China

Technology - Overall

China's semi industry – Entrusted with a mission

- Chine semi-related names outperformed other hardware names after the US put Huawei on the BIS Entity List on 17 May 2019.
- Rebuilding the supply chain is expected to offer growth opportunities for local semi names with strong R&D capability.
- The start of Science & Technology Innovation Board (S&T Board) in the near term is expected to boost sentiment on the listed (both HK & A-share) China semi names.
- The market will focus on both the design and manufacturing segments at this stage, but upstream names, especially in the materials segment, will gain market attention.
- We have updated the industry value chain and major players in China. The acquisitions made by A-share-listed names will attract market attention to the sector. We still prefer SMIC [0981.HK] over Hua Hong [1347.HK]. Shanghai Fudan's [1385.HK] FPGA development makes it interesting to investors.

China's semi industry expected to become the market focus again

China's semi industry was a major investment theme after the Chinese government released policies to boost the development of the industry, especially through the direct participation of the China IC fund. However, because of weakness in downstream demand, global semi names, including HK- and A-share-listed names, were somewhat out of favour and under selling pressure in 2018. After the US Department of Commerce added Huawei Technologies Co Ltd (Huawei) and 70 affiliates to the BIS Entity List earlier this month, the China semi industry became the market focus again. There is no doubt that China semi names have been laggards compared to their global peers, owing partly to barriers to access to advanced technology and processes, and the effect on the supply chain. However, the escalating trade tension between China and the US is expected to result in a rebuilding of global electronics supply in China. We believe that China is more determined to build a local supply chain, especially its semi industry, with capacity moving out from China by both Chinese and non-Chinese companies. The rebuilding of the global supply chain will offer a huge growth opportunity for local semi names. Given the increasing demand for semiconductor products and low self-sufficiency rate, the Chinese government is actively promoting the local semiconductor industry value chain to reduce dependence on overseas companies. We can't rule out the possibility that the Chinese government will release policies to boost the development of the local semi industry. The China IC fund has been a major investor in China's local semiconductor companies. It can work as a collaboration coordinator among local semi names to navigate through the challenging environment. In general, China's semiconductor industry can be grouped into four categories: a) upstream, which includes mainly materials and equipment; b) fabless and design companies; c) midstream companies, which are manufacturers, especially foundries; and d) downstream companies, which focus mainly on packaging and testing.

Capital activity expected to gain market attention

The semiconductor industry is a key focus, as companies along the supply chain (raw materials, IC design and foundries) have filed applications for IPOs on the S&T Board. Of these, National Silicon Industry Group Co. Ltd. (semiconductor materials), Montage Technology Co., Ltd. (IC design) and Hejian Technology (semiconductor foundry) are sizable IPOs on the S&T Board. Based on latest news flow, the listing committee will evaluate the IPO of Anji Microelectronics in early Jun 2019. In our view, the kick-off of trading activity on the S&T Board should offer opportunities for HK-listed TMT names, including semi names by a) unlocking value through spin-offs, b) dual-listings, and c) valuation benchmarks. Acquisitions by Unigroup Guoxin [002049.CH], WingTech Technologies [600745.CH] and Will Semi [603501.CH] will attract market attention to the sector, as the acquisition targets are leading players in their respective industries.

Foundries expected to continue to outperform in the near term

Since most listed companies in Hong Kong focus on manufacturing, foundries, especially SMIC and Hua Hong, will remain the focus of the market regarding China's semi industry investment theme. Investors are likely to turn their attention increasingly to other semiconductor-related markets, like fabless, and testing and packaging, so we provide an update on the industry value chain and major players in China. We still prefer SMIC over Hua Hong, as SMIC is migrating to a more advanced node to narrow the gap between the leading players. The market is looking at N+1 technology as a game changer for SMIC. Shanghai Fudan's FPGA development makes it looking interesting to investors, as FPGA is one of the sub-segments which is controlled mostly by overseas players such as Xilinx and Intel.

