中国：传统半导体行业的新前沿 (摘要)

证券研究报告

半导体设计公司更具竞争优势；首次覆盖矽力杰（买入）和中芯国际（卖出）

收入持续强劲增长…

尽管全球行业已进入整合期，中国半导体行业的收入强劲增长受到**三项因素的推动：1) 中国在硬件设计领域的地位上升；2) 政府大力支持；3) 全球并购机会丰富。**例如，2011-2015 年中国在领先晶圆企业的硅片采购额年均复合增速高达 27%，远高于 13%的行业增速。在本文中，我们通过对台湾地区、日本、韩国和中国大陆的多项案例分析来识别出中国的主要企业和基金，对竞争结局作出预测，并得出中国半导体行业蓬勃发展将令哪些企业受益、并对哪些企业不利。

…但竞争优势是盈利的必要条件

虽然收入增长无须担忧，但真正的竞争优势才是盈利能力得以维持的必要条件。鉴于此，我们找出了中国企业的三项关键优势：1) 贴近本土客户（例如中国 OEM/ODM 厂商）；2) 可获取低成本资金（A 股的高估值）；3) 低薪酬工程师供应充足。我们还发现了一项重要劣势，即技术壁垒（摩尔定律）。

相对于 12 吋晶圆，我们更看好半导体设计…

我们基于这一竞争力框架**将半导体行业供应链各环节的盈利能力前景进行了排序：半导体设计 -> 封装 -> 晶圆代工 -> 存储 -> 设备。**我们认为半导体设计环节最具吸引力，因其拥有较低的技术壁垒以及较大的本土客户群优势。相反，12 吋晶圆的技术壁垒较高、需要大量研发投入、而其本土客户群仍然较小。

…相对中芯国际更看好矽力杰；买入华虹半导体

我们首次覆盖**矽力杰评为买入**（中国领先的模拟 IC 企业；上涨空间 18%），首次覆盖**中芯国际评为卖出**（中国领先的 12 吋晶圆企业；下跌空间 31%）。我们还**重申对华虹半导体的买入评级**（8 吋晶圆企业；上涨空间 24%）。从全球范围来看，我们预计中国政府对制造业和存储器的重视将令设备股受益（例如 **LRCX、AMAT、Tokyo Electron、ASML**）；中国企业的并购活动应对标的企业有利，但很多二线半导体企业将面临着来自中国公司的更激烈竞争，其中**联电**和**联发科**已经感受到了压力，我们预计随后将是**日月光**和**矽品**。

**全文翻译随后提供*

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Prices in this report are as of the April 12, 2016 market close unless indicated otherwise.

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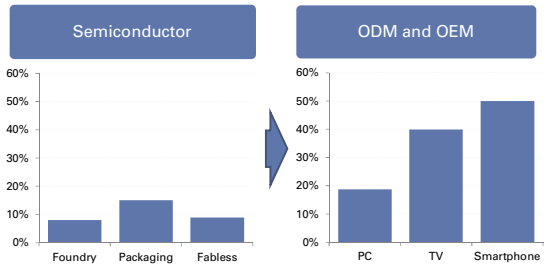
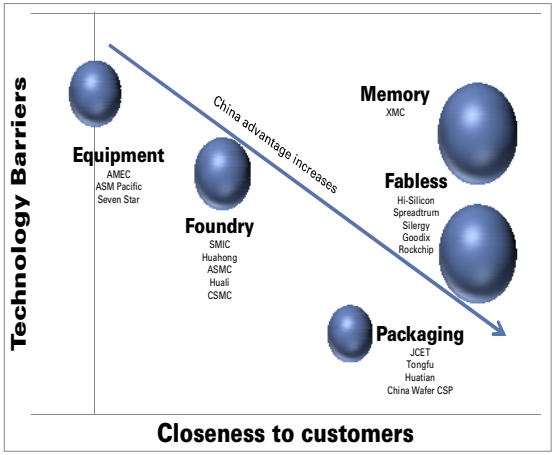
Our view in six charts

Exhibit 1: China's ascendancy in hardware design provides fertile ground for its semi industry



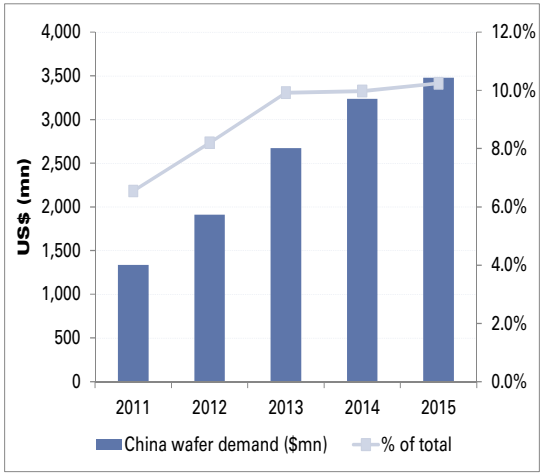
Source: Gao Hua Securities Research, Goldman Sachs Global Investment Research.

Exhibit 2: We prefer fabless over 12" foundry
A competitive analysis of Chinese semi supply chain



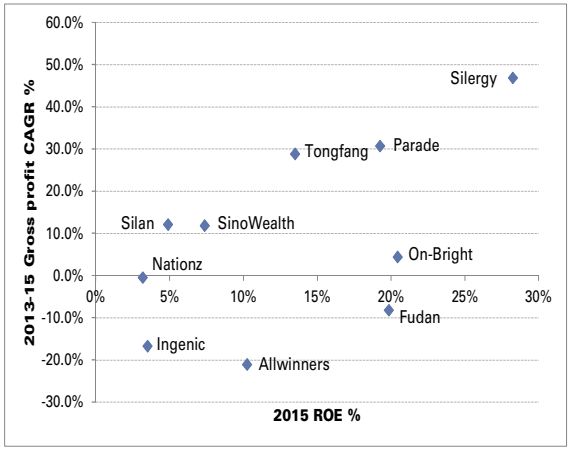
Source: Gao Hua Securities Research, Goldman Sachs Global Investment Research.

Exhibit 3: China wafer demand saw 27% CAGR
Total China revenues at TSMC, UMC, and SMIC



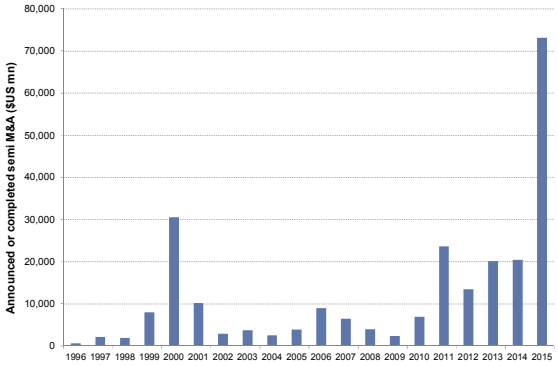
Source: Gao Hua Securities Research, Goldman Sachs Global Investment Research.

Exhibit 4: Silergy leads in profit growth and ROE
Our investment framework of China fabless



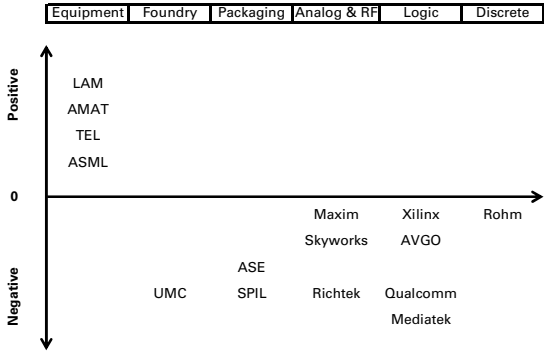
Source: Company data.

Exhibit 5: Consolidation to benefit China semi
Global semi M&A deals



Source: Company data.

Exhibit 6: China's to deflate global semi stocks
China's impact on global semi stocks



Source: Gao Hua Securities Research, Goldman Sachs Global Investment Research.

China Semiconductors in Numbers

LARGE SHARE

50%

The share of global smartphone units that Chinese companies design. (p. 8)

SMALL SHARE

7-12%

Chinese companies' market share in semiconductor equipment, foundry, packaging and fabless deign markets. (p. 17)

GOVERNMENT GOAL…

20% CAGR

The State Council's target for semiconductor industry growth in 2015-2020. (p. 9)

…IN CONTEXT

2.4%

The average growth rate of the global semiconductor industry in 2010-2015. If China achieves its 20% growth target, it would double its market share. (p. 9)

MEMORY SUPPORT

$24bn

The amount Chinese governments have committed for XMC to build 300K and 1mn wafer-per-month memory capacities in 2020 and 2030, respectively. Semiconductor memory is roughly 1/3 of the total semi market. (p. 29)

VALUATION ADVANTAGES

50%-100%

The size of the P/E premium China A-share semis enjoy over their global peers. These companies can also raise low-cost capital for M&A and capex. (p. 16)

DEEP TALENT POOL

10x

The size of China's graduating engineer class in 2012 vs. the size of the class in the US. While China's junior engineers earn much less than their peers in the US, their salaries are on par with engineers in Taiwan, limiting China semis' labor cost advantage. (p. 16)

THIRD TIME'S THE CHARM?

2

The number of previous ineffective semiconductor stimulations by the Chinese government. (p. 9)

PROMISING FABLESS

27%

The growth CAGR of wafer purchases by Chinese fabless companies in 2011-2015. (p. 21)

UPGRADE BY ACQUISITION

$1.8bn

The value of the overseas M&A deals completed by the top three Chinese packaging companies in 2014-2015. The acquisitions should help the companies close the technology gap. (p. 9)

PM Summary: China is a new frontier in the old semiconductor world

Against the backdrop of consolidation in the global semiconductor industry, we believe China's semi industry is poised for robust revenue growth, driven by China's ascendancy in hardware design, strong support from the government, and ample global M&A opportunities. Armed by ample case studies in Taiwan, Japan, Korea, and China, we seek to identify the players, predict the outcome, and delineate those that stand to benefit or be disrupted by the rise of China**.**

Chinese semiconductor industry poised for robust revenue growth…

We see ample revenue upside potential for China's semiconductor industry driven by three reasons: (1) Chinese fabless design companies have only 9% of global market share in 2015, well below that of their local customers, China OEM (original equipment manufacturers) and ODM (original design manufacturers) at 20-50%. OEM and ODM design hardware and decide on what semiconductor to use. We expect Chinese design companies to be open to use local suppliers for time-to-market and superior service. (2) Chinese central and local governments are investing billions of dollars in semiconductor manufacturing, R&D, and overseas M&A, and "encouraging" global semiconductor leaders such as Qualcomm and Mediatek to source from Chinese foundry and packaging companies. (3) The global semiconductor industry is rapidly consolidating. We believe this presents several overseas M&A opportunities for Chinese companies to acquire technologies and a customer base. While we believe that overseas M&A can be a win-win for both Chinese acquirers and overseas targets, there are high regulatory hurdles in the US and Taiwan. We list major Chinese semiconductor companies, government funds and PEs in Appendices 6 and 7.

…but profit growth depends on competitive advantages

While Chinese semi companies see strong revenue growth, profit growth is hard to find (for more details, see case studies in China and overseas in the Appendix). Since China's semi growth is mostly through market share gains, we believe only companies with specific competitive advantages can generate sustainable profit growth. We identify three key competitive advantages: (1) close to local customers; (2) low cost capital from high A-share valuations and government support; and (3) abundant supply of engineers. At the same time, technology barriers can be a major hurdle, especially challenges related to slowing of Moore's Law.

Our investment framework: Favor fabless over foundry and equipment in China

Based on our competitive analysis, we have examined the entire semiconductor supply chain for their local customer presence and technology barriers (Exhibit 8). We believe fabless design companies have relatively low technology barriers and are have a strong local customer base (Chinese OEM/ODM). Packaging has relatively low technology barriers too, and the top three Chinese packaging companies have recently made overseas acquisitions to gain advanced technology and a customer base. However, we have a cautious ROE outlook for the packaging industry due to intensifying competition without apparent differentiation. On the other hand, 12" foundries have very high capex and R&D needs. While high capex requirements are arguably positive for Chinese foundries, the technology barrier for 12" foundries has been detrimental to ROE. In addition, Chinese foundries still do not have a strong local customer base and, based on TSMC's experience in the US, providing services to local customers does not seem critical for a foundry. Similarly, Chinese equipment makers face very high technology barriers and have a relatively small local customer base.

China fabless: Silergy is our top pick

China has over 500 fabless design houses. Most of them are still private, including industry leaders Hi-Silicon and Spreadtrum, and it is expected that some (such as Gigadevice and Goodix) will be listed on the A-share market soon, according to EastMoney. While we believe the fabless design sector is attractive, many Chinese companies make me-too products and compete on pricing without cost advantages. For example, both Mediatek and Spreadtrum have suffered severe margin erosion in smartphone SOC partially owing to Spreadtrum's aggressive pricing strategy. Among fabless stocks, we prefer analog and high-end MCU companies as they operate in a fragmented market with low presence of Chinese competitors and high barriers to entry. We also like companies that can efficiently leverage Chinese low-cost engineers to launch new products at a fast pace or those that possess a time-to-market advantage with innovative products. Consequently, a good fabless design company should generate high gross profit growth at attractive ROE. In line with this, we initiate Buy on Silergy, the largest analog company in China that focuses on power management IC (PMIC). The company has a proprietary process technology and an efficient R&D team. Among Chinese fabless design companies, it leads in our profit growth and ROE metrics. Our 12-month target price of NT$500 implies 18% upside.

While Parade is Taiwan-listed, we treat it as a virtual Chinese semiconductor company because its founders have a Chinese background and its employees are mostly located in China. In addition, Parade has many Chinese customers including Huawei, Tianma, BOE, and Lenovo. We raise our 2016-2018 EPS estimates 0%-22% to reflect its progress in SIPI drivers and our 12m TP to NT$320 from NT$290. We change our valuation methodology from NTM P/B-ROE to 15X NTM P/E (based on Parade's avg. NTM P/E over the last 12 months).

China foundry: We prefer Hua Hong over SMIC

While SMIC has government support in the form of low-interest loans and customer orders, the gap in production between SMIC and TSMC has widened from 13 quarters at 40nm to 17 quarters at 28nm as the pursuit of Moore's Law becomes increasingly difficult. We expect the widening gap to reduce the ROE of SMIC's 28nm investment as TSMC's 28nm equipment is fully depreciated to support low prices. On the demand side, SMIC expects 28nm to be a long node and is entering a new capex cycle for 28nm in 2016. But in recent quarters, 28nm demand has declined sharply and is not much better than 65nm at the same stage at the end of 2015. So, we expect SMIC's ROE to deteriorate in 2016-2017. We initiate coverage of SMIC with a Sell rating and a 12-month target price of HK$0.48 (implying 28% downside) based on peer P/B-ROE regression. On the other hand, Hua Hong only has an 8" foundry business that has low technology hurdles and capex burden. We thus prefer Hua Hong for its attractive valuation and steady ROE outlook. We reiterate Buy on Hua Hong while we lower our 12-month target price by 6% to HK$9.7 (implying 24% upside), also based on peer P/B-ROE regression. Globally, TSMC has prevailed through its widening leadership in technology, but UMC has lost market share to SMIC.

The rise of China to benefit global equipment vendors and disrupt other companies

The Chinese government's focus on semiconductor manufacturing and especially the US$24bn memory project at XMC should benefit global semiconductor equipment companies such as LAM, AMAT, Tokyo Electron, and ASML as well as material suppliers such as SUMCO. Another group of beneficiaries is the potential M&A target companies. We note that most targets in the past have a market cap of US$300mn-US$1.5bn and are profitable. On the negative side, we believe the rise of China has already disrupted second-tier foundries such as UMC, significantly affected Mediatek's smartphone SOC margins, and should start to exert pressure on the advanced packaging operations of ASE and SPIL.

Key growth drivers

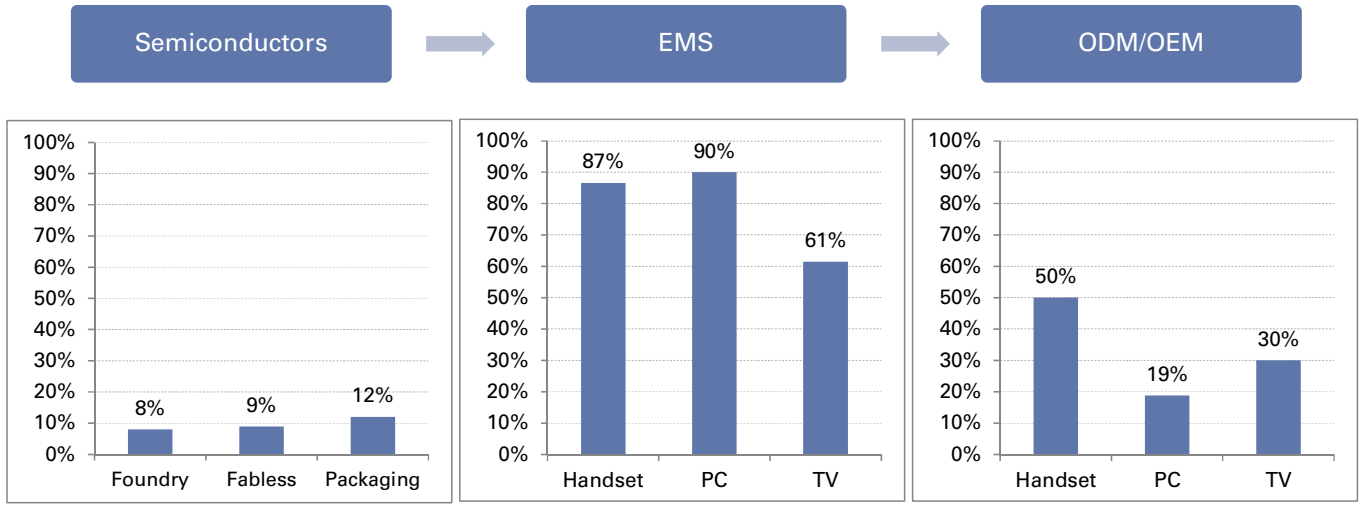
1. China’s ascendancy in hardware design

We believe the uneven development of China’s technology supply chain presents a great growth opportunity for Chinese semicon firms. China has a dominant EMS (electronics manufacturing service) industry represented by Hon Hai and BYD; rapidly growing OEMs and ODMs (Huawei, Lenovo, Xiaomi, DJI, Huaqin); and a relatively weak semiconductor and component industry (Exhibit 7). In smartphones, the largest tech application today, we estimate China assembles and designs 87% and 50% of all smartphones in the world, but supplies less than 5% of smartphone semiconductors. Smartphones have been a major driver of Chinese OEMs and ODMs since 2011. The strong EMS industry means China imports a large sum of semiconductors. For example, according to the Chinese government, China imported US$231bn worth of semiconductors in 2013 (vs. US$220bn of oil). We believe this import figure includes semicon wafers and equipment because global total semicon sales were only US$306bn in 2013 and China’s imports are unlikely to have reached 76% of global semiconductor sales. For China’s semicon industry, we believe the most important metric is its market share gap with China OEMs and ODMs as they determine semiconductor purchases.

Consumption by Chinese consumers, corporates, and governments is much less than semiconductor imports. Based on the sell-through of handsets, PCs, TVs, and autos, we estimate China consumes about 25% of global semiconductors. In smartphones, China represented 29% of total global shipments in 2015, but we believe China’s ASP is below the global average, so China represented about 25% of global smartphone and semiconductor consumption in value.

