

May 12, 2020 09:00 PM GMT

## Global Semiconductors | Asia Pacific

# Potential impact if further restrictions are put on Huawei's semiconductor supply

HiSilicon is at the core of Huawei's local semiconductor supply for advanced chips, such as 5G, AI, and surveillance. We address the potential impact on the semi supply chain if it were to be further restricted.

## **Investor concerns have been raised again since late April on Huawei's export ban:**

We have written previously ([link](#)) on the potential change in US export policy (i.e., the 'de minimis rule' and the 'direct product rule') in the past few months – and there has been a step forward. On April 28, the US Commerce Department posted a draft of three new rules to further control exports of US technology to countries including China. That covers semiconductor supply that could be used for military purposes even under a civil entity. The grace period of the above rules should be 30-60 days, but that has led to investor concerns on potential disruption of Chinese companies, e.g., Huawei.

## **Huawei's captive design house, HiSilicon, is currently supplying advanced chips internally:**

Under current export restrictions, Huawei can still produce telecom equipment and smartphones, since: 1) US semi vendors may apply for the de minimis exception, as China's growth in 5G communication remains a key business opportunity; 2) for those chips restricted to supply (e.g., Xilinx's high-end FPGA), Huawei can design its own chips and produce them at TSMC. Tighter export control on only HiSilicon (vs. on the whole Huawei group) would have a different impact on the global semi supply chain, because Huawei's demand could continue – Huawei would just have to use third-party chips.

**1) Potential impact on US semis:** A HiSilicon ban would likely be most negative for the foundry supply chain (notably, equipment stocks such as AMAT, KLA and LRCX) and companies that have maintained high shipments to Huawei under the de minimis exception (MU, QRVO, TXN). In a narrow sense, a HiSilicon ban could be positive for companies that would stand to benefit from any resulting Huawei share loss, including ADI, Xilinx and Marvell in infrastructure, QCOM in smartphone chipsets, and Avago, Qorvo and Skyworks in RF.

**2) Potential impact on Greater China semis:** TSMC, WIN Semi and KYEC are key foundry suppliers to HiSilicon. MediaTek (smartphone chips), SMIC (local foundry) and Realtek (networking chips) might see short-term gains. ACMR (equipment) and China IC design firms could benefit from China semi localization.

**3) Potential impact on non-US/China semis:** [Exhibit 1](#) lists global semi makers that could be affected by a HiSilicon ban. STMicro, Samsung, SEMCO, Renesas, Rohm might benefit; Advantest and Hynix might see short-term impacts.

## MORGAN STANLEY TAIWAN LIMITED+

**Charlie Chan**  
EQUITY ANALYST  
Charlie.Chan@morganstanley.com

+886 2 2730-1725

## MORGAN STANLEY &amp; CO. LLC

**Joseph Moore**  
EQUITY ANALYST  
Joseph.Moore@morganstanley.com

+1 212 761-7516

**Michael D Zezas, CFA**  
STRATEGIST  
Michael.Zezas@morganstanley.com

+1 212 761-8609

## MORGAN STANLEY ASIA LIMITED+

**Shawn Kim**  
EQUITY ANALYST  
Shawn.Kim@morganstanley.com

+852 3963-1005

## MORGAN STANLEY &amp; CO. LLC

**Craig Hettenbach**  
EQUITY ANALYST  
Craig.Hettenbach@morganstanley.com

+1 212 761-6435

## MORGAN STANLEY MUFG SECURITIES CO., LTD.+

**Kazuo Yoshikawa, CFA**  
EQUITY ANALYST  
Kazuo.Yoshikawa@morganstanleymufg.com

+81 3 6836-8408

## MORGAN STANLEY &amp; CO. INTERNATIONAL PLC+

**Dominik Olszewski, CFA**  
EQUITY ANALYST  
Dominik.Olszewski@morganstanley.com

+44 20 7425-7238

## MORGAN STANLEY TAIWAN LIMITED+

**Daniel Yen, CFA**  
EQUITY ANALYST  
Daniel.Yen@morganstanley.com

+886 2 2730-2863

**Jeff Hsu**  
EQUITY ANALYST  
Jeff.Hsu@morganstanley.com

+886 2 2730-2864



## Greater China Technology Semiconductors

Asia Pacific  
IndustryView

In-Line

Morgan Stanley does and seeks to do business with companies covered in Morgan Stanley Research. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of Morgan Stanley Research. Investors should consider Morgan Stanley Research as only a single factor in making their investment decision.

For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

+ = Analysts employed by non-U.S. affiliates are not registered with FINRA, may not be associated persons of the member and may not be subject to FINRA restrictions on communications with a subject company, public appearances and trading securities held by a research analyst account.

# 每日免费获取报告

1. 每日微信群内分享**7+**最新重磅报告；
2. 定期分享**华尔街日报、金融时报、经济学人**；
3. 和群成员切磋交流，对接**优质合作资源**；
4. 累计解锁**8万+行业报告/案例，7000+工具/模板**

申明：行业报告均为公开整理，权利归原作者所有，  
小编整理自互联网，仅分发做内部学习。

限时领取【行业资料大礼包】，回复“2020”获取

手机用户建议先截屏本页，微信扫一扫

或搜索公众号**“有点报告”**

回复<进群>，加入每日报告分享微信群



(此页只为需要行业资料的朋友提供便利，如果影响您的阅读体验，请多多理解)

## The potential short-term impact on global semis if the tighter ban on HiSilicon were to occur

TSMC and its US equipment/IP vendors are key enablers to HiSilicon. TSMC supplies several HiSilicon-designed infrastructure chips, such as FPGA, CPU, AI accelerators, ASICs, surveillance SoCs and high-end converters. These chips currently are not able to be produced by the local China foundry, SMIC, with insufficient yield and capacity. Semi equipment producers are indirect suppliers to HiSilicon through the wafer foundry fabs. Among the others, US origin equipment/technology vendors are most critical, and difficult to be totally replaced by Japanese vendors. EDA/IP are also core for chip design, but HiSilicon has acquired a term-license beforehand.

A further ban on Huawei or HiSilicon would result in different outcomes to the semi supply chain. The restriction on Huawei could cause market share loss at its main chip vendors, as Huawei may lose market share to other system brands such as Samsung and Apple.

Tighter export controls on only HiSilicon (instead of the whole Huawei group) would result in a different impact on the global semi supply chain, since Huawei could still produce systems by using non-HiSilicon vendors, for example, Xilinx in FPGA and MediaTek in 5G smartphone SoC. The general impact would be on the direct suppliers to HiSilicon (e.g., TSMC, WIN Semi, and KYEC), which would suffer revenue shortfalls, whereas HiSilicon's competitors (e.g., MediaTek) may gain share.

If the ban on HiSilicon occurs, global semi stocks that have higher exposure to HiSilicon projects could react negatively in the short term, while some others may benefit - see as Exhibit 1.

**Exhibit 1:** Potential beneficiaries within global semi supply chain (at least one-year time frame) in the scenario of HiSilicon restriction

Beneficiaries		Above-average risks	
Ticker	Company name	Ticker	Company name
<b>US</b>			
XLNX.O	Xilinx	LRCX.O	Lam Research
MRVL.O	Marvell	AMAT.O	Applied Materials
QCOM.O	Qualcomm	KLAC.O	KLA
ADI.O	Analog Devices	MU.O	Micron
AMBA.O	Ambarella	QRVO.O	Qorvo
<b>Europe</b>			
STM.PA	STMicro		
<b>Korea</b>			
005930.KS	Samsung	000660.KS	SK Hynix
009150.KS	Semco		
<b>Japan</b>			
6723.T	Renesas	6857.T	Advantest
6963.T	Rohm		
<b>China</b>			
0981.HK	SMIC		
ACMR.O	ACM Research		
603986.SS	GigaDevice		
<b>Taiwan</b>			
2454.TW	MediaTek	2330.TW	TSMC
		3105.TWO	WIN Semi
		2449.TW	KYEC
		3661.TW	Alchip

Source: Morgan Stanley Research

## US Semi implications (Joe Moore, Craig Hettenbach)

**In general - before discussing the HiSilicon restrictions - we have seen trade tensions as a negative for the US semiconductor group.** Short term, anxiety from the supply chain has resulted in Chinese companies building substantial buffer inventory. Intermediate term, it has pushed Chinese design win preference to European or Asian alternative to their US suppliers. And longer term, it has provided additional incentive for China to develop semiconductor self sufficiency.

In that sense, the escalation from HiSilicon restrictions, as well as any counter reaction from China, is a negative for the whole group, at a time where there are already significant fundamental challenges. US semiconductor stocks have been substantially and negatively impacted by the trade tensions of the last 18 months.

Having said that, there are a number of companies that could see some upside opportunities in the shorter term, as well as negatives. We would think about several categories of companies:

*Companies with high exposure to Huawei through various exceptions to the entity list rule*

*will be negatively impacted at the margin as Huawei's builids would likely contract:* Under the prior entity list restriction, several companies were able to maintain shipments to Huawei through the 75% de minimis exception. We would include here Micron, Texas Instruments, Qorvo, and Inphi. To be clear, though, most companies' forecasts have been given with a cautious view of Huawei's trajectory. Also, we note that the impact would be mitigated somewhat by demand at other customers - particularly for memory, where overall supply and demand would only have moderate impact.

