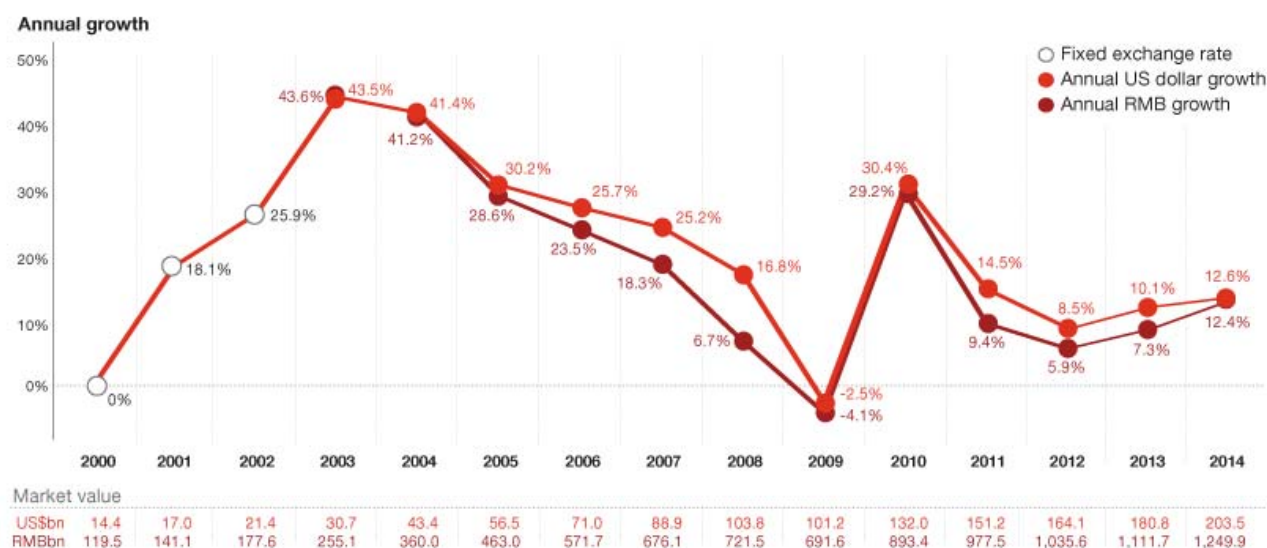
For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: Semiconductor Industry Association (SIA), McClean Report 2014 (MCR 14), Gartner Dataquest (GDQ), CCID Consulting (CCID)

©2015 PricewaterhouseCoopers LLP, a Delaware limited liability partnership. All rights reserved. PwC refers to the US member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see [www.pwc.com/structure](http://www.pwc.com/structure) for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494 pt

For the fourth consecutive year China's semiconductor consumption growth continued to far exceed worldwide semiconductor market growth in 2014. While the worldwide semiconductor market increased 9.8% in 2014, China's semiconductor consumption market grew by 12.6% in 2014 to reach a new record of 56.6% of the global market. During the past eleven years, China's semiconductor consumption has grown at an 18.8% compounded annual growth rate (CAGR), while total worldwide consumption has only grown at a 6.6% CAGR. The worldwide semiconductor market as reported by World Semiconductor Trade Statistics (WSTS) has grown by US\$169bn from 2003 to 2014 while China's semiconductor consumption as reported by the China Semiconductor Industry Association (CSIA) has grown by US\$173bn.

## China's semiconductor market growth, 2000–2014



**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.



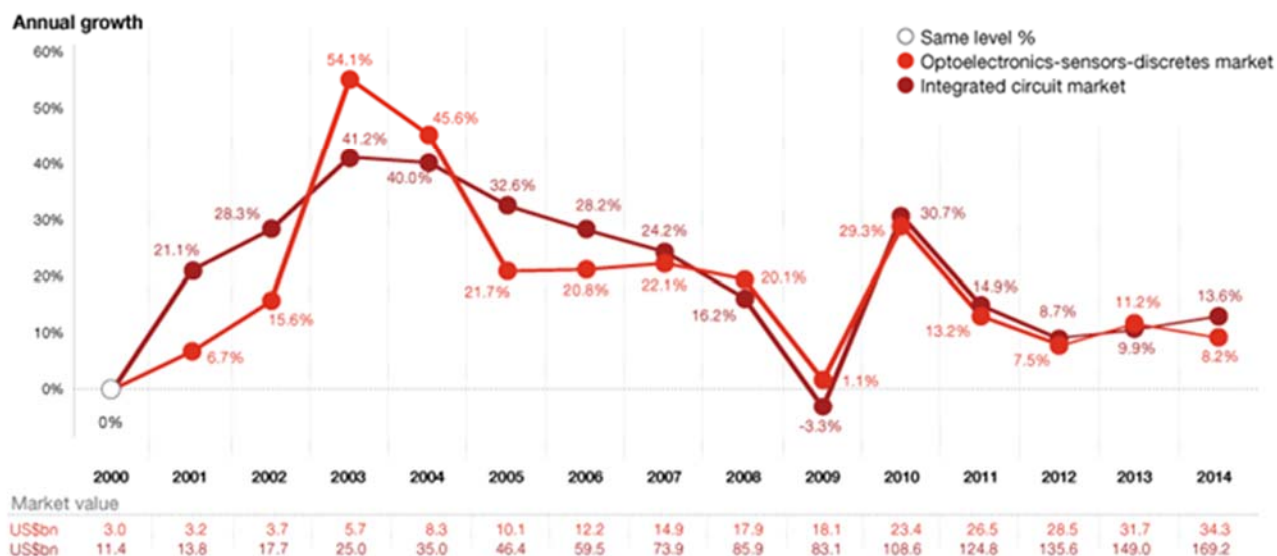
For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: CCID Consulting (CCID), Semiconductor Industry Association (SIA)

© 2015 PricewaterhouseCoopers LLP, a Delaware limited liability partnership. All rights reserved. PwC refers to the US member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see [www.pwc.com/structure](http://www.pwc.com/structure) for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

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. Most industry analysts predict that the trend of an increasing share of electronic equipment production in China will moderate but continue over the next several years. According to Gartner, China's share of electronic equipment production is forecast to increase to more than 38% by 2017; the semiconductor content of that production to gradually increase to over 35% while the worldwide average content increases to 25%; and China's share of worldwide semiconductor consumption to increase by a further 4%.

## China's IC and O-S-D market growth, 2000-2014



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



Source: CCID Consulting (CCID), Semiconductor Industry Association (SIA)

For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

© 2015 PricewaterhouseCoopers LLP, a Delaware limited liability partnership. All rights reserved. PwC refers to the US member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see [www.pwc.com/structure](http://www.pwc.com/structure) for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494 pt

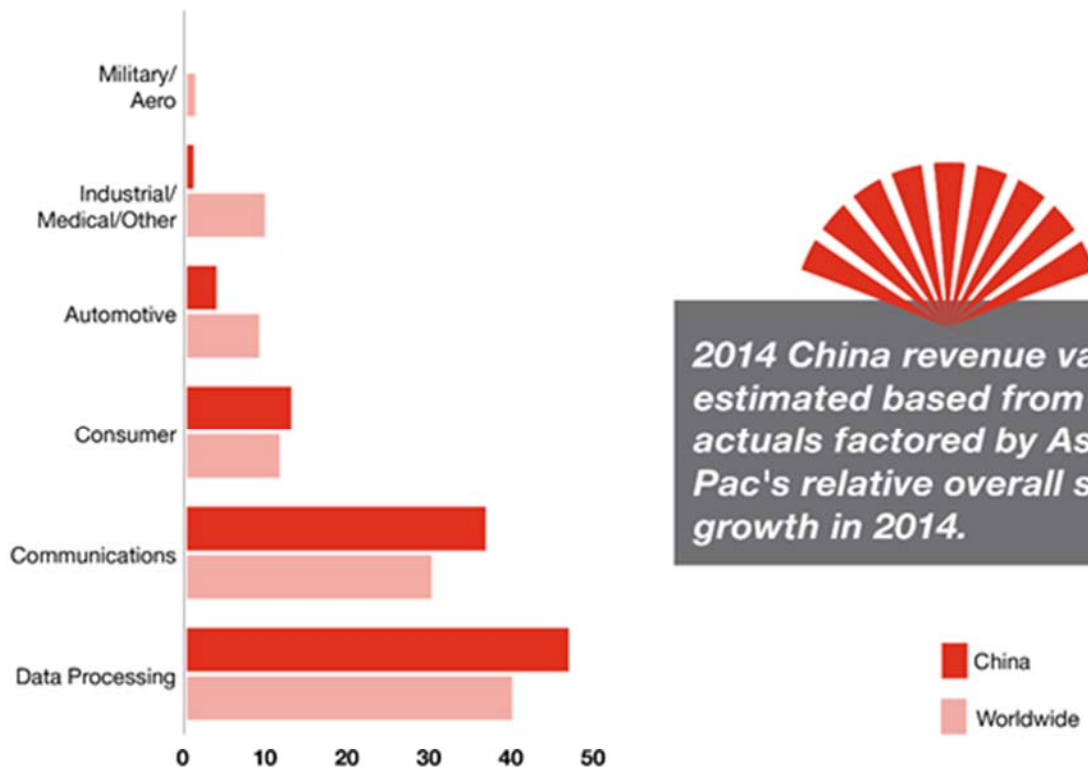
The integrated circuit (IC) consumption market in China grew 13.6% to US\$169bn in 2014 while the worldwide IC market saw only a 10.1% increase. As a result, China's IC consumption represented almost 57% of worldwide consumption in 2014. During 2014 China's IC consumption increased by more than US\$20bn while the worldwide market increased by US\$26bn. However during the past ten years China's IC consumption has grown by more than US\$134bn while the worldwide market increased by only US\$99bn. China's IC consumption has grown at the expense of IC markets in other regions although China's rate of IC consumption market growth is gradually moving closer to the worldwide rate.