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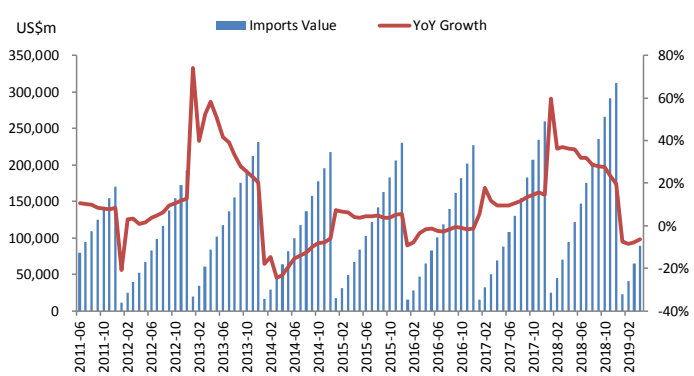
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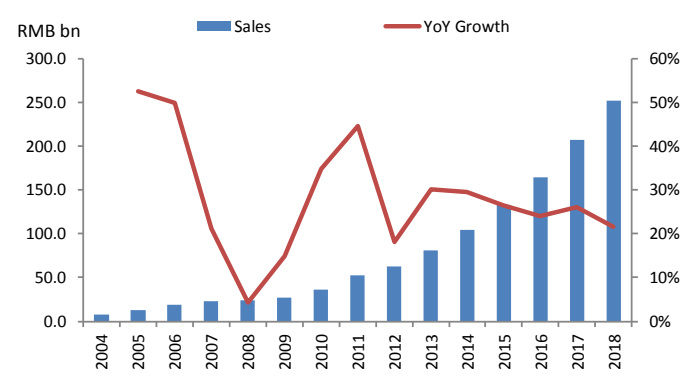
China is a major importer of semis

China reported strong growth in imports of semis in the past several years, but reported a YoY drop of 6.5% in Jan–Apr 2019.



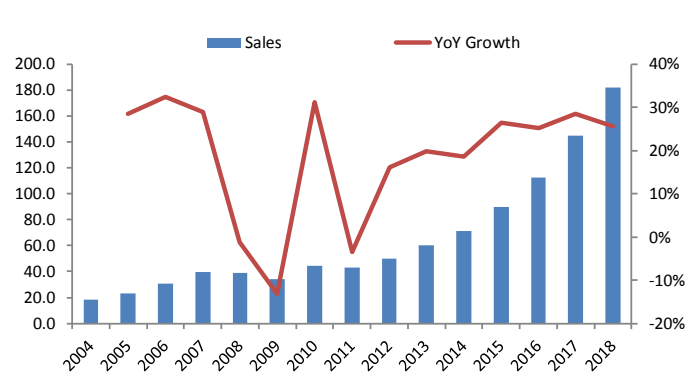
Fast-growing IC design segment

China's IC design sub-segment reported a CAGR of 27.4% in 2010–2018.



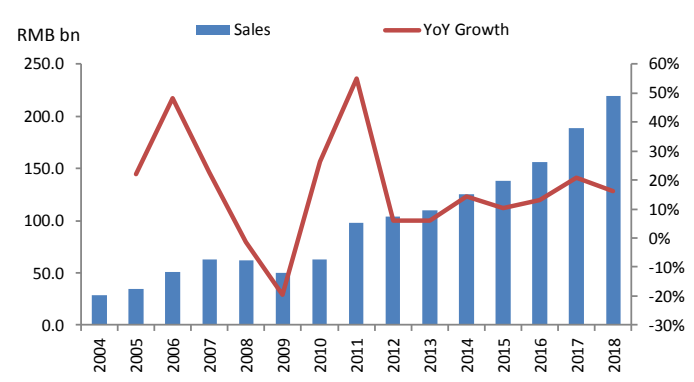
Manufacturing reported steady growth

The manufacturing segment, including foundries, reported steady turnover at a CAGR of 19.2% in 2010–2018.



