



# **Semiconductor Road Conditions: Slow, Bumpy, But Straight Ahead**

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Gartner

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# Presentation Overview

- Semiconductor Devices
- Application Markets
- Outsourcing Services – Foundry & SATS/OSAT
- Mergers/Acquisitions
- Summary & Recommendations

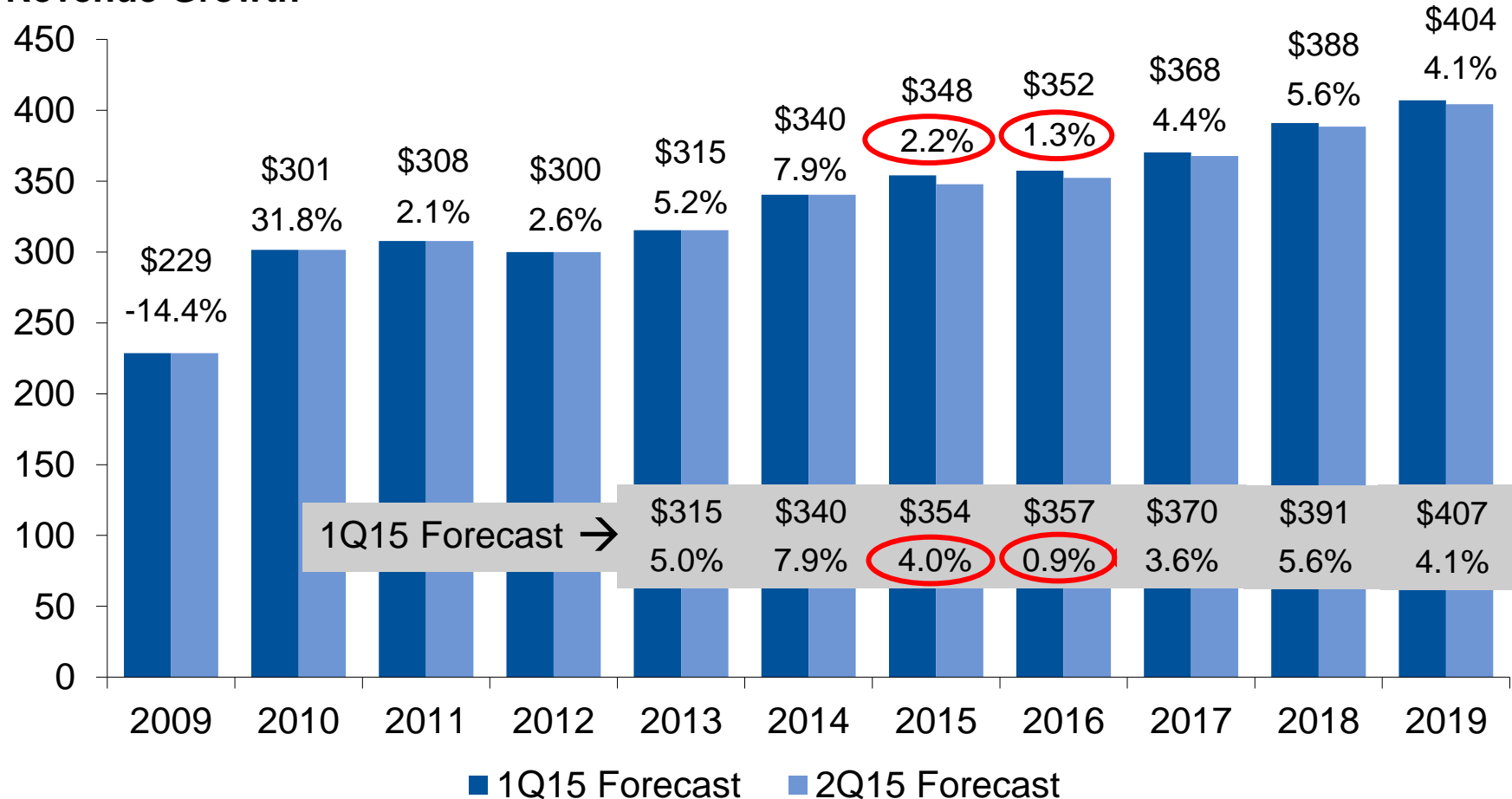
**The outlook for 2015 semiconductor growth has weakened due to softness in key electronic equipment categories including PCs, smartphones and tablets**

# Key Assumptions: Semiconductor Electronic Equipment

- Strong dollar remains an issue as electronic equipment vendors increase prices in affected regions, impacting demand
- Traditional PC weaker, 2015 set to decline 8.7% slightly worse than previously expected
- 2015 total ultramobile unit production expected to decline 1.9%, down from growth of 6.2% previously. Outlook for hybrids, clamshells and tablets all lower
- Any issues with the launch of Windows 10 or Intel's Skylake in 3Q15, which are expected to reinvigorate PC sales, could lead to further downside.
- 2015 total mobile phone unit production growth lowered to 0.7% versus 3.0% in our previous update. Smartphone growth lowered to 14.8% on softness in key markets

# Worldwide Semiconductor 2Q15 Revenue Forecast: 2015 Growth Reduced Again, Memory Cycle Unchanged

Billions of Dollars and Revenue Growth

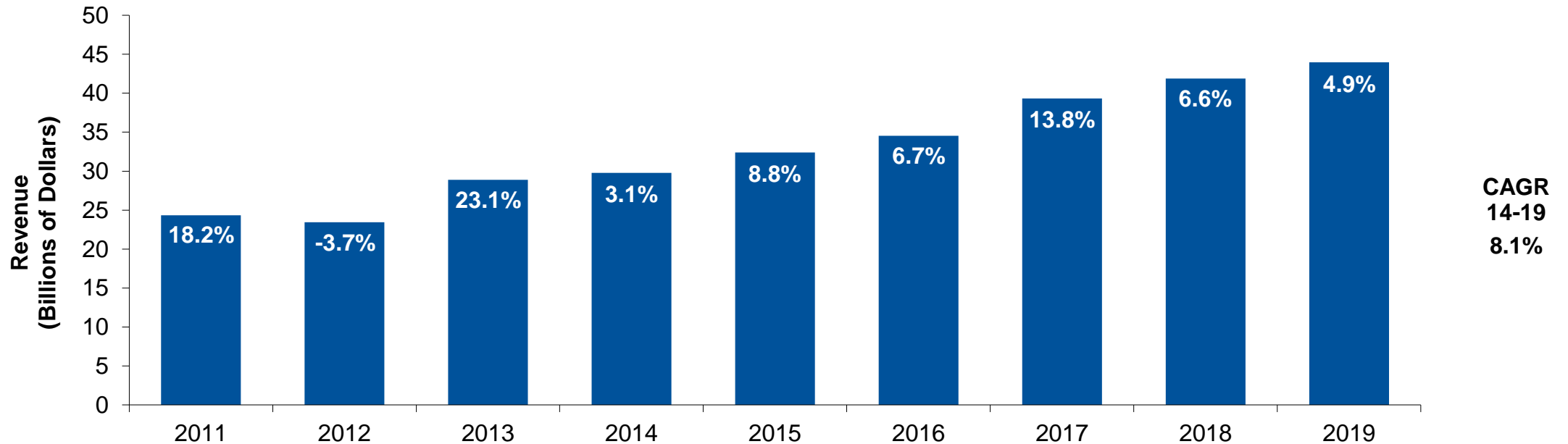


# Semiconductor Revenue, 2Q15 Update: Device Revenue and Annual Growth

Revenue (\$B)	2014	2015	2016	2017	2018	2019	CAGR
Memory	80.3	84.4	78.0	80.1	89.5	92.5	2.9%
Microcomponents	63.7	63.5	65.5	67.9	68.8	71.1	2.2%
Logic	12.8	12.9	13.7	14.6	15.3	15.9	4.4%
Analog	20.8	21.1	21.8	22.2	22.7	23.5	2.4%
Discrete	19.1	19.5	19.9	20.2	20.8	21.6	2.4%
Optoelectronics	27.1	29.3	31.7	34.7	37.5	40.3	8.3%
ASIC	20.6	21.4	22.0	22.6	23.4	24.7	3.7%
ASSP	89.0	88.6	91.7	96.9	101.1	104.5	3.3%
Non-Optical Sensors	6.8	7.2	7.9	8.7	9.5	10.3	8.5%
<b>Total Semiconductor</b>	<b>340.3</b>	<b>347.8</b>	<b>352.2</b>	<b>367.8</b>	<b>388.5</b>	<b>404.3</b>	<b>3.5%</b>
Annual Growth (%)							
Memory	16.6%	5.1%	-7.5%	2.6%	11.7%	3.4%	
Microcomponents	6.3%	-0.4%	3.3%	3.6%	1.3%	3.3%	
Logic	4.7%	0.5%	6.2%	6.2%	4.8%	4.5%	
Analog	7.6%	1.2%	3.1%	2.0%	2.2%	3.4%	
Discrete	7.3%	1.9%	2.2%	1.5%	2.9%	3.6%	
Optoelectronics	5.7%	8.2%	8.4%	9.4%	8.1%	7.4%	
ASIC	4.1%	3.9%	2.8%	2.9%	3.7%	5.2%	
ASSP	4.2%	-0.4%	3.4%	5.7%	4.3%	3.4%	
Non-Optical Sensors	8.0%	5.5%	9.3%	10.0%	9.4%	8.5%	
<b>Total Semiconductor</b>	<b>7.9%</b>	<b>2.2%</b>	<b>1.3%</b>	<b>4.4%</b>	<b>5.6%</b>	<b>4.1%</b>	
<b>Non-Memory</b>	<b>5.5%</b>	<b>1.3%</b>	<b>4.1%</b>	<b>4.9%</b>	<b>3.9%</b>	<b>4.3%</b>	