In 2014 China's O-S-D (optoelectronics-sensor-discrete) consumption market grew 8.1% to reach a new peak of US\$34.3bn. For the first time in four years this increase was slightly less than the worldwide O-S-D market increase. As a result, China's share of that market remained relatively flat at 56% in 2014



## China compared with worldwide semiconductor market by application, 2014

Percentage by application



Source: Gartner Dataquest

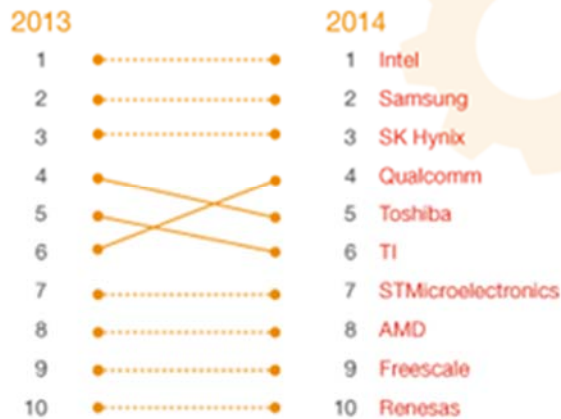
For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

©2015 PricewaterhouseCoopers LLP, a Delaware limited liability partnership. All rights reserved. PwC refers to the US member firm, and may sometimes refer to the PwC network. Each member firm is a separate legal entity. Please see [www.pwc.com/structure](http://www.pwc.com/structure) for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494 pt

During 2014 China's semiconductor consumption continued to be more concentrated in the data processing (computing) and communications applications sectors and became slightly more concentrated in the consumer sector than the worldwide market while remaining less concentrated in the automotive and noticeably less concentrated in the industrial/medical/other and military/aerospace sectors. China's share of 2014 worldwide semiconductor consumption was largest for the communications (computing) sector where it increased along with China's share of the 2014 worldwide data processing and consumer sectors. China's share of the worldwide automotive, industrial/medical/other and mil/aero sectors decreased during 2014.

## Semiconductor suppliers to the Chinese market

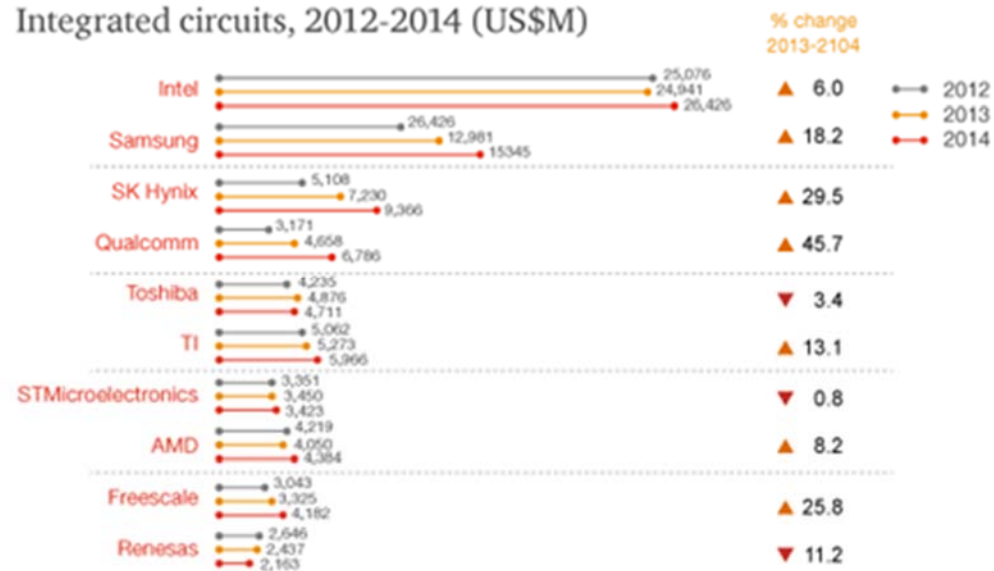
Top 10 ranking, 2013-2014



Source: CCID IC Market China Conferences—March 2014 and 2015

## Semiconductor suppliers to the Chinese market

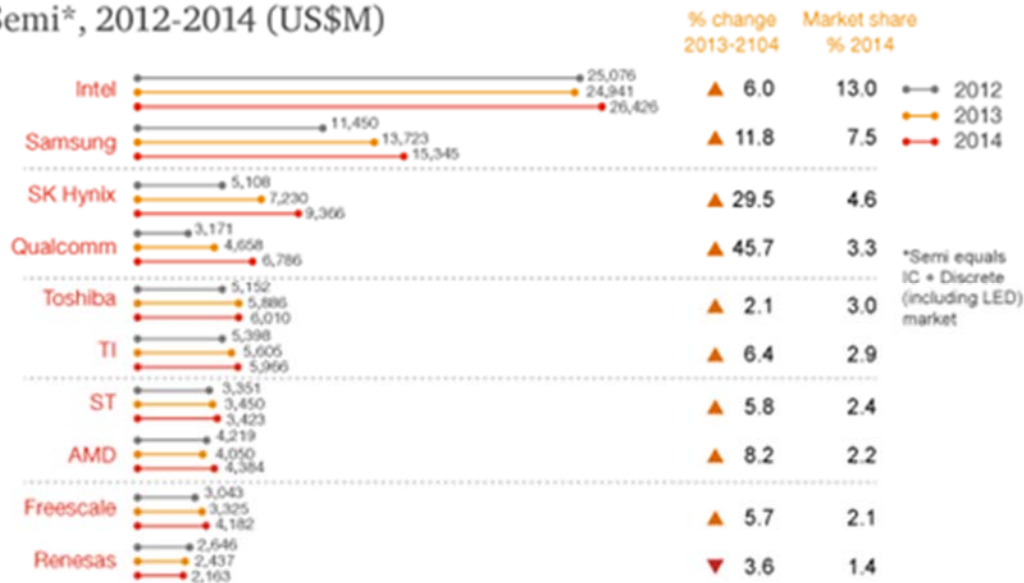
Integrated circuits, 2012-2014 (US\$M)



Source: CCID IC Market China 2012-2015 Conferences—March 2013, 2014 and 2015

## Semiconductor suppliers to the Chinese market

Semi\*, 2012-2014 (US\$M)



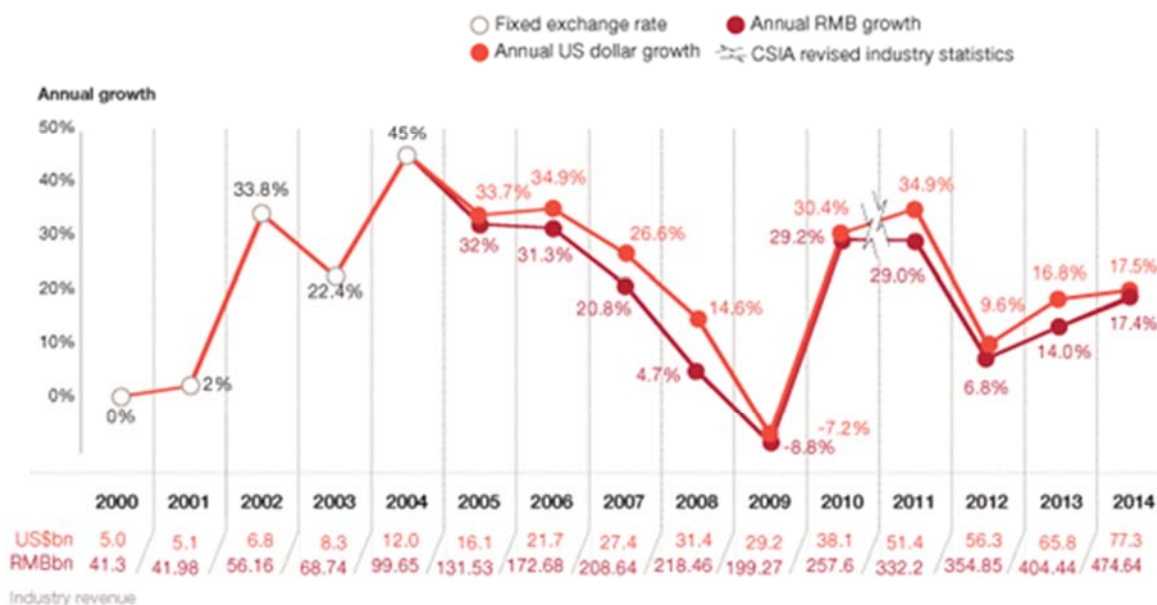
Source: CCID IC Market China 2012-2015 Conferences—March 2013, 2014 and 2015

The major global semiconductor companies continue to dominate the Chinese market. The three graphs above shows the top 10 suppliers with the largest value of semiconductors consumed in China during 2014. There have only been 14 different companies among these top ten suppliers over the past eleven years. Seven companies have been among the top ten suppliers to China every year from 2003 through 2014: Intel, Samsung, TI, Toshiba, SK Hynix, ST and Freescale. AMD joined the list in 2004 and has been among the top ten suppliers to China for the last ten years. Qualcomm, which joined the list in 2012 at number 10, moved up to number 6 in 2013 and to number 4 in 2014. During 2014 China's consumption of semiconductor products from these ten largest suppliers increased by 11%, somewhat less than the growth of the overall semiconductor market in China. The Chinese semiconductor consumption market continued a trend of becoming less concentrated than the worldwide market as the top 10 suppliers' share of China's consumption declined to 42.4% in 2014, down from 43% in 2012 and 45% in 2011.