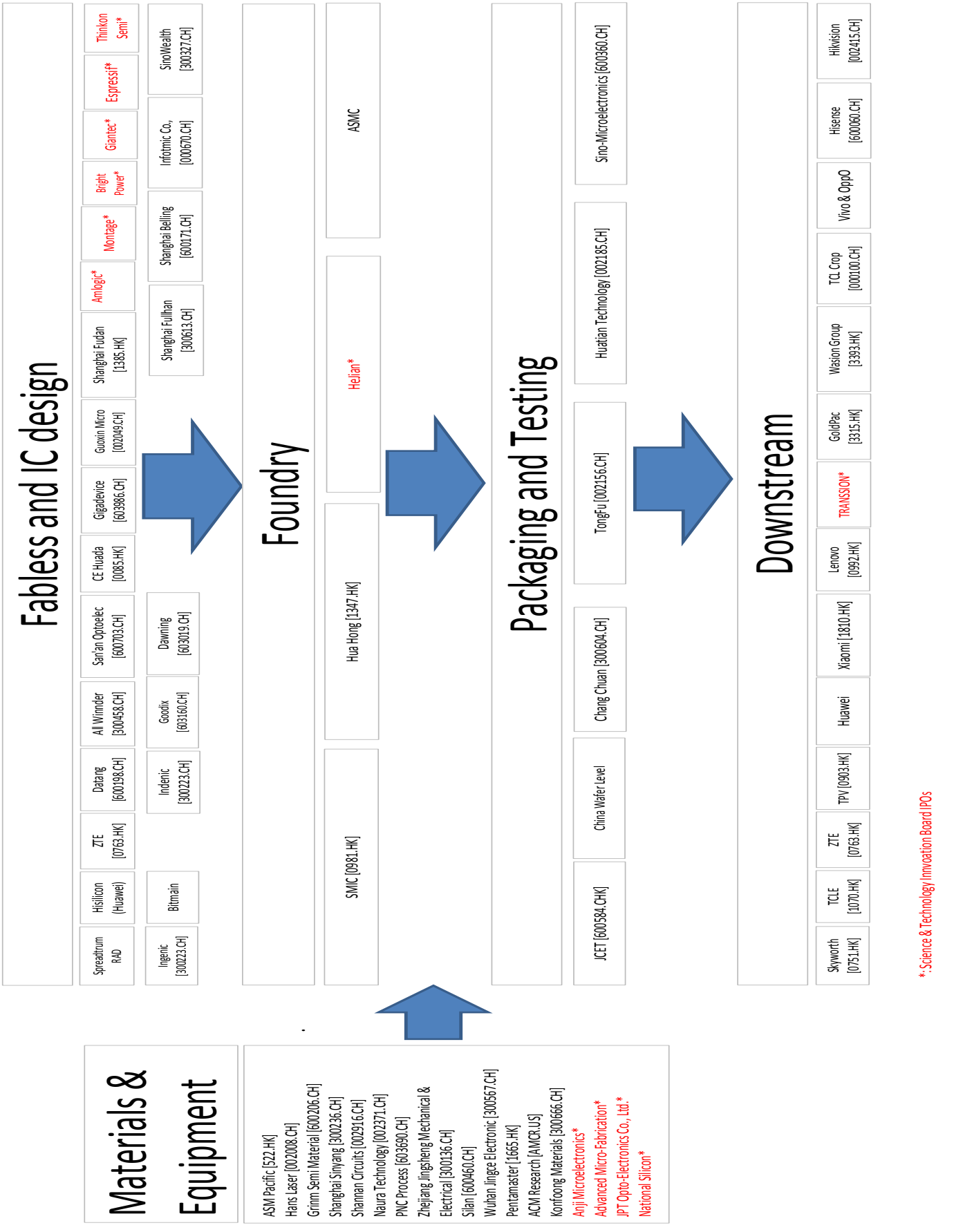
OSAT reported the slowest growth

The OSAT segment reported slower turnover at a CAGR of 18.9% in 2010–2018.