*Companies that compete with HiSilicon, or that have high exposure to Huawei competitors, should benefit.* Companies that directly compete with HiSilicon include Qualcomm, Ambarella, and more recently Xilinx. Companies with high exposure to non Huawei base station vendors, such as Xilinx and Marvell, would also benefit. Qualcomm also is not currently collecting royalties from Huawei, so a share shift to competitors would be helpful. Ambarella would also be a direct beneficiary, given that HiSilicon is their primary competition in high end surveillance computer vision chips, and increasingly in autos as well.

*Companies in the foundry supply chain:* Applied Materials, KLA, and Lam Research could all be negatively impacted by potentially weaker foundry, as highlighted by our foundry team. Having said that, we would note that with front half loaded foundry spending budgets, this will be less of a factor in 2H.

**Semicap companies such as AMAT, LRCX and KLA would be negatively impacted indirectly as HiSilicon is one of TSMC's largest customers.** HiSilicon has been one of the large contributors to the strength in the logic WFE market that has buoyed semicap companies over the last 12 months. If HiSilicon was no longer able to purchase silicon from TSMC it would pressure semicap companies and would have outsized impact on those with most logic exposure such as KLA. Longer term if China's domestic chipmaking capabilities were accelerated it could produce some offsetting benefit assuming there were no further restriction on equipment sales to domestic Chinese companies.

**In RF (radio frequency),** we think US suppliers (AVGO, QRVO, SWKS) remain well positioned at the high-end and in particular leadership in integrated modules, although we recognize increasing risk in the mid end. Huawei has been an important growth driver for Qorvo, representing 10% of revenue for Qorvo in the December 2019 quarter and averaging over mid single digits the last 3 quarters.

## European Semi implications (Dominik Olszewski)

**European chipmakers are potential interim beneficiaries of the centre of gravity for the supply chain moving eastwards.** If restrictions on export of US chips to China increase, depending on the exact shape of restrictions put in place, European chipmakers stand able to meet some of this Chinese demand. Market share where Europeans could prosper (where there is also meaningful US presence) include: microcontrollers, discretes and some sensor technologies. This would be particularly relevant for the likes of STM. The upside from potential design wins with Chinese customers are not baked into future estimates, nor do we think the current multiples reflect optionality on this mid-term theme. We have written about this longer-term potential "De-Americanisation" theme [in more detail here](#).

**Recent reports also mention a more specific tie-up involving STM.** Nikkei reported (28 April) that Huawei is working with STMicroelectronics to co-design mobile and automotive-related chips. The article talks about the potential for such an arrangement to "shield [Huawei] from Washington's possible tightening of export restrictions", as well as accelerating the company's progress in autonomous driving. Such a collaboration is said to bring the benefit of enabling Huawei to secure access to the latest development software.

**Regarding the potential policy decisions around Huawei, the STM CEO, Jean-Marc Chery, said** (at 1Q20 results - on 22 April): policy proposals are "*linked to technology with a metal pitch below 80nm, which potentially affect technology like a 14nm FinFET and below. And you know ST strategy on personal Electronics is to focus on subsystem like sensor, specialized imaging sensor, secure solution, analog, RF, mixed signal and power management, And all this technology is enabled with a metal pitch well above 80nm. So intrinsically, ST will not be impacted.*" However, he also added "*I cannot forecast...what will be the overall impact if such a measure will occurs.*"

## Japan Semi implications (Kazuo Yoshikawa)

### Above-average risk

Advantest: We estimate HiSilicon (including its OSATs) represented a high single digit percentage of Advantest's revenues in 2019.

### Potential beneficiaries

If restrictions on exports of US chips to China increase, Japanese chipmakers such as Renesas Electronics and Rohm may benefit from share gains in microcontrollers, battery management and other analog IC markets.

In the case of stricter controls, it is probably impossible to build a wafer fab without the support of AMAT and LAM. TEL cannot replace some of the differentiated processes served by US companies.

## Korea Tech implications (Shawn Kim)

Huawei is a large customer for both Hynix (~15% of revenue) and Samsung (~10% of memory revenue).

**Samsung:** We don't think HiSilicon can divert HPC to a Samsung foundry either given the US semi equipment supply. Huawei is 3% of total exposure mainly from memory. But could take high-end smartphone and 5G network equipment share from Huawei if that is included, as well as OLED panel share from non-Huawei Chinese smartphone OEMs. Samsung can benefit from smart share upside to non-Huawei Chinese customers in smartphones/networks. Samsung's revenue from the component business and iPhone OLED should also increase.

**SK Hynix:** The implication is slightly negative, given its high revenue exposure to Huawei, if Huawei were to experience some semi supply hiccup.

**Samsung Electro-Mechanics** has 20% MLCC revenue (~10% of total revenue) exposure to non-Huawei Chinese smartphones and should benefit.

## Greater China Semi implications (Charlie Chan, Daniel Yen)

Foundry vendors to HiSilicon have asked for a commitment for the placed orders, therefore, the revenue stream can still last for another quarter or two. But if the restrictions continue and Huawei starts to lose market share after running out of backlog, it could create some order shifts in 2021.

### Above-average risk:

**TSMC:** HiSilicon (Huawei's subsidiary) accounts for 15%-20% of TSMC's revenue, and it is one of the most aggressive users of TSMC's leading edge capacity. After the Huawei order backlog runs out, TSMC may suffer a few quarters of slower growth.

**WIN Semi:** 100% of HiSilicon's GaAs PA is produced by WIN Semi. HiSilicon accounts for 15% of revenue.

**KYEC:** Huawei's infrastructure chips account for 25% of company's revenue. The company does the final tests for ASIC, RF, AI accelerator, CPU, FPGA, and other networking chips.

**Alchip:** the company takes a 7nm CPU design service for China's HPC customer, which accounts for 10% of Alchip's revenue.

### Potential beneficiaries

**SMIC:** Huawei may try to shift some advanced semiconductor production to SMIC. However, SMIC's 14nm capacity is limited, and it is still not mature for most advanced chip production.

**MediaTek:** If Huawei is allowed to use third-party chips, MediaTek may benefit from the share gain. MediaTek currently supplies 30% of Huawei's smartphone chipset, mainly for low-end 4G phones.

**Realtek:** We think the company could benefit from market expansion (TV SoC and networking related chips) in China. Currently, Hisilicon is a strong competitor in TV SoC and STB controllers in China. The pricing environment could also be better as Hisilicon usually offers low prices.

**ACM Research:** China fabs may be more dependent on local equipment supply.

The exhibit below shows companies' exposure to the Huawei brand smartphone and networking system. This may serve as a source of sensitivity analysis if the ban is on Huawei instead of HiSilicon.

**Exhibit 2:** Global semi exposure to Huawei infrastructure and smartphone demand

Ticker	Total infrastructure exposure (2019e)			Total smartphone exposure (2019e)				Total Huawei
	Huawei Brand	Other brands	Total infra.	Huawei Brand	Other Android	Total Android	Apple iPhone	
<b>Greater China Semi Foundries</b>								
TSMC	2330.TW	5%	10%	15%	15%	10%	25%	20%
UMC	2303.TW				5%	30%	35%	0%
SMIC	0981.HK	10%	5%	15%	15%	15%	30%	0%
Win Semi	3105.TWO	5%	15%	20%	15%	15%	30%	40%
ASE	3711.TW	1%	4%	5%	10%	15%	25%	20%
Chipbond	6147.TWO				13%	15%	28%	7%
JCET	600584.SS	2%	3%	5%	10%	37%	47%	3%
CHPT	6510.TWO	5%	0%	5%	25%	25%	50%	20%
ASM Pacific	0522.HK	2%	3%	5%	10%	15%	25%	15%
KYEC	2449.TW	20%	5%	25%	5%	20%	25%	5%
<b>Greater China IC Design/IDM</b>								
Nanya Tech		10%	5%	15%	0%	13%	13%	0%
Will Semi	603501.SS	1%	0%	1%	25%	50%	75%	0%
Goodix	603160.SS				30%	68%	98%	0%
Novatek	3034.TW				15%	23%	38%	0%
MediaTek	2454.TW				3%	37%	40%	0%
SIMO	SIMO.O				3%	22%	25%	0%
Silergy	6415.TW				2%	3%	5%	0%
Egis	6462.TWO				0%	100%	100%	0%

Source: Morgan Stanley Research estimates

## Background of US semiconductor technology export controls

One year after Huawei was put on the US entity list, China's efforts in semi localization have been more successful than we had expected

Since Huawei was put on the US 'entity list' in May 2019, China semi localization has accelerated. The local semi alternatives got a chance to try to enter smartphone and infrastructure applications, although performance and cost are still not comparable to the US designs. Under the current export restrictions, Huawei can still produce telecom equipment and smartphones since: 1) US semi vendors still intend to supply to Huawei to participate in China growth in 5G, and 2) Huawei and other Chinese entities design their own chips which are allowed to be manufactured at advanced foundries like TSMC. We therefore think further tightening concerns from investors are valid.