---

## ***Part II – China's semiconductor industry***

## China's semiconductor industry revenue and growth 2000-2014



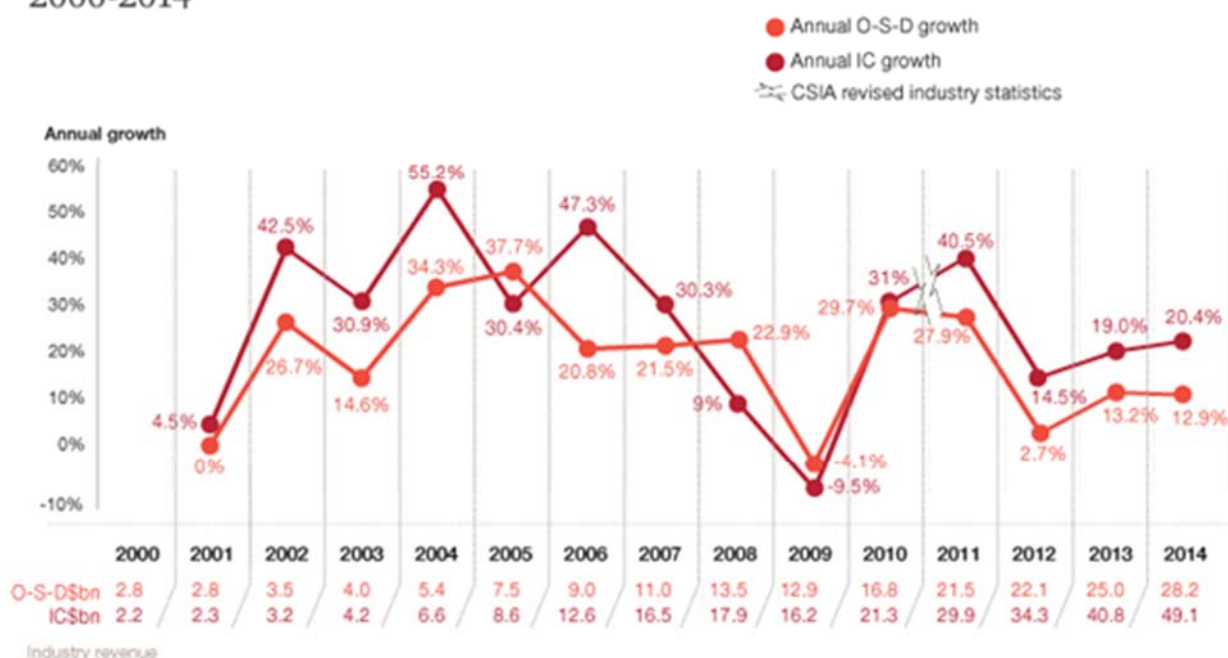
For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: CCID, CSIA

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

China's reported 2014 semiconductor industry revenue growth continued to exceed both its semiconductor consumption and the worldwide semiconductor market growth. China's semiconductor industry grew by 17.5% in 2014 to a record US\$77.3bn. China's semiconductor industry has grown at an equal or greater rate than its semiconductor market consumption for eight of the past ten years. From 2004 through 2014 China's semiconductor industry grew at a ten-year compound annual growth rate (CAGR) of 20.5% while its semiconductor consumption grew at a 16.7% and the worldwide semiconductor market at a 4.7% CAGR. China's share of the worldwide semiconductor industry is continuing to grow and become significant. Compared to the sum of worldwide semiconductor device sales revenue plus the value of all wafer fabrication and packaging, assembly and test production, China's 2014 semiconductor industry revenues accounted for 13.4% of the worldwide semiconductor industry, up from 12% in 2013 and 11.6% in 2012.

## China's O-S-D and IC industry revenue and growth 2000-2014



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: CCID, CSIA

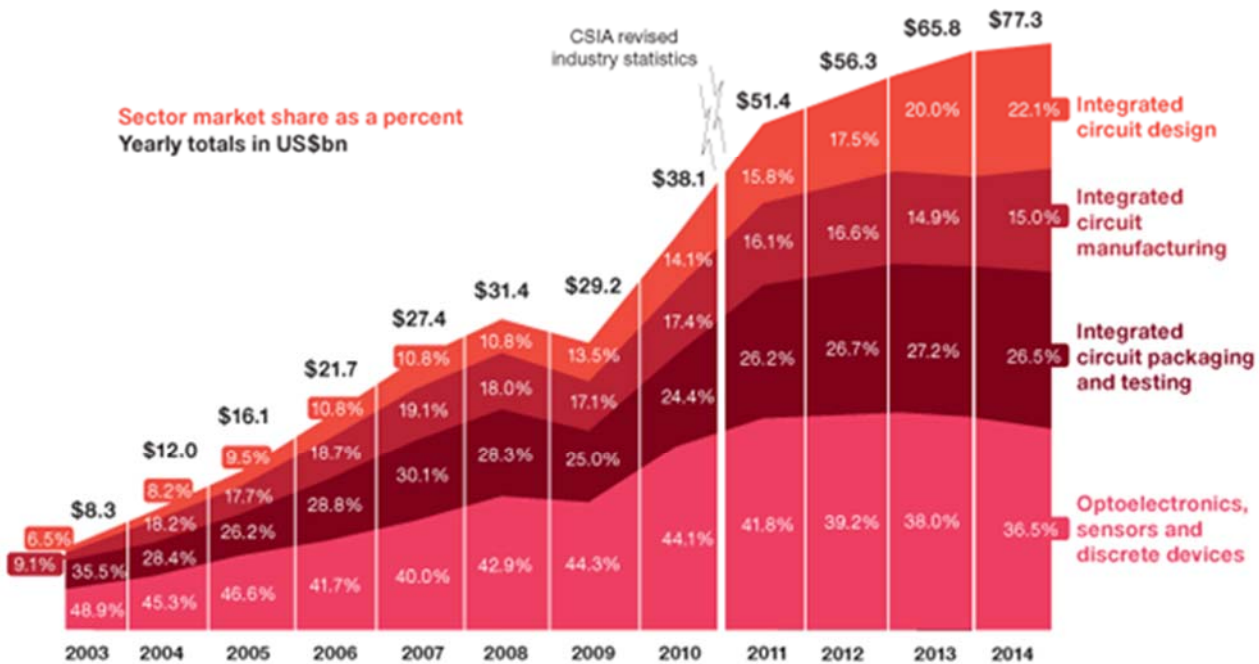
©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

The overall performance of China's IC (integrated circuit) industry (the sum of IC design, IC wafer manufacturing and IC packaging and testing) continued to be the major contributor to China's overall semiconductor industry growth in 2014. It grew by 20.4% in 2014 while China's O-S-D (optoelectronics-sensors-discretes) industry revenue only grew by 12.9%. Since 2010 China's IC industry revenues have more than doubled, growing 130%, while China's O-S-D industry revenues only increased by two-thirds, growing 68%. China's 2014 IC industry revenues of US\$49.1bn were nearly twice their O-S-D revenues of US\$28.2bn.



## China's semiconductor industry by sector

2003-2014



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: CCID, CSIA

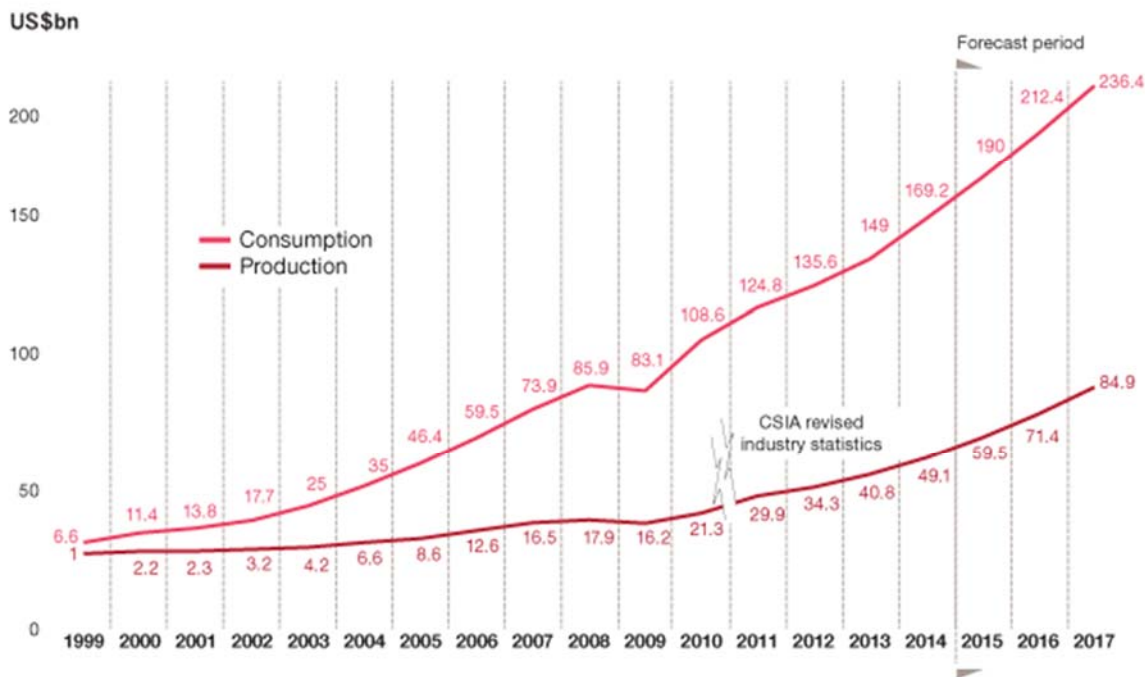
©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

The distribution of China's semiconductor industry revenue continued its gradual shift towards the IC sectors in 2014. From 2004 through 2014 the once small IC design sector has grown at a 33% CAGR while the larger IC packaging and test sector achieved a 19.6% CAGR. The much larger O-S-D and smaller IC manufacturing sectors have only grown at an 18% CAGR. As a result, China's three IC industry sectors have grown from 51.5% to 63.6% of China's total semiconductor industry.