# NAND Market: Cautious Optimism, As Long as the Industry Remains Responsible

Petabytes	18,796	30,466	43,359	61,065	84,631	117,176	161,176	214,479	275,314	CAGR 14-19
Bit Growth	77.5%	62.1%	42.3%	40.8%	38.6%	38.5%	37.6%	33.1%	28.4%	35.1%



ASP 1GB eqv.*	1.24	0.73	0.64	0.46	0.36	0.28	0.23	0.19	0.15	CAGR 14-19
ASP Change	-33.4%	-40.6%	-13.5%	-26.8%	-21.5%	-22.9%	-17.2%	-19.9%	-18.3%	-20.0%
~ Cost Curve	-35%	-30%	-20%	-23%	-20%	-18%	-15%	-20%	-20%	

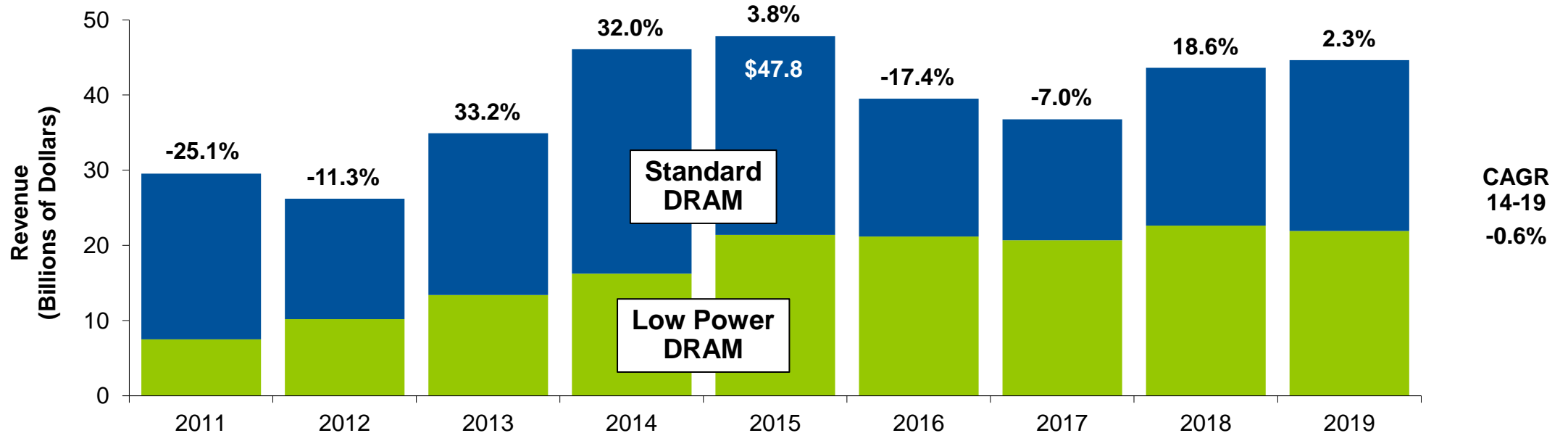
**SSD Price Declines outpacing NAND price Declines through 2016 →**

Source: Gartner June 2015

Upcoming "Forecast Analysis: NAND Flash, Worldwide, 2Q15 Update"

# DRAM Forecast, 2Q15: DRAM Market Metrics – 2015 an All Time High

Megabytes Bn	2,910	3,837	4,716	6,156	7,717	10,098	12,975	16,137	19,807	CAGR 14-19
Bit Growth	48.6%	31.9%	22.9%	30.5%	25.4%	30.8%	28.5%	24.4%	22.7%	26.3%



ASP 4Gb eqv.	5.20	3.50	3.79	3.83	3.17	2.00	1.45	1.38	1.15	-21.4%
ASP Change	-49.6%	-32.7%	8.4%	1.1%	-17.2%	-36.9%	-27.6%	-4.6%	-16.6%	
ASP 4Gb eqv.*	3.55	2.03	2.84	3.52	2.62	1.39	0.97	1.04	0.91	-23.8%
ASP Change	-61.9%	-42.8%	39.9%	24.2%	-25.8%	-46.7%	-30.7%	7.8%	-12.8%	

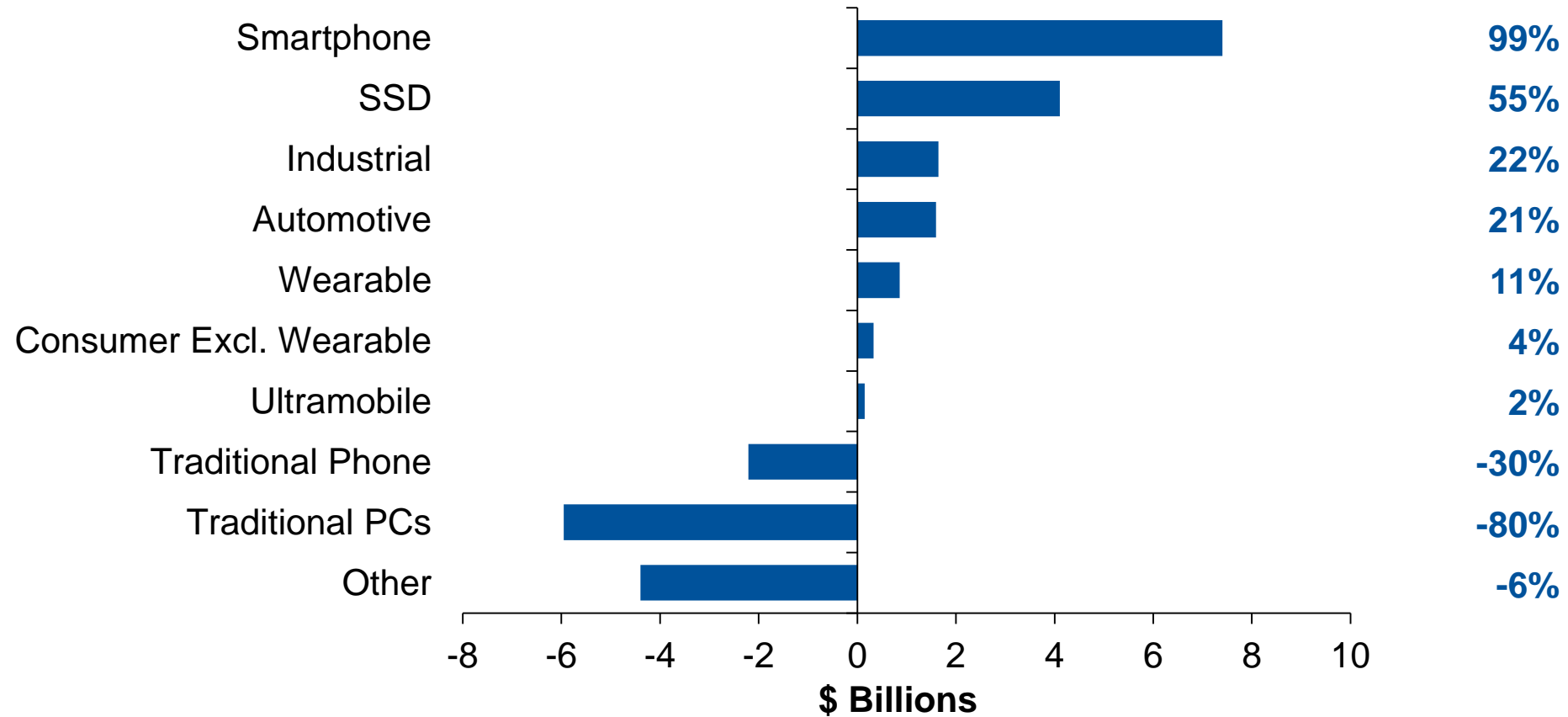
\* Commodity pricing, the blended average of device densities being sold into the PC market.