**Exhibit 3:** 'National Security' sensitive projects: 5G communication, AI, surveillance

Date	China company	Business	Sanction
Apr-18	ZTE	Communication	Denial Order List
Oct-18	Fujian Jinhua	DRAM	Export embargo of components and software
May-19	Huawei	communication	Entity List
Jun-19	Sugon	Supercomputers / Datacenters	Entity List
	Hikvision Dahua Technology	Surveillance Surveillance	Entity List Entity List
Oct-19	IFLYTEK Megvii Sense Time	AI AI AI	Entity List Entity List Entity List

Source: US Department of Commerce, Morgan Stanley Research

## Why Huawei can still produce systems after being placed on the entity list a year ago

The 'de minimis rule' of a 25% threshold is too high, we believe, as semi vendors can shift their supply chain or IP source to suppliers that depend less on US technology exports.

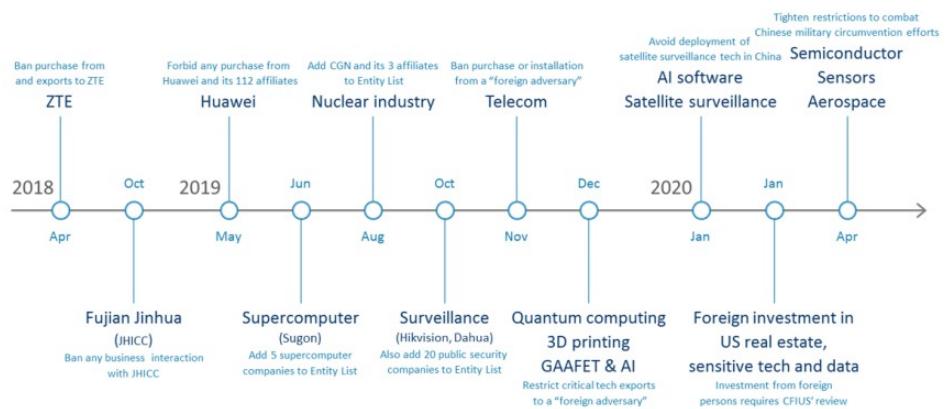
In our previous report, [TSMC: Tighter US technology exports: assessing the impact of this risk \(18 Feb 2020\)](#), we briefly discussed the implementation of the Direct Product Rule. That would require suppliers to Huawei to acquire a license from the US government. Because this rule applies to global vendors, not just TSMC, it is difficult to find a way to work around foundry supply for advanced chips.

## Recent US policy developments on technology exports to China

The exhibit below shows US technology controls introduced since 2018, which cover semiconductors, nuclear, telecoms, supercomputers, and even aerospace segments.

However, on April 28, according to [Nikkei Asian Review](#), "the US Commerce Department announced stricter controls on exports of American technologies to China, Russia and Venezuela to prevent their use in military applications. The new rules expand military end-use and end-user controls to cover items such as chip equipment, sensors and other technologies. They also remove a license exception for exports to civilian end-users in countries of national security concern, though it is not yet clear what if any impact this will have on trading activities with Huawei."

**Exhibit 4:** Time line of the US's technology export tightening



Source: Morgan Stanley Research

## HiSilicon is the core of Huawei's local semiconductor supply, while TSMC is the key enabler

HiSilicon is currently supplying Huawei's FPGA, CPU, AI accelerators, ASICs, and high-end converters, while its main foundry supplier is TSMC.

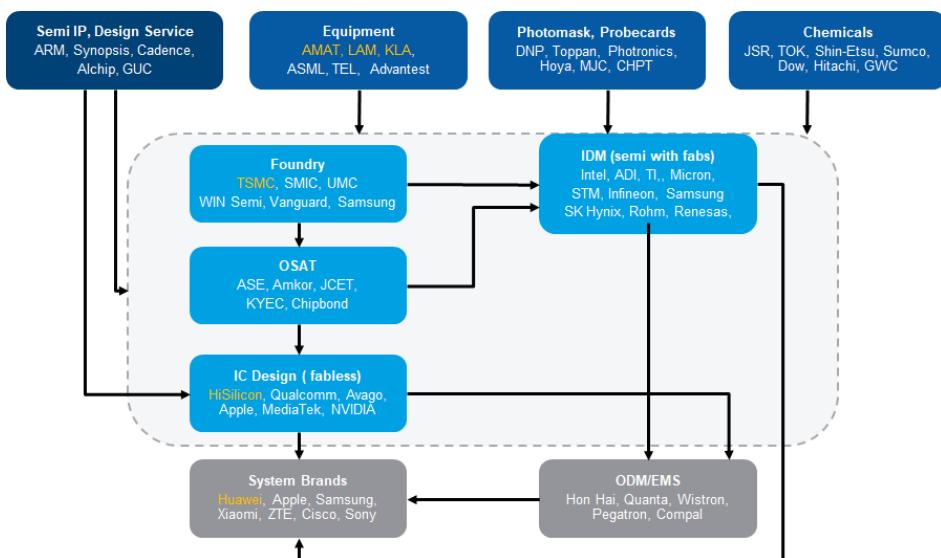
Some of TSMC's equipment/IP are supplied or originated from US vendors. For example, KLA for inspection tools, and ASML for lithography, are difficult to replace with Chinese local vendors and Japanese/European vendors. If the US were to reduce or stop the supply of critical equipment, it would be difficult for China to further migrate to a new generation, or expand its capacity.

China fabs still depend on the equipment supply and related maintenance services. In the Fujing Jinhua case, which was embargoed for equipment supply, the company could not further expand its capacity. In this case, China may need to consume its previously accumulated semi and system inventory, and need to use the local foundries' current capacity (such as SMIC, HLMC, and HHGrace) to produce older generation products which could be even less competitive.

**Exhibit 5:** The seven most critical vendors in China's semiconductor supply chain

Company	Ticker	Market Cap (US\$bn)	Location	Brief Description	Market Share (2018)
ASML	ASML.AS	115.8	Europe	Advanced lithography tools (EUV)	90%
ARM	Not listed	na	UK	ARM-based CPU core architecture	90%
WIN Semi	3105.TWO	3.9	Taiwan	GaAs foundry services for RF components	73%
KLA	KLAC.O	23.1	US	Inspection and process controlling tools	72%
TSMC	2330.TW	245.6	Taiwan	Advanced logic foundry services	56%
Infineon	IFXGn.DE	20.1	Europe	IGBT chip and power semis	29%
Synopsys	SNPS.O	20.4	US	EDA tools and IP	28%

Source: Gartner, Company Data, Morgan Stanley Research estimates

**Exhibit 6:** Global semiconductor supply chain flow chart

Source: Morgan Stanley Research

## Commentary by our US policy expert on Huawei, and by semiconductor vendors on the impact of the rule change

In the report, [US Public Policy Brief: Assessing COVID-19's Impact on US/China Trade \(6 May 2020\)](#), Morgan Stanley US Policy analyst Michael Zezas indicated that, "if the US were to impose further restrictions on the technology supplied to Chinese firms, Beijing could respond with some non-tariff measures on specific products."

We cannot predict the timing or possibility of a further Huawei ban, or the possibility of a response from China or the impact on the global economy. Instead, we quote industry association and related party commentary.

### SEMI (headquartered in the US)

"SEMI Warns Against New Unilateral U.S. Export Controls on Commercial Technology", "With U.S. producers accounting for roughly 40 percent market share, over \$21 billion in U.S. equipment sales to non-U.S. fabs could be affected." [SEMI Warns Against New Unilateral U.S. Export Controls on Commercial Technology](#), SEMI, March 3, 2020

### TSMC

TSMC said it shares the stance of SEMI, which urged the US government not to change the technology export rule (TSMC added that companies like TSMC should have a 30-day or 60-day grace period before the new export rule becomes effective, so it wouldn't be an immediate concern).

The company says it will comply with the new US rule if it becomes effective. TSMC and its customers have certified that their semiconductors are not for military usage.

# China semi localization to proceed further, to realize "self-controlled" semi technology

## Potential controls on semi technology sources, not just on chip production

There are indeed risks of a further tightening of US technology exports, for example, via potential restrictions on foundry suppliers producing advanced chips for Chinese companies, or a tighter review of equipment supplies to fabs that supply to the China market. However, our base case is to assume: 1) the restriction on US technology exports would focus more on national security, judging from the previous entity lists. Consumer-related products still follow market competition. 2) China will continue to build its own semi supply chain, in particular equipment, leading-edge foundries, memory, and infrastructure-related chip design. 3) In our base case, we see some duplication of semiconductor demand.

### **This assumes some dependency on US technology is still allowed**

The goal of China's semi localization is to replace imports of foreign designed/manufactured components, but the achievement of semi localization may still largely depend on US origin technologies, for both hardware and software. For China to achieve the bifurcation of technology, the full supply chain and ecosystem would need to decouple from US technology, either by developing the technology sources locally, and/or by depending on non-US technology vendors.

#### **1. National security-sensitive semis**

The most critical segment would be semiconductors that are related to China's infrastructure and national security, and which mostly depend on US vendors. For example, CPUs, GPUs, and memory for cloud data center servers. China's infrastructure indeed depends on power semis such as IGBTs and MOSFETs, but Europe and Japan account for 70% of global supply.

#### **2. China system brand semi consumption**

The second priority would be addressing demand from China's system companies, which can decide the source of the semiconductor supply. The products involved are non-sensitive semiconductor products, and we believe Chinese vendors will gradually realize self sufficiency. We estimate the TAM is around US\$100-120bn, by assuming that Chinese system companies consumed around 20%-25% of global semis in 2019.