On the supply side, we estimate Chinese firms have 5%-9% market share in the semicon equipment, foundry, packaging materials, and fabless design markets. China’s packaging industry has much higher penetration after the recent acquisition of Stats-ChipPac. Across the semicon supply chain, Chinese firms have been taking market share over the last 10 years. We expect this to continue.

Exhibit 7: China’s ascendancy in hardware design at OEM and ODM provides a fertile ground for its semiconductor industry
China’s penetrations at various parts of technology supply chain, 2015



Source: Company data.

2. Chinese government stimulus: Third time’s a charm?

In June 2014, the State Council of China announced national guidelines to promote the semiconductor industry. The key target of the guideline is above 20% CAGR for the Chinese semiconductor industry in 2015-2020. Mr. Ma Kai, a vice premier, is directly in charge of the effort, highlighting that semiconductors have become a national priority. Based on the abovementioned growth target, China would double its market share from 2015 to 2020 given that that consensus expectation is for the global semiconductor to post an average growth rate of only 5% over the same period.

This is not the first time that the Chinese government has tried to stimulate the domestic semiconductor industry. In the 1980s and 1990s, the government tried to kick-start the domestic semiconductor industry by focusing on IDM and semiconductor foundries and to a lesser extent packaging companies. These efforts however only led to the creation of small foundries such as ASMC, Hua Hong, and CSMC, two of which are trading well below book value currently. Many investors have questioned if this stimulus round would be any different. We believe that the third time might indeed be a charm based on the following reasons:

- Chinese OEMs and ODMs have grown from a miniscule scale to 30-50% of global market share in 2015, offering Chinese fabless design companies competitive advantages in time-to-market and local penetration. In IoT, which we believe is the next growth driver of technology, Chinese OEMs and ODMs should become even more important. For example, at the 2016 CES (Consumer Electronics Show), Chinese companies represented 1/3rd of all participating companies.
- The overall semiconductor supply chain is much stronger in China today than 15 years ago. Almost all the global semiconductor equipment, material, IP (intellectual property), EDA (electronics design aid), and design service companies now have offices in China.
- Since the 1990s, many overseas Chinese semiconductor professionals have returned to China. The R&D centers of global semiconductor companies have also trained many engineers. The supply of experienced engineers has greatly improved.
- The previous stimulus rounds were part of the “planned economy”. However, the current stimulus is more market driven and includes PEs, which closely look at IRR. The government is also forming a leasing company to reduce the capex burden of domestic companies. In addition, we believe the government is more flexible on overseas acquisitions as exemplified by JCET’s acquisition of Stats-ChipPac.
- Cost of capital is lower today than in the 90s for Chinese semiconductor companies. In addition to government funding, semiconductor companies have a high A-share P/E of over 50X, well above that of 15X in the overseas market.

3. M&A: Stage set for China to upgrade technology through overseas transactions

Overseas M&A intensifying

We view overseas M&A as a key growth driver for the Chinese semiconductor industry. Many Chinese companies are very interested in acquiring overseas technology companies and have made headlines in the last few years. Exhibit 22 lists a few recent overseas technology and semiconductor deals by Chinese companies, many of which. The strong China deal flow in 2015 is consistent with the global semiconductor M&A theme. We attribute the strong global semiconductor M&A activity in 2015 to a slowing industry growth outlook post the smartphone cycle, customer consolidation, and intensifying competition from Asia. We believe overseas M&A can provide the following benefits:

- Despite the recent correction, Chinese semiconductor stocks still trade at average 25X NTM P/E, well above the global average of 15X. These companies need new products to drive growth and M&A is one of the options. High valuations could help Chinese companies to raise money for M&A and encourage various financial players to privatize overseas semiconductor companies for an A-share listing.
- After a large M&A deal, the merged company often spins off unwanted assets. These assets can be attractive to Chinese companies. For example, JAC Capital acquired NXP’s RF power amplifier business after the merger of NXP and Freescale. The strong global semiconductor M&A activity in 2015 can be a feeder for Chinese M&A deals in the next few years.
- In some technology M&A cases such as Joyson and Preh, Chinese companies have acquired valuable technology and products while overseas companies got access to the China market. Meanwhile, the merged company has increased R&D investment in its overseas entity. We believe that there are abundant opportunities for this kind of win-win scenario.

Exhibit 8: Overseas M&A in the Chinese semiconductor industry
A list of Chinese technology and semiconductor overseas M&A deals

Announced	Buyer	Target	Target EV (US$, mn)	Deal size (US$, mn)	EV / Revenue LTM	EV / Revenue NTM	EV / EBITDA LTM	EV / EBITDA NTM	P/E LTM	P/E NTM
China technology deals										
02/02/16	Joyson	KSS	920	920						
12/07/15	Luxshare	Merry	485	123	1.3				22.4	
10/12/15	VeriSilicon	Vivante								
09/18/15	Fenghua Advanced	Viking Tech	107	40	2.5				23.9	
05/21/15	Unisplendour	New H3C	6,538	3,335	1.8				9.1	
03/12/15	Derun	Meta	97	58	0.7		5.9		63.1	
12/16/14	Joyson	Quin	108	81	0.7				5.7	
10/21/14	GoerTek	Dynaudio	47	39	0.9				14.4	
06/19/14	Joyson	IMA	19	19	0.4	0.4				
03/26/14	O-Film	DOC	38	38						
01/13/14	JCET	STATSChipPAC	735	735	0.5					
10/25/13	Luxshare	SuK	6	6						
11/29/12	Accelink	IPX	3	3	0.5					
03/29/12	Joyson	Preh	315	315	0.5	0.5			12.9	11.6
				Average	**1.0**	**0.5**	**NM**	**NM**	**21.7**	**NM**
				Median	**0.7**	**0.5**	**NM**	**NM**	**14.4**	**NM**
China semiconductor deals										
12/11/15	Unigroup	ChipMOS	1,037	259	1.6	1.5	5.4	5.0	17.7	16.9
12/03/15	E-Town Dragon	Mattson	298	298	1.5	1.6	19.2	15.6	32.5	58.3
10/30/15	Unigroup	Powertech	2,363	591	1.9	1.3	5.4		14.7	12.8
10/17/15	Tongfu	AMD	429	365	1.3				16.6	21.8
07/02/15	Summitview	ISSI	630	630	1.9		21.0		39.1	
05/28/15	JAC Capital	NXP RF	1,717	1,717	1.8	1.6				
04/30/15	Hua Capital	Omnivision	1,812	1,812	1.4	1.5	16.3		21.0	20.4
06/11/14	Pudong sci & tech investment	Montage	661	661	4.4	3.3		10.7	15.0	10.6
10/25/13	Unigroup	RDA	879	879	2.6	1.9			32.0	12.1
07/12/13	Unigroup	Spreadtrum	1,677	1,677	1.8	1.6			12.6	11.0
				Average	**1.9**	**1.6**	**13.5**	**10.4**	**22.3**	**20.5**
				Median	**1.8**	**1.6**	**11.5**	**8.6**	**18.9**	**16.9**

Note: Joyson/KSS deal is pending regulatory approvals.

Source: Company data.

Exhibit 9: Global semiconductor M&A deals had a NTM P/E of 25X in 2015
Average NTM P/E of select global semiconductor M&A deals in 2015

Date	Buyer	Target	NTM P/E
11/18/2015	ON Semiconductor	Fairchild	NM
10/30/2015	Skyworks	PMC Sierra	17.7
10/21/2015	Western Digital	SanDisk	22.7
10/21/2015	Lam Research	KLA Tencor	17.9
10/19/2015	Microsemi	PMC Sierra	20.9
9/30/2015	Mellanox	EZChip	16.2
9/18/2015	Dialog	Atmel	29.6
9/7/2015	Mediatek	Richtek	16.7
8/27/2015	Mediatek	ILITEK	NA
6/11/2015	Uphill	ISSI	22.7
6/1/2015	Intel	Altera	42.5
5/28/2015	Avago	Broadcom	19.0
5/28/2015	JAC Capital	NXP's RF business	NM
4/30/2015	Knowles	Audience	NM
3/18/2015	Microsemi	Vitesse Semiconductor	NM
2/25/2015	Avago	Emulex	14.9
2/3/2015	MaxLinear	Entropic	37.6
1/27/2015	Lattice	Silicon Image	45.6
		Average	**24.8**
		Median	**20.4**

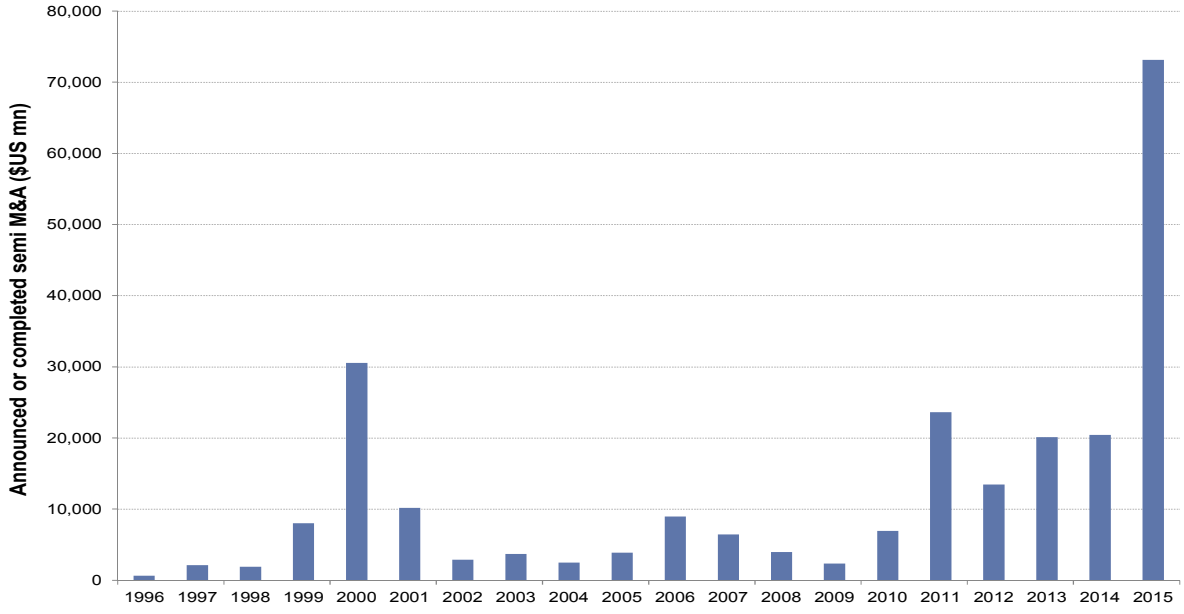
Source: Company data

Exhibit 10: China semiconductor companies are trading at 45X NTM P/E
NTM P/E of select Chinese semiconductor companies, 2015

Ticker	Company	Market cap (Rmb, mn)	NTM P/E
002049.SZ	Tongfang Guoxin	27,352	42.4
002180.SZ	ApexMic	25,272	
600584.SH	JCET	22,854	
000938.SZ	Unisplendour	22,689	41.0
601231.SH	USI	21,951	16.0
300458.SZ	All Winner	13,319	45.0
002185.SZ	Huatian	11,778	21.0
603005.SH	WLCSP	10,614	34.6
002138.SZ	Sunlord	10,342	26.0
600171.SH	Shanghai Belling	10,231	
300077.SZ	Nationz	10,036	61.0
002156.SZ	Nantong Micro	9,945	21.0
002371.SZ	Sevenstar	9,633	48.0
600360.SH	Sino-Microelectronics	7,976	23.0
600667.SH	Taiji Industry	7,521	
300373.SZ	Yangjie Tech	6,656	36.0
002079.SZ	Goodark	6,292	110.0
300327.SZ	SinoWealth	5,252	62.0
300223.SZ	Ingenic	4,336	84.0
300046.SZ	Tech Semi	2,542	
		Average	**44.7**
		Median	**41.0**

Source: Company data

Exhibit 11: Global semiconductor industry is consolidating and had record level of M&A deals in 2015. This trend should facilitate growth of Chinese semiconductor industry
Total global semiconductor M&A deal size



Source: Company data.

Chinese technology M&A in the US

In the US, the Committee on Foreign Investment in the United States (CFIUS) has blocked many Chinese deals. CFIUS's intention to review Unisplendour's potential acquisition of a 15% stake of Western Digital led to Unisplendour cancelling the deal.

Chinese technology M&A in Taiwan

We believe that many Taiwanese semiconductor companies can benefit from R&D capital and market access of Chinese companies. Similar to CFIUS, the Investment Commission, Ministry of Economic Affairs (MOEAIC) reviews all investment proposals for an over 10% stake in a target company in Taiwan. The Taiwan government currently prohibits China investment in its semiconductor design companies, and restricts investments in foundry and packaging to: 1) no controlling interests; 2) no presence in management team; 3) no majority board seats; and 4) requires case by case approval. In October 2015, Tsinhua Unigroup proposed to acquire a 25% stake in Powertech (6239 TT), a memory packaging company, via Powertech's private placement. MOEAIC indicated that Powertech is on the list of permissible investments for Chinese companies, but would need to get approval from the Mainland Affairs Council, Financial Supervisory Commission, National Security Bureau, and Industrial Bureau of MoEA before its final review. We believe that this case should serve as leading indicator of future semiconductor M&A activities between Taiwan and China.

Exhibit 12: CIFUS has blocked several deals
A list of Chinese deals approved or blocked by CFIUS

Deals approved by CFIUS			
Buyer	**Seller**	**Sector**	**Year**
JAC Capital	NXP RF	Technology	2015
Lenovo	IBM PC	Technology	2005
Lenovo	IBM x86 server	Technology	2014
Lenovo	Motorola Mobility	Technology	2014
CAIGA	Cirrus	Aviation	2011
Geely	Volvo	Auto	2010
CNOOC	Chesapeake	Energy	2010
CCPC	Devon	Energy	2012
Shuanghui	Smithfield	Food	2013
CNOOC	Nexen	Energy	2013
Wanxiang	A123	Battery	2013
Dalian Wanda	AMC	Media	2012
Deal blocked by CFIUS (including withdraw)			
Buyer	**Seller**	**Sector**	**Year**
Huawei	3Leaf	Technology	2011
Huawei	3Com	Technology	2006
CNOOC	Unocal	Energy	2005
Ralls	Terna Energy wind farm	Energy	2012
Northwest Nonferrous International Investment	Firstgold	Mining	2009
Tangshan Caofeidian Investment	Emcore	Technology	2010

Source: Company data.

Exhibit 13: Taiwan government prohibits Chinese companies from investing in fabless design and closely regulates those in foundry and packaging
A list of Chinese deals approved/blocked/under review by Taiwan regulator

Deals approved			
Buyer	**Seller**	**Sector**	**Year**
Luxshare	Merry	Acoustic	2015
Luxshare	Speed Tech	Connector	2012
Fenghua	Viking	Discretes	2015
Deals blocked (including withdraw)			
Buyer	**Seller**	**Sector**	**Year**
Unigroup	SPIL	Packaging	2015
Deals under review			
Buyer	**Seller**	**Sector**	**Year**
Unigroup	ChipMos	Packaging	2015
Unigroup	Powertech	Packaging	2015

Source: Company data.

Case study: China has acquired advanced packaging technology through overseas M&A

In 2014-2015, the top three Chinese packaging companies successfully acquired advanced packaging technology and expanded their customer base through overseas M&A. We believe these M&A deals, partially supported by government funding, would help Chinese companies to close the technology gap between global peers in the next 1-2 years.

- **JCET** acquired STATS ChipPAC, the fourth largest packaging service vendor globally, in 2015 for US$780mn. Before acquiring STATS ChipPAC, majority of JCET's revenues were derived from wirebonding and leadframe based packaging and the company was in the early ramp up stage of flip chip packaging and wafer bumping. STATS ChipPAC specializes in advanced technology including flip chip, solder/Cu pillar bumping, and wafer level packaging, and addresses high-end applications such as graphic processing unit (GPU), mobile device application processor (AP) and baseband, system in package (SiP), and multi-chip packaging. STATS ChipPAC has solid partnerships with global top tiered IC customers including Qualcomm, Broadcom, Texas instrument, Avago and Nvidia, thus complement JCET's existing technology and customer portfolios.
- **Hua Tian** acquired Flip Chip International (FCI) in April 2015 for US$40mn. Flip Chip International owns key IPs, technology know-how, and capacity in wafer bumping (solder ball and Cu pillar), flip chip packaging, and wafer level packaging (mainly WLCSP). FCI has a wide range of IC customers in the US such as On Semiconductor, NXP, and Texas Instrument. After acquiring FCI, Hua Tian has leveraged FCI's technology to expand its capacity in wafer based packaging and product offering to US IC customers.
- **NT Fujitsu** announced in October that it would acquire two back-end facilities (Suzhou, China and Penang, Malaysia, 5 production lines in total) for US$971mn via a joint venture with AMD. The company expects to close the deal by 1H2016 pending regulatory approvals. AMD's facilities have flip chip BGA technology for AMD's PC/server CPU and GPU. The technology complements that of NT Fujitsu.

Exhibit 14: Chinese packaging companies have acquired advanced packaging technology through overseas M&A
A list of recent major overseas M&A of Chinese packaging companies

Chinese OSATS	M&A target	Acquisition cost	Announcement date	Completion date	Key technology	Key customers
JCET	STATS ChipPAC	US$780mn (US$260mn from JCET)	11/6/2014	10/19/2015	Bumping, flip chip, WLCSP, FOWLP, SiP, 2.5D/3D	Apple, Qualcomm, Broadcom, TI, Avago, NVIDIA
Hua Tian	Flip Chip International	US$40.6mn	11/14/2014	4/1/2015	Flip chip, WLP, bumping	NXP, On Semi
Fujitsu NT	AMD back-end facilities	US$370.6mn	10/16/2015	Not complete; regulatory approvals pending	Flip chip BGA	AMD

Source: Company data.

Competitive framework

Profit growth requires three key advantages...

Only competitive strength can create value for investors

While we are positive on the revenue growth potential of Chinese semiconductor companies, we believe that only companies with certain competitive advantages can create profits or value because their growth driver is market share gains through fierce competition. **Based on our meetings with Chinese semiconductor companies and case studies in Taiwan and China, we identify three key competitive advantages needed for sustained profit growth and one key disadvantage for Chinese semiconductor companies.**

1) **Local customers:** We believe this is most important competitive advantage in order to provide faster time-to-market in new product development and superior services**.** For example, a Chinese fabless design company is better at understanding the needs of Chinese OEMs and ODMs to develop a timely product. It is also easier for a Chinese design company to send a field engineer to customers to resolve technical issues on time. Since Chinese OEMs and ODMs already have 30-50% of global market share, Chinese fabless companies are well poised to take market share in our view. A similar story is the case of Taiwan, where the growth of consumer electronics companies and PC ODM drove the growth of many fabless design companies over the years.

2) **Low cost of capital:** Chinese A-share semiconductor companies enjoy a 50% to 100% P/E premium over their global peers and can thus raise low-cost capital for M&A and capex. Also, Chinese governments have offered R&D grants and free R&D equipment, and subscribed to shares of Chinese semiconductor companies in the past. For example, the Chinese government's PE subscribed to JCET's shares to provide capital and reduce the effective interest rate of loans for JCET's acquisition of Stats-ChipPac. Low cost of capital is a meaningful advantage for capital-intensive foundry and packaging companies and design companies inclined toward M&A. On the negative side, low-cost capital may introduce excessive competition and over-capacity, in our view.