During 2014 IC design grew 29.7%, IC manufacturing 18.7%, IC packaging and test 14.4% and O-S-D 12.8%, slightly changing their relative share but not the order of their distribution which became:

1. O-S-D devices 36.5%
2. IC packaging and testing 26.5%
3. IC design 22.0%
4. IC manufacturing 15.0%

## Comparison of China's integrated circuit consumption and production 1999-2017



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Note: Actual annual average FX rates used for 1999-2014 and 2014 average FX rate used for forecast 2015-2017

Source: CCID, CISA, PwC 2004-2015.

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

China's IC consumption/production gap increased again in 2014 to a new record annual high despite all the various government plans and efforts to reduce it. This gap is the yearly difference between IC consumption and IC industry revenues. Based upon the most recent CSIA industry statistics, this annual gap grew by a further US\$11.9bn (11.0%) in 2014 to reach US\$20.1bn. During the eleven year span of our reports on China's semiconductor industry, this gap has grown from US\$20.8bn in 2003 to US\$120.1bn in 2013, widening every year except 2009. The ratio of China's IC production revenue to IC consumption has shown some improvement. It had grown with yearly variability from 17% in 2001 to a peak of 29% in 2014. According to CSIA, this ratio is now expected to increase to 36% by 2017, which is up from the 32% they had forecast for 2016 a year ago. However, this will still result in a further increase in China's IC consumption/production gap which is now forecast to reach US\$151.5bn in 2017 despite all the Chinese government's plans and efforts to reduce it. It is our belief that this gap continues to contribute to the Chinese government's ongoing initiatives to increase indigenous IC production.

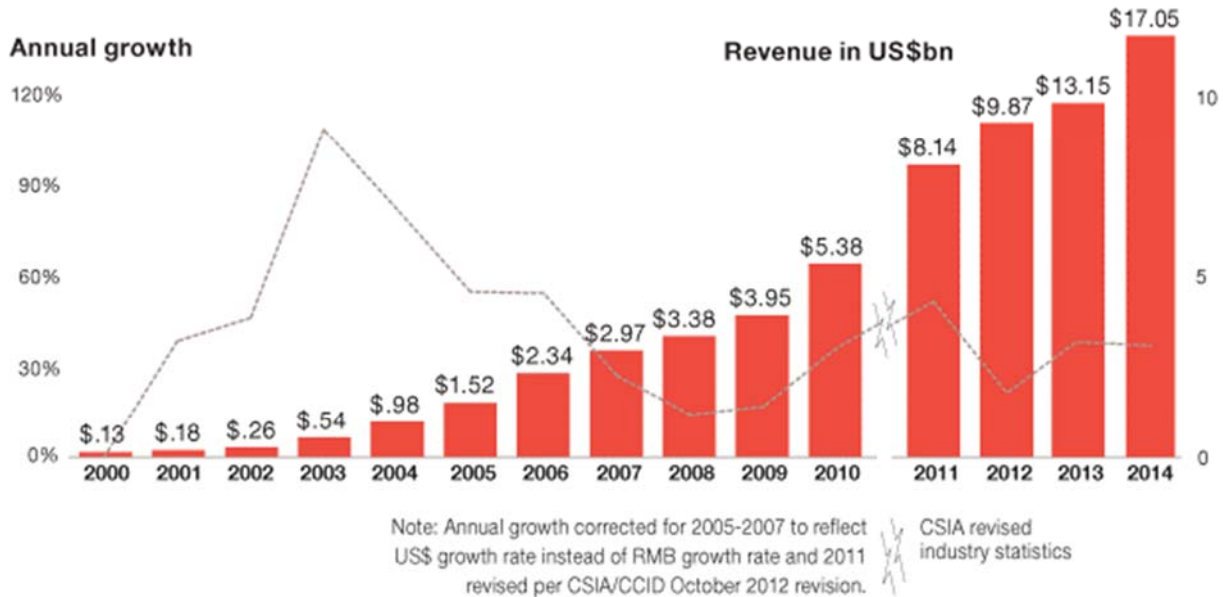


---

## ***Part III – China's design industry***

## China's IC design industry revenue and growth

2000-2014



Source: CCID, CSIA

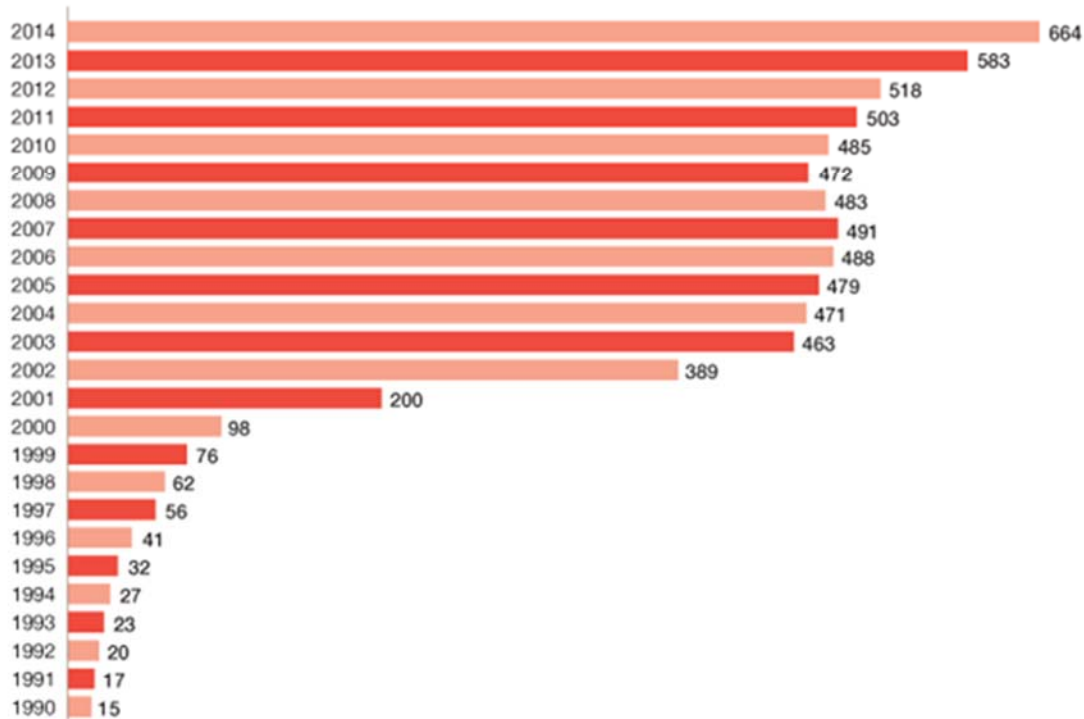
For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

Integrated circuit (IC) design continues to be the fastest growing segment of China's semiconductor industry. It grew by 30% in 2014 to reach record revenues of US\$17.1bn. During the eleven years from 2003 through 2014 China's IC design (fabless) industry has grown at a 36.8% compound annual growth rate (CAGR) from US\$541mn to over US\$17.1bn.

According to the China Center of Information Industry Development (CCID) and the China Semiconductor Industry Association (CSIA), IC design sector revenue contributed more than 34% to China's semiconductor industry revenue growth in 2014 and has grown from 20% in 2013 to represent 22% of China's total semiconductor industry. During the last eleven years China's IC design industry has grown from representing just 0.4% of the worldwide IC market and 2.5% of the worldwide fabless IC industry in 2003 to representing almost 6% of the worldwide IC market and 19.4% of the worldwide fabless IC industry in 2014.

## Number of IC design enterprises in China 1990-2014



Source: CCID, CSIA

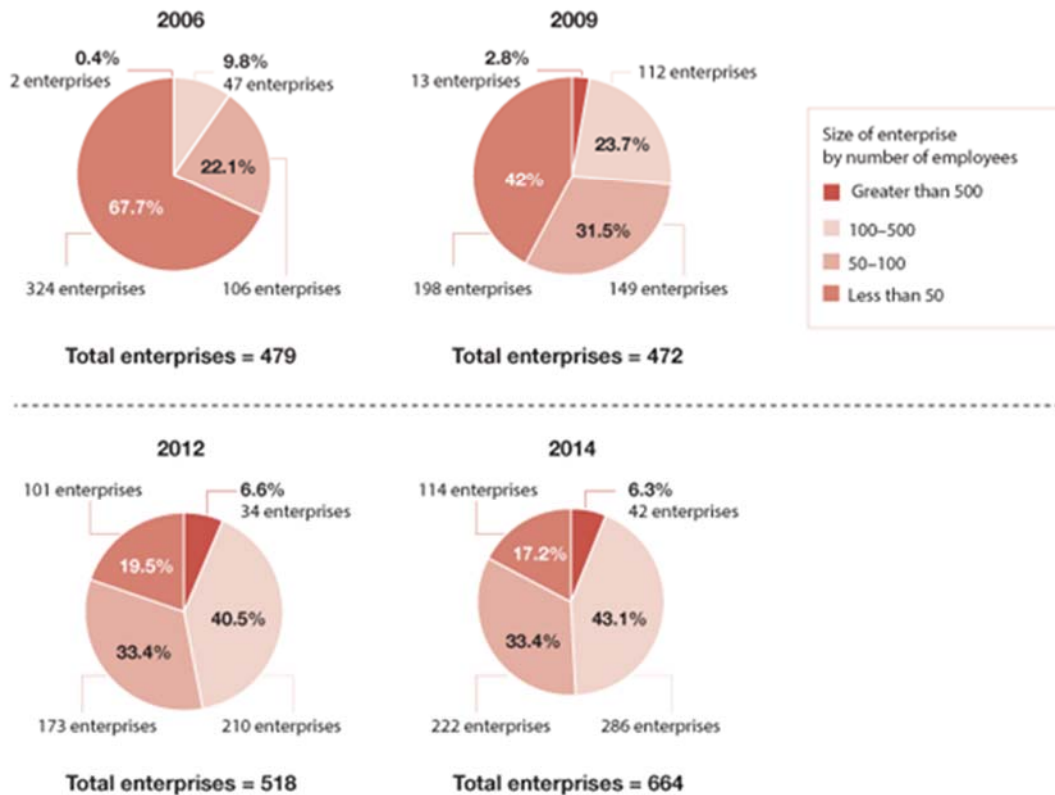
For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