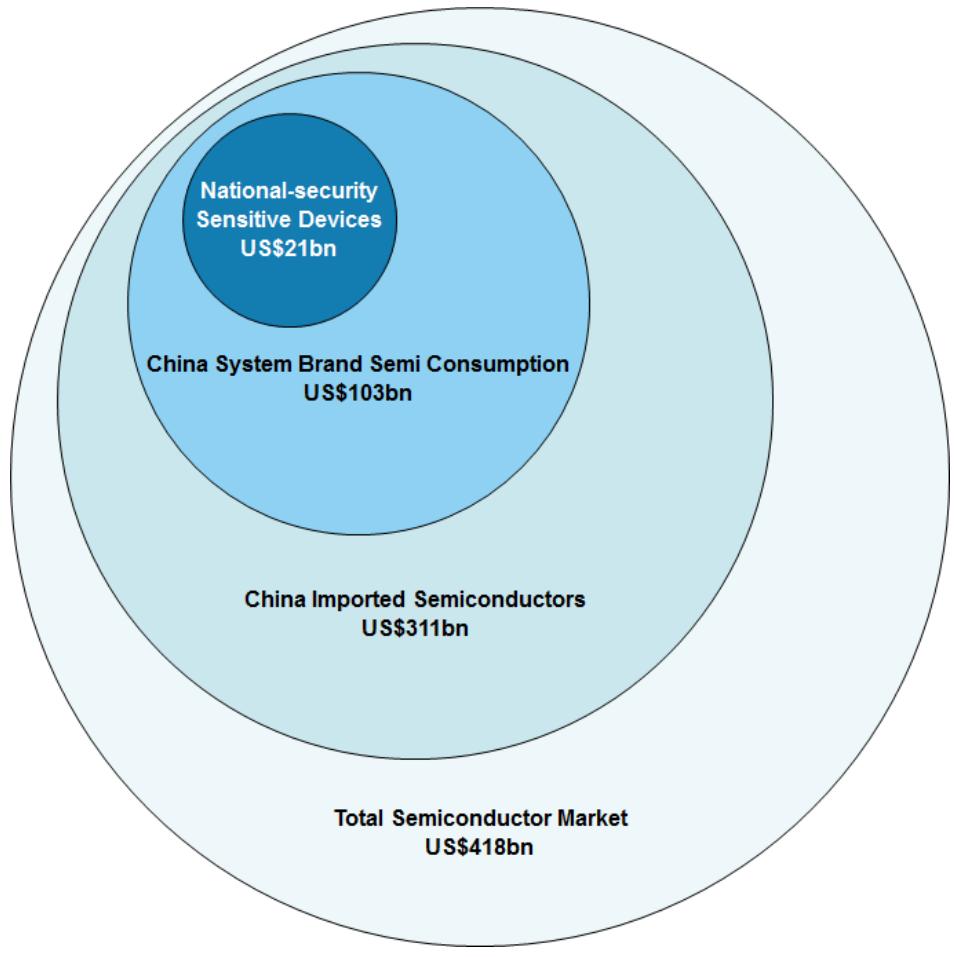
#### **3. China semi imports**

The last would be imports for semiconductor assembly. For example, the Apple processors and memory shipped to Foxconn. A certain portion of the semiconductor procurement can be decided by the factory that owns the system design capacity (or so-called ODM).

#### 4. Global semi total market size

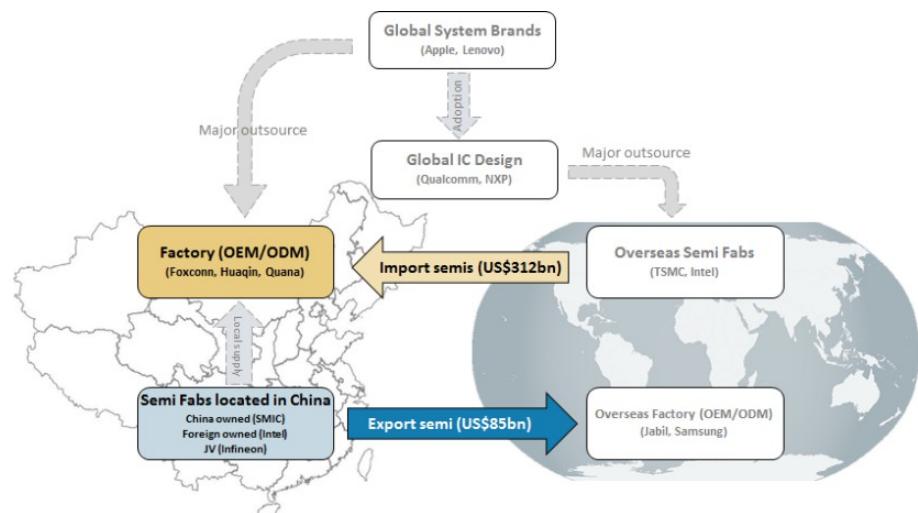
Some Chinese chip suppliers are able to supply to international brands, for example Will Semi and Goodix supply sensors to Samsung, while GigaDevice supplies NOR Flash to Apple Airpod. The TAM is the global semi industry revenue size of US\$418bn.

**Exhibit 7:** TAM for China Semis



Source: Gartner, Company Data, Morgan Stanley Research estimates

**Exhibit 8:** China imports US\$312bn in semis, but its own-brand system semi demand is only US\$100-102bn a year



Source: Gartner, Company Data, Morgan Stanley Research estimates

**Exhibit 9:** Few China IC design companies can supply to internal system brands

Company	Main Product	Global market share	China market share	Global brand customers
<b>Companies with global customers</b>				
Will Semi	CMOS image sensor	12%	24%	Samsung, LG
Goodix	Fingerprint sensor	60%	80%	Samsung
GigaDevice	NOR/MCU	15%	35%	Apple
Silergy	Analog IC	2%	4%	Samsung, Sony
<b>Companies without global customers</b>				
HiSilicon	Smartphone AP	11%	25%	
Spreadtrum	Smartphone AP	1%	4%	
Phytium	PC CPU	<1%	3%	
Bitmain	ASIC	4%	12%	
Canaan	ASIC	1%	2%	
Galaxy Core	CMOS image sensor	3%	5%	

Source: Gartner, Company Data, Morgan Stanley Research estimates for market share figures