# Where is the Semi Growth in 2015? Smartphones and SSDs Drive the Market

2014 to 2015 Growth Contribution by Electronic Application

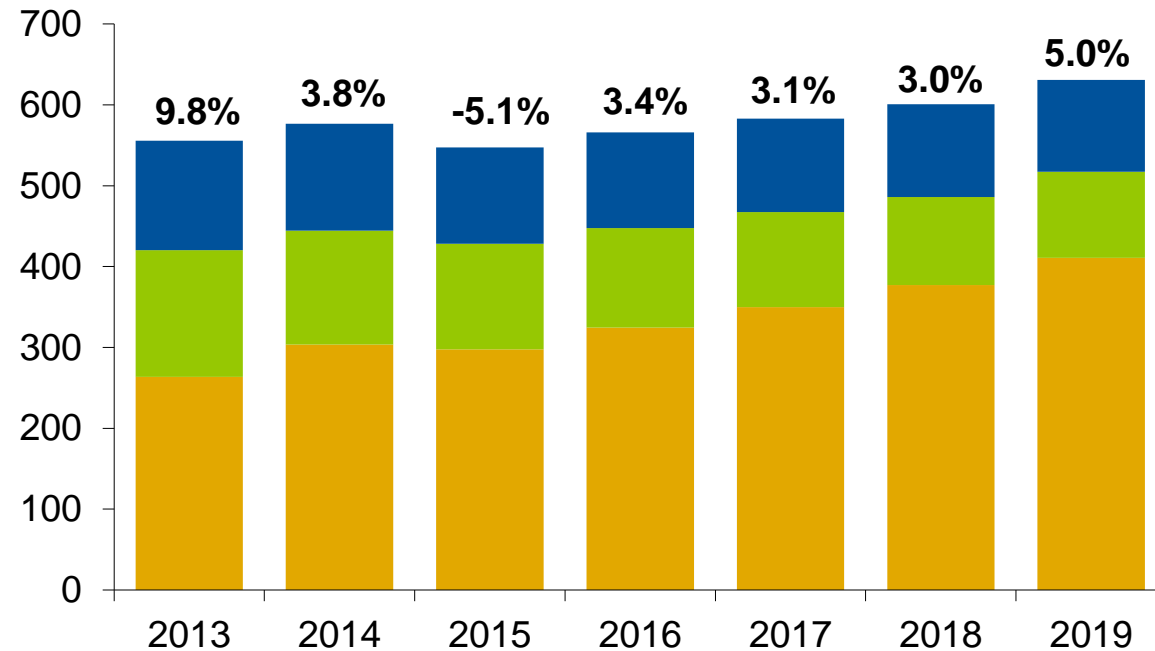
Share of Growth



Source: Gartner, June 2015 "Semiconductor Forecast Database, Worldwide, 2Q15 Update"

# PC and Ultramobile Production Forecast Waiting for Windows 10 and Skylake

PC and Ultramobile Unit Production (Millions of Units)



Semi Revenue and Share of Market (Billions of Dollars)

61.2	64.4	58.6	56.6	56.6	57.8	59.4
19.4%	18.9%	16.9%	16.1%	15.4%	14.9%	14.7%

■ Desk-based PCs ■ Notebook PCs ■ Ultramobile

- Traditional notebook and desktop segments shrinking, units down 8.7% in 2015, slightly weaker compared to 1Q15 forecast
- Inventory in the PC market remains high despite vendors looking to clear the supply chain in anticipation of Windows 10 and Intel's Skylake
- Corporate PC refresh cycle has run its course
- Production CAGR '14-'19 is 1.8%
- Semi TAM CAGR '14-'19 is -1.6%

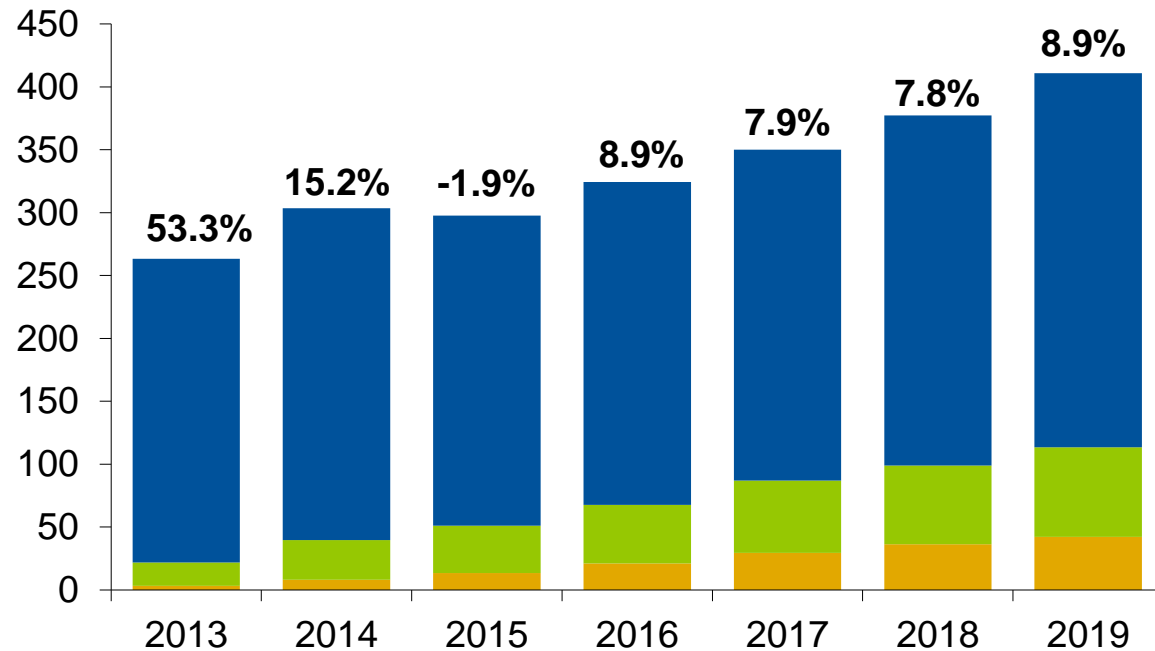
Source: Gartner, June 2015

"Semiconductor Forecast Database, Worldwide, 2Q15 Update"

# Ultramobile Production Forecast

## Hybrids and Clamshells Countering Tablets Slack

Ultramobile Unit Production (Millions of Units)



Semi Revenue and Share of Market (Billions of Dollars)

17.1	20.4	20.6	22.6	25.0	27.3	30.0
5.4%	6.0%	5.9%	6.4%	6.8%	7.0%	7.4%

■ Ultramobile Tablet ■ Ultramobile Clamshell ■ Ultramobile Hybrid

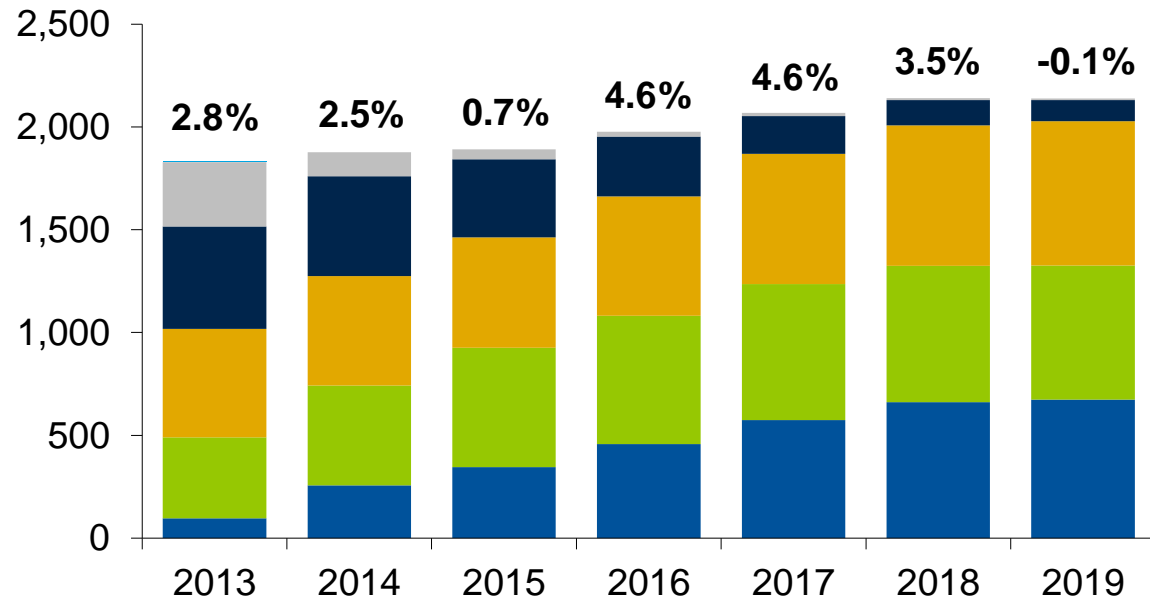
- Outlook for tablets revised downward significantly, Apple units down 23% in 1Q15
- Tablet form factor represents 87% of ultramobile units in 2014 and will decline to 72% in 2019
- Hybrid and Clamshell form factors remain small but represent a significant portion of the premium category (86%) in 2019
- MediaTek and Intel taking share in application processor market
- Cellular penetration increasing
- Production CAGR '14-'19 is 6.3%
- Semi TAM CAGR '14-'19 is 8.0%

Source: Gartner, June 2015

"Semiconductor Forecast Database, Worldwide, 2Q15 Update"