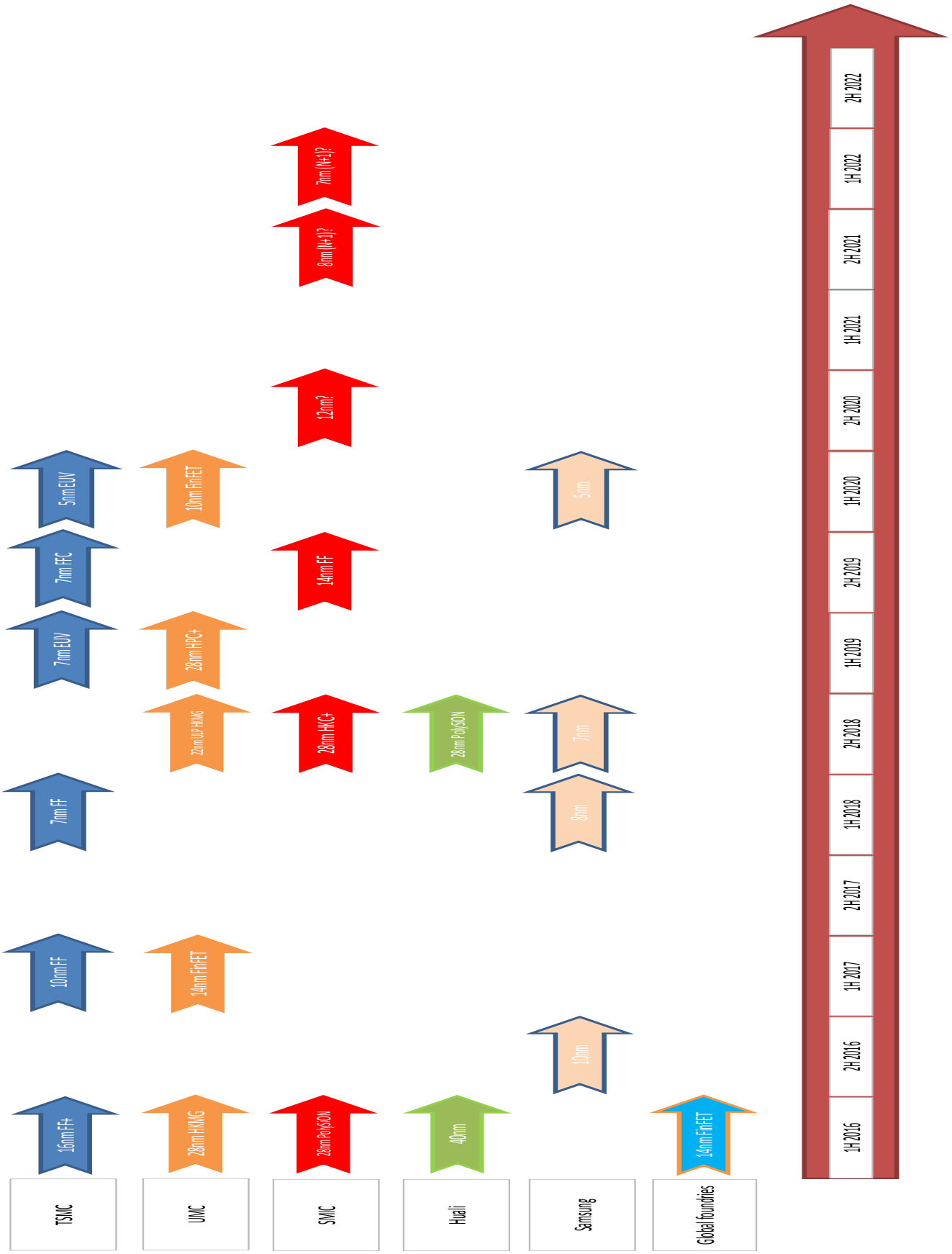
SOURCES: WIND, HIS, CGIS RESEARCH, COMPANY DATA, BLOOMBERG

Figure 1: China's semi supply chain



SOURCES: COMPANY DATA,CGIS RESEARCH, COMPANY DATA, BLOOMBERG

Figure 2: Technology roadmap of leading foundries



SOURCES: WWW.DIGITIEMS.COM, CGIS RESEARCH, COMPANY DATA, BLOOMBERG

Semiconductor industry overview

China's share of the worldwide semiconductor industry is continuing to grow and become significant. The revenue of China's IC design market increased from RMB8.2bn in 2004 to RMB251.9bn in 2018, for a CAGR of 27.8%. Total sales of China's IC manufacturing companies increased from RMB18.1bn in 2004 to RMB181.8bn in 2018, for a CAGR of 17.9%. The OSAT market generated total sales of RMB219.4bn in 2018, up from RMB15.8bn in 2014, for a CAGR of 15.8%. Comparing these three major markets, we note that the fabless market experienced the most rapid growth since 2010, followed by manufacturing, and then OSAT. China's semiconductor consumption growth continued to far exceed worldwide semiconductor market growth for the sixth consecutive year. The trade deficit for integrated circuits (ICs) was US$165.7bn in 2016. In general, the IC market is the major product segment, accounting for over 81.0% of the global semiconductor industry in 2016. The complete semiconductor industry chain, including dozens of processes, can be broadly divided into three categories: a) design, b) manufacturing, and c) packaging and testing, as well as IC equipment manufacturing, production of key materials, and other related support industries.