## Share Prices

ACM Research Inc (ACMR.O): US\$53.84

Advanced Micro Devices (AMD.O): US\$55.74

Advantest (6857.T): JPY\$5,300

Alchip Technologies Ltd (3661.TW): NT\$280

Alibaba Group Holding (BABA.N): US\$205.4

Apple, Inc. (AAPL.O): US\$315.01

Applied Materials Inc. (AMAT.O): US\$54.01

ASM Pacific (0522.HK): HK\$81

ASMedia Technology Inc (5269.TW): NT\$918

ASML Holding NV (ASML.AS): €279.1

Broadcom Inc. (AVGO.O): US\$275.4

China Overseas Land & Investment Ltd. (0688.HK): HK\$26.2

Chipbond Technology Corp (6147.TWO): NT\$61.4

Epistar (2448.TW): NT\$39

GigaDevice Semiconductor Beijing Inc (603986.SS): Rmb220.38

Infeneon Technologies AG (IFXGn.DE): €17.81

Intel Corporation (INTC.O): US\$60.13

Jiangsu Changjiang Electronics Tech (600584.SS) Rmb26.51

King Yuan Electronics Co Ltd (2449.TW): NT\$36.45

KLA Corp (KLAC.O): US\$168.78

Lam Research Corp (LRCX.O): US\$262.23

Macronix International Co Ltd (2337.TW): NT\$35.9

Marvell Technology Group Ltd (MRVL.O): US\$26.34

Maxim Integrated Products Inc. (MXIM.O): US\$54.6

MediaTek (2454.TW): NT\$410

Microchip Technology Inc. (MCHP.O): US\$88.3

Micron Technology Inc. (MU.O): US\$48.2

Nanya Technology Corp. (2408.TW): NT\$64.7

NVIDIA Corp. (NVDA.O): US\$322.62

NXP Semiconductor NV (NXPI.O): US\$102.56

Phison Electronics Corp(8299.TWO): NT\$284

Qorvo Inc (QRVO.O): US\$101.9

Qualcomm Inc. (QCOM.O): US\$80.48

Renesas Electronics (6723.T): JPY\$590

Rohm (6963.T): JPY\$7,130

Samsung Electro-Mechanics (009150.KS): KW\$116,500

Samsung Electronics (005935.KS): KW\$41,500

Shin-Etsu Chemical (4063.T): JPY\$12,120

Silergy Corp. (6415.TW): NT\$1,365

SK Hynix (000660.KS): KW\$84,500

Skyworks Solutions Inc (SWKS.O): US\$110.41

SMIC (0981.HK): HK\$17.04

STMicroelectronics NV (STM.PA): €22.81

Texas Instruments (TXN.O): US\$114.88

Tokyo Electron (8035.T): JPY\$22,720

Toshiba (6502.T): JPY\$2,764

TSMC (2330.TW): NT\$301

Vanguard International Semiconductor (5347.TWO): NT\$70.2

Western Digital (WDC.O): US\$42.39

WIN Semiconductors Corp (3105.TWO): NT\$282.5

Xilinx (XLNX.O): US\$86.45

Share prices as of May 11, 2020



## Disclosure Section

The information and opinions in Morgan Stanley Research were prepared or are disseminated by Morgan Stanley Asia Limited (which accepts the responsibility for its contents) and/or Morgan Stanley Asia (Singapore) Pte. (Registration number 199206298Z) and/or Morgan Stanley Asia (Singapore) Securities Pte Ltd (Registration number 200008434H), regulated by the Monetary Authority of Singapore (which accepts legal responsibility for its contents and should be contacted with respect to any matters arising from, or in connection with, Morgan Stanley Research), and/or Morgan Stanley Taiwan Limited and/or Morgan Stanley & Co International plc, Seoul Branch, and/or Morgan Stanley Australia Limited (A.B.N. 67 003 734 576, holder of Australian financial services license No. 233742, which accepts responsibility for its contents), and/or Morgan Stanley Wealth Management Australia Pty Ltd (A.B.N. 19 009 145 555, holder of Australian financial services license No. 240813, which accepts responsibility for its contents), and/or Morgan Stanley India Company Private Limited, regulated by the Securities and Exchange Board of India ("SEBI") and holder of licenses as a Research Analyst (SEBI Registration No. INH000001105); Stock Broker (BSE Registration No. INB011054237 and NSE Registration No. INB/INF231054231), Merchant Banker (SEBI Registration No. INM000011203), and depository participant with National Securities Depository Limited (SEBI Registration No. IN-DP-NSDL-372-2014) which accepts the responsibility for its contents and should be contacted with respect to any matters arising from, or in connection with, Morgan Stanley Research, and/or PT. Morgan Stanley Sekuritas Indonesia and their affiliates (collectively, "Morgan Stanley").

For important disclosures, stock price charts and equity rating histories regarding companies that are the subject of this report, please see the Morgan Stanley Research Disclosure Website at [www.morganstanley.com/researchdisclosures](http://www.morganstanley.com/researchdisclosures), or contact your investment representative or Morgan Stanley Research at 1585 Broadway, (Attention: Research Management), New York, NY, 10036 USA.

For valuation methodology and risks associated with any recommendation, rating or price target referenced in this research report, please contact the Client Support Team as follows: US/Canada +1 800 303-2495; Hong Kong +852 2848-5999; Latin America +1 718 754-5444 (U.S.); London +44 (0)20-7425-8169; Singapore +65 6834-6860; Sydney +61 (0)2-9770-1505; Tokyo +81 (0)3-6836-9000. Alternatively you may contact your investment representative or Morgan Stanley Research at 1585 Broadway, (Attention: Research Management), New York, NY 10036 USA.

### Analyst Certification

The following analysts hereby certify that their views about the companies and their securities discussed in this report are accurately expressed and that they have not received and will not receive direct or indirect compensation in exchange for expressing specific recommendations or views in this report: Charlie Chan; Craig Hettenbach; Jeff Hsu; Shawn Kim; Joseph Moore; Dominik Olszewski, CFA; Daniel Yen, CFA; Kazuo Yoshikawa, CFA; Michael D Zezas, CFA. Unless otherwise stated, the individuals listed on the cover page of this report are research analysts.

### Global Research Conflict Management Policy

Morgan Stanley Research has been published in accordance with our conflict management policy, which is available at [www.morganstanley.com/institutional/research/conflictpolicies](http://www.morganstanley.com/institutional/research/conflictpolicies). A Portuguese version of the policy can be found at [www.morganstanley.com.br](http://www.morganstanley.com.br).

### Important Regulatory Disclosures on Subject Companies

As of April 30, 2020, Morgan Stanley beneficially owned 1% or more of a class of common equity securities of the following companies covered in Morgan Stanley Research: Advantest, Alchip Technologies Ltd, ASMedia Technology Inc, Aspeed Technology, King Yuan Electronics Co Ltd, MediaTek, Nanya Technology Corp., Parade Technologies Ltd, Realtek Semiconductor, Silergy Corp., STMicroelectronics NV, UMC, Universal Scientific Ind. (Shanghai), Vanguard International Semiconductor, WIN Semiconductors Corp, Xilinx.

Within the last 12 months, Morgan Stanley managed or co-managed a public offering (or 144A offering) of securities of Broadcom Inc., Micron Technology Inc.. Within the last 12 months, Morgan Stanley has received compensation for investment banking services from Broadcom Inc., Micron Technology Inc., Rohm. In the next 3 months, Morgan Stanley expects to receive or intends to seek compensation for investment banking services from Advantest, Applied Materials Inc., ASE Technology Holding Co. Ltd., Broadcom Inc., Infineon Technologies AG, KLA Corp, Lam Research Corp, Marvell Technology Group Ltd, MediaTek, Micron Technology Inc., Nanya Technology Corp., Qorvo Inc, Qualcomm Inc., Renesas Electronics, Rohm, Samsung Electro-Mechanics, Samsung Electronics, Shenzhen Goodix Technology Co Ltd, SK Hynix, Skyworks Solutions Inc, SMIC, STMicroelectronics NV, UMC, Xilinx.

Within the last 12 months, Morgan Stanley has received compensation for products and services other than investment banking services from Applied Materials Inc., ASE Technology Holding Co. Ltd., Broadcom Inc., Infineon Technologies AG, King Yuan Electronics Co Ltd, Marvell Technology Group Ltd, MediaTek, Micron Technology Inc., Montage Technology Co Ltd, Nanya Technology Corp., Novatek, Realtek Semiconductor, Silicon Motion, SMIC, UMC, Universal Scientific Ind. (Shanghai), Winbond Electronics Corp.

Within the last 12 months, Morgan Stanley has provided or is providing investment banking services to, or has an investment banking client relationship with, the following company: Advantest, Applied Materials Inc., ASE Technology Holding Co. Ltd., Broadcom Inc., Infineon Technologies AG, KLA Corp, Lam Research Corp, Marvell Technology Group Ltd, MediaTek, Micron Technology Inc., Nanya Technology Corp., Qorvo Inc, Qualcomm Inc., Renesas Electronics, Rohm, Samsung Electro-Mechanics, Samsung Electronics, Shenzhen Goodix Technology Co Ltd, SK Hynix, Skyworks Solutions Inc, SMIC, STMicroelectronics NV, UMC, Xilinx.

Within the last 12 months, Morgan Stanley has either provided or is providing non-investment banking, securities-related services to and/or in the past has entered into an agreement to provide services or has a client relationship with the following company: Applied Materials Inc., ASE Technology Holding Co. Ltd., Broadcom Inc., Infineon Technologies AG, King Yuan Electronics Co Ltd, Macronix International Co Ltd, Marvell Technology Group Ltd, MediaTek, Micron Technology Inc., Montage Technology Co Ltd, Nanya Technology Corp., Novatek, Qualcomm Inc., Realtek Semiconductor, Renesas Electronics, Silicon Motion, SMIC, TSMC, UMC, Universal Scientific Ind. (Shanghai), Winbond Electronics Corp, Xilinx.

Morgan Stanley & Co. LLC makes a market in the securities of Applied Materials Inc., ASE Technology Holding Co. Ltd., Broadcom Inc., KLA Corp, Lam Research Corp, Marvell Technology Group Ltd, Micron Technology Inc., Qorvo Inc, Qualcomm Inc., Silicon Motion, Skyworks Solutions Inc, TSMC, UMC, Xilinx.

The equity research analysts or strategists principally responsible for the preparation of Morgan Stanley Research have received compensation based upon various factors, including quality of research, investor client feedback, stock picking, competitive factors, firm revenues and overall investment banking revenues. Equity Research analysts' or strategists' compensation is not linked to investment banking or capital markets transactions performed by Morgan Stanley or the profitability or revenues of particular trading desks.

Morgan Stanley and its affiliates do business that relates to companies/instruments covered in Morgan Stanley Research, including market making, providing liquidity, fund management, commercial banking, extension of credit, investment services and investment banking. Morgan Stanley sells to and buys from customers the securities/instruments of companies covered in Morgan Stanley Research on a principal basis. Morgan Stanley may have a position in the debt of the Company or instruments discussed in this report. Morgan Stanley trades or may trade as principal in the debt securities (or in related derivatives) that are the subject of the debt research report.

Certain disclosures listed above are also for compliance with applicable regulations in non-US jurisdictions.

### STOCK RATINGS

Morgan Stanley uses a relative rating system using terms such as Overweight, Equal-weight, Not-Rated or Underweight (see definitions below). Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold and sell. Investors should carefully read the definitions of all ratings used in Morgan Stanley Research. In addition, since Morgan Stanley Research contains more complete information concerning the analyst's views, investors should carefully read Morgan Stanley Research, in its entirety, and not infer the

contents from the rating alone. In any case, ratings (or research) should not be used or relied upon as investment advice. An investor's decision to buy or sell a stock should depend on individual circumstances (such as the investor's existing holdings) and other considerations.