According to the China Center of Information Industry Development (CCID), the number of China's IC design enterprises increased from 583 in 2013 to 664 by the end of 2014. That increase of 81 additional IC design enterprises during 2014 is by far the largest net increase in the last ten years. However, it has been exceeded at least two times in China's earlier semiconductor history by the reported increase of 111, and 189 IC design enterprises in 2001 and 2002. The number of reported IC design enterprises increased from less than 500 in 2010 to more than 660 in 2014. The Chinese government policy of offering tax incentives to promote the development of its semiconductor industry since the implementation of its 12th Five-Year plan in 2011 seems to have played a key role in the growth of IC design enterprises in China. There continues to be considerable debate about the size and make-up of these 664 enterprises as well as a great diversity among this group. Of the 664 IC design enterprises reported at the end of 2014 as many as 250 could be the design or research and development (R&D) units or activities of foreign invested or subsidiary multinational companies (MNC). 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.

## China's IC Design Enterprises by Employee Count

2006-2014



Source: CCID

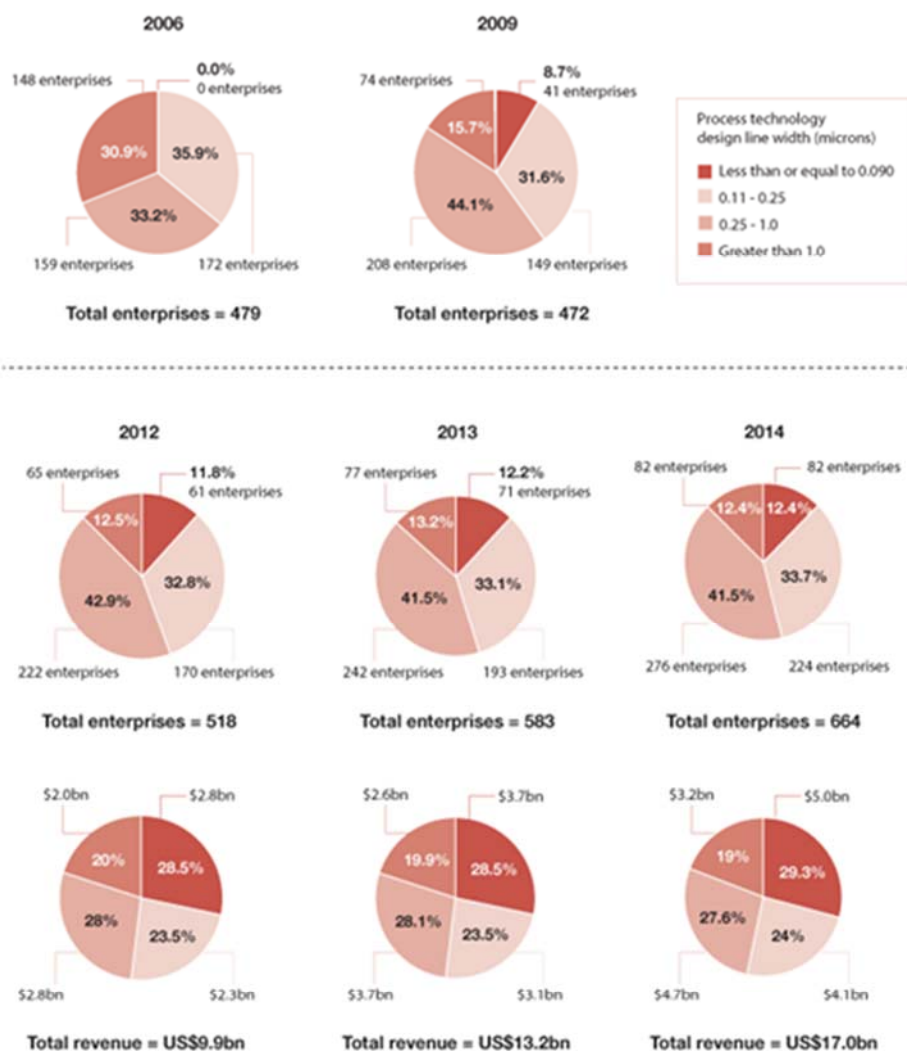
For more information, please visit:

[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

From 2013 to 2014, employment in China's IC design sector increased along with the significant addition of IC design enterprises. According to the China Center of Information Industry Development (CCID), the total number of employees in the IC design sector increased by almost 15% in 2014 to about 147,000 with the distribution shifting slightly to the mid-size companies with 100 to 500 employees. This year-over-year growth represents relative stability in employee density, resulting from the 13.9% increase in the number of enterprises accompanied by an 11% increase in the number of employees, along with a significant, 30% increase in revenue, a slight 0.9% increase in the average number of employees per enterprise, and a positive 13% increase in average sales per employee to US\$116,000.

## China's IC Design Industry by Process Technology 2006-2014



Source: CCID

For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

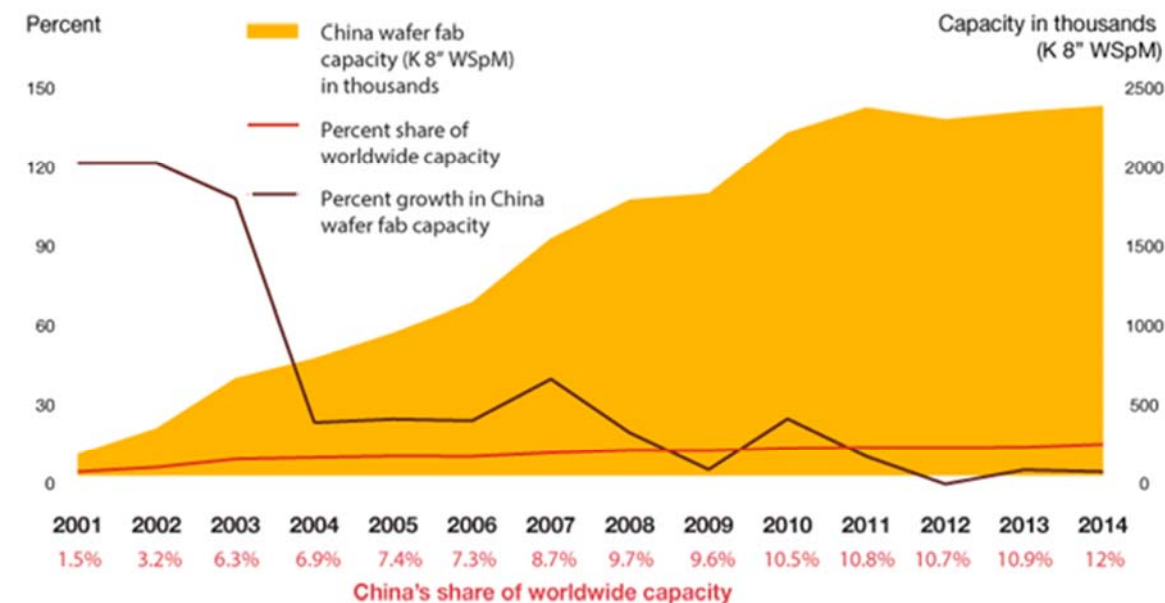
©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

China's IC design industry continued to make a further modest migration to finer design line widths in 2014. The number of design enterprises with design capabilities equal to or less than 0.25 microns increased by 16% in 2014 to 306 which represents slightly more than 46% of China's total IC design enterprises, up slightly from 45% in 2013. More significant, the total revenues of these enterprises with finer design line widths increased by almost 34% in 2014 to account for more than 53% of total IC design revenues.

---

## ***Part IV – China's semiconductor manufacturing***

## China's wafer fabrication capacity and share of worldwide capacity – 2002-2014



Note: Capacity is in thousands of 8-inch equivalent wafer starts per month/fully ramped. This is the maximum number of wafers per month that could be started if the fab were fully equipped as defined in the fab design specifications and if the equipment were fully utilized.



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: World Fab Watch 2002-2013

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

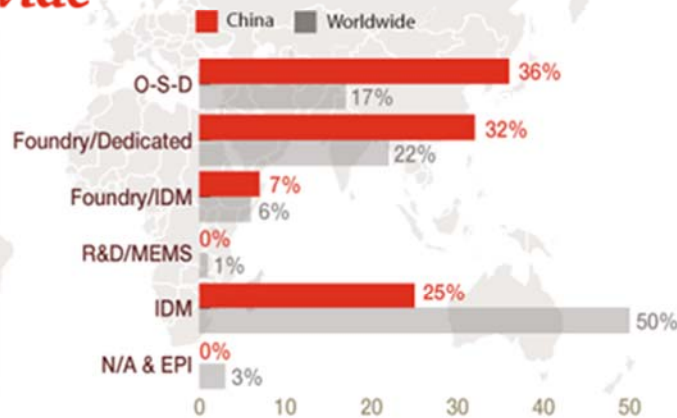
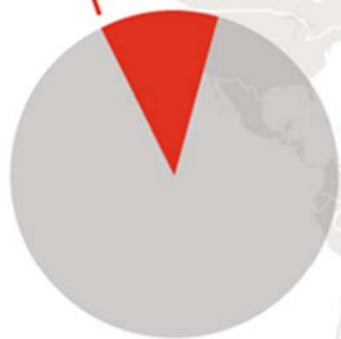
China's total wafer fab capacity has remained relatively constant over the past four years from 2011 through 2014 while its share of worldwide wafer fab capacity has increased by more than a percentage point from 10.8% in 2011 to 12% in 2014. During 2014 China's number of wafer fabs in production increased from 160 to 165 with the addition of three discrete and one each IDM and R&D/MEMS fabs for a combined increase of 35K (1.5%) 8-inch equivalent wafer starts per month (WSpM). Total worldwide wafer fabs in production decreased from 1,076 to 1,040 during 2014 for a combined decrease of 157K (7.4%) 8-inch equivalent WSpM.