# Mobile Phone Production Forecast: Smartphone Growth Revised Down to 15%

Mobile Phone Unit Production and Growth (Millions of Units)



Semi Revenue and Share of Semiconductor Market (Billions of Dollars)

66.7	72.9	78.1	80.4	85.3	90.3	90.1
21.1%	21.4%	22.5%	22.8%	23.2%	23.3%	22.3%

- Premium Traditional OS
- Utility Traditional OS
- Basic Smart OS
- Basic Traditional OS
- Premium Smart OS
- Utility Smart OS

Source: Gartner, June 2015

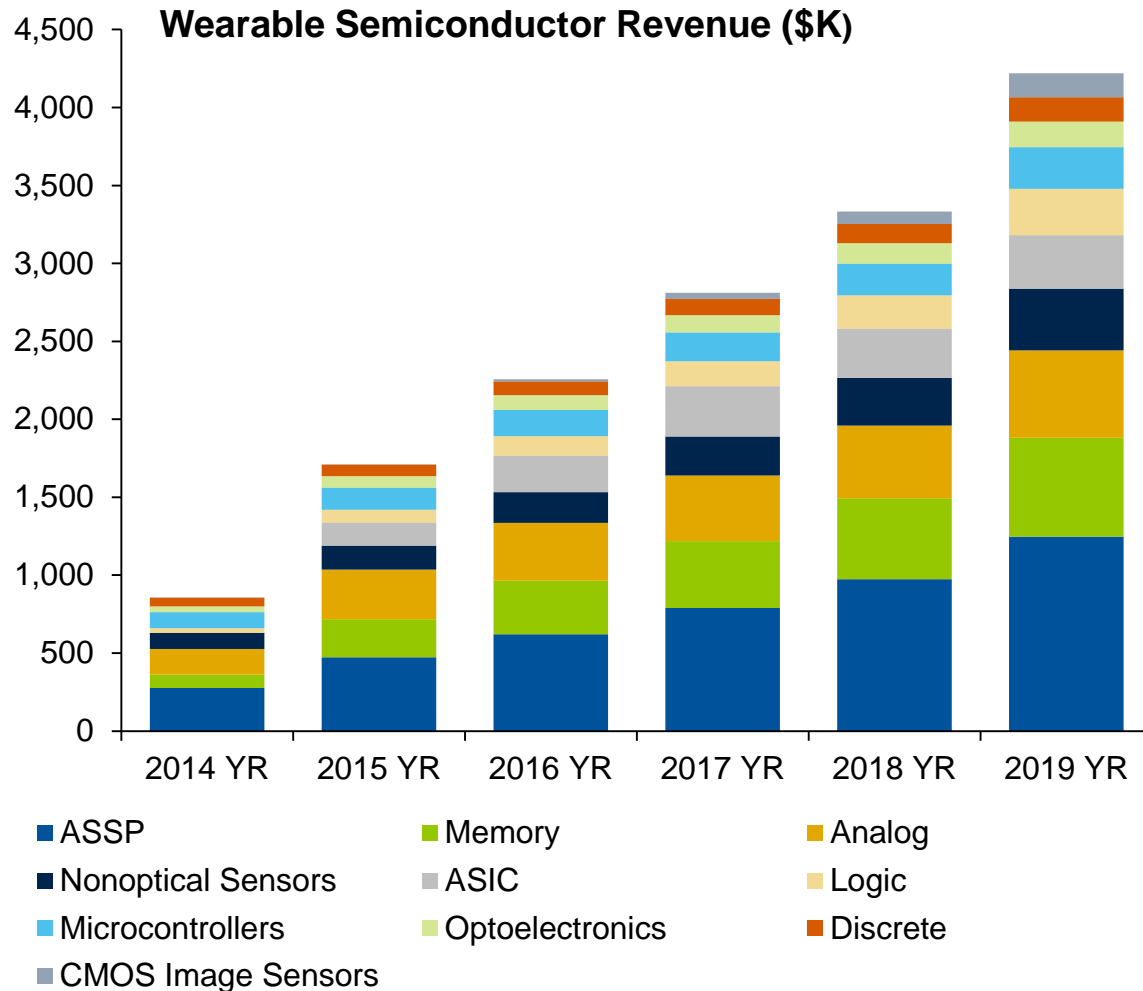
“Semiconductor Forecast Database, Worldwide, 2Q15 Update”

- Apple iPhone Units bright spot for the market with units and ASPs up strongly driven by iPhone 6 and 6 plus
- High-end Android units have been muted
- Softness in the overall China smartphone market
- Shift to LTE in key markets like China continues to accelerate at the expense of 3G, a key driver for semiconductor content
- Smartphones expected to account for over 95% of total phone units in 2019
- Production CAGR '14-'19 is 2.6%
- Semi TAM CAGR '13-'18 is 4.3%

# Smartphone Type and Semiconductor Content

Smartphone Component	Ultra-low cost Smartphone	Low cost Smartphone	Mid-range Smartphone	Mid-range Smartphone (LTE)	High end Smartphone (LTE)	Flagship Smartphone (LTE)
Baseband Processor	\$ 3.50	\$ 5.50	\$ 10.00	\$ 15.00	\$ 25.00	\$ 15.00
Application/Multimedia Processor	Integrated in BB	Integrated in BB	Integrated in BB	Integrated in BB	Integrated in BB	\$ 25.00
RF Content	\$ 1.50	\$ 2.50	\$ 4.00	\$ 6.50	\$ 10.00	\$ 12.00
Wireless Connectivity	Bundled in BB	Bundled in BB	Bundled in BB	Bundled in BB	\$ 4.00	\$ 5.50
Memory - Total	\$ 3.00	\$ 6.00	\$ 11.50	\$ 11.50	\$ 23.00	\$ 38.00
DRAM	\$ 2.00	\$ 4.00	\$ 8.00	\$ 8.00	\$ 16.00	\$ 24.00
NAND	\$ 1.00	\$ 2.00	\$ 3.50	\$ 3.50	\$ 7.00	\$ 14.00
User Interface + Sensors	\$ 1.50	\$ 2.00	\$ 3.00	\$ 3.00	\$ 6.00	\$ 8.00
Power Management	Bundled in BB	Bundled in BB	Bundled in BB	Bundled in BB	Bundled in BB	\$ 3.00
Other Semiconductors	\$ 2.00	\$ 3.00	\$ 5.00	\$ 5.00	\$ 7.00	\$ 8.50
Display/touchscreen	\$ 6.00	\$ 10.00	\$ 18.00	\$ 18.00	\$ 35.00	\$ 60.00
Display Size	3.5-4.0-inch Capacitive, HVGA	4.0-4.5-inch Capacitive, WVGA	4.5-5.0-inch WVGA, 720p	4.5-5.0-inch WVGA, 720p	5.0-5.5-inch 1080p	5.0-5.5-inch 2K qHD
Camera Module/Image Sensor	\$ 1.00	\$ 1.80	\$ 5.00	\$ 5.00	\$ 10.00	\$ 22.00
Camera Details	2MP	3MP	5/8MP, 1.3MP Front	5/8MP, 1.3MP Front	8MP/13MP Primary, 2~5MP Front	16MP+ OIS Primary, 5~8MP Front
Battery	\$ 2.00	\$ 2.50	\$ 4.00	\$ 4.00	\$ 6.50	\$ 8.00
Battery Size	1300mAh	1500mAh	1800mAh	1800mAh	2500mAh	3000mAh
Casing/PCBs/Connectors/etc.	\$ 3.50	\$ 5.00	\$ 8.00	\$ 8.00	\$ 18.00	\$ 22.00
<b>Total</b>	<b>\$ 24.00</b>	<b>\$ 38.30</b>	<b>\$ 68.50</b>	<b>\$ 76.00</b>	<b>\$ 144.50</b>	<b>\$ 202.00</b>

# Wearable Semiconductor Content Forecast: Strong Growth but off a Small Base



- Wearable semiconductor revenue grows > 5X from 2014 to 2019, but is only 1% of total semi revenue in 2019
- ASSP and ASIC combined represent over 1/3 of wearables semi revenue from 2015 to 2019; more opportunity to integrate
- Memory has CAGR of 49.0% mainly due to growth of smart watches and HMD/cameras
- Complete reference designs/turnkey solutions will be opportunity for semi companies, distributors and integrators
- Semi TAM CAGR '14-'19 is 25.3%

# 2Q15 Semiconductor Market Summary:

- 2Q15 bounce has not materialized, overall 2015 growth lowered to 2.2% compared to 4.0% previously
- Outlook for all market electronic equipment categories have been revised downward as strong dollar impact continues
- PC market in 2015 is backend loaded with Windows 10 and Intel's Skylake expected to drive momentum
- Excess inventory continues in 2Q15
- Memory cycle remains on schedule with downturn in 2016
- Wearable unit production will grow by 2.5 times through 2019, but will contribute only 1% of semiconductor revenue