## Global Stock Ratings Distribution

(as of April 30, 2020)

The Stock Ratings described below apply to Morgan Stanley's Fundamental Equity Research and do not apply to Debt Research produced by the Firm. For disclosure purposes only (in accordance with FINRA requirements), we include the category headings of Buy, Hold, and Sell alongside our ratings of Overweight, Equal-weight, Not-Rated and Underweight. Morgan Stanley does not assign ratings of Buy, Hold or Sell to the stocks we cover. Overweight, Equal-weight, Not-Rated and Underweight are not the equivalent of buy, hold, and sell but represent recommended relative weightings (see definitions below). To satisfy regulatory requirements, we correspond Overweight, our most positive stock rating, with a buy recommendation; we correspond Equal-weight and Not-Rated to hold and Underweight to sell recommendations, respectively.

STOCK RATING CATEGORY	COVERAGE UNIVERSE		INVESTMENT BANKING CLIENTS (IBC)			OTHER MATERIAL INVESTMENT SERVICES CLIENTS (MISC)	
	COUNT	% OF TOTAL	COUNT	% OF TOTAL IBC	% OF RATING CATEGORY	COUNT	% OF TOTAL
							MISC
Overweight/Buy	1216	38%	300	42%	25%	533	37%
Equal-weight/Hold	1432	45%	325	46%	23%	698	48%
Not-Rated/Hold	3	0%	1	0%	33%	3	0%
Underweight/Sell	553	17%	81	11%	15%	220	15%
<b>TOTAL</b>	<b>3,204</b>		<b>707</b>			<b>1454</b>	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

## Analyst Stock Ratings

Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

## Analyst Industry Views

Attractive (A): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be attractive vs. the relevant broad market benchmark, as indicated below.

In-Line (I): The analyst expects the performance of his or her industry coverage universe over the next 12-18 months to be in line with the relevant broad market benchmark, as indicated below.

Cautious (C): The analyst views the performance of his or her industry coverage universe over the next 12-18 months with caution vs. the relevant broad market benchmark, as indicated below.

Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

## Stock Price, Price Target and Rating History (See Rating Definitions)

Samsung Electro-Mechanics (009150.KS) - As of 5/11/20 in KRW  
Industry : S. Korea Technology



Stock Rating History: 5/1/15 : O/I; 9/16/15 : E/I; 2/15/17 : O/I; 11/26/17 : O/C; 11/21/18 : E/C; 7/30/19 : E/I; 10/6/19 : O/I; 11/18/19 : O/A

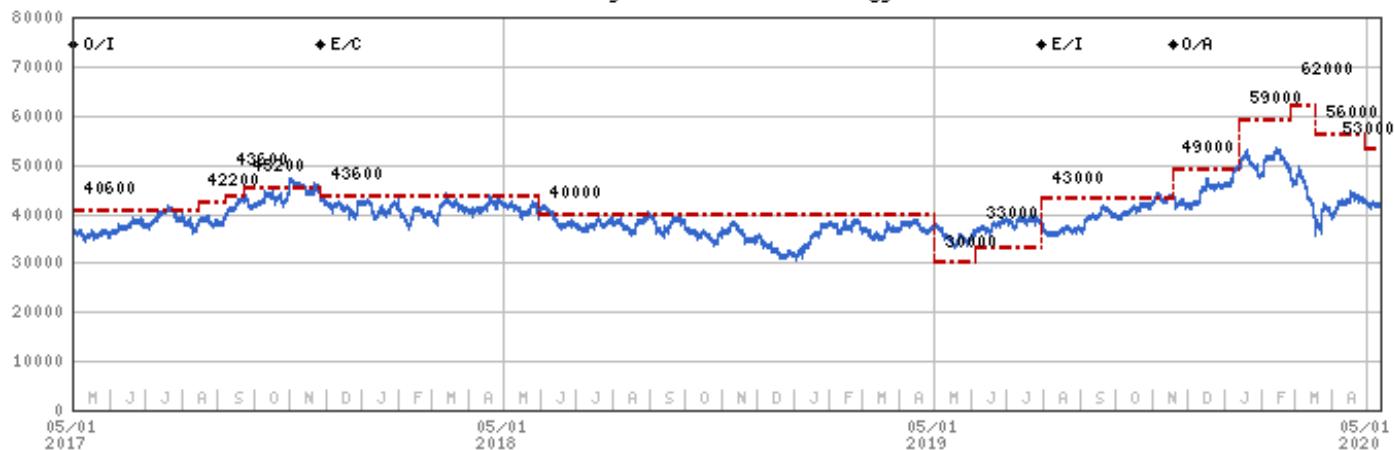
Price Target History: 2/2/15 : 85000; 7/13/15 : 65000; 7/29/15 : 64000; 2/18/16 : 66000; 4/27/16 : 58000; 7/22/16 : 55000; 1/9/17 : 51000; 1/25/17 : 58000; 2/15/17 : 74000; 3/29/17 : 82000; 5/30/17 : 93000; 7/7/17 : 127000; 10/19/17 : 130000; 1/22/18 : 120000; 5/20/18 : 170000; 8/1/18 : 200000; 11/1/18 : 170000; 11/21/18 : 115000; 12/17/18 : 109000; 1/22/19 : 100000; 4/16/19 : 115000; 7/4/19 : 100000; 7/24/19 : 92000; 10/6/19 : 140000; 1/29/20 : 150000; 2/20/20 : 165000; 3/19/20 : 130000; 4/1/20 : 120000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target --- No Price Target Assigned (NA)  
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst)  
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View  
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)  
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

Samsung Electronics (005935.KS) - As of 5/11/20 in KRW  
Industry : S. Korea Technology



Stock Rating History: 5/1/15 : E/I; 12/12/16 : O/I; 11/26/17 : E/C; 7/30/19 : E/I; 11/18/19 : O/A

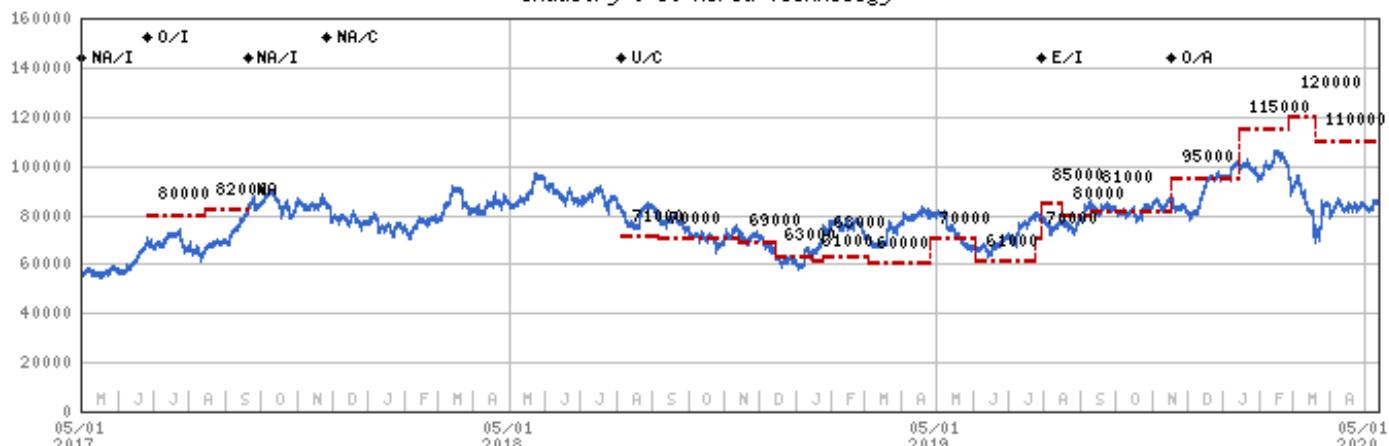
Price Target History: 10/31/14 : 21800; 9/14/15 : 20720; 10/30/15 : 22200; 1/29/16 : 20800; 6/6/16 : 22400; 7/2/16 : 25200; 12/12/16 : 31200; 1/25/17 : 34400; 3/8/17 : 35800; 4/28/17 : 40600; 8/15/17 : 42200; 9/7/17 : 43600; 9/22/17 : 45200; 11/26/17 : 43600; 5/31/18 : 40000; 4/30/19 : 30000; 6/4/19 : 33000; 7/30/19 : 43000; 11/18/19 : 49000; 1/14/20 : 59000; 2/26/20 : 62000; 3/19/20 : 56000; 4/29/20 : 53000

Source: Morgan Stanley Research Date Format : MM/DD/YY Price Target --- No Price Target Assigned (NA)  
Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst)  
Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View  
Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)  
Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

SK Hynix (000660.KS) - As of 5/11/20 in KRW  
Industry : S. Korea Technology



Stock Rating History: 5/1/15 : E/I; 6/15/15 : U/I; 12/21/15 : O/I; 2/8/17 : NA/I; 6/27/17 : O/I; 9/20/17 : NA/I; 11/26/17 : NA/C; 8/5/18 : U/C; 7/30/19 : E/I; 11/18/19 : O/A

Price Target History: 7/3/14 : 50000; 6/15/15 : 40000; 7/23/15 : 36000; 8/17/15 : 34000; 10/19/15 : 33000; 10/22/15 : 31000; 12/21/15 : 48000; 3/15/16 : 45000; 4/26/16 : 44000; 10/13/16 : 50000; 1/4/17 : 55000; 1/31/17 : 61000; 2/8/17 : NA; 6/27/17 : 80000; 8/15/17 : 82000; 9/20/17 : NA; 8/5/18 : 71000; 9/6/18 : 70000; 11/13/18 : 69000; 12/14/18 : 63000; 1/15/19 : 61000; 1/25/19 : 63000; 3/3/19 : 60000; 4/25/19 : 70000; 6/4/19 : 61000; 7/25/19 : 70000; 7/30/19 : 85000; 8/16/19 : 80000; 9/10/19 : 81000; 11/18/19 : 95000; 1/14/20 : 115000; 2/26/20 : 120000; 3/19/20 : 110000

Source: Morgan Stanley Research Date Format: MM/DD/YY Price Target --- No Price Target Assigned (NA)

Stock Price (Not Covered by Current Analyst) — Stock Price (Covered by Current Analyst)

Stock and Industry Ratings (abbreviations below) appear as ♦ Stock Rating/Industry View

Stock Ratings: Overweight (O) Equal-weight (E) Underweight (U) Not-Rated (NR) No Rating Available (NA)

Industry View: Attractive (A) In-line (I) Cautious (C) No Rating (NR)

Effective January 13, 2014, the stocks covered by Morgan Stanley Asia Pacific will be rated relative to the analyst's industry (or industry team's) coverage.