Upstream – fabless companies

In recent years, China's fabless players have been increasing their market share of the smartphone application processor (AP) market and some other niche chipset markets, such as CMOS image sensors (CIS) and fingerprint ICs. China's IC design market has experienced rapid growth since 2016, driven mainly by a) increasing demand for semiconductor products in many areas, like smartphones, 5G and NB-IoT; b) increasing investment from government funds; and c) positive government policies to encourage localization of the IC design market. China's IC design market has made constant progress in developing more advanced products. For example, HiSilicon has adopted 7nm technology in its high-end models of mobile phones. But because of the high technology barriers and large initial investment, there still is a gap between local IC design companies and overseas players. The capacity of high-end IC designs still cannot meet domestic needs, and the major product focus is mainly on mid- to low-end markets.

Major fabless companies in China

HiSilicon is a China-based fabless semiconductor company in Shenzhen, fully owned by Huawei. The Company focuses mainly on developing and manufacturing system-on-chip (SoC), based on ARM processors. Currently, HiSilicon is one the largest IC design companies in China. Its total revenue was US$7,573m in 2018, up 34.2% YoY; approximately 90% of its total revenue was generated from Huawei.

Bitmain is a privately owned company, engaged primarily in developing and selling bitcoin miners using the Company's ASIC chip technology. The Company also operates Antpool, which is one of the world's largest bitcoin mining pools.

Unigroup Spreadtrum RDA is a mobile-design subsidiary of Tsinghua Unigroup. The company ranked second in China's top 10 IC design companies in 2018.

Sanechips (ZTE Microelectronics), a subsidiary of ZTE [763.HK], is engaged mainly in IC design and verification technologies for communication chipsets. It is currently targeting chipsets for NB-IoT and the 5G network.

Unigroup Guoxin [002049.CH] is one of the largest domestic listed companies for IC design in the semiconductor industry. The Company focuses mainly on the development of smart card chips, special industry ICs, field-programmable gate arrays (FPGA) and memory chips. Its revenue in 2018 was RMB2,458.42m, up 34.4% YoY. Its revenue in Q1 2019 was RMB669.14m, up 29.8% YoY.

Shenzhen Goodix [603160.CH] is the largest IC design company in China by market cap. The Company mainly develops, manufactures, and distributes capacitive touch controller chips. Its revenue in 2018 was RMB3,721.29m, up 1.1% YoY. Its revenue in Q1 2019 was RMB1,224.79m, up 114.4% YoY.

Dawning Information Industry Co., Ltd [603019.CH] is engaged mainly in the provision of information technology services. The Company's major focus is on R&D and manufacturing of high-performance computers, storage and other related products. Its revenue in 2018 was RMB9,056.88m, up 43.9% YoY. Its revenue in Q1 2019 was RMB2,242.09m, up 52.6% YoY.

Ingenic Semiconductor Co., Ltd [300223.CH] is a fabless technology company, which focuses mainly on designing embedded CPU products for mobile and consumer SOC applications in China. The company provides application processors and CPU technology products for smart IoT, smart videos and smart wearables. Its revenue in

2018 was RMB259.67m, up 40.8% YoY. Its revenue in Q1 2019 was RMB49.00m, up 25.0% YoY.

Nationz Technologies [300077.CH] is a China-based company, which designs ICs and chips. The Company's major products include secure storage chips, trusted computing chips, mobile payment chips, communication interface chips, and radio frequency communication chips. Its revenue in 2018 was RMB602.06m, down 13.4% YoY. Its revenue in Q1 2019 was RMB85.95m, down 56.0% YoY.

Infotmic Co.,Ltd [000670.CH] is an IC design company, which focuses mainly on R&D of mobile internet terminal application processor chips. In Q3 2017, the Company's total revenue was RMB43.3m, down 37.9% YoY. Its revenue in 2018 was RMB102.58m, down 57.4% YoY, and revenue in Q1 2019 was RMB0.76m, down 97.7% YoY.

Gigadevice Semiconductor [603986.CH] designs, manufactures, and sells in the global market flash chips, including NOR, NAND, and other IC products. Its revenue in 2018 was RMB2,245.79m, up 10.6%. Its revenue in Q1 2019 was RMB456.34m YoY, down 15.7% YoY.