# Manufacturing Markets - Outsourcing Services: Foundry and SATS/OSAT

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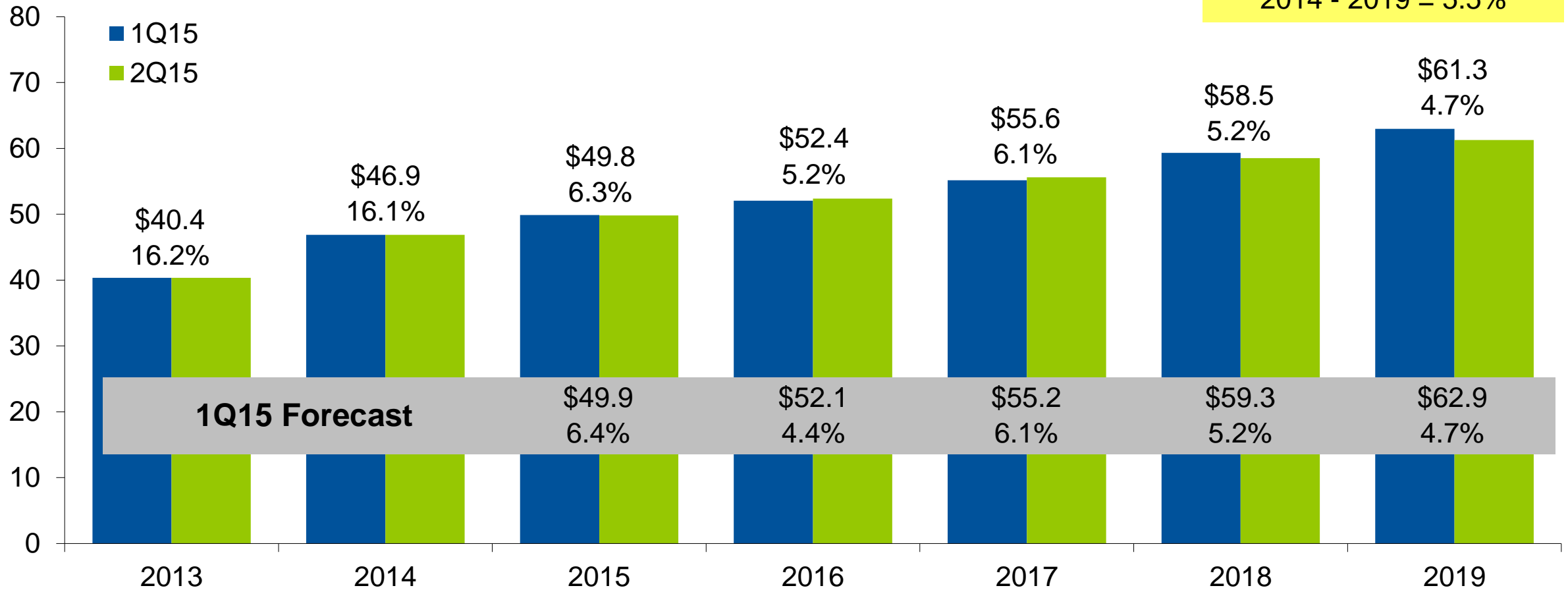


# 2Q15 Foundry Highlights

- The growth of foundry revenue slows to single-digit rate as markets which have driven high growth saturate
- In 2015, foundry capex increases by 17.2% to \$22.2 billion, lowered than our previous forecast due to 20nm capacity will be converted sooner to 16nm
- Competition in wafer prices intensifies as fab utilization rate drops to 85% or lower starting 2Q15
- The policy of aggressive investment to semiconductor manufacturers by Chinese government has benefited the supply chain in China and many JVs have been announced

# 2Q15 Foundry Revenue and Forecast

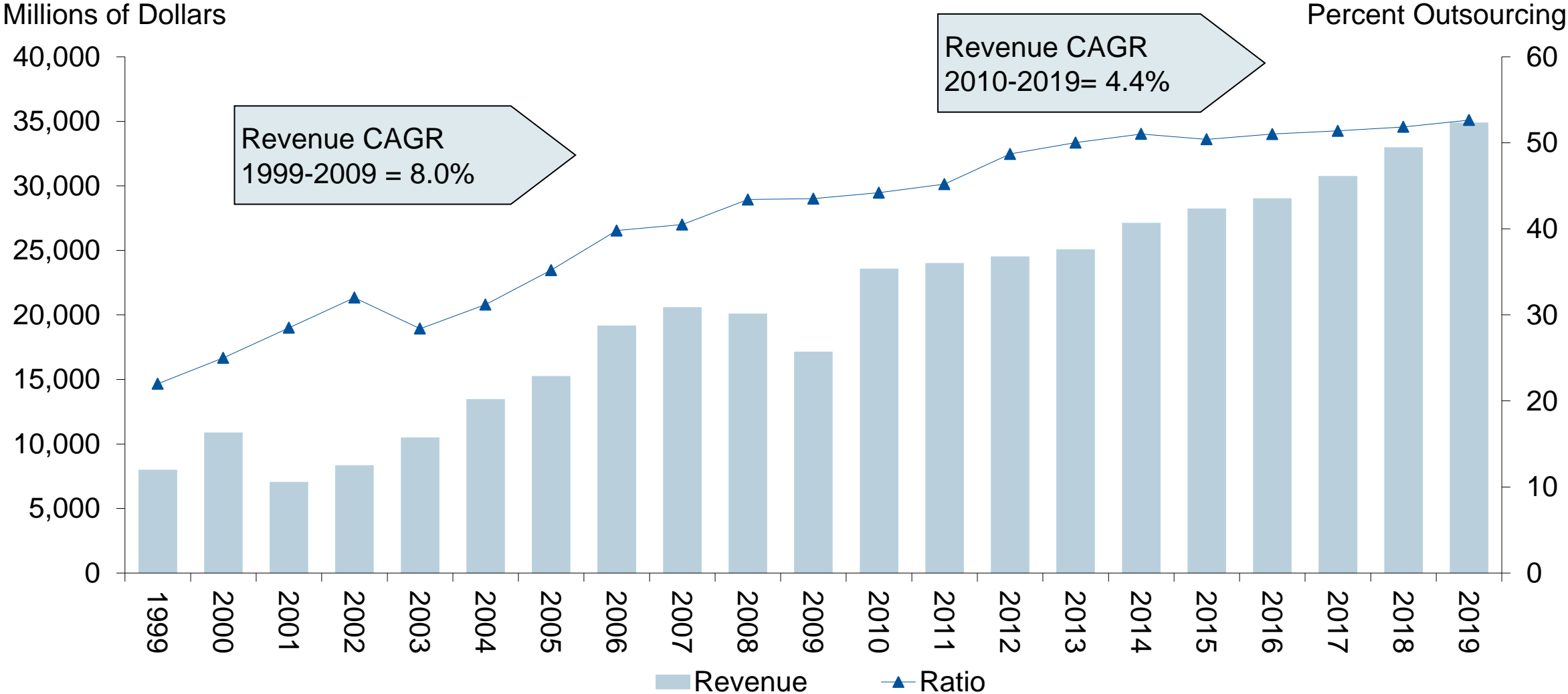
Billions of Dollars and Revenue Growth



# SATS Industry Highlights – 2015

- **Virtual and vertical integration of outsourcing** is occurring as the manufacturing processes of wafer fab, packaging, and system assembly converge. Outsourcing business models are changing as system level integration is re-established.
- **Wafer-based packaging processes** are now mainstream. In addition to companies within the SATS market, the foundry market has also emerged as a SATS competitor. Process leverage is key.
- The SATS industry has reached above the 50% outsourcing mark, but will still exhibit a growth rate above that of the overall semiconductor device industry with a (CAGR) of 5.2% from 2014 through 2019.
- **China is the growth market for semiconductor manufacturing**, with \$100 billion supplied by China Gov't, including M&A and JV. Expansion into China by SATS companies continues, as engineering expertise and supply chain infrastructure are fully developed in the area.
- Consolidation must occur among the more than 150 companies participating **in the SATS industry**. 36 have revenue over \$100 million USD. Many SATS companies will not be able to develop the necessary capital required for the increased complexity and wafer-like equipment cost required to stay competitive.
- As competition intensifies and capital requirements increase, the **SATS market will stratify into three segments**: leading edge, specialty niche and sunset/mature packaging services.