## Current wafer fab capacity comparison – China and worldwide

# Capacity

**China's capacity is 2.3 million, or 11.7% of worldwide**



Note: Capacity in thousands of 8-inch equivalent wafer starts per month. WF probability  $\geq 1.0$



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: SEMI Wafer Fab Watch, Feb. 2015

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

China's current wafer fab capacity remains notably different from worldwide in that 39% is devoted to foundry production versus 28% worldwide (Dedicated and IDM combined), 36% to O-S-D production versus 17% worldwide; and only 10 fabs are 300mm out of a total of 118 worldwide. Because China represents a disproportionately large share (25%) of both worldwide LED fab capacity and discrete fab capacity, it continued to have a much higher mix of smaller wafer size (150mm or less) and mature technology node (0.7 $\mu$ m or greater) fab capacity than worldwide. However, while its share of worldwide intermediate technology node (0.2 to 0.028 $\mu$ m) capacity decreased in 2014 by more than one percent, to 13%, its share of advanced technology node (28nm or less) was established for the first time at 5% of worldwide.



**Current and committed wafer fab capacity comparison –  
China and worldwide**

# Capacity

**China's capacity is 2.9 million,  
or 12.5% of worldwide**



Note: Capacity in thousands of 8-inch equivalent planned full-capacity wafer starts per month. WF probability  $\geq 0.8$



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: SEMI Wafer Fab Watch, Feb. 2015

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

Current foundry production (Dedicated and IDM combined) continued to constitute the largest share of China's wafer fab capacity in 2014 at 39% of total compared to the worldwide average of 28%. Current IDM production only constituted 25% of China's wafer fab capacity, compared to 50% worldwide. That mix will only change slightly when all the committed fabs currently under construction are brought into production, with China's foundry share (Dedicated and IDM combined) increasing to 42% versus 29% worldwide and IDM share decreasing to 24% versus 50% worldwide.

## Comparison of China and all remaining countries' SPA&T resources – 2014

### Resources



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: Gartner

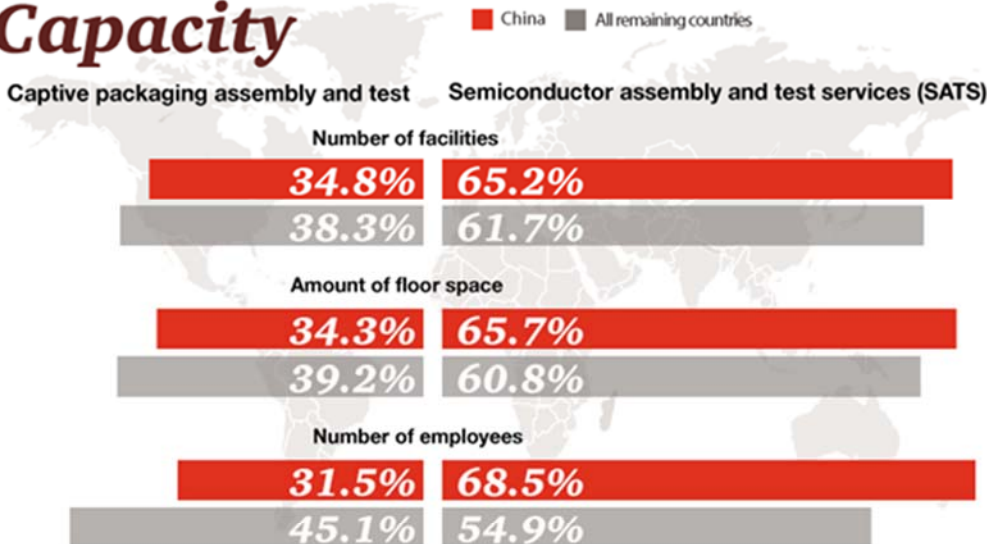
©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

Semiconductor packaging, assembly and test (SPA&T) nominal capacity in China was notably increased during 2014, with IC unit production increasing by more than 19% and O-S-D unit production by 12%. During the past year, China reported the closure of three SPA&T facilities; one each Switzerland, Japanese and USA SATS facility; the addition of three existing but previously not reported facilities, the opening of twenty new facilities and the consolidation of a few others, resulting in a 50% increase in reported net manufacturing floor space but with just a 9.2% increase in number of employees.

As of the end of 2014, China had 120 SPA&T facilities in operation, an increase from an adjusted total of 97 in 2013. These 120 facilities represent 22% of the total number of worldwide SPA&T facilities, 33% of worldwide SPA&T manufacturing floor space and 25% of reported worldwide SPA&T employees. As a result, China's SPA&T facilities continued to rank first in share of SPA&T manufacturing floor space—a proxy for potential manufacturing capacity—for the sixth year, noticeably ahead of Taiwan (at almost 23%) and Japan (at 10%). China's SPA&T facilities also ranked first in number of reported employees, with 25% of worldwide employees at the end of 2014, ahead of Taiwan (19%) and Malaysia (17%).

## Comparison of China and all remaining countries SATS share of SPA&T capacity – 2014

### Capacity



For more information, please visit:  
[www.pwc.com/chinasemicon](http://www.pwc.com/chinasemicon)

Source: Gartner

©2015 PwC. All rights reserved. PwC refers to the PwC network and/or one or more of its member firms, each of which is a separate legal entity. Please see <http://www.pwc.com/structure> for further details. This content is for general information purposes only, and should not be used as a substitute for consultation with professional advisors. MW-15-2494

China's SPA&T capacity continues to be slightly more concentrated in the SATS sector than that of other regions. In 2014, 66% of China's SPA&T manufacturing floor space and SPA&T facilities were dedicated to the SATS sector versus 62% for all other countries. Eight of the ten largest worldwide SATS companies had one or more facilities in China for a total of 20 out of the 93 top ten SATS facilities worldwide. These 20 facilities accounted for 29% of the top ten SATS manufacturing floor space worldwide. One of the ten largest worldwide SATS companies is a Chinese company, Jingsu Changjiang Electronics Technology (JCET), which ranked sixth in 2014. There were two other Chinese SATS company, Tianshui Huatian Microelectronics (TSHT) which ranked 13th and Natong Fujitsu Microelectronics (NFME), which ranked 18th, within the top twenty worldwide SATS companies in 2014. In total there were 34 Chinese SATS companies, with 38 existing facilities, that accounted for 20% of worldwide SATS manufacturing floor space in 2014. 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: the IC packaging and testing and O-S-D sectors. The composite weighted average of China's 2013 SPA&T production is now estimated to be about 58% of worldwide, up from a revised 52% in 2012.

---

## ***Part V – Top Chinese semiconductor companies and manufacturers***

## Top 10 Chinese semiconductor manufacturers – 2003-2014

The table below shows the relative ranking history of China's top ten semiconductor manufacturers during the period from 2003 through 2014. The composition of the top 10 manufacturers has been notably more dynamic than that of the top 10 suppliers shown earlier in our update. There have been twenty-two different groups or companies that have been among China's top 10 manufacturers during one or more of the years from 2003 through 2014.

***There have been twenty-two different groups or companies that have been among China's top 10 manufacturers during one or more of the years from 2003 through 2014.***

Only two—SMIC, and Xinchao Group—have been among the top 10 for every year during that period. By contrast two others—ASMC and ASE—have only been among the top 10 for one single year during that period. During the period from 2003 through 2013 China's top 10 semiconductor manufacturers have accounted for an average 26.8% of China's total semiconductor industry revenues.

Name of company	Rank											
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
SK Hynix				11	4	1	2	2	2	2	2	1
HiSilicon Technology					24	11	7	8	5	4	1	2
SMIC	2	2	1	1	2	3	3	3	3	3	3	3
Micron										6	6	4
Intel	7	8	10	9	17	17	1	1	1	1	4	5
Samsung			18	21	18	15	15	18	7	8	9	6
Spreadtrum								15	8	12	8	7
Xinchao Group	8	7	5	7	7	8	6	6	6	5	5	8
Hangzhou Cree									12	10	11	9
RFMD		4	4	4	5	7	5	5	16	11	10	10
Freescall	1	1	2	2	1	2	4	4	4	7	7	12
Natong Huada Micro	10	9	12	13	12	13	13	9	13	14	13	13
China Resources Micro	24	13	15	16	6	6	8	7	11	15	14	14
ASE					20	18	16	14	10	13	12	16
Renesas	3	5	6	10	9	5	9	10	15	18	15	17
Huahong Group	4	3	7	5	8	12	11	12	9	9	20	21
Panasonic	16	16	11	8	10	9	10	11	14	17	24	32
Leshan Radio	5	10	13	15	15	16	14	16				
ST Microelectronics	6	11	3	6	11	10	12	13	18			36
ASMC	9	12	19	17	25							
HeJian Technology		6	8	12	14	23	22	25				44
Infineon/Quimonda			9	3	3	4	17	17	22	23	25	28
<b>China semiconductor industry revenue (US\$mn)</b>	<b>8,282</b>	<b>12,006</b>	<b>16,053</b>	<b>21,660</b>	<b>27,431</b>	<b>31,434</b>	<b>29,171</b>	<b>38,053</b>	<b>51,402</b>	<b>56,325</b>	<b>65,758</b>	<b>77,303</b>
<b>Total Top 10 manufacturers (US\$mn)</b>	<b>2,372</b>	<b>3,752</b>	<b>4,354</b>	<b>6,709</b>	<b>8,954</b>	<b>9,605</b>	<b>9,409</b>	<b>12,015</b>	<b>14,503</b>	<b>16,048</b>	<b>13,724</b>	<b>15,022</b>
<b>Top 10% China semiconductor industry</b>	<b>28.6%</b>	<b>31.3%</b>	<b>27.1%</b>	<b>31.0%</b>	<b>32.6%</b>	<b>30.6%</b>	<b>32.3%</b>	<b>31.6%</b>	<b>28.2%</b>	<b>28.5%</b>	<b>20.9%</b>	<b>19.4%</b>

Notes: Top 10 totals are based on each year's top 10 manufacturers (highlighted in red). Lists only companies who have been within the top 10 manufacturers for one or more years 2003 through 2014. Rankings below 25 have been omitted. Each manufacturer is listed by its current or surviving group or company name.