3) **Abundant supply of low-cost junior engineers:** in 2012, China had 10X the number of engineering graduates than the US. In addition, the average salary of a junior Chinese IT engineer is only 1/5th that of the US, according to the National Bureau of Statistics of China, Bureau of Labor Statistics. But lately the salary difference between China and Taiwan has become insignificant for both engineers and operators working on production lines. This indicates that Chinese semiconductor companies do not have much of a labor cost advantage over Taiwanese companies.

We also identify one key competitive disadvantage

- **Technology barrier:** This is particularly true given the slowing of Moore's Law or the continuous evolution of other technologies. For example, the gap of R&D spending and technology advancement between TSMC and SMIC has continued to widen.

...and fabless looks best positioned along value chain

The semiconductor industry has a long supply chain including equipment, material, foundry, packaging, and fabless design companies. In addition, memory companies are mostly IDM (integrated device makers) that design chips and own fabs for manufacturing. China has 7% - 12% global market share in each segment of the semiconductor supply chain, led by packaging after JCET's recent acquisition of Stats-ChipPac. Based on our competitive framework, we rank the competitiveness and profitability outlook of each segment in China as fabless > packaging > foundry > memory > equipment.

- **Chinese foundry equipment and material companies do not have a strong local customer base** because TSMC, Samsung, and Intel represent over 50% of the global semiconductor equipment market, well above that of Chinese foundries at less than 10%. The technology barrier is also very high in the foundry equipment and material businesses because most equipment and materials are at the forefront of Moore's Law and built upon historical IP portfolios. However, the technology barriers are moderate in packaging. In Taiwan, despite the prominence of local foundry players such as TSMC and UMC, the local equipment industry is still quite limited in penetration. For Chinese equipment companies, packaging is better positioned than foundry because packaging equipment has relatively low technology barriers and many global companies have their operations in China, Taiwan, or Southeast Asia. For example, ASM Pacific is based in HK and founded by ASMI, a Dutch semiconductor equipment company in 1975. ASM Pacific has become a global leader in packaging equipment and generates 48% of its total revenues from China in 2015, benefiting from its local presence.

- **Chinese 12" foundry faces high and evolving technology barrier.** The industry leader TSMC has widened its lead over SMIC in terms of production gap from 13 quarters in 40nm to 17 quarters in 28nm because TSMC's R&D was 7.6X higher than that of SMIC in 2015. TSMC is also opening a design service center and a 12" 16nm fab in Nanjing China in 2018. Meanwhile, SMIC has benefited from the government's capital, grants, and customer introduction to gain market share from second tier foundries such as UMC. Chinese customers contributed 48% to SMIC's total revenues in 2015, but we note that local services seem to be a relatively insignificant factor for TSMC because US customers have always contributed over 65% of TSMC's total revenues.

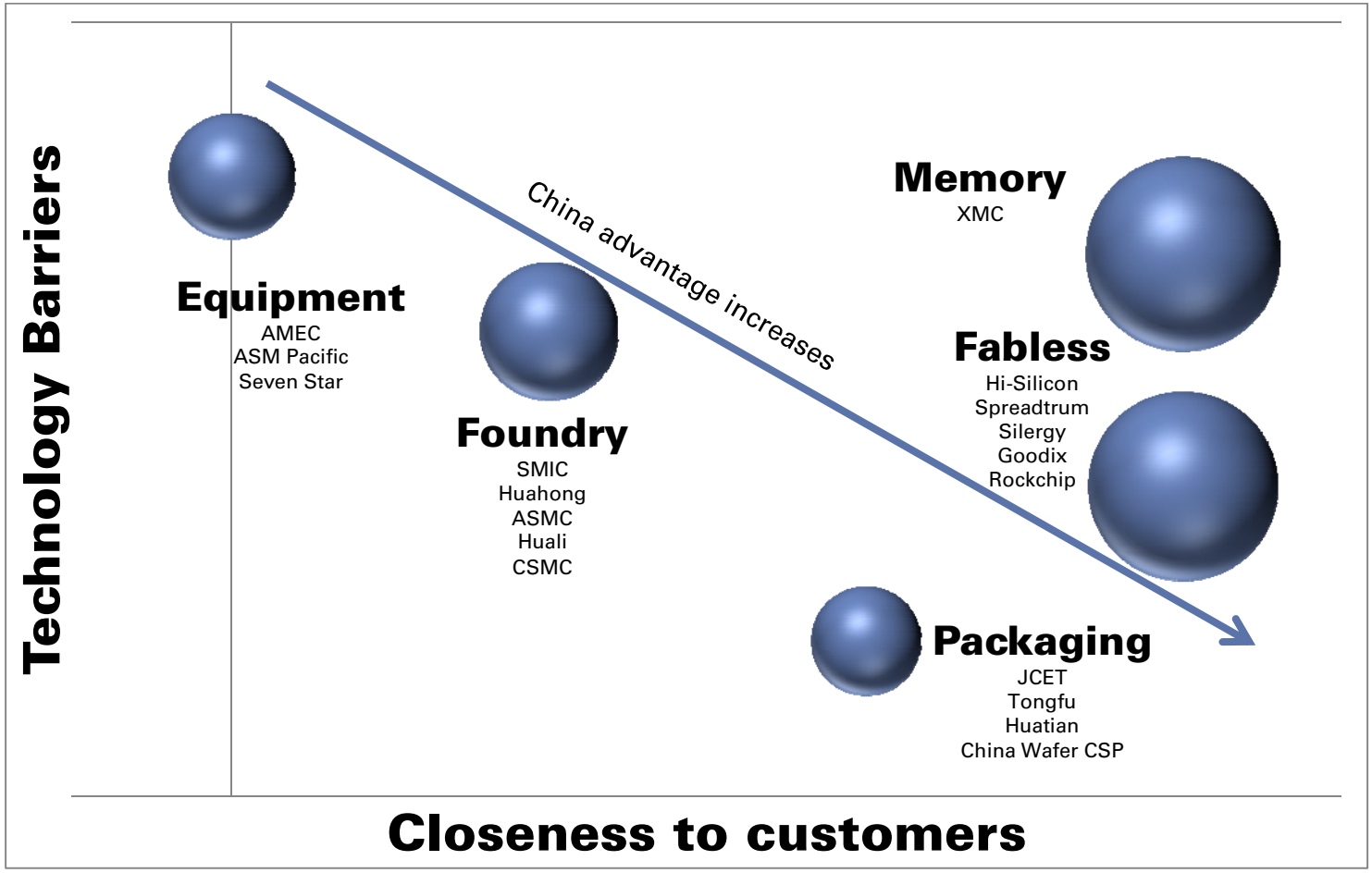
- **Semiconductor packaging has relatively low technology barrier but, similar to foundry, most customers are not based in China.** Since 2000, Chinese packaging companies have steadily gained market share in both revenue and gross profit. Their recent overseas acquisitions should also help them to narrow the technology gap with industry leaders. However, we also note that China is losing its labor advantage over Taiwan and competition is intensifying among Chinese packaging companies. We view packaging as more favorable over foundry but not as attractive as fabless design.

- **Memory has very high technology barriers, similar to foundry.** China does not have any memory design capability today. XMC is developing internal 3D-NAND technology, but we believe it is years from viable commercial production. A memory fab is very capital intensive and hence the low cost of capital in China is an advantage. China is a large market for memory, especially in corporate and government segments, due to security concerns. If one of the global memory makers licenses its IP to China, referencing China's rise in LCD, we expect China to impact global memory supply in five years.

- **Chinese fabless design companies are close to a large and growing customer base and have competitive advantages in time-to-market for new product development and on-time service.** The technology barrier of design is not nearly as high as foundry. Over the last decade, the supply of highly skilled semiconductor engineers has significantly improved as many senior Chinese engineers have returned to China from the US. The high A-share valuation is helping Chinese design companies to attract talent and

acquire overseas companies for technologies and products. We see the huge market share gap of 40% between China OEM/ODM and semiconductor design companies as an opportunity for Chinese fabless design companies.

Exhibit 15: Chinese semiconductor design companies have more competitive advantages than others in the supply chain
Our competitive analysis of the semiconductor supply chain in China; size of bubble represents total addressable market (TAM)



Source: Goldman Sachs Global Investment Research, Gao Hua Securities Research.

Stock implications: Leaders and laggards

Based on our framework and analysis in this report, we present global and Chinese beneficiaries of the trends in China's semiconductor industry. We present our views below by each segment of the semiconductor supply chain.

Equipment: We expect global semiconductor equipment companies to benefit from China's emphasis on semiconductor foundry and memory manufacturing and potential low yield at some of these Chinese fabs long term. SMIC (Sell), UMC-Xiamen, and Huali are building 12" foundry capacity in Beijing, Shanghai, and Xiamen, respectively; XMC and the DRAM project in Hefei are planning to build a large scale NAND and DRAM fab, respectively. However, we believe domestic equipment vendors such as AMEC and Seven Star as well as Beijing E-Town's recent acquisition of Mattson lack meaningful competitive advantages.

In the US, we continue to position Applied Materials (AMAT, CL-Buy) as our top recommendation. AMAT entered the Chinese marketplace in 1979, making it one of the first multi-national semiconductor capital equipment companies to participate in the market. Today, the company holds 20% share of the global wafer fab equipment market, with leading positions in epitaxy (90% market share), sputtering (85%), ion implanters (70%), CMP (70%) and CVD (29%). We believe, with its scale advantage and its long-term track record, AMAT is well-positioned to benefit as China builds out its presence in the semiconductor arena. Our 12-month price target is $24 (based on 13x normalized EPS of $1.85). Key risks include: capex trajectory, competition, and gross margins.

Foundry: We believe that SMIC faces a widening technology gap with TSMC but could take 28nm market share from UMC and GlobalFoundries in 2016-2018. However, SMIC is entering a capex up-cycle while industry growth is moderating, and therefore is likely to suffer from deteriorating returns in 2016-2017. We initiate coverage on SMIC with a Sell rating. We prefer Hua Hong (Buy) as its technology barriers are low while we expect its ROE to be stable and view its valuation as attractive.

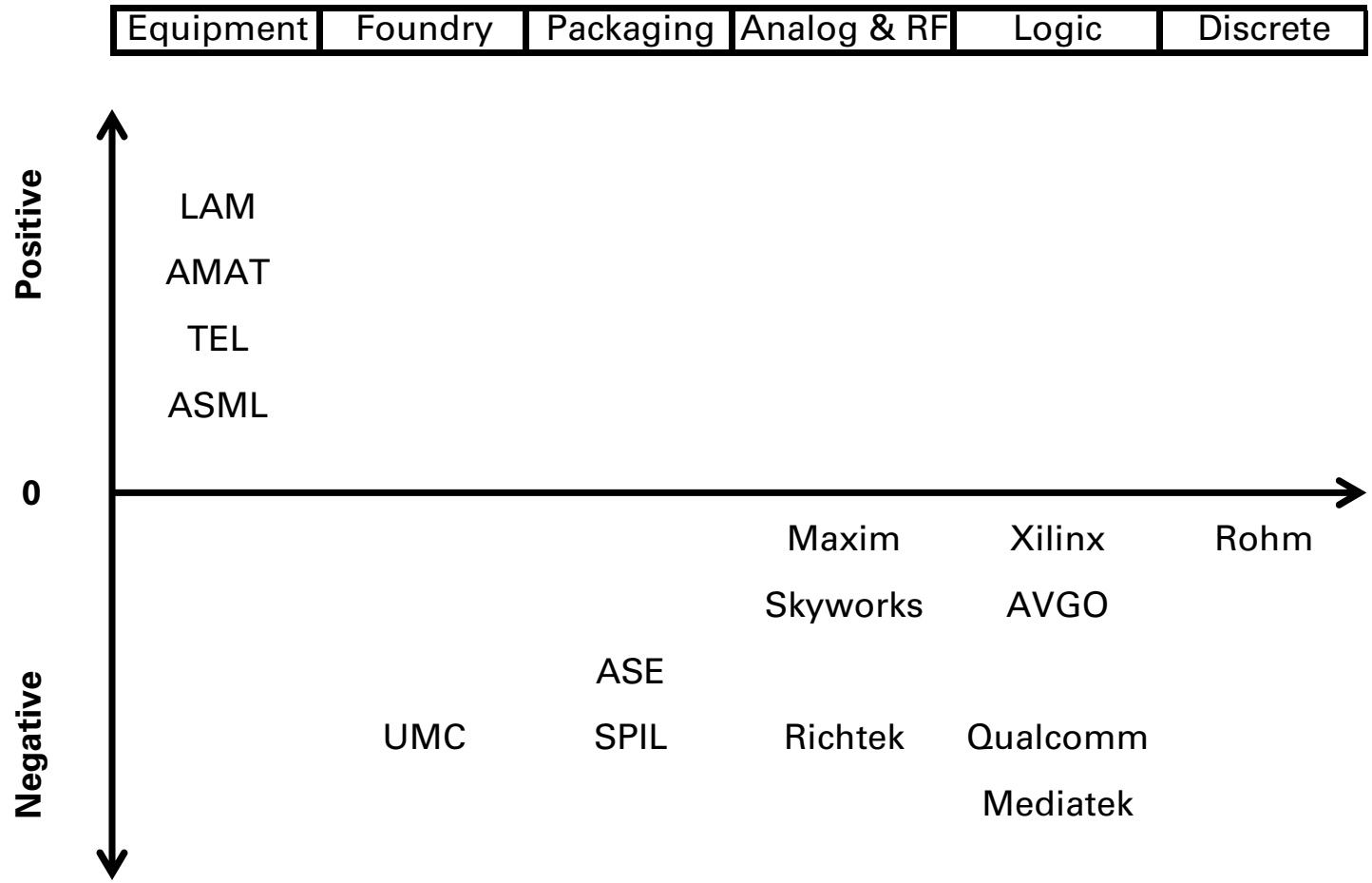
Packaging: Chinese packaging companies JCET and Huatian recently acquired Stats-ChipPac and AMD's China factory, respectively, for flip-chip technology. NT Fujitsu is in the process of establishing a JV with AMD. In light of their aggressive capex in 2016, we believe Chinese packaging companies pose a challenge to overseas packaging companies, especially second-tier players.

Fabless design: We are positive on China fabless design companies because they can offer superior time-to-market and service to the strong local OEM and ODM companies in China. Among fabless design companies, we prefer those with healthy growth potential and steady margins and avoid those that compete on pricing only. We believe Silergy addresses a favorable fragmented market and possesses a relatively high initial technology barrier that would enable it to lead in profit growth at high ROE among the publicly traded Chinese fabless design companies. We initiate coverage on Silergy with a Buy rating. Many Chinese design companies such as Hi-Silicon and Spreadtrum are private but some of them such as Gigadevice and Goodix are planning to IPO in the A-share market soon. Given the competitive advantages Chinese design companies, we expect them to take market share globally from their overseas competitors such as Qualcomm, Mediatek, Macronix, FPC and Synaptics.

Memory: We view memory IP as the key barrier to entry for Chinese memory makers such as XMC and the Hefei DRAM project. Without IP licensing, it might take Chinese memory makers 5-10 years to become a meaningful supplier in the world, taking China's effort in LCD as a reference. We view the potential new memory maker in China (XMC) as positive for semiconductor equipment makers and negative for long-term memory supply/demand and thus sentiment on memory stocks.

Global M&A: We view the track record of successful overseas M&A as an important competitive advantage for a Chinese semiconductor company, but these come with regulatory and political hurdles. Without the hurdle, we expect some US and Taiwan semiconductor stocks will enjoy some M&A premium.

Exhibit 16: Rise of China should benefit global equipment companies and potential M&A targets, and disrupt other semicon firms
Our assessment of broad stock impact from the rise of China semiconductor industry



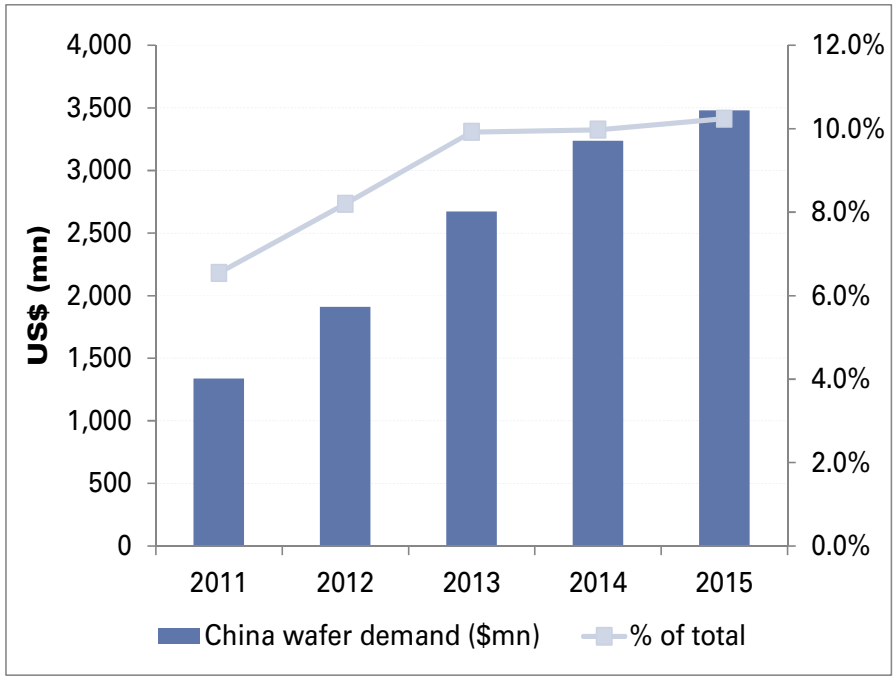
Note: While we take no view on the likelihood of any transaction, for illustrative purposes Exhibit 16 screens for non-Chinese semiconductor companies that could potentially be impacted by increased M&A activity by Chinese firms. We recognize there could be outcomes outside those represented.

Source: Gao Hua Securities Research.