# SATS Market History/Forecast, 1999 to 2019



# Worldwide Packaging & Test Revenue Forecast 2013- 2019 (Millions of US Dollars)

	2013	2014	2015	2016	2017	2018	2019	CAGR 2014-2019
Packaging and Test Market (IDM)*	24,683.8	26,052.0	26,710.2	26,967.2	27,676.0	28,935.0	30,345.3	3.1%
Packaging Revenue Only	19,571.6	20,676.1	21,297.0	21,463.8	21,930.6	23,032.8	24,156.4	3.2%
Test Revenue Only	5,112.2	5,375.9	5,413.2	5,503.4	5,745.5	5,902.2	6,188.9	2.9%
Outsourcing Market (SATS)	25,081.9	27,130.2	28,242.6	29,033.4	30,760.9	32,978.8	34,911.5	5.2%
Packaging Revenue Only	19,600.6	21,328.2	22,050.4	22,516.1	23,800.6	25,651.5	27,231.0	5.0%
Test Revenue Only	5,481.3	5,802.0	6,192.2	6,517.3	6,960.3	7,327.3	7,680.5	5.8%
Worldwide Total Packaging and Test Market	49,765.7	53,182.2	54,952.8	56,000.6	58,436.9	61,913.8	65,256.7	4.2%
Total Packaging and Test Market Growth	3.5%	6.9%	3.3%	1.9%	4.4%	5.9%	5.4%	
Worldwide Total Packaging Market	39,172.2	42,004.2	43,347.3	43,980.0	45,731.2	48,684.3	51,387.3	4.1%
Outsourced Packaging Market	50.0%	50.8%	50.9%	51.2%	52.0%	52.7%	53.0%	
Worldwide Total Test Market	10,593.5	11,178.0	11,605.5	12,020.6	12,705.7	13,229.5	13,869.4	4.4%
Outsourced Test Market	51.7%	51.9%	53.4%	54.2%	54.8%	55.4%	55.4%	
Ratio of Outsourced Market	50.4%	51.0%	51.4%	51.8%	52.6%	53.3%	53.5%	
SATS Growth Rate	2.3%	8.2%	4.1%	2.8%	6.0%	7.2%	5.9%	

# 2015 Capex, Top SATS Companies

	<u>2014</u>	<u>2015</u>
Advanced Semiconductor Engineering	1,442.6	905.0
Amkor Technology	680.0	600.0
SPIL	642.0	468.0
STATS ChipPAC	534.7	365.0
Powertech Technology	330.0	254.0
King Yuan Electronics	140.0	140.0
Jiangsu Changjiang Electronic Technology (JCET)	105.0	121.3
ChipMOS Technologies (Bermuda) LTD.	112.9	120.0
J-Devices	45.2	104.5
UTAC	120.0	100.0
Other Companies	869.6	832.8
<b>Total SATS Spending</b>	<b>5,022.0</b>	<b>4,010.6</b>

# 2014 SATS Market Share (Top 20)

2014 Rank	2013 Rank	Company	Region	2013 Revenue	2014 Revenue	2013 Market Share (%)	2014 Market Share	Change 2013-2014
1	1	ASE	Taiwan	4,740	5,170	18.9%	19.1%	9.1%
2	2	Amkor Technology	United States	2,956	3,129	11.8%	11.5%	5.9%
3	3	SPIL	Taiwan	2,335	2,741	9.3%	10.1%	17.4%
4	4	STATS ChipPAC	Singapore	1,599	1,586	6.4%	5.8%	-0.8%
5	5	Powertech Technology	Taiwan	1,267	1,321	5.1%	4.9%	4.3%
6	6	Jiangsu Changjiang Electronics Technology	China	850	982	3.4%	3.6%	15.5%
7	7	J-Devices	Japan	843	864	3.4%	3.2%	2.5%
8	8	UTAC	Singapore	748	734	3.0%	2.7%	-1.9%
9	9	ChipMOS Technologies	Taiwan	649	696	2.6%	2.6%	7.3%
10	10	Chipbond Technology	Taiwan	530	575	2.1%	2.1%	8.5%
11	11	STS Semiconductor	South Korea	499	522	2.0%	1.9%	4.6%
12	13	Tianshui Huatian Microelectronics	China	398	519	1.6%	1.9%	30.3%
13	12	King Yuan Electronics	Taiwan	426	477	1.7%	1.8%	11.9%
14	18	Nantong Fujitsu Microelectronics	China	287	343	1.1%	1.3%	19.4%
15	14	Carsem Semiconductor	Malaysia	350	336	1.4%	1.2%	-4.0%
16	17	Walton Advanced Engineering	Taiwan	296	331	1.2%	1.2%	11.8%
17	15	Unisem	Malaysia	315	319	1.3%	1.2%	1.3%
18	21	Orient Semiconductor Electronics	Taiwan	228	317	0.9%	1.2%	38.6%
19	19	AOI Electronics	Japan	282	306	1.1%	1.1%	8.6%
20	16	Formosa Advanced Technologies	Taiwan	302	304	1.2%	1.1%	0.6%
		Top 20 Total		19,901	21,572	79.3%	79.5%	8.4%
		Other Companies		5,180	5,558	20.7%	20.5%	7.3%
		Total Market		25,082	27,130	100.0%	100.0%	8.2%

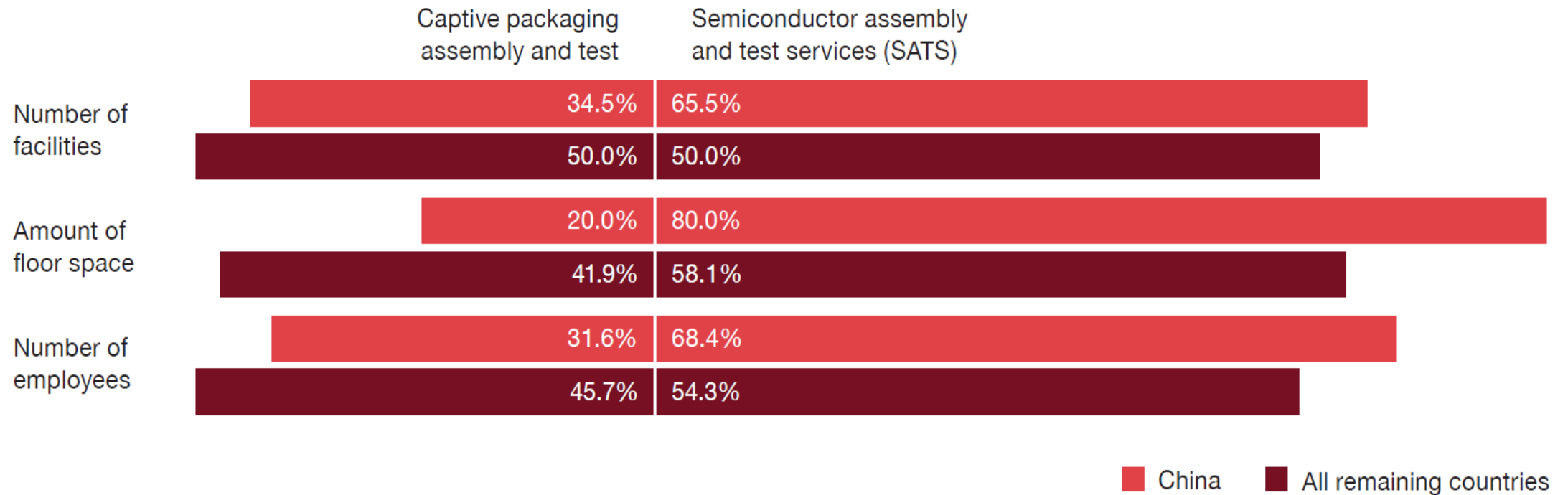
# 2014 semiconductor revenue by major companies headquartered in China

Company	Foundry/SATS	Revenue \$M
SMIC	Foundry	1,970
JCET	SATS	982
Shanghai Huahong Grace Semiconductor	Foundry	665
Tianshui Huatian Microelectronics	SATS	519
Nantong Fujitsu Microelectronics	SATS	343
CSMC	Foundry	341
ANST (aka CRMAT)	SATS	185
ASMC	Foundry	132
China Wafer Level CSP	SATS	98
Taiji Semiconductor	SATS	90
Foshan Blue Rocket Electronics	SATS	81
Great Team Backend Foundry	SATS	50
<b>Total</b> above foundries/SATS		<b>5,456</b>

Company	Fabless/IDM	Revenue \$M
Shenzhen HiSilicon Technologies	Fabless	1,600
Tsinghua Unigroup	Fabless	1,406
Sanan Optoelectronics	IDM	381
Galaxycore	Fabless	367
Hangzhou Silan Microelectronics	IDM	263
Fuzhou Rockchip Electronics	Fabless	220
Jilin Sino-Microelectronics	IDM	208
Datang Microelectronics Technology	Fabless	203
Elec-Tech International	IDM	202
CEC Huada Electronic Design	Fabless	183
Allwinner Technology	Fabless	168
Montage Technology	Fabless	167
Foshan Nationstar Optoelectronics	IDM	152
Tongfang Guoxin Electronics	Fabless	145
GigaDevice Semiconductor	Fabless	138
Shanghai Fudan Microelectronics	IDM	111
Leadcore Technology	Fabless	115
Shanghai Huahong Integrated Circuit	Fabless	111
Wuxi China Resources Semico	IDM	110
Suzhou Good-Ark Electronics	IDM	109
<b>Total</b> above fabless/IDM		<b>6,359</b>