Source: CCID, CSIA

## Major Chinese semiconductor manufacturers (including groups) – 2014

The table below lists the 50 largest semiconductor manufacturers in China—those reporting 2014 revenues of US\$205mn or more. This revenue threshold is up 20% from the US\$171mn threshold in our 2014 update, which reflects the continuing growth in number and size of Chinese semiconductor manufacturers.

The combined 2014 revenues reported for these top 50 enterprises is US\$ 34.8bn, representing 45.0% of China's total 2014 semiconductor industry revenue of US\$77.3bn. This is an increase in combined revenue, but a slight decrease in share from the revised US\$29.7bn or 45.2% of US\$65.8bn now reported for 2013. China's industry continues to be noticeably less concentrated than the worldwide industry, where the top 10 companies accounted for 54% of the total market. The combined reported revenues of the continuing 49 of these top 50 manufacturers increased by 15.3% in 2014, which is slightly (1.4%) less than the increase reported by China's total semiconductor industry. During 2014 these top 50 enterprises accounted for 59% of China's IC chip manufacturing (foundry and IDM) revenues; 62% of IC packaging and testing revenues; 52% of IC design (fabless) revenues; but only 23% of O-S-D revenues.

**The revenue threshold to be included in this listing is up 20% from last year, reflecting continuing growth in number and size of Chinese semiconductor manufacturers.**

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 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, The table also lists a single entry for each of several multinational semiconductor companies that have more than one manufacturing facility in China although each facility may be legally organized as a separate company.

Name of company	Rank		Sales revenue (RMB: 100mn)				Sector	Sales revenue (US\$m)		
	2013	2014	2013	2014	Change			2013	2014	Change
SK Hynix Semiconductor (China) (incl Hitech JV)	2	1	129.40	147.80	14.2%	■◆		2,104	2,407	14.4%
HiSilicon Technologies Co., Ltd.	1	2	130.40	146.00	12.0%	●		2,120	2,378	12.1%
SMIC (Semiconductor Manufacturing International Corp.)	3	3	126.50	120.20	-5.0%	●		2,057	1,958	-4.8%
Micron Semiconductor (Xi'an) Co., Ltd.	6	4	73.21	83.68	14.3%	◆		1,190	1,363	14.5%
Intel Products/Semiconductor (Chengdu/Dalian) Co., Ltd.	4	5	93.10	76.40	-17.9%	■◆		1,514	1,244	-17.8%
Samsung Electronics (Suzhou Semi & LED) Co., Ltd.	9	6	59.60	76.40	28.2%	▼◆●		969	1,244	28.4%
Spreadtrum Communications Inc.	8	7	62.30	72.00	15.6%	●		1,013	1,173	15.8%
XINCHAO Group	5	8	77.20	69.10	-10.5%	◆		1,255	1,125	-10.3%
Huizhou Cree	11	9	52.60	67.80	28.9%	▼		855	1,104	29.1%
RFMD (RF Micro Devices (Beijing)) Co., Ltd.	10	10	56.00	63.00	12.5%	◆		911	1,026	12.7%
Everlight Electronics	22	11	28.50	59.50	108.8%	▼		463	969	109.1%
Freescale Semiconductor (China) & (Tianjin) Co., Ltd.	7	12	66.80	53.90	-19.3%	◆●		1,086	878	-19.2%
Nantong Huada Microelectronics Group Co., Ltd.	12	13	45.40	52.10	14.8%	◆		738	849	14.9%
China Resources Microelectronics (Holdings) Ltd.	14	14	39.20	50.40	28.6%	▼●●		637	821	28.8%
TianJin ZhongHuan Semiconductor Co., Ltd.	16	15	37.26	47.68	28.0%	▲		606	777	28.2%

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





Name of company	Rank		Sales revenue (RMB: 100mn)				Sales revenue (US\$m)		
	2013	2014	2013	2014	Change	Sector	2013	2014	Change
ASE Assembly & Test (Shanghai+Khunshan+WeiHai +Suzhou) Ltd.	13	16	41.33	47.24	14.3%	◆	672	769	14.5%
Renesas Semiconductor (Beijing & Suzhou) Co., Ltd.	15	17	37.88	43.30	14.3%	◆●	616	705	14.5%
Sanan Optoelectronics	30	18	21.40	42.10	96.7%	▼	348	686	97.0%
Diodes Shanghai Co., Ltd.	17	19	35.90	41.03	14.3%	◆	584	668	14.5%
Tianshui Huatian Technology Co., Ltd.	18	20	35.40	40.30	13.8%	◆	576	656	14.0%
Shanghai Huahong (Group) Co., Ltd.	20	21	35.20	40.30	14.5%	●	572	656	14.7%
MLS Co., Ltd.	34	22	19.60	40.00	104.1%	▼	319	651	104.4%
TSMC (Shanghai) Co., Ltd.	19	23	35.30	39.30	11.3%	●	574	640	11.5%
Liteon Technology	21	24	29.60	38.15	28.9%	▼	481	621	29.1%
China Huada Integrated Circuits Design (Group) Co., Ltd.	37	25	17.90	32.10	79.3%	●	291	523	79.6%
Huada Semiconductor Co.		26		32.10		●		523	
Datang Semiconductor Design Co., Ltd.	28	27	24.00	31.30	30.4%	●	390	510	30.6%
Infineon Technologies (Wuxi) Co., Ltd.	25	28	27.00	30.86	14.3%	◆	439	503	14.5%
SanDisk Semiconductor (Shanghai) Co., Ltd.	26	29	27.00	30.86	14.3%	◆	439	503	14.5%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	41	30	15.32	30.60	99.7%	●	249	498	100.1%
Amkor Technology China Ltd.	27	31	25.00	28.58	14.3%	◆	407	465	14.5%
Shangahi Panasonic Semiconductor Co., Ltd.	24	32	27.70	25.50	-7.9%	◆	450	415	-7.8%
Beijing Nari Smart Chip Microelectronics Co., Ltd.	29	33	21.50	24.80	15.3%	●	350	404	15.5%
No. 55 Research Institute of China Electronics Technology Group Corp.	31	34	20.05	23.76	18.5%	■	326	387	18.7%
STATS ChipPAC	32	35	20.00	23.30	16.5%	◆	325	379	16.7%
ST Microelectronics	33	36	19.98	22.84	14.3%	◆	325	372	14.5%
RDA Microelectronics, Inc.	23	37	28.00	22.00	-21.4%	●	455	358	-21.3%
Siliconware Technology (Suzhou) Co., Ltd.	35	38	18.22	20.82	14.3%	◆	296	339	14.5%
Galaxycore, Inc.	38	39	16.80	20.40	21.4%	●	273	332	21.6%
Hangzhou Silan Microelectronics Co., Ltd.	36	40	18.00	19.60	8.9%	●	293	319	9.1%
Shenzhen National Holdings Co., Ltd.	42	41	14.96	19.37	29.5%	●	243	316	29.7%
Xi'an Microelectronics Technology Institute	39	42	15.90	19.00	19.5%	■	259	309	19.7%
Beijing Vimicro Co., Ltd.	40	43	15.40	17.50	13.6%	●	250	285	13.8%
HeJian Technology (Suzhou) Co., Ltd.	43	44	13.70	16.20	18.2%	●	223	264	18.4%
Shenzhen Netcom Electronics Co., Ltd.	46	45	12.19	15.79	29.5%	●	198	257	29.7%
Leshan Phoenix Semiconductor Co., Ltd. (ON Semi JV)	44	46	13.26	15.16	14.3%	◆	216	247	14.5%
Allwinner Technology	47	47	11.69	15.14	29.5%	●	190	247	29.7%
Elec-Tech International Co., Ltd.	50	48	10.52	13.56	28.9%	▼	171	221	29.1%
UTAC Dongguan, Shanghai Co., Ltd.	48	49	11.07	12.65	14.3%	◆	180	206	14.5%
Jilin Sino Microelectronics Co., Ltd.	45	50	12.50	12.60	0.8%	▲	203	205	1.0%

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

Source: MIIT, Gartner, Thomson Reuters, company reports



## Summary of listed major Chinese semiconductor companies by report/update – 2004-2015

During the past eleven years, our table listing of the top Chinese semiconductor companies has grown from 26 companies with average revenue of US\$39mn first listed in the 2005 Update to the 50 companies with average revenue of US\$262mn listed in this 2015 Update. The revenue of the largest listed company increased more than twenty-five times from US\$93mn in 2005 to US\$2.38bn, in 2015 while that of the smallest listed company increased four times from US\$15mn to US\$63mn. Only one of the current top ten Chinese semiconductor companies, Datang Semiconductor Design, was among the top Chinese semiconductor companies listed in the 2005 Update. Ten other of the companies listed in the 2005 Update are among the companies in the current listing of top Chinese semiconductor companies.