Fabless: Look for profitable growth at good ROE

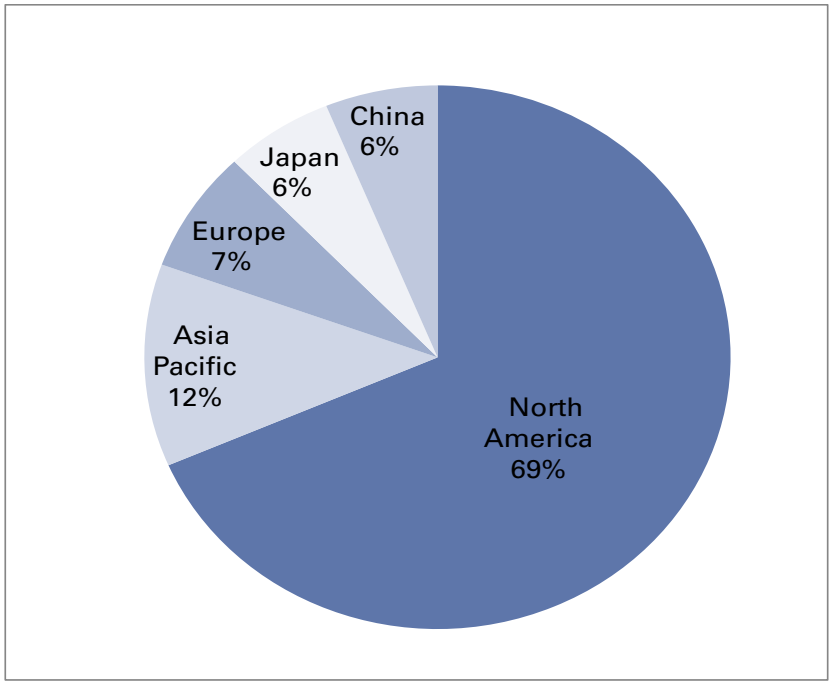
China has over 500 fabless design companies. We have listed the top 29 companies in Exhibit 40. Since most of these companies are private and do not report their financial data, we use their total wafer purchase to estimate their size and growth. Based on the reported China revenue at TSMC, SMIC, and Hua Hong, and assuming 9% revenue exposure to China at UMC, we estimate that China wafer purchases increased at a 27% CAGR in 2011-2015 to reach US$3.5bn in 2015, representing 10% of total foundry revenue in 2015. Assuming 65% of COGS from wafer and 35% GPM, we estimate Chinese fabless revenue of $15bn in 2015, or 2.3X that of Mediatek. At TSMC, the most advanced foundry, China represented 6% of total revenues in 2015, similar to that of Japan and Europe. This indicates that leading Chinese semiconductor companies such as Hi-Silicon and Spreadtrum have become early adopters of leading process technologies. In fact, we believe that Hi-Silicon is the first 16nm customer at TSMC.

Exhibit 17: China's wafer purchases increased at a 27% CAGR, well above industry growth of 13% in 2011-2015
Total revenues to Chinese customers at TSMC, UMC, SMIC, and Hua Hong



Source: Gartner.

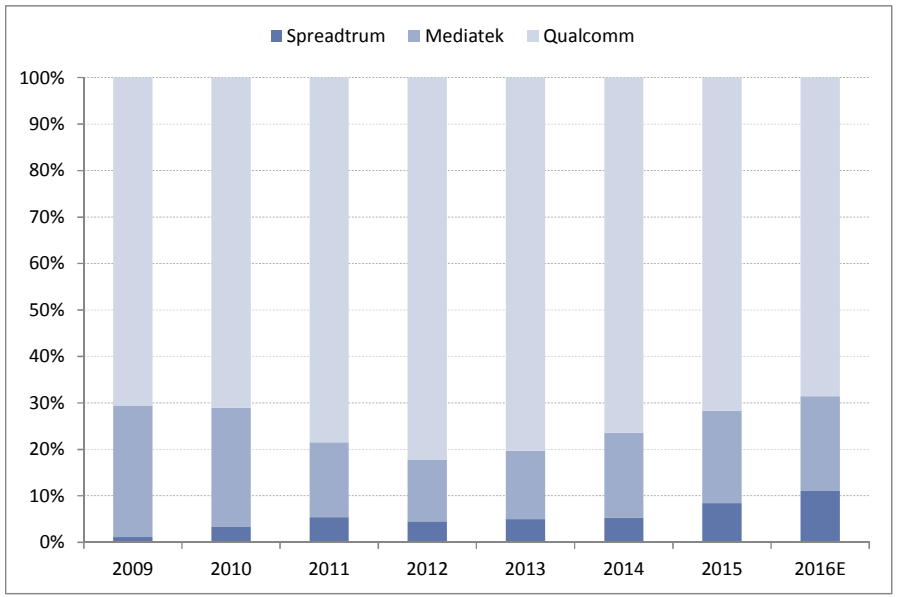
Exhibit 18: Chinese design companies catching up with Japan and Europe in advanced process
TSMC revenue by region in 2015



Source: Company data.

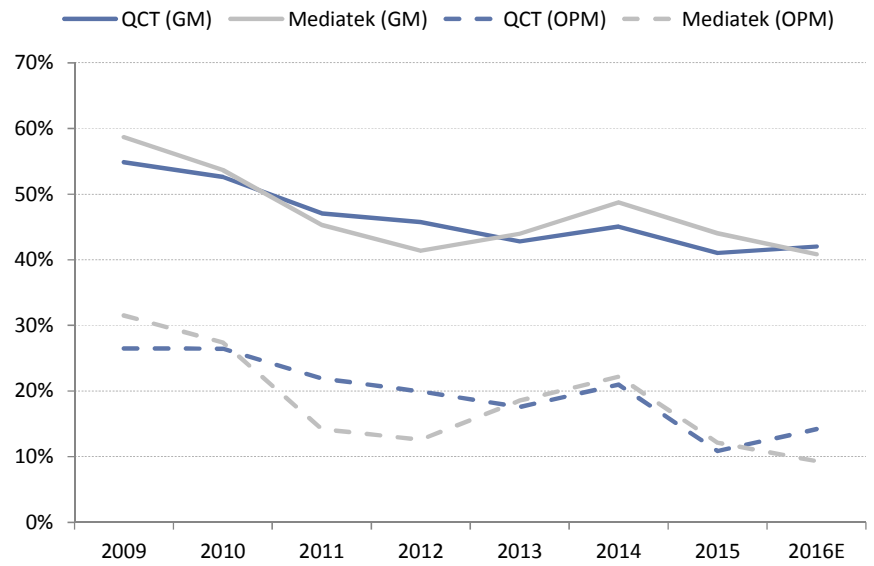
While we are positive on the revenue growth potential of China's design companies, we are less confident on their total profitability outlook. Similar to the situation in Taiwan, many Chinese design companies compete on price with me-too products. Their strategy is to be the "last man standing" of a segment and improve profitability after competitors exit the market. Most global technology investors are familiar with the case study of the handset SOC market where Chinese design companies, Hi-Silicon and Spreadtrum, gained market share but at the expense of industry margin (Exhibit 12). We believe that the strategy may work for a start-up but is not long-term viable for a public company because once the margin improves, players that exited could return to the market. We believe that only robust growth at steady and sustainable gross margin can offer value to long-term investors. Accordingly, we show below a simple investment framework.

Exhibit 19: Spreadtrum gained market share in handset SOC market…
Handset SOC revenue market share of Qualcomm, Mediatek and Spreadtrum



Source: Company data, Gao Hua Securities Research.

Exhibit 20: …at the expense of industry margins
Gross and operating margins of Qualcomm QCT and Mediatek



Source: Company data, Gao Hua Securities Research.

We identify favorable markets and technologies:

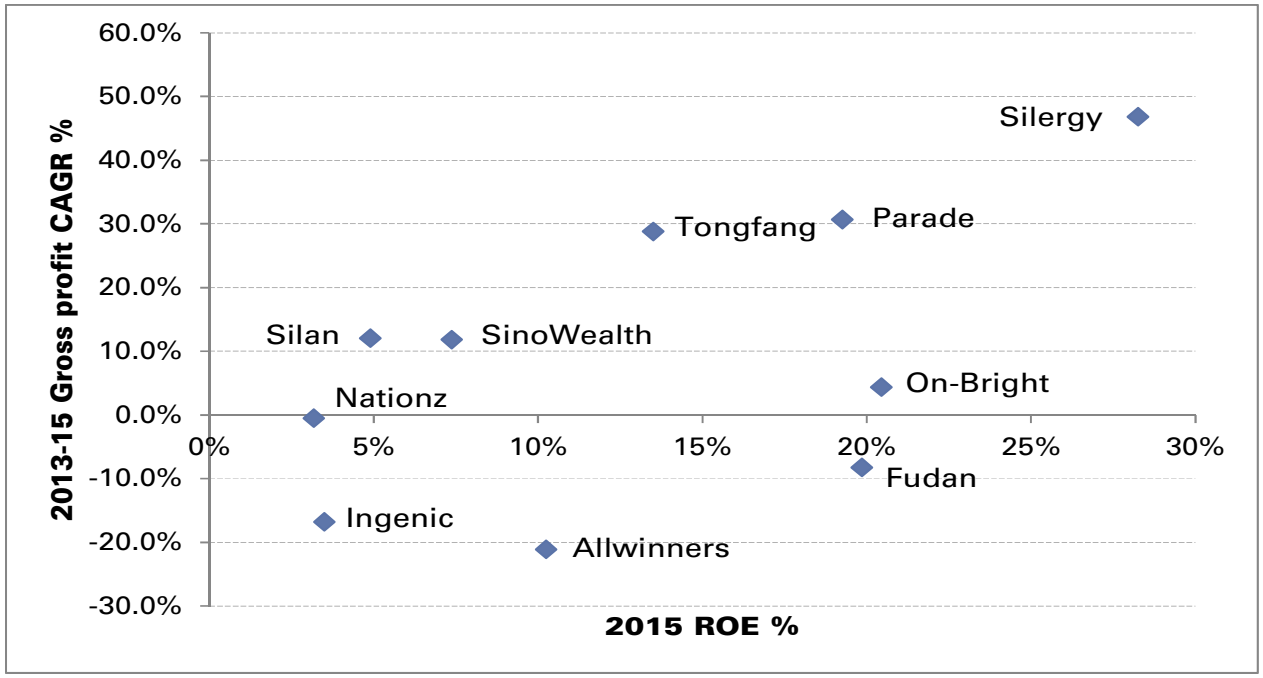
- **We prefer fragmented markets where Chinese companies still have low market share.** This kind of market tends to have a diversified product portfolio and customer base including many Chinese OEMs and ODMs. We view analog, power management IC (PMIC), MCU, RF, discrete, and sensors as favorable markets. A large concentrated market such as smartphone SOC is a high reward, but most likely low return for many years, in our view.
- **We prefer a steady and high technology barrier so that a small Chinese company can gradually narrow its technology gap with global leaders and take market share.** For example, analog, PMIC, and MEMS sensors require company-specific

manufacturing processes, which have high barriers to entry but do not change rapidly. Smartphone SOC is at the forefront of the evolving Moore's Law that requires high R&D expense and scale. On the other hand, some discrete have very low technology barriers and are overly competitive in China.

We recommend two types of design companies in China:

- Starting from favorable markets and technology, a niche company can have a long runway to gain market share and create value for investors. In our view, a necessary condition is that the management is focused on new product launches and can introduce new products at a faster pace than its peers to maintain gross margin. This approach usually requires an efficient and integrated R&D and sales team to serve local Chinese customers. We believe that Silergy fits this bill in China.
- Another type of winner is the innovator in business model or technology. For example, Mediatek implemented the "total solution" model that provides chips, software, and total design to reduce the R&D burden and enable fast time-to-market for Chinese handset makers in 2005. The total solution has helped Mediatek to grow rapidly in the handset SOC market, a large and concentrated market with evolving technology barriers. TSMC, the global foundry leader, is also an innovator of the foundry business model. We look forward to the emergence of an innovator in China.

Exhibit 21: Silergy and solid lead in value creation and profit growth among public companies in China
Comparison of gross profit growth and ROE of selected Chinese semiconductor design companies



Source: Company data, Gao Hua Securities Research.

Silergy is well poised for profitable growth in China

Silergy's products are mostly analog and PMIC. PMIC is a large fragmented market where Chinese companies currently have very low penetration. The key technology barrier for analog and PMIC is the manufacturing process that leads to differences in performance, power consumption, and die size (cost). Major global analog companies have proprietary processes at their own fab or at a foundry.

For a start-up fabless company, the first challenge is to develop in-house process technology; the second challenge is to convince a foundry to go through the trouble to implement the process for only one small customer. Silergy's founding team developed its own process technology and implemented the process at the 8" fab of Hejian, UMC's China subsidiary, during the financial crisis in 2008-2009. We view Silergy's process technology as a key competitive advantage and barrier to entry for other Chinese analog start-up companies.

The analog process can also be migrated but is at a much slower than and four generations behind the leading logic process so that the R&D burden should be relatively moderate for analog companies. Going forward, to become a global leader, we believe Silergy needs to advance its process technology further to 90nm at a 12" fab because global leaders such as TI and Maxim have shown that 90nm is more efficient for smart PMIC. Therefore, while Silergy needs to advance its process technology, we believe it is at a better position to negotiate with foundries to implement its potential new process as its scale increases.

Silergy has also leveraged the large talent pool of junior Chinese engineers to launch new products at a fast pace. The average age of its R&D employees was only 30 years in 2015, but this young team under the guidance of experienced founders has launched many new products. This organizational capability to leverage new engineers is particularly important to an analog company that is highly dependent on experienced engineers to design new products. Furthermore, to align employee interests with management, Silergy indicated that all its employees receive stock compensation.

On sales and marketing, Silergy has an efficient structure whereby its field application engineers (FAE) perform many sales functions to improve the time-to-market and insight of a customer's roadmap. Of course, Silergy has the advantage of being the largest China PMIC maker as it seeks to provide local services to a large and growing Chinese customer base.

Packaging: Better track record than foundry, but high capex a concern

Chinese packaging companies taking market share from a low base

The Chinese packaging industry is oligopolistic with the top five companies (JCET, Huatian, NT Fujitsu, ANST, and China WLCSP) accounting for more than 90% market share in China. Driven by increasing demand from domestic customers (e.g. Spreadtrum, RDA, Galaxycore), Chinese packaging companies expanded their total global market share from 6% in 2012 to 8% in 2014. In terms of technology, Chinese packaging companies focus on conventional packaging technology such as wirebonding and leadframe packaging for mostly analog ICs and low-pin count logic IC. Their ASP and margins are behind that of to global leaders such as ASE, Amkor, SPIL, and STATS ChipPAC. In 2015, JCET, the largest Chinese packaging company, acquired Stats-ChipPac with the help of IC Capital. The acquisition should supplement JCET with advanced technology. Meanwhile, both Huatian and NT Fujitsu have also acquired overseas companies for advanced technology.

Exhibit 22: By end of 2014, Chinese OSAT vendors mainly focused on mid-to-low range products with lower pin count, simplified packaging structure, and less advanced nodes
Overview of major Chinese OSAT vendors

Company	JCET	Hua Tian	Fujitsu NT	ANST	China WLCSP
Ticker	600584	002185	002156	Not listed	603005
Market cap (US$mn)	3,503	1,747	1,547	unlisted	1,256
2014 Mkt. share (China)	1st	2nd	3rd	4th	5th
2014 Mkt. share (Globe)	6th	12th	14th	26th	37th
2014 revenues (US$mn)	982.1	518.6	343.1	185	98.3
Key packaging technology	Wirebonding, flip chip, WLP, SiP	Wirebonding, flip chip, WLP	Mainly wirebonding, ramping flip chip and WLP	Wirebonding	WLCSP
Main product	Logic IC, Analog, RF, Camera module, fingerprint sensor	CIS, MEMS, LED, fingerprint sensor	Automotive, analog, RF, Logic ICs	Analog, mixed-signal	CIS, optical sensor, MEMS, smart card
Key customers	Spreadtrum, RDA, TI, Skyworks, Fairchild, Hisilicon, etc.	Galaxycore, Aptina, Superpix, Goodix, Memsic	TI, STM, Mediatek, Fujitsu, Spreadtrum, Leadcore	Intersil, IBM	Apple, Omnivision, Galaxycore
Advanced packaging mix	22% in 2014	20% in 2014	Low	Low	Majority
2012-2014 sales cagr	17%	37%	11%	17%	34%
2015 sales growth target	15-20% yoy	20% yoy	25-30% cagr in 3-year	N.A	N.A

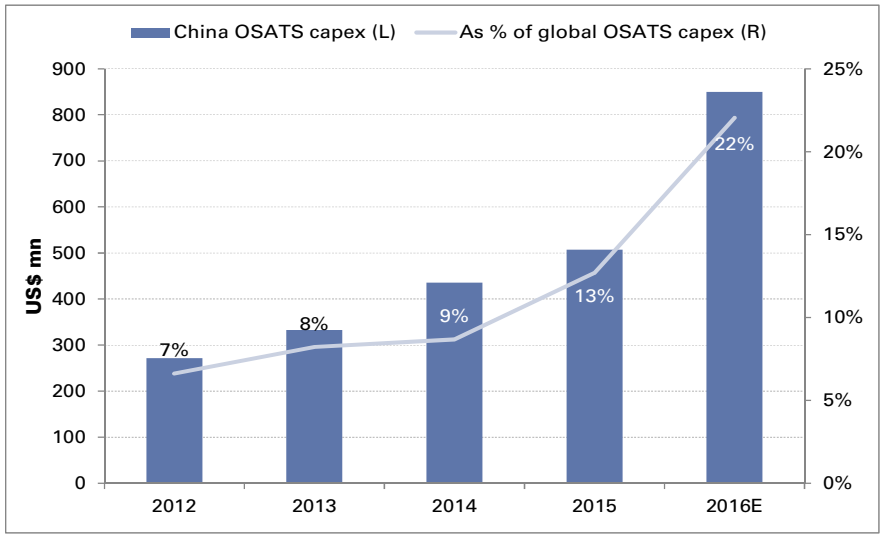
Note: *Not including STATS ChipPAC.

Source: Bloomberg, company data, Gartner, Goldman Sachs Global Investment Research.

Increasing capex to drive revenues and technology migration

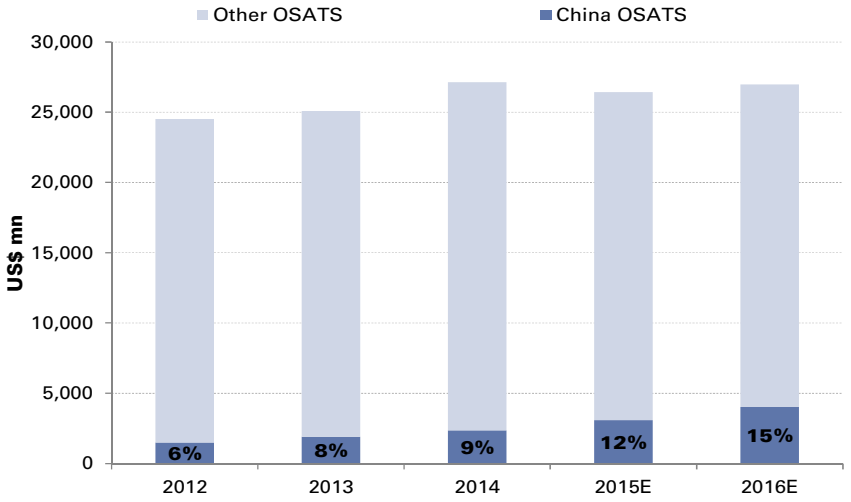
While global packaging service capex is slated to decline 20% to US$4bn in 2015 according to Gartner, Chinese companies accelerated their revenue growth and increased their total packaging capex by 13% yoy. Furthermore, JCET and NT Fujitsu guided capex of $900mn and $800mn in 2016E-2017E for expansion into SiP after the Stats-ChipPac acquisition and for building flip chip technology, respectively. We estimate China will represent 15% of global total packaging service capex in 2016E, up from 12% in 2015 and 6% in 2012. Since capex is a key leading indicator of market share, we expect Chinese companies to accelerate their market share gains.

Exhibit 23: We expect China OSATS capex to continue to outpace industry, reaching 22% of global spending by 2020E…
Capex of China OSATS



Source: Gartner, Company data, Goldman Sachs Global Investment Research.

Exhibit 24: …leading to market share gains
Market share of China OSATS



Source: Gartner, Company data, Goldman Sachs Global Investment Research.