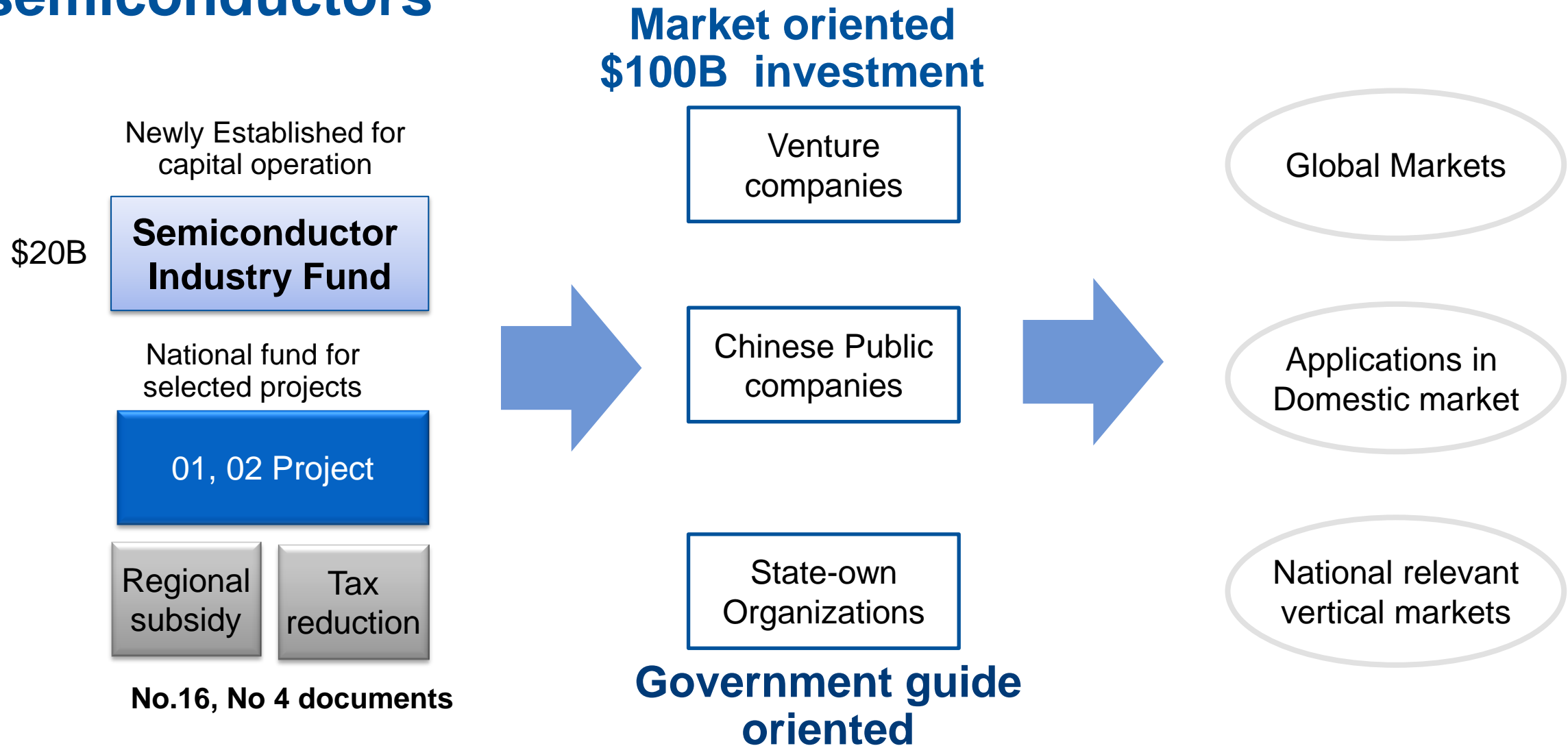


# China vs. Rest of World – Packaging/Test Manufacturing, 2013

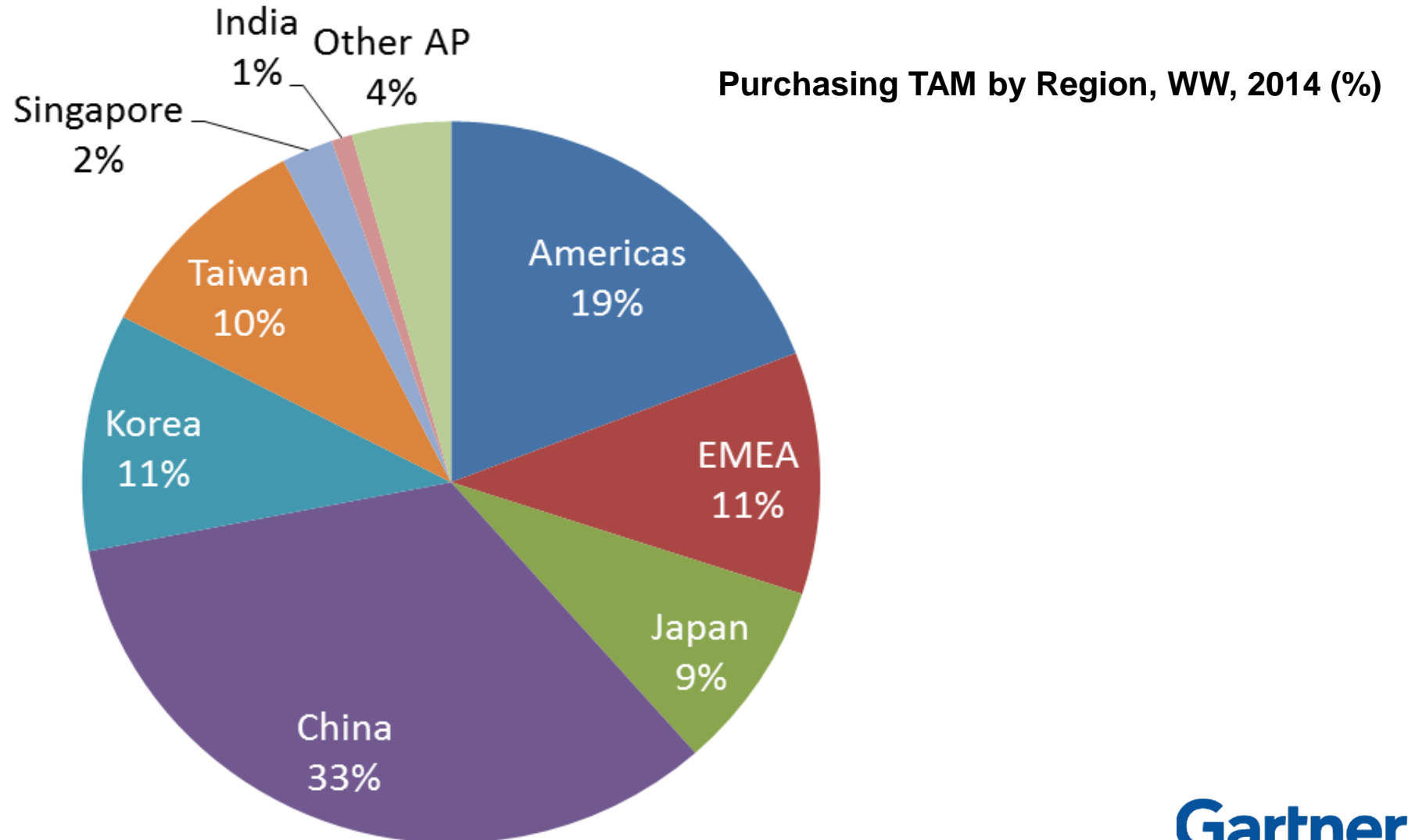


Source: Gartner

# How new Chinese national policy supports homegrown semiconductors



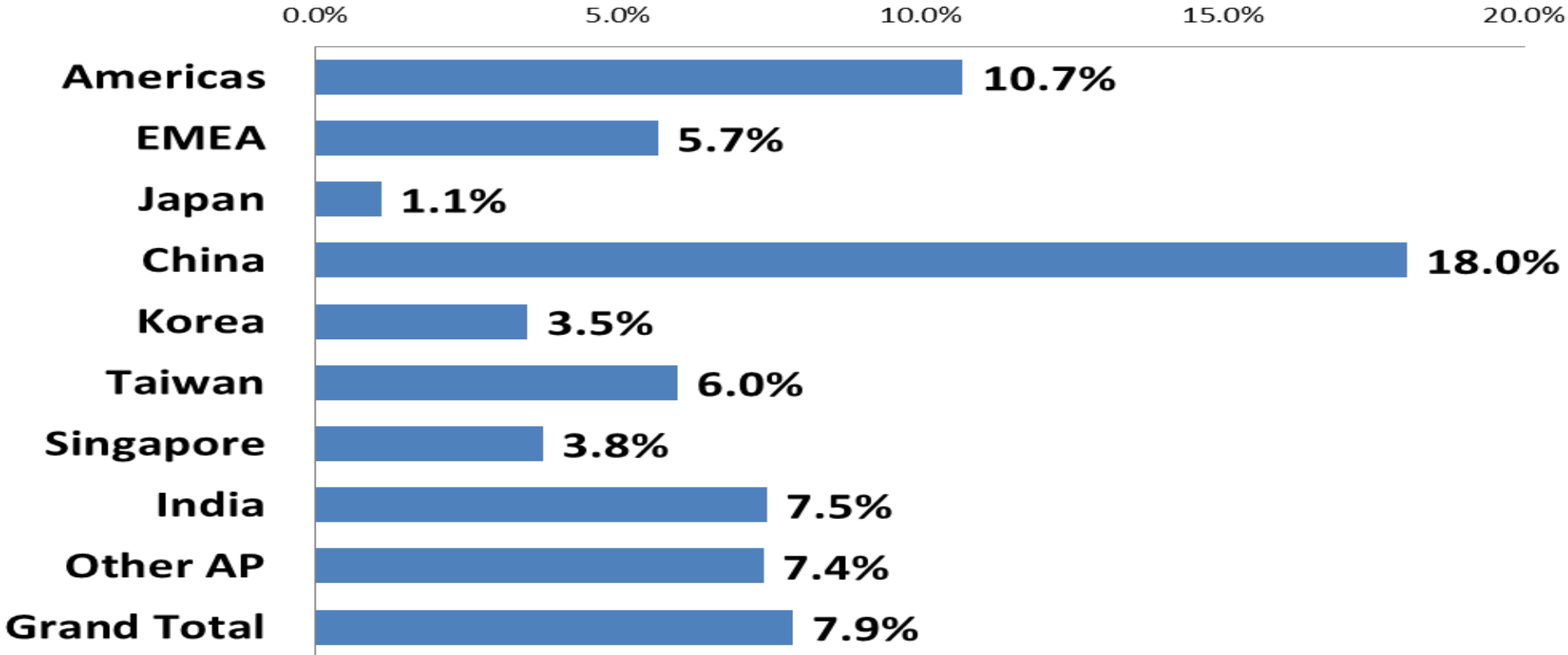
# China market represents 33% of the total purchasing TAM for semiconductor chip vendors



Source: Gartner (May 2015)

# China has the fastest growing market of design TAM of semi vendors

Growth Rate of Design TAM by Region, WW, 2014 (%)



Source: Gartner (May 2015)



# Top 10 SATS Competitive Analysis – 2015

- ASE - Diversified IDM/Fabless customer base and factory locations, advanced Strong position in the SiP, flip-chip, wafer-bumping and test markets and emerging TSV market. Focus on top tier semi companies. *EMS division becoming a growing advantage, especially for SiP and supply chain management.*
- Amkor - Diversification and scale of manufacturing sites. IDM strength. Technical expertise for package/die stacking, copper pillar, and lead-frame packaging. Leadless-lead-frame (QFN, SON, DFN and MLF) market pioneer. *TSV leader. Strong marketing/sales. New Korea factory.*
- SPIL – *Fabless customer base strength*; provides flip-chip packaging solutions for graphics and computer chipset markets. Recognized as executing effectively. Reputation of excellent support to design companies and foundries. Very strong financially – no debt.
- JCET/STATSChipPAC - Technology and patent innovator. Largest China-based SATS. Provides excellent packaging and test solutions for WLP, 3D and SiP technologies. RDL services, wafer bumping and WLP, integrated passive devices and TSV into complex package designs. STATSChipPAC weak sales and finances. *Large customer concern over I.P. protection due to China takeover.*

# Top 10 SATS Competitive Analysis – 2015

- **PTI** - Leading-edge and largest memory packaging/test provider; DRAM and NAND flash memory customers. Competitive advantage in wafer-level burn-in and thin-wafer handling. Copper pillar bump, RDL and WLCSP, 3D and TSV technologies. Acquisition of Greatek reducing dependence on memory market to become more broad-based supplier
- **UTAC** - Broad package portfolio. Leading supplier of leadless-lead-frame packages (SON, DFN and QFN). Expertise in RF, mixed signal and memory testing. Weak sales and financials.
- **ChipMOS** – Niche market focus. LCD driver packaging market leader. Excellent expertise in wafer bumping, tape carrier packaging (TCP), chip-on-film (COF) and chip-on-glass (COG). Packaging and test for LP-DRAM, flash memory, and mixed-signal products for mobile applications. Wall Street darling.
- **J-Devices** – Japanese IDM factory consolidator with Toshiba, Fujitsu, Renesas, Sony. Mostly Japanese customers. Automotive and industrial focus. Amkor now majority owner of JV. Will become part of Amkor in 2016.
- **Chipbond Technology** - Solder bumping, copper bumping, gold bumping and RDL. Tape carrier packaging (TCP), COF and COG packaging for LCD display drivers. Growing RDL and WLP market. Fabless companies main customers.

# Second Tier SATS – Revenue (Millions of USD)

2014 Rank	2013 Rank	Company	Region	2013 Revenue	2014 Revenue	2013 Market Share (%)	2014 Market Share	Change 2013-2014	Market Focus