Sino Wealth Electronic Limited [300327.CH] designs and sells IC products and provides after-sales and technical services. The Company's major products are micro-control units, which are used in various end products, such as household appliances and automotive electronics. Its revenue in 2018 was RMB757.71m, up 10.5% YoY. Its revenue in Q1 2019 was RMB173.76m, down 11.0% YoY.

Shanghai Fullhan Microelectronics [300613.CH] is engaged principally in R&D and sales of digital signal processing (DSP) chips. The Company's major products include security video monitor multimedia processing chips and digital interface modules. Its revenue in 2018 was RMB412.00m, down 8.3% YoY. Its revenue in Q1 2019 was RMB92.33m, up 7.0% YoY.

Shanghai Belling [600171.CH] designs, develops, manufactures and sells IC-related products for telecommunications and multi-media systems. The Company also produces silicon chips and other electronic components. Its revenue in 2018 was RMB784.34m, up 39.6% YoY. Its revenue in Q1 2019 was RMB186.32m, up 13.2% YoY.

All Winner Technology [300458.CH] is a fabless design company dedicated to smart application processors SoCs and smart analogue ICs. Its revenue in 2018 was RMB1,364.69m, up 13.6% YoY. Its revenue in Q1 2019 was RMB325.94m, up 10.5% YoY.

China Electronics Huada Technology Company Limited [0085.HK] designs, develops, manufactures and sells electronics products and components. The company offers products and services for computer and core computer parts, software and systems integration, telecommunications, and consumer electronics. Its revenue in 2018 was HK$1,687.00m, up 16.1% YoY.

Solomon Systech Limited [2878.HK] designs, develops and sells IC products and system solutions. Its products include consumer electronics, wearables, portable devices and industrial appliances. Its revenue in 2018 was US$98.15m, up 19.0% YoY.

Shanghai Fudan Microelectronics Company [1385.HK] is engaged principally in IC-related businesses. The Company operates in two business segments: a) the design, development and sales of IC products, and b) the provision of testing services for IC products. Its revenue in 2018 was RMB1,409.63m, down 0.8% YoY.

OmniVision Technologies was acquired by Will Semi [603501.CH] for more than US$2bn Will Semi, established in May 2007, is a semiconductor device and mixed-signal IC design house.

Amlogic (Shanghai) Co., Ltd. manufactures semiconductor products. The company produces fabless semiconductors, semiconductor integrated circuit chips, and other products. Amlogic (Shanghai) supplies its products in set top boxes, smart televisions, smart home products, and other fields.

Montage Technology Group Limited designs, develops, and markets analogue and mixed-signal semiconductor solutions for the home entertainment and cloud computing markets in China and internationally. It offers semiconductor solutions with customized software and support for set-top boxes; semiconductor solutions for cable, satellite, and terrestrial set-top boxes; digital TV products for satellite and terrestrial applications; and memory interface solutions to increase the memory capacity and throughput speed of

the data centres in the cloud computing environment.

Shanghai Bright Power Semiconductor Co., Ltd. manufactures and distributes semiconductor products. The company produces crystal diodes, unijunction transistors, field effect transistors, and other related products. Shanghai Bright Power Semiconductor manufactures lighting driver chips and motor drive products.

Giantec Semiconductor, Inc., a fabless company, engages in the R&D, manufacture, marketing and sales of EEPROM-related products, MCU products and smart cards.

Midstream – Foundries

SMIC [981.HK] is a key player in advanced node processes in China and one of the major beneficiaries of China's increasing domestic wafer consumption and domestic sourcing trend. Currently, the company provides different foundry services, ranging from 0.35 μm to 28 nm. We believe SMIC will be a major beneficiary of the development of local foundries in China, as it has the most advanced technology nodes of all Chinese foundries. Its revenue in 2018 was US$3,359.98m, up 8.3% YoY. Its revenue in Q1 2019 was US$668.90m, down 19.5% YoY.

Hua Hong [1347.HK] is engaged mainly in the manufacture and sales of semiconductor products. The Company's primary products include semiconductors on 8-inch wafers for specialty applications, e-non-volatile memory (eNVM) and power discrete applications. Its revenue in 2018 was US$930.27m, up 15.1% YoY. Its revenue in Q1 2019 was US$220.75m, up 5.1% YoY.

ASMC is a chip manufacturer, engaged primarily in the manufacture and sale of 5", 6" and 8" semiconductor wafers.