Chinese packaging companies to take share from global peers starting with marginal players

We believe Chinese packaging companies are well poised to gain market share because they recently acquired advanced technology, have access to low-cost capital and government support, and should benefit from the growth of local Chinese fabless companies. However, their own profitability outlook hinges on the pricing environment and ROE as they are entering a capex cycle and lack a meaningful competitive advantage in cost and yield relative to their Taiwan competitors.

Chinese packaging companies have captured market share in the low-end to mid-tier packaging market from mostly marginal players. We expect this trend to accelerate. In advanced packaging technology (flip chip, bumping, Wafer level packaging), if Chinese companies can fully integrate their acquired technology in 1-2 years, we expect them to have an impact on global top packaging companies such as ASE, SPIL, and Amkor.

Foundry: Low ROE is the price to pay for chasing Moore's Law

Foundry has a relatively long history in China. The Chinese government has focused on foundry and IDM in the past stimulus efforts in the 1980s and 1990s (Appendix 1), but the massive investments have resulted in the creation of only several small foundries, Hua Hong (1347.HK, Buy), ASMC (3355.HK, NC), and CSMC, two of which (Hua Hong and ASMC) are trading at 2016E P/Bs of 0.6X and 1.02X (2016 consensus estimates for ASMC). SMIC, trading at a 2016E P/B of 0.7X, was founded as a private company, but has become an "SOE" because the government had to step in with funding to save the company and own 36% of its total shares outstanding. We believe SMIC has three competitive challenges and two government-related advantages, as we outline below.

Chinese 12" foundry facing high and evolving technology barrier – Moore's Law. The industry leader TSMC has widened its R&D gap with SMIC since 2011. Consequently, TSMC's lead in production gap over SMIC has increased from 13 quarters in 40nm to 17 quarters in 28nm because TSMC's R&D was 7.6X higher than that of SMIC in 2015. TSMC is also opening a design service center and a 12" 16nm fab in Nanjing China in 2018 to compete with SMIC. Meanwhile, SMIC has narrowed its gap in R&D and product launch with UMC since 2013. On the other hand, Hua Hong is an 8" fab and does not chase Moore's Law. We believe that Hua Hong has a relatively low and inexpensive technology barrier and a more positive ROE outlook.

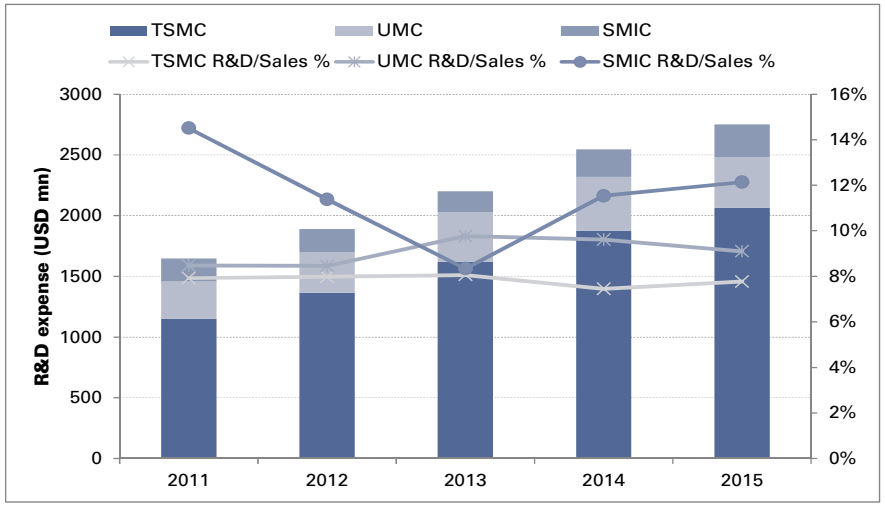
Local service not as important for foundry customers. Over the last 20 years, TSMC has generated 65%-70% of revenues from US customers and it has not built a 12" fab in the US, while GlobalFoundries, the only 12" US foundry, has not gained any market share in the US since inception. Chinese customers contributed 48% and 55% to total revenues at SMIC and Hua Hong in 2015, respectively. We estimate that Chinese design companies currently outsource 40% of wafers to Chinese foundries but most leading edge wafers to TSMC. We believe that Chinese design companies are insufficient in scale to drive the growth of Chinese foundries.

TSMC indicated that China is higher cost than Taiwan due to lack of cluster effect, insufficient scale, and material costs. For example, an equipment vendor would charge more for maintenance in Beijing than in Hsinchu because a service engineer can take care of more machines at TSMC and UMC in Hsinchu than at SMIC in Beijing.

Chinese government has successfully persuaded leading semiconductor companies such as Qualcomm and NXP to source from SMIC. We believe that Qualcomm is crucial for SMIC's 28nm ramp up and sustainability. But the profitability of SMIC's 28nm is likely very poor because we believe SMIC is too far behind TSMC in terms of technology. TSMC's 28nm fab is almost fully depreciated in 2016 while SMIC is accelerating its 28nm capacity build-up. At the next 16nm node, SMIC is likely to fall further behind TSMC and TSMC is building a 12" fab and a design center in China. We believe that these global leading customers are incrementally positive for SMIC's market share gain but negative to SMIC's ROE because these customers ask SMIC for a price concession for their business and help with technology.

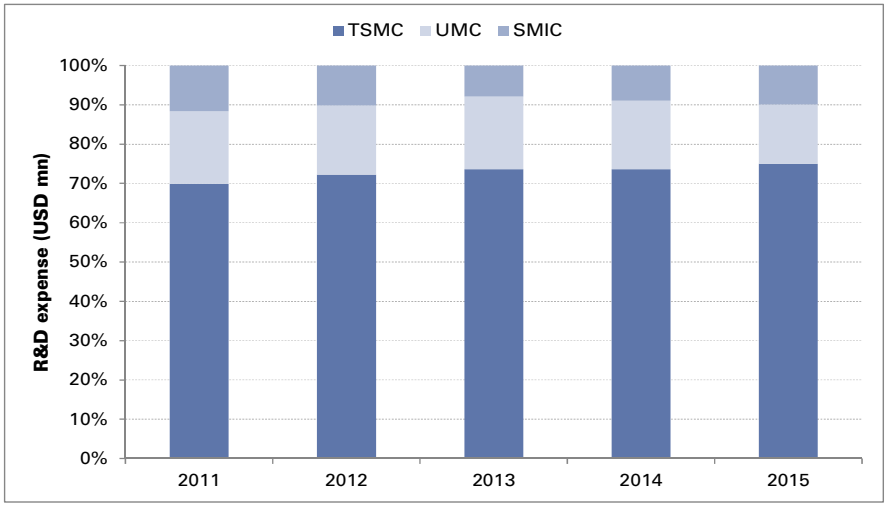
Government's R&D grant is positive but equity investments are dilutive to investors. The Chinese government offers SMIC and other Chinese foundries free usage of expensive equipment for R&D as well as R&D grants (US$99mn or 15% of SMIC's total R&D expenses in 2013-2015). Compared to R&D support, we believe direct financial infusion has a much higher scale. The Beijing government is slated to invest US$2bn in its 12" JV with SMIC. IC Capital has subscribed 18% new SMIC shares for US$620mn of SMIC's total shares outstanding at 0.6X 2016E P/B, versus the current 0.7X P/B. While IC Capital has a strategic mission to boost China's semiconductor manufacturing, it also has an IRR target of 6%. We note that another national fund, CIC, has bought and sold to IC Capital. We believe this direct financial support will dilute earnings or EPS of investors and will not be incrementally positive to investors.

Exhibit 25: TSMC has widened its R&D gap with UMC and SMIC
R&D expense and R&D expense to sales ratio of 3 foundries



Source: Company data.

Exhibit 26: TSMC has widened its new process lead over UMC and SMIC
R&D expense share of 3 foundries



Source: Company data.

Exhibit 27: TSMC has widened its gap with SMIC from 40nm to 28nm
Gap between TSMC/UMC and SMIC

Technology progression		TSMC	UMC	SMIC	TSMC vs. SMIC	UMC vs. SMIC
Over 2% revenue	40nm	3Q09	2Q10	4Q12	13Q	9Q
	28nm	4Q11	2Q14	1Q16	17Q	6Q

Source: Company data, Gao Hua Securities Research.

In conclusion, we believe that SMIC and other Chinese 12” foundries will gain market share through low cost of capital and government support in customer recruiting, but the ROE outlook should remain muted due to high technology barriers and cost disadvantages. We thus recommend Chinese 8” foundries such as Hua Hong for investors looking to add positions in the industry.

Memory: China embarking on an odyssey with XMC as flagship

Semiconductor memory (DRAM and NAND) is a large market and represents approximately 1/3rd of the global semiconductor market. China has no presence in commodity memory, but is a large consumer of memory for security concerns. Both the DRAM and NAND industries have consolidated considerably with most Taiwanese and Japanese companies exiting the market over the last 10 years (Exhibits 20-21). We believe that a new entrant would have significant headwinds in technology and profitability.

Chinese government has selected XMC to lead its memory effort. The Chinese central, provincial Hubei, and municipal Wuhan governments have jointly committed US$24bn for XMC to build 300K and 1mn wafer-per-month (WPM) memory capacities in by 2020 and 2030, respectively. XMC is slated to develop both NAND and DRAM, but we believe that 3D-NAND will be its first priority. In addition to XMC, Nikkei reported that the former CEO of Elpida has formed a company called Sino King Technology to participate in a $7bn DRAM project in Hefei, Anhui province, China. We believe that XMC is likely the only memory company to receive capital investment from the central government.

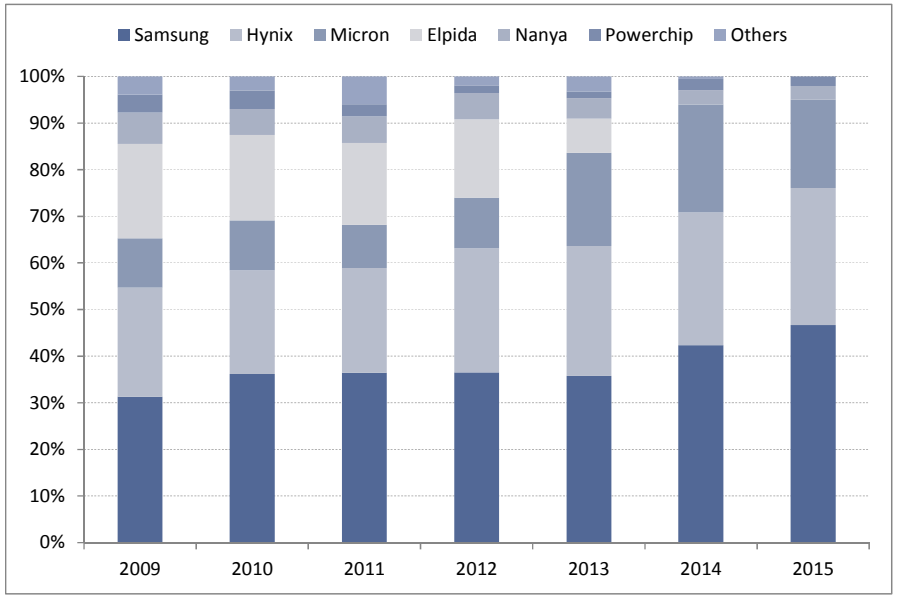
Technology barrier for memory is very high and rapidly evolving, as was foundry technology. We believe that memory IP is the top challenge to China's ambition into the commodity memory market. DRAM is moving to 18nm HBM, while NAND is heading to 64 layer (64L) 3D-NAMD in 2017. Samsung, Hynix, and Micron are top DRAM suppliers. Samsung, Hynix, Micron/Intel, and Sandisk/Toshiba are top NAND makers in the world. Our checks with global semiconductor comps indicate that none of these companies intend to license memory IP to China. Meanwhile, the Korea, US, and Japan governments are likely to closely guard memory technology. Sino King has no track record of any technology. XMC is developing its 3D-NAND technology in-house; it has completed a 9L testing chip and is taping out a 32G 32L testing chip. XMC targets to tape out its 32G 32L commercial chip by early 2017. XMC and Spansion have a cross-licensing agreement to protect XMC indirectly for certain 3D-NAND IP issued before 2018.

Another challenge is XMC's current ownership structure. XMC is a 100% state-owned-enterprise (SOE) and cannot use its stock to incentivize its employees. The SOE structure can also restrict the implementation of tough decisions, such as Samsung's anti-cyclical capex decision, in our view. Under the SOE structure, we believe it will be challenging for XMC leadership to make tough business decisions versus TSMC and Mediatek for example (see Appendix 2). On the positive side, XMC should have strong financial support from the government and a large captive market.

Memory has high capital intensity. We estimate that each 10K WSPM (wafer shipment per month) of 20nm DRAM equipment costs $500-$700mn, 10K WSPM of 3D NAND costs US$600-US$900mn, and a memory shell costs about $1bn. We estimate that a $10bn investment in either DRAM or NAND would equate to 10-15% of incremental capacity in the industry. Since the primary focus of the Chinese central and local governments is not return, in our view, we believe high capital intensity is an advantage to XMC.

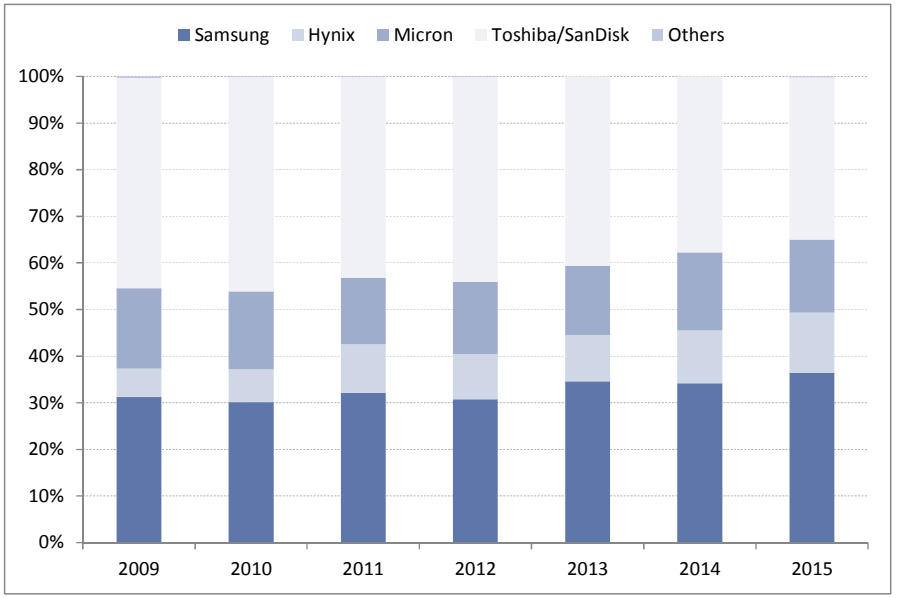
We believe XMC can become a global leader if it can overcome the seemingly insurmountable challenges in technology and ownership structure. Otherwise, it would turn into another memory casualty as those in the US, Europe, Japan, and Taiwan. In LCD, another technology commodity with arguably lower technology barriers than memory, Chinese companies led by BOE took 7 years to become number 5 in the world after entering production. If XMC can enter commercial production in 2018 as planned, we expect XMC to meaningfully impact global NAND prices in 2022-2027.

Exhibit 28: Global DRAM market is highly concentrated among three players
Global DRAM market share



Source: Company data.

Exhibit 29: Global NAND market is highly concentrated among four players
Global NAND market share



Source: Company data.

Equipment: Still need local fab customers and narrowing of the technology gap

China has a leading packaging equipment company, ASM Pacific, which is based in HK and dominates in wirebonding, die bonding, sorting, and molding equipment. ASM Pacific was founded in 1975 as the distributor of ASM International, which still owns 40% of ASM Pacific shares. In 1980, ASM Pacific acquired ASM Assembly Automation to make semi-automatic wirebonders and became an equipment maker through acquisition. ASM Pacific finally developed its own fully automatic wirebonder and diebonder in 1984 and was listed on the Hong Kong Stock Exchange in 1989. We attribute ASM Pacific's success to: 1) its parent company's initial technology transfer; and 2) most semiconductor packaging operations are based in South East Asia and China.

China has only a few relatively small SPE makers (please refer to Exhibit 42 for a list of equipment companies). AMEC is arguably the flagship of China. AMEC initially made both CVD and Etch tools but then focused on only fab MOCVD equipment. Its installed base is mostly in China and Taiwan. In July 2015, AMEC announced its 100th tool shipment. We are aware that AMEC is profitable today over ten years after inception. We have also met with a few other Chinese SPE makers of etch tools, vacuum pump, and metrology equipment. Most of them are not yet profitable. The founders of these companies were engineers at leading global semiconductor equipment companies. Their initial funding came mostly from local government and local VC.

Our case studies in Japan and Korea have shown that the SPE vendors there started by servicing local customers and gradually ventured to the overseas market. Since the 12" foundry, IDM, and memory customers are relatively weak or do not yet exist, we believe Chinese SPE makers do not have a local customer advantage. In addition, SPE has very high technology barrier-to-entry and takes years to develop. The technology constantly evolves and follows Moore's Law. We expect challenging ROE for Chinese SPE makers until Chinese foundry and memory companies grow up.

Valuations, earnings, risks

SMIC (0981.HK, Sell, 12-m TP HK$0.48): SMIC is the largest foundry in China and ranks fifth in the world. We initiate coverage on SMIC with a Sell rating given its challenging ROE outlook because: (1) SMIC has fallen further behind TSMC from 13 quarters in at the 40nm era to 17 quarters in the 28nm era; (2) we think 28nm may not be a very long node because 28nm demand today is only 12% above that of 65nm at the same stage; (3) SMIC is entering a new capex cycle for 28nm capacity expansion while TSMC's 28nm capex is fully depreciated. If its revenue and depreciation increase 20% yoy in 2016E and by US$220mn depreciation as guided and EBITDA margin remains flattish, we believe its EBIT should decline 40% yoy in 2016E, 20% below BBG consensus. Key risks: more demand upside from further policy support.

Silergy (6415.TW, Buy, 12-m TP NT$500): We believe China's fabless sector is attractive, with Silergy (largest power management IC supplier in China) our top pick as it operates in a fragmented market globally with low Chinese presence. In addition, Silergy's process technology has high barriers to entry on account of setup costs and it evolves slowly thereby reducing capex needs. Silergy has also steadily gained market share to build a large Chinese customer base since it implemented its proprietary low-cost process at UMC in 2009. The company has an efficient R&D team to leverage the strong supply of low-cost Chinese engineers. In 2013-2015, Silergy generated 48% CAGR gross profit growth at 28% 2015 ROE, ranking highest among all Chinese fabless design companies we cover. We thus initiate at Buy, with our 12-m TP of NT$500 implying 20% upside. Key risks: M&A execution risks; consolidation of Smart Meter/NXP LCD progress slower than expected.

Hua Hong (1347.HK, Buy, 12-m TP HK$9.70): We prefer Hua Hong for its attractive valuation and steady ROE outlook. We reiterate Buy on Hua Hong while we lower our 12-month target price by 6% to HK$9.7 (implying 24% upside), based on peer P/B-ROE regression. Our TP is based on 0.82X NTM P/B derived from a regression of its peer P/B-ROE and the trough P/B-ROE of SMIC and UMC. We apply this regression to figure out the right position of Hua Hong in a P/B vs. ROE valuation framework, based on its expected ROE in the coming 12-months. We also add some historical data points from the trough period to complete the range of the framework. Key risks: weakening demand in China caused by RMB depreciation.