11	11	STS Semiconductor	South Korea	499	522	2.00%	1.90%	4.60%	Memory
12	13	Tianshui Huatian Microelectronics	China	398	519	1.60%	1.90%	30.30%	SOT, SOIC, QFP
13	12	King Yuan Electronics	Taiwan	426	477	1.70%	1.80%	11.90%	Test
14	18	Nantong Fujitsu Microelectronics	China	287	343	1.10%	1.30%	19.40%	BGA, CSP
15	14	Carsem Semiconductor	Malaysia	350	336	1.40%	1.20%	-4.00%	QFN, Analog
16	17	Walton Advanced Engineering	Taiwan	296	331	1.20%	1.20%	11.80%	Memory
17	15	Unisem	Malaysia	315	319	1.30%	1.20%	1.30%	QFN, Analog
18	21	Orient Semiconductor Electronics	Taiwan	228	317	0.90%	1.20%	38.60%	Memory Cards, SiP modules
19	19	AOI Electronics	Japan	282	306	1.10%	1.10%	8.60%	Japanese OEM's
20	16	Formosa Advanced Technologies	Taiwan	302	304	1.20%	1.10%	0.60%	Memory
		<b>Second 10 Total</b>		<b>3,384</b>	<b>3,773</b>	<b>13.50%</b>	<b>13.90%</b>	<b>11.50%</b>	
		Total Market		25,082	27,130	100.00%	100.00%	8.20%	
Note: Numbers may not add to totals shown because of rounding.									
Source: Gartner (April 2015)									

# SATS/OSAT - Taiwan vs. China

## Growing the Market via Consolidation

- Complimentary Product/Packages/Customers
  - Non-memory + memory; memory + memory
    - OSE + PTI ( or Walton, Nantong Fujitsu)
    - Consolidation of Korean memory SATS (Signetics/STS/Hana Micron/AT Semicon/LB Semicon)
    - Tianshui Huatian + ??
  - Packaging + Test
    - KYEC + SPIL (SPIL owns part already)
    - Ardentec + Sigurd
  - Top 10 Merger
    - ASE + SPIL
    - UTAC + (PTI or Korean company)
    - Amkor + J-Devices (2016)
    - Amkor + PTI
    - ChipBond or ChipMOS + ??



# Recommendations

- SATS vendors must establish partnerships/joint ventures or merge with foundries, electronics manufacturing service/original design manufacturing (EMS/ODM) companies and/or materials and equipment suppliers as system level integration evolves for the IoT.
- Chip-to-package and package-to-board manufacturing technologies continue to converge and overlap. Establish closer customer partnerships to reduce competition for value-added services.
- Successful SATS vendors will strengthen design and test engineering staffs to ensure a steady stream of new package and test offerings. Adjust company R&D budgets accordingly.
- Develop China SATS partner or JV. Just having a factory there will not be enough.
- Second and third tier SATS companies must decide to merge, consolidate, or pursue specialty, alternative manufacturing markets that require less capital in order to survive in the longer term

# Executive Summary: Q3 2015 Preliminary Forecast Growth

Revenue Growth (%)	2015			2016		
	Dec	Apr	July	Dec	Apr	July
Global Real GDP	+3.1	+2.9	+2.6	+3.5	+3.3	+3.3
U.S. Real GDP	+2.6	+3.0	+2.1	+2.8	+2.7	+2.7
Elec. Equipment <sup>1</sup>	+2.4	+2.3	-0.5	+4.0	+3.7	+3.4
Semiconductor <sup>2</sup>	+5.2	+4.0	+2.2	+0.7	+0.9	+1.3
Foundry	+5.9	+6.4	+5.5	+4.3	+4.4	+5.2
SATS	+5.8	+5.7	+1.5	+4.0	+3.9	+2.8
Capital Spending	+0.8	+4.1	+2.5	-0.4	-3.0	-3.3
WL Equip. Spending	+6.8	+5.1	+0.1	-2.6	-2.8	-3.5
WFE	+6.7	+4.9	-0.2	-2.7	-2.7	-3.7
WL PAE	+8.9	+7.5	+2.2	-1.2	-4.2	-1.3
Silicon (MSI)	+3.6	+3.8	+4.4	+1.3	+1.6	+0.2

<sup>1</sup> Production revenue

<sup>2</sup> Excluding solar

Source for GDP data: IHS Global Insight, Jun 2015