HeJian provides foundry services for the semiconductor industry in China. The company offers libraries for designs implemented with its process technologies from mature nodes to leading-edge processes; and enables designers and system developers to overcome SOC and time-to-market hurdles by providing access to third party IP blocks ready for integration into customer designs. As at February 1, 2013, HeJian Technology (SuZhou) Co., Ltd. operated as a subsidiary of United Microelectronics Corporation.

Downstream – OSAT

The OSAT companies in China have been consolidating capacity and expanding their technology portfolios through acquisitions and partnerships. Also, an increasing number of overseas fabless companies have transferred orders from local OSAT providers to their Chinese peers.

Major OSAT companies in China

Jiangsu Changjiang Electronic Technology [600584.CH] is a China-based company, which specializes in semiconductor packaging assembly and testing. The company provides various solutions, including wafer probes, package design, packaging assembly and test subcon. Its revenue in 2018 was RMB23,856.49m, up 0.0% YoY. Its revenue in Q1 2019 was RMB4,514.77m, down 17.8% YoY.

Tianshui Huatian Technology [002185.CH] is engaged primarily in the packaging and testing of IC products, and also provides LED products. The Company's IC packaging and testing products consist of dual in-line package (DIP) series, small out-line package (SOP) series, shrink small out-line package (SSOP) series, quad flat package (QFP) series and small out-line transistor (SOT) series products. Its revenue in 2018 was RMB7,121.71m, up 1.6% YoY. Its revenue in Q1 2019 was RMB1,711.33m, down 11.2% YoY.

TongFu Microelectronics [002156.CH] is a China-based company, which focuses mainly on packaging and testing of IC products. The Company provides various solutions, including wafer-level, flip chip, and ball grid arrays. Its revenue in 2018 was RMB7,222.86m, up 10.8% YoY. Its revenue in Q1 2019 was RMB1,653.68m, up 0.8% YoY.

China Wafer Level CSP [603005.CH] is a China-based company, which is engaged principally in packaging and testing in the sensor industry. The company's major products include image sensor chips, environment light sensor chips and MEMS. Its revenue in 2018 was RMB566.23m, down 9.9% YoY. Its revenue in Q1 2019 was RMB85.13m, down 39.7% YoY.

Support industries – equipment and raw materials

The semi equipment market can be grouped into four categories by technology process:

a) wafer manufacturing equipment; b) packaging equipment; c) testing equipment; and d) other equipment. Although it will take time for China's equipment vendors to minimize the technology gaps with their international peers, the overall equipment industry has experienced significant growth over the past few years. We expect China's equipment manufactures to continue to see meaningful growth because of a) positive policy support from the government; b) the localization trend; and c) funding support from the government. For raw material vendors, the major materials include silicon, photoresist, and so on. Silicon wafers are the key material for semiconductor manufacturing. The cost of silicon wafers accounts for about 39% of the total cost of semi materials in China.

Major equipment vendors

ASMPT [522.HK] is the leading supplier of semiconductor assemblies and SMT equipment globally. The Company's core business includes three major segments: a) back-end equipment; b) SMT solutions; and c) materials. Its revenue in 2018 was HK$19,550.59m, up 11.6% YoY. Its revenue in Q1 2019 was HK$3,660.02m, down 15.8% YoY.

Naura Technology Group [002371.CH] is engaged primarily in the R&D, manufacture and distribution of electronic process equipment and precision electronic components, and the provision of related technical services. The company's major products include etching equipment, PVD and CVD equipment, and cleaning equipment. Its revenue in 2018 was RMB3,323.85m, up 49.5% YoY. Its revenue in Q1 2019 was RMB707.94m, up 30.5% YoY.

Pentamaster International [1665.HK] is a Malaysia-based company and a spin-off of Pentamaster Corporation Berhad (PENT.MK). Pentamaster focuses mainly on automation technology and solutions in the semiconductor, telecommunications, automotive and consumer electronics sectors. Its revenue in 2018 was MYR417.10m, up 53.1% YoY. Its revenue in 2019Q1 was MYR116.67m, up 12.2% YoY.

Wuhan Jingce Electronics Group Ltd [300567.CH] is engaged mainly in manufacturing display testing equipment. Its revenue in 2018 was RMB2,535.71m, up 30.1% YoY. Its revenue in Q1 2019 was RMB567.83m, up 0.4% YoY.