Parade (4966.TWO, Neutral, 12-m TP NT$320): We raise our 12-m TP from NT$290 to NT$320, based on NTM P/E due to Parade's growth profile in 2016-18E. We apply 15X (average of NTM P/E in the last 12 months) to Parade's NTM earnings. Key risks: Upside: further product design-in at Apple, Samsung, and Huawei. Downside: poor sales of the iPad.

Mediatek (2454.TW, Neutral, 12-m TP NT$235): We believe Mediatek's margin recovery depends not only on its own products but also on Qualcomm's royalty income trend and Spreadtrum's progress, both of which are still threatening, in our view. Key risks: upside: a competitive X20; downside: FX fluctuation.

HMI (3658.TWO, Neutral, 12-m TP NT$1045): We view its progress in CDU, in-line memory production, and potential in EUV as encouraging but look for more details on its SkyScan trial at TSMC. Key risks: upside: breakthrough in SkyScan; downside: decline of inspection market.

UMC (2303.TW, Neutral, 12-m TP NT$14.5): With competition intensifying in the 28nm space, we have become incrementally negative on UMC's ROE and balance sheet in the long term, given its aggressive capex in a year of muted tech demand. Key risks: upside – poor 28nm HKMG progress at SMIC; downside – fast 28nm price erosion.

Exhibit 30: Valuation comparison

Ticker	Company	Rating		TP		Market price	Upside/ downside	Valuation methodology
		New	Old	New	Old			
1347.HK	Hua Hong (HK$)	Buy	Buy	9.7	10.3	7.8	24%	0.82X PB based on peers' PB-ROE regression
6415.TW	Silergy (NT$)	Buy	NA	500	NA	422.5	18%	20X NTM PE (LTM average PE)
3658.TWO	HMI (NT$)	Neutral	Neutral	1045	1045	899.0	16%	19X PB/ROE
2303.TW	UMC (NT$)	Neutral	Neutral	14.5	14.5	13.2	10%	16X NTM PB/ROE
2330.TW	TSMC (NT$)	Buy	Buy	173	173	158.5	9%	13X NTM PE
UMC	UMC-ADR(US$)	Neutral	Neutral	2.1	2.1	2.1	0%	16X NTM PB/ROE
4966.TWO	Parade (NT$)	Neutral	Neutral	320	290	320.0	0%	15X NTM PE (LTM average PE)
2454.TW	MediaTek (NT$)	Neutral	Neutral	235	235	241.0	-2%	15X NTM PB/ROE
TSM	TSMC-ADR (US$)	Buy	Buy	24.4	24.4	25.5	-4%	13X NTM PE
0981.HK	SMIC-H shares (HK$)	Sell	NA	0.48	NA	0.7	-31%	0.58X PB based on peers' PB/ROE regression
SMI	SMIC (ADR) (US$)	Sell	NA	3.08	NA	4.4	-30%	0.58X PB based on peers' PB/ROE regression

Note: As of April 12, 2016.

Source: Bloomberg, Gao Hua Securities Research

Company snapshots

Silergy Corp. (6415.TW): Right market, good timing, solid execution; initiate at Buy

Source of opportunity

We believe China's fabless sector is attractive, with Silergy (largest power management IC supplier in China) our top pick as it operates in a fragmented market with low Chinese presence. In addition, Silergy's process technology has enabled low-cost products and is difficult to replicate. The company has an efficient R&D team to leverage the strong supply of low-cost Chinese engineers. In 2013-2015, Silergy generated 48% CAGR gross profit growth and achieved 28% 2015 ROE, ranking highest among all Chinese fabless design companies we cover. We thus initiate at Buy, with our 12-m TP of NT$500 implying 18% upside.

Catalyst

We see market share gain and M&A as two catalysts in 2016E. (1) Silergy's revenue increased by 46% yoy in 1Q16 driven by share gains in smartphones and TV. In 2H16E, we expect its AC/DC and smart lighting products to start ramping up. We forecast 34% organic revenue growth at Silergy in 2016E. (2) Silergy closed its acquisition of Maxim's smart meter business in March. Management has indicated the acquisition will contribute around 13%-14% of revenues and be 3% to 4% accretive to EPS in 2016-2017, assuming Silergy issues its planned CB for its acquisition. Strategically, the Maxim team brings in SOC technology expertise and synergy to its customer base. In addition, Silergy acquired the LED driver business (transaction not yet closed) from NXP to augment its high-end LED product. Management said the LED acquisition should be slightly accretive to EPS. We expect Silergy's revenue and EPS to increase at a 32% and 23% CAGR in 2015-18E.

Valuation

Our 12-month TP of NT$500 is based on Silergy's average NTM P/E of 20X over the last 12 months. We believe it is sustainable given our EPS estimates are 11%-25% above Bloomberg consensus.

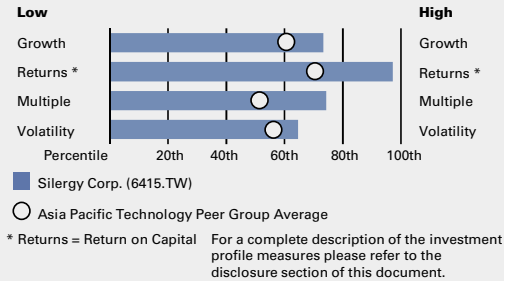
Key risks

Our 12m TP of NT$500 is based on Silergy's average NTM P/E of 20X over the last 12 months. We believe it is sustainable given our EPS estimates are 11%-25% above Bloomberg consensus.

INVESTMENT LIST MEMBERSHIP
Asia Pacific Buy list

Coverage View: Neutral

Investment Profile



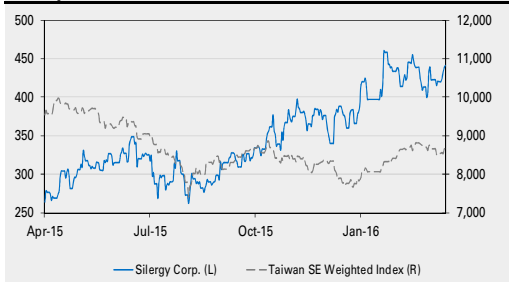
* Returns = Return on Capital

For a complete description of the investment profile measures please refer to the disclosure section of this document.

Key data	Current
Price (NT$)	441.00
12 month price target (NT$)	500.00
Market cap (NT$ mn / US$ mn)	1,520,479.8 / 46,932.7
Foreign ownership (%)	38.0

	12/15	12/16E	12/17E	12/18E
EPS (NT$)	15.66	20.72	27.73	32.20
EPS growth (%)	48.4	32.3	33.8	16.1
EPS (diluted) (NT$)	15.03	18.08	24.20	28.10
EPS (basic pre-ex) (NT$)	15.66	20.72	27.73	32.20
P/E (X)	19.1	21.3	15.9	13.7
P/B (X)	5.0	5.8	4.5	3.6
EV/EBITDA (X)	17.0	21.3	15.2	12.5
Dividend yield (%)	1.1	1.1	1.4	1.9
ROE (%)	29.6	30.5	32.0	29.5
CROCI (%)	37.3	49.0	71.3	53.7

Price performance chart



Share price performance (%)	3 month	6 month	12 month
Absolute	19.2	39.1	56.4
Rel. to Taiwan SE Weighted Index	6.5	36.8	74.0

Source: Company data, Goldman Sachs Research estimates, FactSet. Price as of 4/14/2016 close.

SMIC (0981.HK, Sell): Another capex cycle, another test on ROE; initiate with Sell

Source of opportunity

We initiate on SMIC, the largest foundry in China, with a Sell rating given its challenging ROE outlook and because (1) SMIC has fallen behind TSMC from 13 quarters at the 40nm era to 17 quarters at the 28nm era; (2) We think 28nm may not be a very long lasting node because 28nm demand is only 12% above that of 65nm at the same stage; (3) SMIC is entering a new capex cycle for 28nm capacity expansion while TSMC's 28nm capex is fully depreciated. If its revenue increases 20% yoy in 2016E and by $220mn in depreciation as guided and EBITDA margin remains flattish, we believe its EBIT should decline 40% yoy in 2016E, 20% below Bloomberg consensus.

Catalyst

(1) While we expect 28nm revenue to increase qoq at SMIC in 2Q16E as 28nm yield improves from a low base, we believe the incremental 28nm revenue is likely below the incremental depreciation so that its EBIT margin will decline sequentially throughout 2016E.

(2) SMIC had $1bn cash in 4Q15 but we estimate negative free cash flow of -$1.1bn in 2016E and -$590mn in 2017E. While the government's IC fund should financially support SMIC, it will be dilutive to earnings.

(3) TSMC is building a large design service center and a 16nm 20K WPM fab in Nanjing with production starting by 2018 when SMIC plans to start 16nm production under its best case scenario. We expect SMIC's 16nm ROE to trend below that of 28nm competition from TSMC, and widen the technology gap.

Valuation

Our 12m TP of HK$0.48 implies 31% downside (lowest in our coverage) and is based on 0.58X NTM P/B derived from a regression of its peer P/B-ROE and the trough P/B-ROE of SMIC and UMC. We initiate SMIC at Sell.

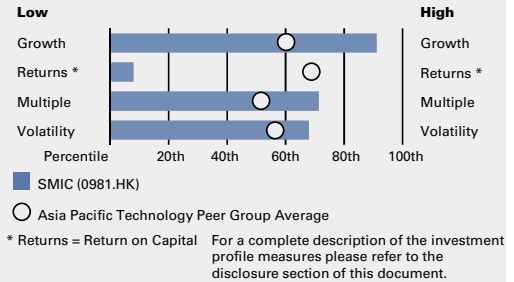
Key risks

Strong support from Qualcomm, NXP, and other major customer with ties to Chinese SOEs.

INVESTMENT LIST MEMBERSHIP
Asia Pacific Buy list

Coverage View: Neutral

Investment Profile



* Returns = Return on Capital

For a complete description of the investment profile measures please refer to the disclosure section of this document.

Key data	Current
Price (HK$)	0.68
12 month price target (HK$)	0.48
SMI Price ($)	4.35
SMI 12 month price target ($)	3.10
Market cap (HK$ mn / US$ mn)	24,957.0 / 3,218.6
Foreign ownership (%)	--

	12/15	12/16E	12/17E	12/18E
EPS ($)	0.01	0.00	0.00	0.00
EPS growth (%)	35.9	(47.6)	(58.2)	143.1
EPS (diluted) ($)	0.00	0.00	0.00	0.00
EPS (basic pre-ex) ($)	0.01	0.00	0.00	0.00
P/E (X)	17.1	29.0	69.5	28.6
P/B (X)	0.9	0.8	0.8	0.7
EV/EBITDA (X)	6.3	6.3	5.9	5.0
Dividend yield (%)	0.0	0.0	0.0	0.0
ROE (%)	6.7	3.3	1.4	3.2
CROCI (%)	4.6	6.7	7.0	7.9

Price performance chart

Share price performance (%)	3 month	6 month	12 month
Absolute	(6.8)	(10.5)	(26.9)
Rel. to Hang Seng China Ent. Index	(11.1)	6.6	15.7

Source: Company data, Goldman Sachs Research estimates, FactSet. Price as of 4/12/2016 close.

Appendices

Appendix 1: A brief review of previous semiconductor stimulation efforts in China

Chinese State Council led by vice premier Ma Kai announced National Guidelines for Semiconductors in June 2014. The central government plans to invest US$19bn itself and hopes local governments, SOE, and private enterprises will invest an additional US$100bn-$150bn into the domestic semiconductor industry. Unlike previous stimulation efforts, the central government intends to focus on only leaders in each segment and adopt a more market oriented strategy. The guideline also set specific targets for 2015, 2020, and 2030. For example, China should enter volume production of 32nm/28nm and 16nm/14nm in 2015 and 2020, respectively. But SMIC has generated merely 0.1% of revenues from 28nm in 2015. Since the normal cadence between 28nm and 16nm is 2-3 years, the target for 16nm seems sluggish, in our view. That said, while the details of the guideline are complex, we do expect the government funding to propel revenue growth of Chinese semiconductor companies.

The Chinese government has tried to stimulate the domestic semiconductor industry since the 1980s. In the previous two stimulation efforts in the 1980s and 1990s, the Chinese government focused on investing in IDM, foundry, and packaging industries. The result of the stimulation, except that of JCET, has been dismal, partially attributable in our view to the lack of an ecosystem, poor management, lack of technology preparation or licensing, and inadequate incentives to employees. In the 2000s, private capital started to fund foundry, packaging, and design houses in China. Some of these companies such as Spreadtrum, Goodix, Gigadevice, and Galaxycore have performed well. In 2010, overseas M&A become another driver. Based on our analysis, we believe that the maturing OEM and ODM industry should drive the growth of the semiconductor industry in China. So, the third round of stimulus might indeed be a charm for the Chinese government in stimulating the domestic semiconductor industry.

Based on our experience in Taiwan, we believe that the most effective semiconductor policies are: 1) reducing the tax burden and 2) encouraging stock compensation to employees. In addition, the government should be careful not to invest in capital intensive efforts such as DRAM and NAND without proven technology preparation and licensing.

Exhibit 31: Chinese government has tried to stimulate the domestic semiconductor industry in 1980s and 1990s in vain, but we believe its current program is likely to be more effective (given the three core advantages mentioned above)

A brief summary of Chinese government's previous semiconductor stimulation packages and results

Years	Policy	Company	Outcome	Technology
1980s	State Council formed IC Development Committee (led by vice premier) and laid out China IC plan	Jiangsu 742 factory introduced Toshiba TV IC fab/packaging line (first foreign investment in history);	Shanghai Philips later became ASMC (3355.HK), went IPO in 2006. Share price dropped 60% since IPO	742 foundry capacity: 10k 3" WPM and 26mn IC per year
	IC Development Committee proposed to consolidate the scattered small IC investments/development across the country	871 factory renamed as Huayue Micro. The 14th factory formed foreign JV Shanghai Belling. A few factories and foreign investment formed Shanghai Philips	Huajing Microelectronics is now Huarun Huajing Microelectronics, a discrete maker	ASMC has 5", 6", and 8" fab
	"531" plan: market 5um, develop 3um and research 1um	742 factory and Yongchuan Semi Research formed China Huajing Microelectronics		
	"Eighth 5-year Plan": encouraged industry cluster, focused on specialty IC, and reinforced R&D			
1990s	Project 908: build a large 0.8-1.2um production line at Huajing with a Rmb2bn government investment	Shougang and NEC formed JV Shougang NEC	Shougang bought back all shares from NEC in 2013 and opened up as a foundry for MCU and other products	Project 908 wafer capacity: 0.9um 6k 6" WPM. The first 8" fab in Beijing
	"Ninth 5-year Plan": Project 909 formed Huahong NEC (0.5um fab) and 7 design houses with Rmb10bn government investment; Project 909 was more market-oriented.	JCET was formed in cooperation with Philips.	JCET (600584.SS) is the largest China packaging companies. Share price grew 4.5X since IPO in 2003	Low-end packaging technology
	Project 908 started production after 7-year's construction, failed due to slow construction progress, not market-oriented	Huahong and NEC formed Shanghai Huahong NEC, a US1.2bn investment	Merged with Grace in 2011 and went IPO (1347.HK) in 2014; market cap $1bn; share price dropped by 30% since IPO.	Three 8" fabs for up to 90nm CMOS production technology
2000s	The 18th document offered tax benefits and R&D grants to semi companies	SMIC was founded by private capital and started pilot production in 2001	SMIC (981.HK) went IPO in 2004 and share price dropped by 68% since IPO	SMIC build a 12" fab and started 65nm production.
	Eleventh 5-year target: China to produce 80bn chips, Rmb300bn revenue (30% CAGR), and 10% global market share by 2010.	Grace was founded as a foundry fab by private capital and Shanghai government		
	In 2010, according to Chinese government, China produced 65bn chips and Rmb144bn rev, or 8.6% global market share.	Spreadtrum and other fabless companies were funded.		
2010s	Twelfth 5-year target: China semi revenue to reach Rmb330bn or 15% global market share by 2015, and grow at 20% CAGR into 2020.	JCET acquired STATS ChipPAC to rank 4th in the world in 2015.		JCET acquired flip-chip and SiP technologies.
	MIIT formed IC Capital with RMB120bn funding.	Chinese PE acquired Spreadtrum, RDA, Montage, Omnivision, ISSI, Mattson, and NXP's RF business.	XMC and Hefei government plan NAND and DRAM fab, respectively.	SMIC became an "SOE" and started 28nm production in 2015.
	Numerous Chinese PE (Hua Capital, SummitView, JAC, etc.) have formed with partial government support for overseas M&A.	Many Chinese fabless companies have went or plan to IPO.	Hi-Silicon and Spreadtrum ranked 6th and 10th largest fabless companies in the world in 2015, respectively.	Hi-Silicon became TSMC's first 16nm customer in 2015.

Source: Goldman Sachs Global Investment Research, Gao Hua Securities Research.

Appendix 2: Taiwan's success story – TSMC and Mediatek

Since 1980, Taiwan has become a global leader in foundry, packaging, and fabless design, but did not excel in memory. Similar to China, the Taiwan government was instrumental in the genesis of its semiconductor industry. When TSMC was founded in 1980, Taiwan's KMT government provided 48% of the initial funding, followed by Philips and local private funding at 28% and 24%, respectively. Taiwan government's Development Fund still owns 6.4% of TSMC shares and is the largest shareholder of TSMC. Similarly, at its formation in 1987, UMC was funded mainly by the government (70%). TSMC has become an extremely successful company and industry leader while UMC has become a distant number 2 and has lost meaningful market share. In addition to its visionary founder, Dr. Morris Chang, and customer focus culture, we attribute TSMC's success to the four factors below:

- TSMC is the first semiconductor foundry, a business innovation that did not become mainstream to attract global top-tier competitors until early 2000s. The merit of the foundry business model is beyond the scope of this report. By the time Intel and Samsung decided to enter the foundry industry in early 2000, TSMC has already built and continued to enhance its barriers to entry. Comparatively, Taiwan memory companies were all me-too new entrants and had lack of innovation in their business model.
- TSMC has issued a meaningful amount of stock bonus to its employees. Before 2008, Taiwan companies reported pro forma earnings excluding the negative impact of employee stock compensation. Employees also paid income tax based on the face value of the stock, which is substantially below the market price. Therefore, both TSMC and its employees were handily rewarded by investors. Since 2008, Taiwan has phased in GAAP accounting, taxed stock bonus on market value, and moderated tax breaks for R&D and capex; we believe that the change has had a negative impact on the growth of Taiwan's semiconductor industry.
- TSMC has operated more like a private company than an SOE from inception. Taiwan government has allowed Dr. Chang to make tough decisions and instill a culture of customer focus. Dr. Chang also followed good corporate governance practices in terms of board composition and functions, which was uncommon among Asian companies. In our view, TSMC has proven that the government stimulation can work for the right company at the right time as long as the government keeps itself at arm's length in managing the company.
- TSMC has focused on its core foundry business and has continued to push itself in technology, service, and ecosystems. In comparison, UMC has had a rich investment portfolio including many fabless design companies that are also its customers. Many of these design companies such as Mediatek and Novatek have become successful public companies partially owing to UMC's support, and thus yielded handsome returns for UMC's initial investment. However, we believe that these investments have diverted focus from its core business.