*Revenue of the largest listed company increased **25** times*

Report/ Update date	Number of companies	Sales revenue (RMB:100mn)			Sales revenue (US\$m)			% China's semi industry
		Minimum	Average	Maximum	Minimum	Average	Maximum	
2004	11	0.52	3.21	6.23	6	37	75	
2005	26	1.21	3.21	7.67	15	39	93	8.4
2006	30	1.63	3.83	12.58	20	47	155	8.5
2007	27	2.09	5.66	13.46	26	71	169	8.3
2008	29	2.30	5.96	12.90	30	78	170	8.6
2009	33	2.15	6.07	30.94	31	87	445	8.8
2010	38	2.05	5.63	39.11	30	82	572	11.2
2011	43	2.25	7.29	44.10	33	107	652	12.2
2012	50	2.85	9.05	66.68	44	140	1,032	13.0
2013	50	3.12	9.69	74.19	50	154	1,178	13.7
2014	50	3.20	13.21	130.40	52	215	2,120	16.3
2015	50	3.87	16.08	146.00	63	262	2,378	16.9

Note: Sales revenue is for the preceeding year.

Source: CSIA, CCID, GSA, Gartner, PwC





## Major Chinese semiconductor companies by revenue – 2014

The table below lists the top 50 Chinese semiconductor companies that had the largest revenues in 2014. 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.

## The threshold for inclusion in this listing continues to grow –up 21% from last year's listing

The threshold for inclusion in this 2014 listing has increased to US\$63mn, up 21% from the US\$52mn used for the 2013 listing. Three companies qualified for inclusion on the 2014 listing for the first time, all Discrete (LED) companies. The combined reported dollar revenues of the continuing 47 of these top 50 Chinese semiconductor companies increased by 19.9% in 2014, which is higher than the 17.5% increase reported by China's total semiconductor industry. During 2014 these top 50 companies accounted for a record 17% of China's total semiconductor industry revenues. They accounted for 48% of China's IC design (fabless) revenues, but only 14% of discrete revenues and 8% of IDM and foundry revenues.

Name of company	Rank		Sales revenue (RMB:100mn)			Sector	Sales revenue (US\$mn)		
	2013	2014	2013	2014	Change		2013	2014	Change
HiSilicon Technologies Co., Ltd.	1	1	130.40	146.00	12.0%	●	2120	2378	12.1%
Spreadtrum Communications Inc.	2	2	62.30	72.00	15.6%	●	1013	1173	15.8%
Sanan Optoelectronics	6	3	21.40	42.10	96.7%	▲	348	686	97.0%
MLS Co., Ltd.	8	4	19.60	40.00	104.1%	▲	319	651	104.4%
Datang Semiconductor Design Co., Ltd.	4	5	24.00	31.30	30.4%	●	390	510	30.6%
Shenzhen ZTE Microelectronics Technology Co., Ltd.	13	6	15.32	30.60	99.7%	●	249	498	100.1%
Beijing Nari Smart Chip Microelectronics Co., Ltd.	5	7	21.50	24.80	15.3%	●	350	404	15.5%
No. 55 Research Institute of China Electronics Technology Group	7	8	20.05	23.75	18.5%	▼	326	387	18.6%
RDA Microelectronics, Inc.	3	9	28.00	22.00	-21.4%	●	455	358	-21.3%
Galaxycore Inc.	10	10	16.80	20.40	21.4%	●	273	332	21.6%
Hangzhou Silan Microelectronics Co., Ltd.	9	11	18.00	19.60	8.9%	●	293	319	9.1%
Xi'an Microelectronics Technology Institute	11	12	15.90	19.00	19.5%	▼	259	309	19.7%
Beijing Vimicro Co., Ltd.	12	13	15.40	17.50	13.6%	●	250	285	13.8%
Jiangsu Aucksun		14		15.90		▲		259	
Shenzhen Netcom Electronics Co., Ltd.	16	15	12.19	15.79	29.5%	●	198	257	29.7%
Fuzhou Rockchip Electronics Co., Ltd.	14	16	15.07	13.51	-10.4%	●	245	220	-10.2%
Jilin Sino Microelectronics Co., Ltd.	15	17	12.50	12.60	0.8%	●	203	205	1.0%
Elec-Tech International Co., Ltd.	18	18	10.52	12.40	17.9%	▲	171	202	18.1%

● Design (Fabless) ▲ Discrete (LED) ▼ IDM ● Discrete



Name of company	Rank		Sales revenue (RMB:100mn)				Sector	Sales revenue (US\$m)		
	2013	2014	2013	2014	Change			2013	2014	Change
CEC Huada Electronics Design Co., Ltd. (HED)	19	19	10.50	11.24	7.0%	●		171	183	7.2%
Wuxi China Resouces Huajian Microelectronics Co., Ltd.	20	20	9.59	11.09	15.6%	▼	●	156	181	15.8%
Allwinner Technology	17	21	11.68	10.32	-11.7%	●		190	168	-11.5%
Montage Techology Group Ltd.	29	22	6.82	10.25	50.3%	●		111	167	50.6%
GigaDevice Semiconductor	26	23	7.87	10.19	29.5%	●		128	166	29.7%
Shenzhen Jufei Optoelectronics Co., Ltd.	27	24	7.50	9.67	28.9%	●		122	157	29.1%
Xiamen Hualian Electronics Co., Ltd.	28	25	7.30	9.41	28.9%	▲		119	153	29.1%
Foshan Nationstar Optoelectronics	21	26	9.00	9.33	3.7%	▲		146	152	3.9%
Tongfang Opto Co., Ltd.		27		9.00		▲			147	
Shandong Inspur Huaguang Optoelectronics Co., Ltd.	24	28	8.00	8.80	10.0%	▲		130	143	10.2%
Shenzhen Refond Optoelectronics Co., Ltd.	33	29	6.82	8.79	28.9%	▲		111	143	29.1%
Shanghai Epilight Technology Co., Ltd.	32	30	6.20	7.99	28.9%	▲		101	130	29.1%
Foshan Blue Rocket Electronics Co., Ltd.	31	31	6.71	7.56	12.7%	●		109	123	12.9%
Shanghai Fudan Microelectronics Co., Ltd.	25	32	7.89	7.49	-5.1%	●		128	122	-4.9%
Wuhan HC SemiTek Co., Ltd.	50	33	3.20	7.10	121.9%	▲		52	116	122.2%
Shanghai Huahong IC Co. Ltd.	30	34	6.77	6.82	0.7%	●		110	111	0.8%
Wuxi China Resources Semico Co., Ltd.	23	35	8.12	6.75	-16.8%	●		132	110	-16.7%
Beijing Huadazhibao Electronic Systems Co., Ltd.	34	36	5.20	6.73	29.3%	●		85	110	29.5%
Suzhou Good-Ark Electronics Co., Ltd.	22	37	8.25	6.69	-18.9%	●		134	109	-18.7%
Silergy Semiconductor Technology (Hangzhou) Co., Ltd.	43	38	4.31	5.96	38.2%	●		70	97	38.4%
Tongfang Microelectronics Company	41	39	4.00	5.18	29.5%	●		65	84	29.7%
HuaLei Optoelectronic Co., Ltd.		40		5.00		▲			81	
Chengdu Yaguan Electronic Co., Ltd.	37	41	4.66	4.82	3.3%	●		76	78	2.2%
Shantou Huashan Electronic Device Co., Ltd.	38	42	4.61	4.76	3.3%	●		75	78	-0.7%
Beijing MXTronics Co., Ltd.	49	43	3.53	4.57	29.5%	●		57	74	29.7%
China Electronics Science & Technology Group Cos.	39	44	4.40	4.55	3.3%	●		72	74	2.1%
Guangzhou Hongli Opto-Electronics	35	45	4.18	4.48	7.2%	▲		68	73	7.3%
Shenzhen State Micro Technology Co., Ltd. (SMIT)	40	46	4.37	4.30	-1.6%	●		71	70	-1.4%
Changelight Co., Ltd.	36	47	4.90	4.20	-14.3%	▲		80	68	-18.5%
Forward Semiconductor Co.	46	48	3.86	3.99	3.4%	●		63	65	3.6%
Yangzhou JingLai Semiconductor (Group) Co., Ltd.	47	49	3.76	3.88	3.3%	●		61	63	3.4%
ShenZhen Si Semiconductor Co., Ltd.	48	50	3.75	3.87	3.3%	●		61	63	3.5%

● Design (Fabless) ▲ Discrete (LED) ▼ IDM ● Discrete

Source: CSIA, CCID, GSA, Gartner, PwC



---

## *About this report*

This update assesses the current status of the semiconductor industry in China and how it has changed since our previous update. As with our previous reports on this issue, we conducted a second-order analysis for the 2015 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 and 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 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 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 this method remained 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.

---

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.

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 have elected to convert the Renminbi (RMB) currency values from various Chinese data sources to US dollar values at the year-end foreign exchange rate for the year reported while recognizing that many 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.

---

# *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, usually including thousands (kilo), millions (mega), and billions (giga), China's reports use two orders of magnitude, 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, (Ministry of Industry and Information Technology), 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 which 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 discretés) 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 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 the 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 stand-alone companies, and the CCID and CSIA consolidate the reports from each company in an industry



sector without any eliminations or offsets. The results are often industry-sector totals that are aggregates of different inputs and therefore misleading. For example, the data might include foundry wafer revenues and wafer shipments combined with IDM finished-unit product sales revenues and unit shipments.

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 the CCID and CSIA compile their data, without any eliminations or offsets, it is very probable that there will be instances of double-counting between sectors. The following example—a hypothetical manufacturing flow for a Chinese fabless semiconductor company that is 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 \$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.

### **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\$)*

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.

### **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 every company, and because Chinese policymakers themselves rely upon these result. 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 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.

## **About PwC**

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 157 countries with more than 208,000 people who are