Han's Laser Technology [002008.CH] focuses primarily on the R&D, production, and sales of laser processing equipment. The company offers laser engraving, marking and etching, laser welding, laser cutting, sub-surface engraving, laser display, and other machine models. In Q3 2017, the company's revenue was RMB3378.5m, up 81.0%YoY. Its revenue in 2018 was RMB11,029.49m, down 4.6% YoY. Its revenue in Q1 2019 was RMB2,126.09m, up 25.7% YoY.

ACM Research Inc [ACMR.US] is a U.S based company, which is engaged mainly in the development of wet processing technology and products for the semiconductor industry. The company specializes in equipment for a range of applications in IC manufacturing and wafer level packaging, focusing on cleaning technologies for semiconductor devices. Its revenue in 2018 was US$74.64m, up 104.5% YoY.

Major materials providers

Zhejiang Jingsheng Mechanical & Electrical Co., Ltd [300316.CH] is in the business of the R&D, manufacture and sales of crystalline silicon growing equipment. The company's major products include automatic single crystal growth furnaces, polycrystalline silicon ingot furnaces, and sapphire crystal furnaces. Its revenue in Q1 2019 was RMB567.83m, up 0.4% YoY.

Shanghai Sinyang Semiconductor Materials [300236.CH] focuses mainly on water processing, packaging and post-packaging treatment for the semiconductor industry. Its major products include traditional semiconductor packaging, semiconductor manufacturing and advanced packaging, and aerospace aircraft electronic component chemical materials . Its revenue in 2018 was RMB559.63m, up 18.5% YoY. Its revenue in Q1 2019 was RMB130.57m, up 15.8% YoY.

Grinm Semi Materials [600206.CH] designs, produces and markets rare earth products, high and ultra pure metal, and optoelectronic materials. It is also engaged in the R&D, production and sales of photoelectric materials, infrared optics/fibre optic materials, and medical equipment materials. Its revenue in 2018 was RMB4,767.91m, up 16.9% YoY. Its revenue in Q1 2019 was RMB1,602.61m, up 59.5% YoY.

Shennan Circuits [002916.CH] is engaged in the R&D and manufacture of high-end printed circuit boards (PCBs), high-density and multi-layer packaging base plate, and electronic assembly. Its revenue in 2018 was RMB7,602.14m, up 33.7% YoY. Its

revenue in Q1 2019 was RMB2,162.87m, up 46.4% YoY.

Konfoong Materials International [300666.CH] is engaged mainly in the manufacture and sales of ultra-high purity metal materials and sputtering target materials for ultra-large-scale integrated circuit chip manufacturing. Its revenue in Q1 2019 was RMB166.61m, up 20.2% YoY.

Anji Microelectronics Technology (Shanghai) Co., Ltd. manufactures semiconductor products. The company produces copper barriers, integrated circuits, wafer level packages, light emitting diodes, and other products. Anji Microelectronics Technology (Shanghai) markets its products throughout China.

National Silicon Industry Group, through its subsidiaries, manufactures semiconductor materials and equipment. The company was founded in 2015 and is based in China.

Other related companies

Zhuhai Orbita Aerospace Science & Technology [300053.CH] is engaged in manufacturing aerospace chips, embedded bus controller chips, embedded modules, integrated circuits, embedded intelligent platforms, and other products.

SG Micro Corp. [300661.CH] focuses mainly on manufacturing and distributing semiconductor products in China. The company specializes in analogue and mixed-signal IC design, LED flash drives, colourful breathing lights, high-speed low power comparators, power management ICs, and other products. In Q3 2017, the company's revenue was RMB144.5m, up 20.7% YoY.

Goke Microelectronics [300672.CH] is a chip manufacture in China. The company produces decoding, high definition, high-end audio, solid state storage control, and security monitoring chips. In Q3 2017, the company's total revenue was RMB58.4m, up 147.7% YoY.

Shanghai Fortune Techgroup [300493.CH] is engaged in the R&D and production of semiconductor chips for the communications industry. It offers sensors, sensor interfaces, and power management and wireless ICs for the consumer, industrial, medical, mobile communication, and automotive markets.

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SELL	:	share price will decrease by >20% within 12 months in absolute terms
HOLD	:	no clear catalyst, and downgraded from BUY pending clearer signal to reinstate BUY or further downgrade to outright SELL

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