TSMC and UMC have also nurtured Taiwan packaging companies such as ASE and SPIL that have become global leaders. Foundry and packaging companies and more importantly attributable to the rise of Taiwan OEM and ODM in consumer electronics and PC has stimulated the growth of Taiwan fabless design companies. Taiwan currently has hundreds of public and private design houses.

Among these design companies, Mediatek stands out as a global leader in smartphone SOC (system-on-chip), TV SOC, DVD/ODD SOC, and other products. Similar to TSMC, Mediatek has invented the "total solution" business model, benefited from abundant employee bonuses, and focused on its core business:

- Most global semiconductor companies used to sell individual semiconductor chips. Mediatek has found that Chinese handset makers lack sufficient R&D capability but are very familiar with local needs and good at low-cost production and distribution. To leverage the strength of its customers and capture more value in the supply chain, Mediatek invented the total solution model that sells its chips together with a reference design of the handset. The reference design matches peripheral components with Mediatek's SOC for the best price performance so that Chinese handset makers can significantly cut their R&D expense and time-to-market. The downside of the

total solution is its very limited flexibility for innovation at handset makers, but we believe it is very robust to ensure good yield at almost any manufacturing environment in China. At the end, we believe this innovative business model has helped Chinese handset makers to take 50% of the global smartphone market share since 2012.

- Mediatek was known to grant generous stock bonuses and has attracted the best engineer graduates in Taiwan.
- Mediatek's Chairman, Mr. Tsai Ming-Kai, aimed for Mediatek to become a global leader and has continued to promote innovation. Mediatek used to focus on entering an established market and quickly taking market share. Since 2014, as Mediatek became a leader in China's smartphone market, Mediatek has become the technology leader in smartphones and become the first adopter of Octa-core and Deca-core SOC.

Our 12-year experience of covering TSMC and Mediatek indicates that a successful semiconductor company needs to innovate, to focus, and to improve continuously. Favorable tax and accounting treatments as well as government support would be a bonus.

Appendix 3: Japan and Korea – tracking the growth path of SPE makers

Japan: SPE makers have left the nest and are operating globally

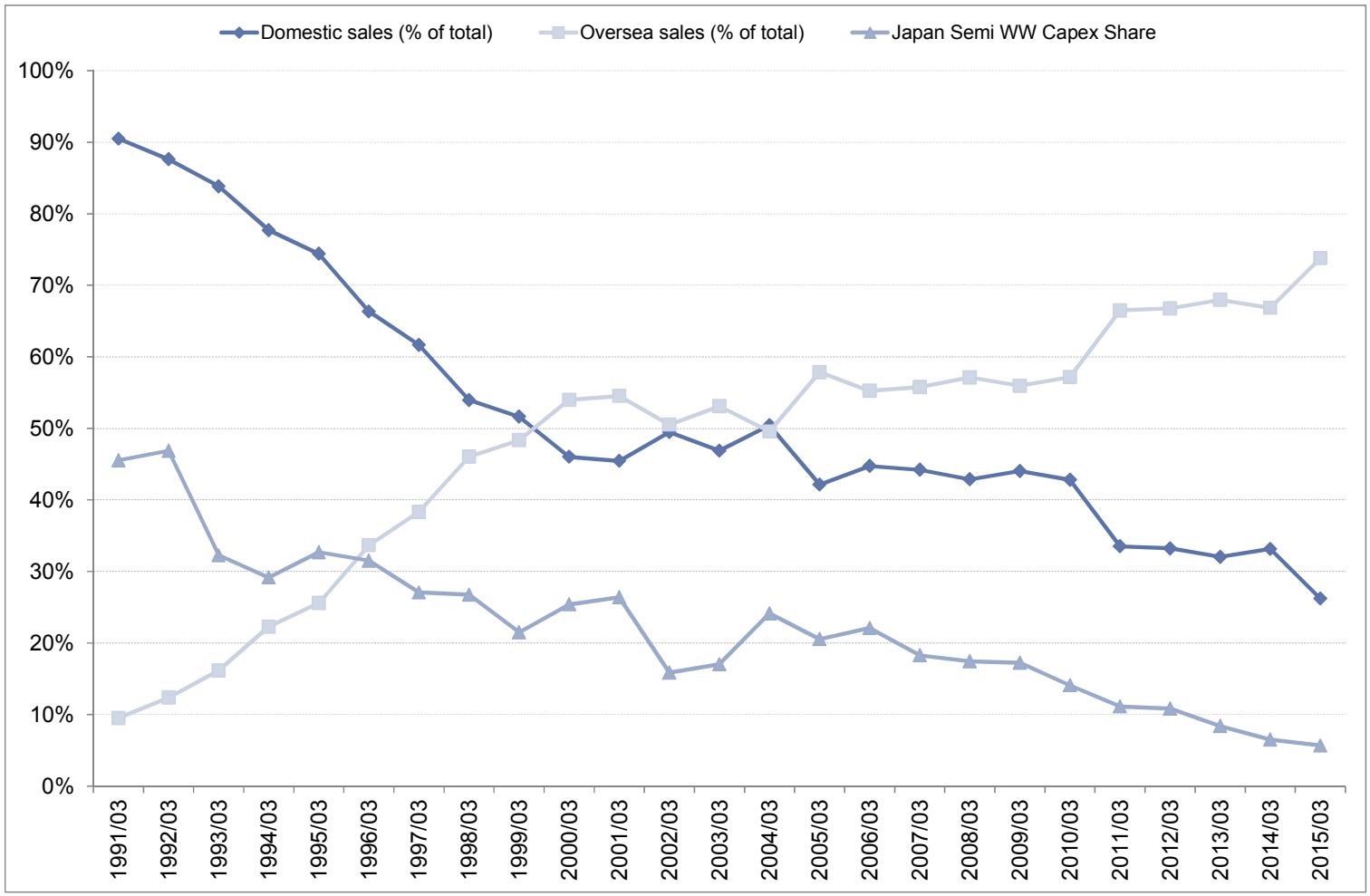
Japanese semiconductor equipment (SPE) makers have honed their technological expertise and expanded business alongside Japanese semi makers. In the 1950s, the early days of semiconductor fabrication in Japan, semiconductor device makers imported production equipment from the US. Tokyo Electron, the 3rd largest SPE maker in the world in 2015, actually started out as a trading company importing US-made SPE. However, due to limited support and maintenance from US-based equipment firms, Japan's semi firms shifted to internally developing process manufacturing technology (US equipment firms established offices in Japan only in the 1970-1980s). Japanese equipment firms were deeply involved in this process, and as a result honed their technical expertise. Some equipment divisions of semi firms were carved out and spun off, while in other cases process technology was transferred from semi device makers to equipment makers (that said, as is the case today, semi device makers control the overall manufacturing process and know-how).

As Japanese semi makers grew their global market shares, business opportunities for Japanese equipment firms also expanded. In the mid-1980s, Japanese semi firms had the top share in the worldwide semiconductor market (i.e., NEC, Mitsubishi, Toshiba and Hitachi had combined 80% market share in DRAM in mid-1980s), and domestic customers accounted for the lion's share of equipment firms' revenue then.

Serving top semi makers gave equipment firms like Tokyo Electron, Disco, and SCREEN the opportunity to accumulate know-how. We note also that working closely with Japanese component makers such as THK and NSK (linear guides) made it easier to develop equipment to satisfy customers' tough specifications in a timely manner.

In the 1990s, as Japanese semi firms began to lose market share to Korean rivals, Japan SPE makers ventured overseas using the experience and know-how they acquired in Japan. Today, overseas sales account for over 80% of total sales of Japan SPE firms such as Tokyo Electron and Disco.

Exhibit 32: Japanese SPE makers started with local customers and have successfully expanded overseas
Regional mix and global market share of Japan SPE makers



Source: Company data.

Korea: Strong ties to local customers can be a double-edged sword

Korean SPE makers such as Wonik IPS, Eugene Technology, Tes, and Jusung Engineering produce Chemical Vapor Deposition (CVD), Atomic Layer Deposition (ALD), and etching equipment. They have captured sales opportunities in the past by working closely with the Korean IDMs such as Samsung Electronics (SEC) and SK Hynix (Hynix), two of the leading semiconductors companies especially in the memory industry.

These Korean SPE companies have expanded sales in the past as both SEC and Hynix have been actively trying to use domestic equipment makers for equipment used for semiconductor manufacturing processes for the following reasons. By working together with local SPE makers starting from the initial stage of R&D, Korean semi companies were able to establish a strong domestic supply chain that shares the know-how of semi production. In addition, working with domestic equipment makers provided the advantage of a fast delivery time of equipment, quick response time in case of issues with the equipment, price competitiveness compared to buying equipment from overseas, and protection from potential technology leakage overseas. Korean semi makers invested in domestic equipment makers to show their commitment in those companies, e.g. SEC owned a 10.2% stake in SFA Engineering and 9.0% stake in Wonik IPS as of end-2015. We believe that both SEC and Hynix will continue to work with domestic SPE companies and leverage their long-standing relationships going forward.

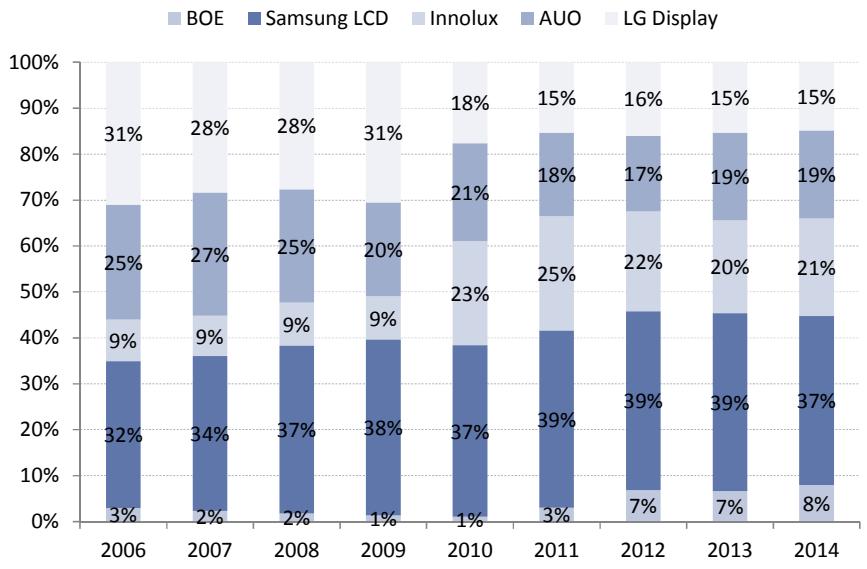
However, we believe that Korean SPE companies have limited growth potential going forward. While the concern over technology leakage is one of the reasons that provided the sales opportunity from SEC and Hynix, we believe that it is also one of the factors that limit Korean equipment makers from actively expanding to overseas clients. Korean SPE makers are bound by their Korean customers to a certain extent and it will be hard for them to expand overseas. Another limitation is that while equipment such as lithography equipment are the ones that are most crucial to the semi manufacturing process and thus have the highest ASP, those are dominated by overseas players such as Canon, Nikon, and ASML. Even in the deposition equipment segment where Korean equipment makers are currently participating, companies like Applied Materials and Tokyo Electron are established global players that can produce equipment in large scale and have a substantial history of customer reference. We therefore believe that to see another phase of growth, Korean equipment makers will have to find ways to develop high value-add equipment and expand their product portfolio, and try to expand to overseas customers.

Appendix 4: China – presence in commodity markets like solar, LCD panel, memory

China LCD panel market: BOE took nine years to capture 8% global market share in 2014

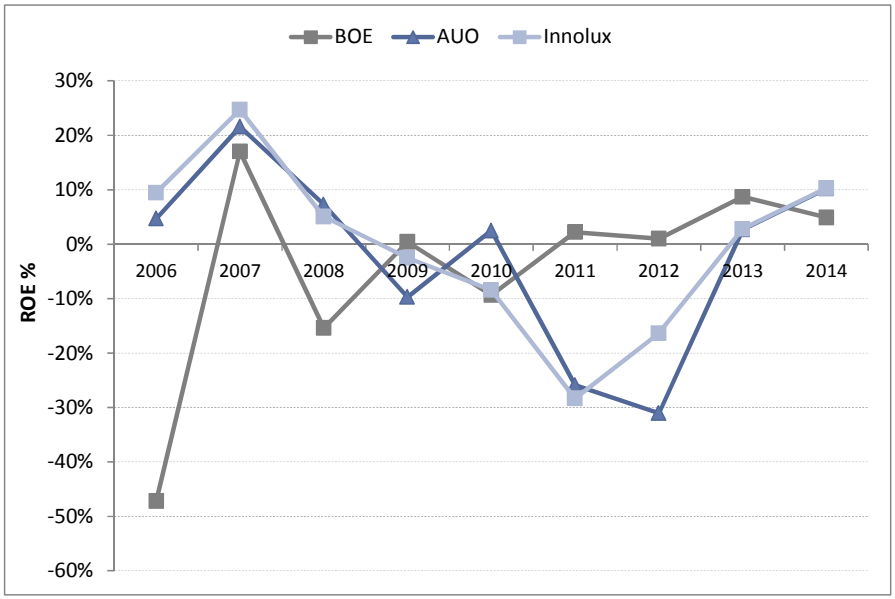
BOE is the flagship of China's LCD efforts. In 2002, BOE started by acquiring Hynix's LCD fab and technology. Since 2006, after digesting the acquired technology, BOE started aggressive capacity expansion. Its accumulated operating profit was US$72mn in 2006-2015, and has generated average ROE of only 4% in 2011-2015. In 2014, BOE ranked fifth in the world and had 8% global market share after ten years of investment. Going forward, Chinese companies aim to double their total LCD capacity within three years. While BOE's financial and global market shares are small, BOE started to negatively impact the margin of second tier players such as AUO and Innolux in 2012-2013 by lowering the price. We believe that LCD and memory are similar because both are commodities, have relatively high and evolving technologies, and demand high capital investments. It took BOE seven years to impact industry margins materially.

Exhibit 33: BOE captured 8% global market share in 2014…
Global LCD market share



Source: Company data.

Exhibit 34: …but put pressure on returns of second tier LCD players
ROE of BOE, AUO, and Innolux



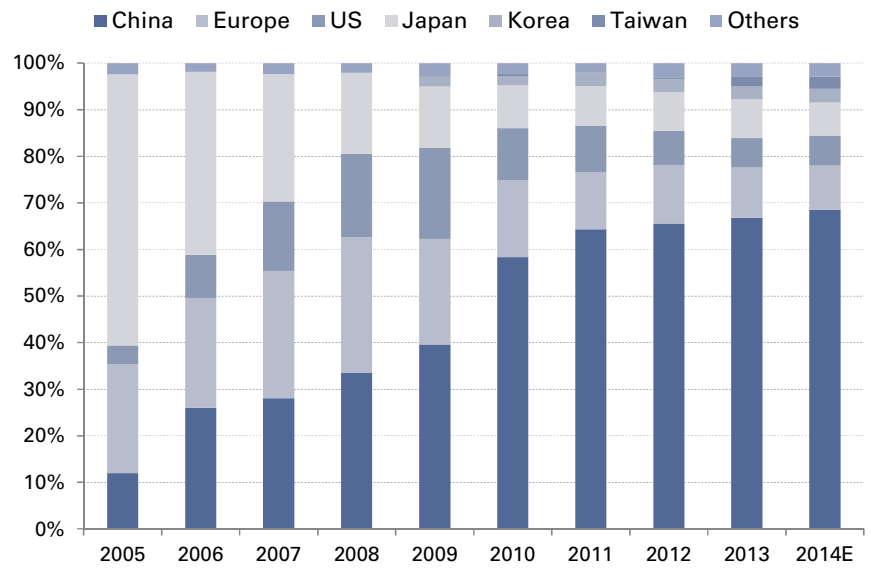
Source: Company data.

China solar panel market: China took six years to dominate the global market by 2010 and is enjoying good profitability

China started in silicon solar panels in early 2000, partially driven by generous investments of local governments. Since the technology barrier of solar panels is much lower than LCD, Chinese companies have quickly ramped up capacity and yield. In 2009, after the global

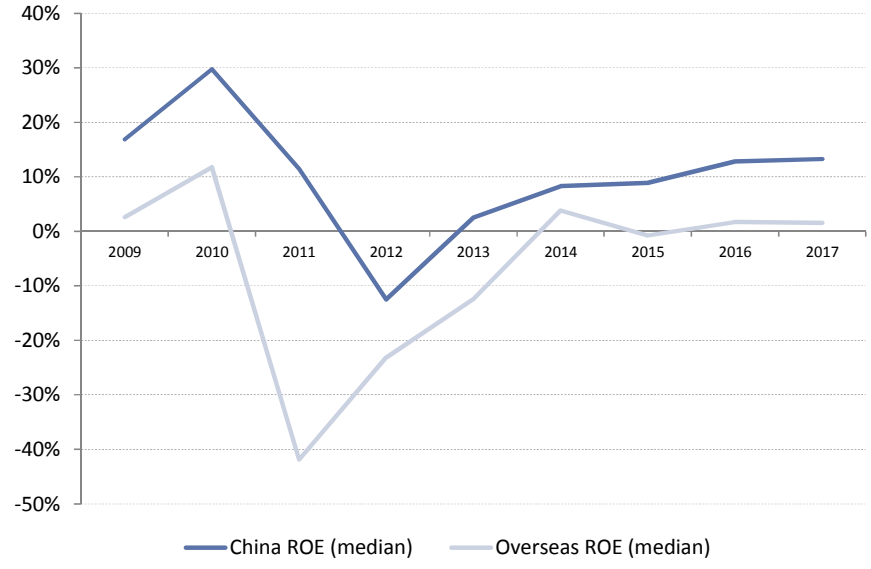
financial crisis, solar wafer and panel prices collapsed due to a supply glut and weakening demand. In response, Chinese companies cut price aggressively to gain significant market share overseas. In 2010, Chinese companies dominated the global market with 60% share. However, profitability has deteriorated since 2010. Suntech, China's solar flagship company, went bankrupt in 2013. LDK filed for bankruptcy in 2015. However, other surviving Chinese companies have done well and continued to improve their average profitability since 2013.

Exhibit 35: China has dominated global solar panel market since 2010
Global solar panel market share



Source: Company data, Gao Hua Securities Research estimates, Goldman Sachs Research estimates.

Exhibit 36: Surviving Chinese solar companies have continued to improve their ROE
Average ROE of Chinese and overseas solar panel companies



Source: Company data. Gao Hua Securities Research, Goldman Sachs Global Investment Research.

Implications for China semiconductor memory: China's long-term impact is likely long-term

Similar to LCD and solar panels, semiconductor memory is a commodity but has much higher technology barriers than even LCD. In our view, The Chinese government is clearly more determined to develop its memory industry than its LCD and solar industries in light of the recently announced $24bn project at XMC, China's flagship memory enterprise. If XMC can develop its 3D-NAND technology and enter commercial production in 2018, we believe XMC will take 5-10 years to become a meaningful player and take share from second tier memory players in the global market. Meanwhile, we believe that global semiconductor equipment makers should be the main beneficiary of the capex of China's memory industry.