Effective January 13, 2014, the industry view benchmarks for Morgan Stanley Asia Pacific are as follows: relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

## Important Disclosures for Morgan Stanley Smith Barney LLC Customers

Important disclosures regarding the relationship between the companies that are the subject of Morgan Stanley Research and Morgan Stanley Smith Barney LLC or Morgan Stanley or any of their affiliates, are available on the Morgan Stanley Wealth Management disclosure website at [www.morganstanley.com/online/researchdisclosures](http://www.morganstanley.com/online/researchdisclosures). For Morgan Stanley specific disclosures, you may refer to [www.morganstanley.com/researchdisclosures](http://www.morganstanley.com/researchdisclosures).

Each Morgan Stanley Equity Research report is reviewed and approved on behalf of Morgan Stanley Smith Barney LLC. This review and approval is conducted by the same person who reviews the Equity Research report on behalf of Morgan Stanley. This could create a conflict of interest.

## Other Important Disclosures

Morgan Stanley & Co. International PLC and its affiliates have a significant financial interest in the debt securities of Broadcom Inc., KLA Corp, Lam Research Corp, Micron Technology Inc., Qualcomm Inc., Rohm, SMIC, STMicroelectronics NV, UMC.

Morgan Stanley Research policy is to update research reports as and when the Research Analyst and Research Management deem appropriate, based on developments with the issuer, the sector, or the market that may have a material impact on the research views or opinions stated therein. In addition, certain Research publications are intended to be updated on a regular periodic basis (weekly/monthly/quarterly/annual) and will ordinarily be updated with that frequency, unless the Research Analyst and Research Management determine that a different publication schedule is appropriate based on current conditions. Morgan Stanley is not acting as a municipal advisor and the opinions or views contained herein are not intended to be, and do not constitute, advice within the meaning of Section 975 of the Dodd-Frank Wall Street Reform and Consumer Protection Act.

Morgan Stanley produces an equity research product called a "Tactical Idea." Views contained in a "Tactical Idea" on a particular stock may be contrary to the recommendations or views expressed in research on the same stock. This may be the result of differing time horizons, methodologies, market events, or other factors. For all research available on a particular stock, please contact your sales representative or go to Matrix at <http://www.morganstanley.com/matrix>.

Morgan Stanley Research is provided to our clients through our proprietary research portal on Matrix and also distributed electronically by Morgan Stanley to clients. Certain, but not all, Morgan Stanley Research products are also made available to clients through third-party vendors or redistributed to clients through alternate electronic means as a convenience. For access to all available Morgan Stanley Research, please contact your sales representative or go to Matrix at <http://www.morganstanley.com/matrix>.

Any access and/or use of Morgan Stanley Research is subject to Morgan Stanley's Terms of Use (<http://www.morganstanley.com/terms.html>). By accessing and/or using Morgan Stanley Research, you are indicating that you have read and agree to be bound by our Terms of Use (<http://www.morganstanley.com/terms.html>). In addition you consent to Morgan Stanley processing your personal data and using cookies in accordance with our Privacy Policy and our Global Cookies Policy ([http://www.morganstanley.com/privacy\\_pledge.html](http://www.morganstanley.com/privacy_pledge.html)), including for the purposes of setting your preferences and to collect readership data so that we can deliver better and more personalized service and products to you. To find out more information about how Morgan Stanley processes personal data, how we use cookies and how to reject cookies see our Privacy Policy and our Global Cookies Policy ([http://www.morganstanley.com/privacy\\_pledge.html](http://www.morganstanley.com/privacy_pledge.html)).

If you do not agree to our Terms of Use and/or if you do not wish to provide your consent to Morgan Stanley processing your personal data or using cookies please do not access our research.

Morgan Stanley Research does not provide individually tailored investment advice. Morgan Stanley Research has been prepared without regard to the circumstances and objectives of those who receive it. Morgan Stanley recommends that investors independently evaluate particular investments and strategies, and encourages investors to seek the advice of a financial adviser. The appropriateness of an investment or strategy will depend on an investor's circumstances and objectives. The securities, instruments, or strategies discussed in Morgan Stanley Research may not be suitable for all investors, and

certain investors may not be eligible to purchase or participate in some or all of them. Morgan Stanley Research is not an offer to buy or sell or the solicitation of an offer to buy or sell any security/instrument or to participate in any particular trading strategy. The value of and income from your investments may vary because of changes in interest rates, foreign exchange rates, default rates, prepayment rates, securities/instruments prices, market indexes, operational or financial conditions of companies or other factors. There may be time limitations on the exercise of options or other rights in securities/instruments transactions. Past performance is not necessarily a guide to future performance. Estimates of future performance are based on assumptions that may not be realized. If provided, and unless otherwise stated, the closing price on the cover page is that of the primary exchange for the subject company's securities/instruments.

The fixed income research analysts, strategists or economists principally responsible for the preparation of Morgan Stanley Research have received compensation based upon various factors, including quality, accuracy and value of research, firm profitability or revenues (which include fixed income trading and capital markets profitability or revenues), client feedback and competitive factors. Fixed Income Research analysts', strategists' or economists' compensation is not linked to investment banking or capital markets transactions performed by Morgan Stanley or the profitability or revenues of particular trading desks.

The "Important Regulatory Disclosures on Subject Companies" section in Morgan Stanley Research lists all companies mentioned where Morgan Stanley owns 1% or more of a class of common equity securities of the companies. For all other companies mentioned in Morgan Stanley Research, Morgan Stanley may have an investment of less than 1% in securities/instruments or derivatives of securities/instruments of companies and may trade them in ways different from those discussed in Morgan Stanley Research. Employees of Morgan Stanley not involved in the preparation of Morgan Stanley Research may have investments in securities/instruments or derivatives of securities/instruments of companies mentioned and may trade them in ways different from those discussed in Morgan Stanley Research. Derivatives may be issued by Morgan Stanley or associated persons.

With the exception of information regarding Morgan Stanley, Morgan Stanley Research is based on public information. Morgan Stanley makes every effort to use reliable, comprehensive information, but we make no representation that it is accurate or complete. We have no obligation to tell you when opinions or information in Morgan Stanley Research change apart from when we intend to discontinue equity research coverage of a subject company. Facts and views presented in Morgan Stanley Research have not been reviewed by, and may not reflect information known to, professionals in other Morgan Stanley business areas, including investment banking personnel.

Morgan Stanley Research personnel may participate in company events such as site visits and are generally prohibited from accepting payment by the company or associated expenses unless pre-approved by authorized members of Research management.

Morgan Stanley may make investment decisions that are inconsistent with the recommendations or views in this report.

To our readers based in Taiwan or trading in Taiwan securities/instruments: Information on securities/instruments that trade in Taiwan is distributed by Morgan Stanley Taiwan Limited ("MSTL"). Such information is for your reference only. The reader should independently evaluate the investment risks and is solely responsible for their investment decisions. Morgan Stanley Research may not be distributed to the public media or quoted or used by the public media without the express written consent of Morgan Stanley. Any non-customer reader within the scope of Article 7-1 of the Taiwan Stock Exchange Recommendation Regulations accessing and/or receiving Morgan Stanley Research is not permitted to provide Morgan Stanley Research to any third party (including but not limited to related parties, affiliated companies and any other third parties) or engage in any activities regarding Morgan Stanley Research which may create or give the appearance of creating a conflict of interest. Information on securities/instruments that do not trade in Taiwan is for informational purposes only and is not to be construed as a recommendation or a solicitation to trade in such securities/instruments. MSTL may not execute transactions for clients in these securities/instruments.

Certain information in Morgan Stanley Research was sourced by employees of the Shanghai Representative Office of Morgan Stanley Asia Limited for the use of Morgan Stanley Asia Limited.

Morgan Stanley is not incorporated under PRC law and the research in relation to this report is conducted outside the PRC. Morgan Stanley Research does not constitute an offer to sell or the solicitation of an offer to buy any securities in the PRC. PRC investors shall have the relevant qualifications to invest in such securities and shall be responsible for obtaining all relevant approvals, licenses, verifications and/or registrations from the relevant governmental authorities themselves. Neither this report nor any part of it is intended as, or shall constitute, provision of any consultancy or advisory service of securities investment as defined under PRC law. Such information is provided for your reference only.