Appendix 5: China discrete makers are making only gradual progress

The global discrete semiconductor market was US$15bn in 2015 according to SIA/WSTS (Semiconductor Industry Association, World Semiconductor Trade Statistics. Revenue CAGR for the past 20 years has been 3%-4%. 40% of total supply is shipped to China. Japan, the US, and EMEA had 33%, 33%, and 32% market share of the global discrete market in 2015, while Chinese makers had only 3% market share, according to Gartner.

The discrete semiconductor market is fragmented. Except the leader Infineon with 14% market share, the other top 10 players have only 4-8% share, and the next 13-14 players have low single digit share each. We attribute the fragmentation to the relatively low fixed cost (such as R&D and capex), and therefore low incentives to deploy resources, leading to low margin and marginal scale. That said, the pace of consolidation has picked up in the discrete industry, following the footsteps of the overall semiconductor industry. In January 2015, Infineon closed its acquisition of International Rectifier. In November 2015, OnSemi announced it would extend and offer to acquire Fairchild.

In our view, discrete seems to be an attractive market to China in light of its fragmented nature, slow evolving technology, and a large Chinese customer base. Chinese discrete semiconductor makers such as Jilin Sino-Microelectronics and Hangzhou Silan Microelectronics are growing and taking market share by supplying to local Chinese customers, but their growth rate has been relatively slow and their global market share is only 1% each. In addition to China, Korea and Taiwan also have had low presence in the discrete market. In addition to being a mature industry that we believe is not attractive from a national agenda standpoint, the discrete industry has its own distinct barriers to entry, in our view:

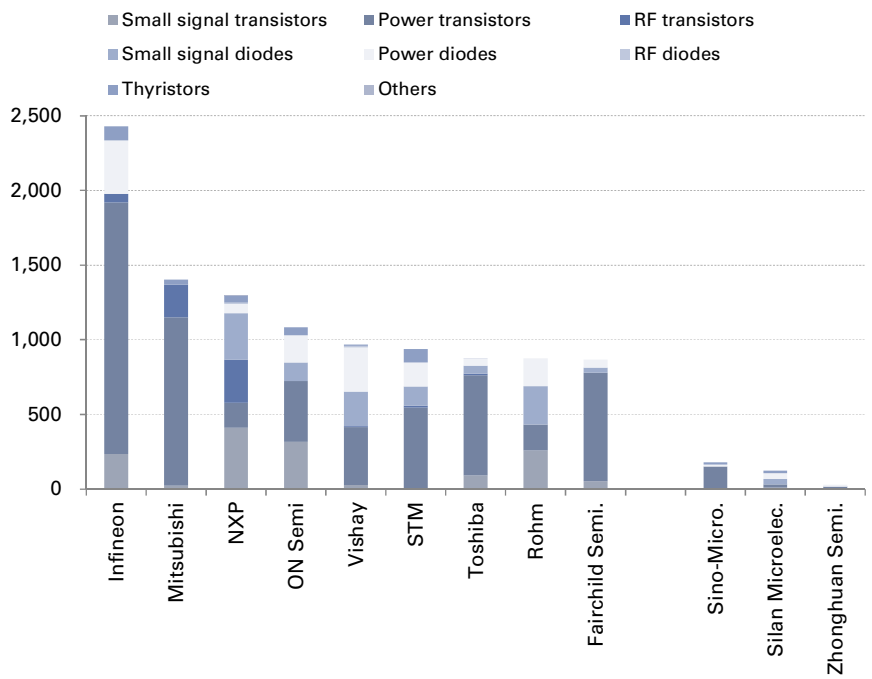
- Packaging and foundry represent approximately 55% and 45% of discrete COGS, respectively. Packaging is more labor intensive and foundry is more capex intensive. Most top discrete makers are IDM (integrated device makers) that own their own fab and packaging facilities. Many incumbents have already moved their packaging operations to low cost countries, and their fabs are mostly fully depreciated. A new entrant would have higher COGS if it is fabless or a high depreciation burden if it is a new IDM.
- Unlike logic and memory that uses many standard libraries and tools, discrete manufacturing requires a lot of company specific know-how that is often instilled in a company-specific tool. So, the initial barrier to entry is relatively high in discrete.
- Discrete production involves exotic materials such as SiC and GaN in addition to standard silicon. Developed countries tend to lead in material sciences.
- Quality control is important. The price of discrete is very low but a defective discrete can damage the entire circuit board. So a long track record of the highest level of quality control commands a strong premium in the discrete industry.
- We also hypothesize that discrete is a very standardized product that does not require a very close local service to customers.

Exhibit 37: Chinese discrete makers are marginal players in the world
Global discrete market share

	Company name	Revenue	share	Type	HG country
1	Infineon Technologies	2,431	13.7%	IDM	Germany
2	Mitsubishi	1,403	7.9%	IDM	Japan
3	NXP	1,298	7.3%	IDM	Netherland
4	ON Semiconductor	1,084	6.1%	IDM	USA
5	Vishay	968	5.5%	IDM	USA
6	STMicroelectronics	938	5.3%	IDM	EMEA
7	Toshiba	879	5.0%	IDM	Japan
8	Rohm	875	4.9%	IDM	Japan
9	Fairchild Semiconductor	867	4.9%	IDM	USA
10	Renesas Electronics	679	3.8%	IDM	Japan
11	Fuji Electric	528	3.0%	IDM	Japan
12	Diodes	493	2.8%	IDM	USA
13	Freescale Semiconductor	444	2.5%	IDM	USA
14	Microsemi	415	2.3%	IDM	USA
15	Broadcom Ltd. (formerly Avago)	303	1.7%	IDM	USA
16	Shindengen Electric	265	1.5%	IDM	Japan
17	Pan Jit	247	1.4%	IDM	Taiwan
18	Toyota	240	1.4%	IDM	Japan
19	Denso	216	1.2%	IDM	Japan
20	Panasonic	216	1.2%	IDM	Japan
21	IXYS	208	1.2%	IDM	USA
22	Semtech	181	1.0%	Fabless	USA
23	Jilin Sino-Microelectronics	181	1.0%	IDM	China
24	Hitachi	175	1.0%	IDM	Japan
25	Sanken	170	1.0%	IDM	Japan
26	Lite-On Semiconductor	143	0.8%	IDM	Taiwan
27	Alpha & Omega Semiconductor	142	0.8%	Fabless	USA
28	Texas Instruments	141	0.8%	IDM	USA
29	Hangzhou Silan Microelectronics	124	0.7%	IDM	China
30	Ampleon	121	0.7%	IDM	Netherland
	Others	1,321	7.5%		
	Total	17,696	100.0%		

Source: Gartner.

Exhibit 38: Chinese discrete makers supply all kinds of products
Sales by product types of top global and China discrete makers, US$ mn, 2015



Source: Gartner.

Appendix 6: Chinese private equity (PE) funds for overseas semiconductor deals

Many investors are curious about various Chinese PE funds making bids for overseas semiconductor companies. We summarize these funds in Exhibit 38. China has many PE funds that invest in the semiconductor industry. The central government and many local governments have technology development funds that aim to develop the domestic industry and boost the local economy. Other funds have private funding or a mixture of private and government money. These private funds focus on capitalizing the P/E premium of A-share semiconductor stocks over other stock markets.

Exhibit 39: Chinese government funds and PE have driven several overseas semiconductor M&A
A list of selected leading Chinese government funds and PE in semiconductor industry

Name	Location	Fund Size (US$mn)	LP	Announced Semi deals
China IC Industry Investment Fund	Beijing	$21,000	China Mobile, China Tobacco, China Development Bank Capital, E-Town Capital, Shanghai Guosheng, etc.	SMIC, Sanan, SILAN, JCET, Spreadtrum, AMEC, ZTE IC, etc.
SummitView	Shanghai	$1,700	Shanghai government funds, Mediatek, SMIC, and Tham Group (Tsinghua)	ISSI
Hua Capital	Beijing		Beijing government funds (RMB30bn)	ISSI, OmniVision
Tsinghua Unigroup	Beijing		Tsinghua University, Unigroup	Spreadtrum, RDA
JAC Capital	Beijing		China Jianyin Investment	NXP RF Power
E-Town Capital	Beijing	$1,310	Beijing Yizhuang Economic Development Area	ISSI, Mattson Technology
Pudong STI	Shanghai	$484	Shanghai Pudong Development Area, fund management	Montage
CITIC Capital, Goldstone	Beijing		Investment arms of CITIC	Omnivision

Source: Company data.

China IC Industry Investment Fund (CICF) is the main investment arm of the central government. Ministry of Industry and Information Technology (MIIT) and Ministry of Finance founded CICF in September 2014. Its LP includes mostly SOE and local government entities. The fund size is RMB138bn (US$21bn). The GP of CICF is SINO IC Capital (IC Capital). The mandate of CICF and IC Capital is to invest 60% of the funds in semiconductor manufacturing (foundry and memory) and the rest in equipment, packaging, and design. The IRR target is 6% (4% for foundry and 10% for others). The fund has a 5-year investment period (2014-2019), 5 years for withdrawal (2019-2024), and another 5 years for potential extension.

Exhibit 40: IC Capital has been active over the last 17 months
A partial list of announced investment deals of IC Capital

Date	Investment Target	Amount	Deal structure
Apr-2016	XMC - China's flagship in memory	Part of US$24bn	For 3D-NAND and DRAM capactiy of 300K and 1mn in 2020 and 2030, respectively.
Mar-2016	Shanghai Silicon - Industry fund	NA	Co-investment for a 4.5% sake in Soitec in France
Mar-2016	SILAN - an IDM for discrete and MCU	US$92mn	Co-investment for 8-inch capacity
Dec-2015	Jiangsu Zhongneng JV - Silicon manufacturer	US$77mn	Co-investment for a 49% stake in a new JV focused on Silicon processing
Dec-2015	Piotech - a semi PECVD equipment maker	US$42mn	A co-invest with AMEC and Juyuan fund
Dec-2015	Huatian - Chinese packaging company	US$77mn	For a 27.23% stake post money
Dec-2015	Seven Star - semi equipment producer	US$86mn	Co-investment for the 100% acquisition of Beijing NMC
Nov-2015	ZTE Microelectronics - ZTE's IC devision	US$369bn	For a 24% stake of ZTE Microelectronics.
Oct-2015	NT Fujitsu - top 3 Chinese packaging house	US$370mn	For the acquisition of AMD China division
Sep-2015	BDStar Navigation - a BD system SoC maker	US$231mn	PIPE investment in BDStar for its BD system SoC R&D and cloud projects.
Sep-2015	SMIC-JCET JV -a wafer bumping house	US$280mn	Co-invested with SMIC and Qualcomm.
Aug-2015	SINO IC Leasing - a semi equipment leasing company	NA	Co-investment for a total amount of US$880mn.
Jun-2015	Goke Microelectronics -a fabless company	US$62mn	For a 11.76% stake post money.
Jun-2015	Sanan Optoelectronics - the leading Chinese LED IDM	US$738mn	For a 9.07% stake to become the the 2nd largest shareholder.
May-2015	ApexMic - a fabless for printer consumable IC	US$133mn	For 4.29% stake post investment.
Feb-2015	Unigroup - an active PE in semi field	US$1,667mn	Promised fund to support Unigroup's Spreadtrum/RDA business.
Feb-2015	SMIC - China's leading foundry	US$400mn	For a 11.58% stake in SMIC post money.
Jan-2015	AMEC - China's leading semi Etch equipment maker	US$74mn	For a 7.14% stake in AMEC post money.
Dec-2014	JCET - China's leading semi packaging company	US$290mn	For JCET's acquisition of STATSChipPAC with US$150mn equity and US$140mn debt.

Source: Company data.

Appendix 7: A list of total 64 major Chinese semiconductor companies

Exhibit 41: 7 foundries and 33 fabless design companies in China
A list of selected top foundries and fabless design companies in China

Company	Ticker	Market cap (US$, mn)	Revenue 2015 (US$, mn)	Main Products	Overseas Main Competitors
Foundry					
SMIC	981.HK	3,641	2,214	8" and 12" logic foundry	TSMC, UMC, Global Foundries
Hua Hong	1347.HK	1,010	674	8" foundry mostly eNVM and power discretes	SMIC, UMC, Vanguard
ASMC	3355.HK	142	118	5", 6", and 8" foundry mostly analog	CSMC
CSMC of CRM	Private			6" and 8" foundry for mostly analog	ASMC
XMC	Private			12" CIS foundry; to be a 3D-NAND IDM	SMIC, Hynix, Sandisk, Toshiba
Shougang NEC	Private			8" foundry	Hua Hong, SMIC
Huali Microelectronics	Private			12" CIS and logic foundry	TSMC, UMC, Global Foundries
Fabless					
HiSilicon	Private		3,830	4G smartphone SOC, Comm IC, surveilance IC, ASIC	Qualcomm, Mediatek
Spreadtrum	Private		1,880	4G smartphone SOC	Qualcomm, Mediatek
ApexMic	002180.SZ	4,037	331	Printer consumable IC	
Galaxycore	Private		280	CMOS image sensor	Omnivision, Superpix
Tongfang	002049.SZ	5,633	214	Smart card, oscilator, ASIC, FPGA	Fudan Micro, Hua Hong IC, Nationz
Allwinners	300458.SZ	2,422	201	Tablet, OTT, IP camera, & auto entertainment SOC	Rockchip, Mediatek
VeriSilicon	Private		180	IP , design, and turnkey total solution service	Global Unichip, Faraday
Goodix	Private		159	Touch controller, finger print sensor and IC	Focaltech, FPC, Synaptics, eGis
Rockchip	Private		159	Tablet, smartphone, smart TV, & speaker SOC	Allwinner, Mediatek
Goke Microelectronics	Private		129	STB & surveilance IC, NAND controller, Comm IC	Hi-Silicon, Silicon Motion, Mstar, STM
Fudan Microelectronics	1385.HK	464	151	Smart card, smart meter IC, SPI NOR & NAND Flash, FPGA	Tongfang, Hua Hong IC, Gigadevice, Nationz
Silergy	6415.TW	894	142	PMIC, smart meter IC	Maxim, MPS, TI, Shanghai Belling
On-Bright	4947.TW	295	93	LED driver and controller	
Nationz	300077.SZ	2,041	85	Smart and security IC	Tongfang, Fudan Micro, Hua Hong IC
Shanghai Belling	600171.SS	2,425	78	Smart meter, PMIC, and analog	Silergy
Solomen	2878.HK	134	71	LCD and OLED drivers, LCD controller	Novatek, Himax
SinoWealth	300327.SZ	876	70	8-bit MCU	
Actions	ACTS.US	62	49	Tablet SOC, Wi-Fi and Bluetooth speaker IC	Sunplus, Allwinner
Awinic	Private		32	Audio IC, LED driver, power PMIC, MEMS Mic	On-Bright, Silergy
Ingenic	300223.SZ	937	22	MIPS processor	
Datang (Leadcore)	600198.SS	3,138		Leadcore supplies 4G smartphone SOC	Spreadtrum, Mediatek
RDA	Private			Cellular PA, transceiver, & switch; WiFi, Bluetooth, FM, & STB tranceiver	RFMD, Skyworks, HunterSun
SG Micro	Private			OPAMP, comparator, PMIC, analog switch, audio/video drivers	
Superpix	Private			CMOS image sensor	Omnivision, Superpix
GigaDevice	Private			SPI NOR and NAND flash, 32-bit MCU	Marconix, Fudan Micro, STM
Vanchip	Private			PA	RFMD, Skyworks, HunterSun
HunterSun	Private			CMOS and GaAs PA, Bluetooth and Wi-Fi chips	RFMD, Skyworks, Vanchip
Montage	Private			STB, TV, and memory interface IC	Goke, Mstar
Hua Hong IC	Private			Smart card	Tongfang, Fudan Micro, Nationz
QST Corp	Private			MEMS, sensor, CMOS	
Shenzhen Longsys	Private			NAND flash controllers and applications	
ZTE Microelectronics	Private			Modem, Comm IC, ASIC	
ASR Microelectronics	Private			Smartphone SOC, baseband	Spreadtrum, Mediatek

Note: Bloomberg consensus used for 2015 revenue of non-covered companies; price as of December 15, 2015.

Source: Company data, Bloomberg.

Exhibit 42: Seven packaging, seven discrete, seven equipment, and three memory companies in China
A list of selected top Chinese packaging, discrete, equipment and memory companies

Company	Ticker	Market cap (US$, mn)	Revenue 2015 (US$, mn)	Main Products	Overseas Main Competitors
Packaging					
USI	601231.SS	4,970	3,549	SiP, EMS	Hon Hai, SPIL
JCET	600584.SS	3,520	1,543	Semiconductor packaging & testing, SiP	ASE, SPIL, Amkor, Sigurd, NT Fujitsu, Huatian
Taiji industry	600667.SS	1,855	1,143	Semiconductor packaging & testing, cloth	Sigurd, JCET, Huatian, NT Fujitsu
Huatian	002185.SZ	2,257	702	Semiconductor packaging & testing	ASE, SPIL, Amkor, Sigurd, JCET, NT Fujitsu
NT Fujitsu	002156.SZ	2,257	357	Semiconductor packaging & testing	ASE, SPIL, Amkor, Sigurd, JCET, Huatian
China WLCSP	603005.SS	1,871	126	Finger print, CIS, and motion wafer level packaging	Xintec
ANST of CRM	Private			Semiconductor packaging & testing	Sigurd, JCET, Huatian, NT Fujitsu
Discrete					
Zhonghuan Semi	002129.SZ	5,232	962	Solar silicon material, wafer, & cell; diode, MOSFET	
Silan	600460.SS	1,655	335	LED driver & controller, MOSFET, Diode, IGBT, MCU, MEMS sensor	
Sino-Microelectronics	600360.SS	1,156	210	Diode, transistor, LED driver, power discrete	
Good-ark	002079.SZ	1,193	133	Diodes, rectifiers, protection devices, MOSFETS, MEMS sensors	
Techsem	300046.SZ	541	33	Rectifier, power module, heatsink	
Yangjie Tech	300373.SZ	1,414	NA	Bridge rectifiers, diode, power discrete	
Huajing	Private			Rectifier, diode, heatsink	
Equipment					
ASM Pacific	522.HK	2,966	1,646	Wirebonder, diebonder, sorter, SMT, etc.	KLIC
Sevenstar	002371.SZ			PVCVD, furnace, washer, solar & TFT equipment, resistor, capacitor, oscillator	
AMEC	Private			Etch	LAM
Piotech	Private			PECVD	AMAT
Taintree	Private			Metrology	KLAC
ACM Research	Private				
KingSemi	Private				
Memory					
XMC	Private			To enter commercial production of 32L and 32G 3D-NAND in 1H2018.	Sandisk, Toshiba, Samsung, Hynix
UMC - Huizhou, Fujian	Private			DRAM and specialty memory	Hynix, Micron
Sino King - Hefei, Anhui	Private			DRAM	Hynix, Micron

Note: Bloomberg consensus used for 2015 revenue of non-covered companies; price as of December 15, 2015.

Source: Company data, Bloomberg.

信息披露附录

申明

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投资摘要部分通过将一只股票的主要指标与其行业和市场相比较来评价该股的投资环境。所描述的四个主要指标包括增长、回报、估值倍数和波动性。增长、回报和估值倍数都是运用数种方法综合计算而成，以确定该股在地区研究行业内所处的百分位排名。

每项指标的准确计算方式可能随着财务年度、行业和所属地区的不同而有所变化，但标准方法如下：

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信息披露

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