Morgan Stanley Research is disseminated in Brazil by Morgan Stanley C.T.V.M. S.A. located at Av. Brigadeiro Faria Lima, 3600, 6th floor, São Paulo - SP, Brazil; and is regulated by the Comissão de Valores Mobiliários; in Mexico by Morgan Stanley México, Casa de Bolsa, S.A. de C.V which is regulated by Comisión Nacional Bancaria y de Valores. Paseo de los Tamarindos 90, Torre 1, Col. Bosques de las Lomas Floor 29, 05120 Mexico City; in Japan by Morgan Stanley MUFG Securities Co., Ltd. and, for Commodities related research reports only, Morgan Stanley Capital Group Japan Co., Ltd; in Hong Kong by Morgan Stanley Asia Limited (which accepts responsibility for its contents) and by Morgan Stanley Asia International Limited, Hong Kong Branch; in Singapore by Morgan Stanley Asia (Singapore) Pte. (Registration number 199206298Z) and/or Morgan Stanley Asia (Singapore) Securities Pte Ltd (Registration number 200008434H), regulated by the Monetary Authority of Singapore (which accepts legal responsibility for its contents and should be contacted with respect to any matters arising from, or in connection with, Morgan Stanley Research) and by Morgan Stanley Asia International Limited, Singapore Branch (Registration number T11FC0207F); in Australia to "wholesale clients" within the meaning of the Australian Corporations Act by Morgan Stanley Australia Limited A.B.N. 67 003 734 576, holder of Australian financial services license No. 233742, which accepts responsibility for its contents; in Australia to "wholesale clients" and "retail clients" within the meaning of the Australian Corporations Act by Morgan Stanley Wealth Management Australia Pty Ltd (A.B.N. 19 009 145 555, holder of Australian financial services license No. 240813, which accepts responsibility for its contents; in Korea by Morgan Stanley & Co International plc, Seoul Branch; in India by Morgan Stanley India Company Private Limited; in Indonesia by PT. Morgan Stanley Sekuritas Indonesia; in Canada by Morgan Stanley Canada Limited, which has approved of and takes responsibility for its contents in Canada; in Germany and the European Economic Area where required by Morgan Stanley Europe S.E., regulated by Bundesanstalt fuer Finanzdienstleistungsaufsicht (BaFin); in Spain by Morgan Stanley, S.V., S.A., a Morgan Stanley group company, which is supervised by the Spanish Securities Markets Commission (CNMV) and states that Morgan Stanley Research has been written and distributed in accordance with the rules of conduct applicable to financial research as established under Spanish regulations; in the US by Morgan Stanley & Co. LLC, which accepts responsibility for its contents. Morgan Stanley & Co. International plc, authorized by the Prudential Regulatory Authority and regulated by the Financial Conduct Authority and the Prudential Regulatory Authority, disseminates in the UK research that it has prepared, and approves solely for the purposes of section 21 of the Financial Services and Markets Act 2000, research which has been prepared by any of its affiliates. RMB Morgan Stanley Proprietary Limited is a member of the JSE Limited and A2X(Pty) Ltd. RMB Morgan Stanley Proprietary Limited is a joint venture owned equally by Morgan Stanley International Holdings Inc. and RMB Investment Advisory (Proprietary) Limited, which is wholly owned by FirstRand Limited. The information in Morgan Stanley Research is being disseminated by Morgan Stanley Saudi Arabia, regulated by the Capital Market Authority in the Kingdom of Saudi Arabia , and is directed at Sophisticated investors only.

The information in Morgan Stanley Research is being communicated by Morgan Stanley & Co. International plc (DIFC Branch), regulated by the Dubai Financial Services Authority (the DFSA), and is directed at Professional Clients only, as defined by the DFSA. The financial products or financial services to which this research relates will only be made available to a customer who we are satisfied meets the regulatory criteria to be a Professional Client.

The information in Morgan Stanley Research is being communicated by Morgan Stanley & Co. International plc (QFC Branch), regulated by the Qatar Financial Centre Regulatory Authority (the QFCRA), and is directed at business customers and market counterparties only and is not intended for Retail Customers as defined by the QFCRA.

As required by the Capital Markets Board of Turkey, investment information, comments and recommendations stated here, are not within the scope of investment advisory activity. Investment advisory service is provided exclusively to persons based on their risk and income preferences by the authorized firms. Comments and recommendations stated here are general in nature. These opinions may not fit to your financial status, risk and return preferences. For this

reason, to make an investment decision by relying solely to this information stated here may not bring about outcomes that fit your expectations. The following companies do business in countries which are generally subject to comprehensive sanctions programs administered or enforced by the U.S. Department of the Treasury's Office of Foreign Assets Control ("OFAC") and by other countries and multi-national bodies: Samsung Electronics. The trademarks and service marks contained in Morgan Stanley Research are the property of their respective owners. Third-party data providers make no warranties or representations relating to the accuracy, completeness, or timeliness of the data they provide and shall not have liability for any damages relating to such data. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and S&P. Morgan Stanley Research, or any portion thereof may not be reprinted, sold or redistributed without the written consent of Morgan Stanley. Indicators and trackers referenced in Morgan Stanley Research may not be used as, or treated as, a benchmark under Regulation EU 2016/1011, or any other similar framework.

## INDUSTRY COVERAGE: Greater China Technology Semiconductors

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/12/2020)
<b>Charlie Chan</b>		
ACM Research Inc (ACMR.O)	O (01/22/2020)	US\$53.84
Advanced Micro-Fabrication Equipment Inc (688012.SS)	U (03/20/2020)	Rmb184.88
Alchip Technologies Ltd (3661.TW)	O (11/08/2019)	NT\$272.00
ASE Technology Holding Co. Ltd. (3711.TW)	E (09/24/2019)	NT\$68.10
ASM Pacific (0522.HK)	U (03/20/2020)	HK\$81.20
Chipbond Technology Corp (6147.TWO)	O (04/24/2019)	NT\$61.30
Chungwa Precision Test Tech (6510.TWO)	E (11/08/2019)	NT\$675.00
Global Unichip Corp (3443.TW)	U (02/12/2020)	NT\$220.50
GlobalWafers Co Ltd (6488.TWO)	E (04/23/2020)	NT\$382.50
Jiangsu Changjiang Electronics Tech (600584.SS)	U (09/22/2015)	Rmb28.15
King Yuan Electronics Co Ltd (2449.TW)	O (09/24/2019)	NT\$36.20
MediaTek (2454.TW)	E (02/17/2020)	NT\$407.00
Nanya Technology Corp. (2408.TW)	U (10/08/2019)	NT\$63.60
Phison Electronics Corp (8299.TWO)	O (05/21/2019)	NT\$285.50
Silergy Corp. (6415.TW)	O (03/06/2020)	NT\$1,300.00
SMIC (0981.HK)	U (02/17/2020)	HK\$17.14
TSMC (2330.TW)	O (09/05/2019)	NT\$295.00
UMC (2303.TW)	E (04/23/2020)	NT\$15.45
Universal Scientific Ind. (Shanghai) (601231.SS)	O (08/04/2015)	Rmb18.64
Vanguard International Semiconductor (5347.TWO)	U (04/23/2020)	NT\$70.80
Will Semiconductor Co Ltd Shanghai (603501.SS)	E (04/23/2020)	Rmb207.05
WIN Semiconductors Corp (3105.TWO)	O (04/18/2019)	NT\$274.50
<b>Daniel Yen, CFA</b>		
ASMedia Technology Inc (5269.TW)	O (01/17/2020)	NT\$930.00
Aspeed Technology (5274.TWO)	O (04/29/2020)	NT\$1,195.00
Egis Technology Inc (6462.TWO)	U (04/23/2020)	NT\$183.00
GigaDevice Semiconductor Beijing Inc (603986.SS)	O (04/24/2019)	Rmb217.89
Macronix International Co Ltd (2337.TW)	E (04/23/2020)	NT\$35.20
Montage Technology Co Ltd (688008.SS)	O (03/26/2020)	Rmb103.50
Novatek (3034.TW)	E (04/23/2020)	NT\$204.00
Parade Technologies Ltd (4966.TWO)	O (03/03/2019)	NT\$786.00
Realtek Semiconductor (2379.TW)	O (08/03/2018)	NT\$244.00
Shenzhen Goodix Technology Co Ltd (603160.SS)	E (04/23/2020)	Rmb238.00
Winbond Electronics Corp (2344.TW)	E (04/23/2020)	NT\$13.50
WPG Holdings (3702.TW)	O (07/31/2017)	NT\$38.70
<b>Jeff Hsu</b>		
Silicon Motion (SIMO.O)	E (03/20/2020)	US\$44.29

Stock Ratings are subject to change. Please see latest research for each company.

\* Historical prices are not split adjusted.

## 有点报告社群

分享8万+行业报告/案例、7000+工具/模版；  
精选各行业前沿数据、经典案例、职场干货等。



截屏本页，微信扫一扫或搜索公众号“有点报告”  
回复<进群>即刻加入