

Asia Semiconductor Sector

US restrictions on Huawei's chip design and manufacturing a deeper supply chain impact

Semiconductor Devices | Forecast Change

Figure 1: CS semiconductor revisions following the additional Huawei restrictions

Company	Ticker	New Rating	Old Rating	Mkt Cap (US\$mn)	Price 5/17/20	New Target	Old Target	2020 Sales YoY New	2020 Sales YoY Change	2021 Sales YoY New	2021 Sales YoY Change	2020 EPS New	2020 EPS Old	2021 EPS New	2021 EPS Old
Foundries															
TSMC	2330.TW	N	OP	\$257,971	\$298.0	\$300.0	\$350.0	9%	-3%	6%	-6%	\$15.14	\$16.00	\$15.50	\$17.25
SMIC	0981.HK	UP	N	\$13,119	\$19.2	\$16.0	\$17.6	15%	-3%	10%	-7%	\$0.31	\$0.35	\$0.39	\$0.49
Vanguard	5347.TWO	N	N	\$3,832	\$70.1	\$66.5	\$70.0	10%	-2%	4%	-3%	\$3.19	\$3.34	\$3.48	\$3.73
Hua Hong	1347.HK	N	N	\$2,748	\$16.5	\$17.5	\$15.0	0%	-4%	23%	-1%	\$0.50	\$0.44	\$0.42	\$0.58
Semiconductor Materials/Equipment															
CHPT	6510.TWO	UP	UP	\$682	\$623.0	\$480.0	\$510.0	10%	-4%	0%	-5%	\$23.68	\$24.69	\$24.00	\$25.56
Back-end Companies															
ASE	3711.TW	OP	OP	\$9,609	\$66.4	\$75.0	\$84.0	5%	-1%	5%	-1%	\$5.30	\$5.50	\$5.80	\$6.00
Asian Fabless															
Mediatek	2454.TW	OP	OP	\$21,816	\$411.0	\$500.0	\$430.0	9%	4%	18%	12%	\$17.50	\$16.00	\$24.78	\$19.77

Source: Company data, Credit Suisse estimates

- **Restrictions to further impact Huawei.** The US Commerce Department published Huawei restrictions Friday in line with our [original expectation](#) requiring a US equipment license to fab chips for Huawei or US EDA license for Huawei to design chips. Unless a license is granted or policy withdrawn, production would stop and impact the semi chain including TSMC (14% of 2019 sales), SMIC (19% of 2019 sales), ASE (8% of 2019 sales) and CHPT (20-25% of 2019 sales) but have upside opportunity for Mediatek.
- **5G infrastructure impacted more than smartphones.** Huawei's 60% share in China 5G infrastructure is more at risk with less viable non-US replacements for its infrastructure ASICs, impacting 5G builds after inventory is drawn in 2020 or requiring other supplier ramps. In smartphones, fabless supplying Huawei have no new restrictions so we maintain 20/21 industry units at -7%/+7% to 1.28 bn and 1.37 bn and only trim Huawei slightly from 196 mn/205 mn to 190 mn/180 mn. We see incremental US\$3 bn TAM for Mediatek to supply Huawei its processor and connectivity and factor 60% share by 2021.
- **Trade war broadening into a tech war.** Potential follow-on implications include: (1) A handicap to TSMC's goal to be everyone's foundry, (2) further efforts by China to step up import substitution and domestic subsidisation, (3) potential China retaliation on US business interests, (4) risk of reimposed tariffs or further equipment restrictions, and (5) further supply chain redundancy and localisation investments needed by the suppliers.
- **US-China trade and COVID-19 dual impacts.** The group has risk now both from COVID-19 semiconductor inventory build and demand risk, and now the escalating US-China tech war. We lower estimates for foundry/back-end suppliers unable to fully recoup the Huawei impact by other customers and impacted by net reduction on 5G deployments into 2020: (1) Downgrade TSMC from Outperform to NEUTRAL and TP from NT\$350 to NT\$300, (2) Downgrade SMIC from Neutral to UNDERPERFORM and TP from NT\$17.60 to NT\$16.00, (3) Maintain CHPT Underperform and lower our TP from NT\$510 to NT\$480, (4) Maintain ASE Outperform and lower our TP from NT\$78 to NT\$75, (5) Maintain Vanguard Neutral and lower our TP from NT\$70 to NT\$66.50. We also stay Outperform on Mediatek and lift our TP from NT\$430 to NT\$500 as they gain into Huawei.

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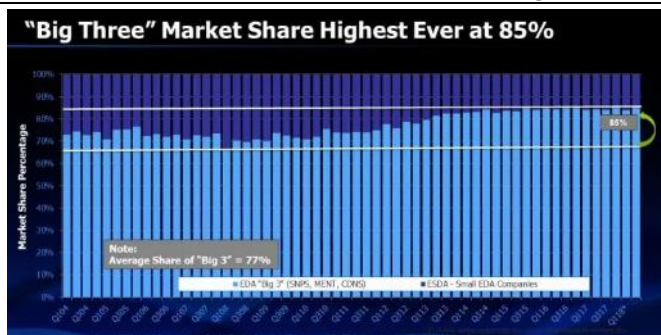
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Focus chart and tables

Figure 2: The US EDA leaders Cadence, Synopsys and Mentor (now part of Siemens) control 85% share of design software



Source: Semi Wiki

Figure 4: US suppliers aside from Huawei lead in wired ICs

Company Name	Country	2018	2019
Broadcom	US	5,552	5,468
Intel	US	1,386	1,441
Texas Instruments	US	1,510	1,339
HiSilicon Technologies	China	930	1,020
Marvell Technology Group	US	846	936
Micron Technology	US	1,264	797
Xilinx	US	503	604
Realtek Semiconductor	Taiwan	308	418
Analog Devices	US	376	406
Mellanox Technologies	US	280	364

Source: Gartner

Figure 6: Huawei a US\$3 bn TAM for Mediatek to address

Huawei Smartphone Application Processor TAM	4G		5G		Total	
	2020	2021	2020	2021	2020	2021
Units (mn)	132.9	83.9	56.5	96.1	189.5	180.0
ASPs (US\$)	\$7.9	\$7.1	\$34.3	\$25.3	\$15.8	\$16.8
Huawei Sales TAM (US\$m)	\$1,053	\$600	\$1,941	\$2,430	\$2,994	\$3,030
Mediatek Huawei Share	30%	60%	20%	60%	27%	60%
Mediatek Huawei sales (US\$m)	\$316	\$360	\$388	\$1,458	\$809	\$1,818
Mediatek Smartphone sales (US\$m)	\$2,520	\$2,202	\$1,327	\$3,009	\$3,880	\$5,230
Huawei % of Mediatek Smartphones	13%	16%	29%	48%	21%	35%
Mediatek Total sales (US\$m)					\$8,964	\$10,611
Huawei % of Mediatek total sales					9%	17%

Source: Company data, Credit Suisse estimates

Figure 8: SMIC generated 18.9% of sales from Huawei in 2019

Top customers	2012	2013	2014	2015	2016	2017	2018	2019
Hi-Silicon				\$324	\$610	\$538	\$582	\$590
% of sales				14.5%	20.9%	17.4%	17.3%	18.9%
Qualcomm	\$283	\$474	\$483	\$367	\$383	\$637	\$528	\$398
% of sales	16.6%	22.9%	24.5%	16.4%	13.1%	20.5%	15.7%	12.8%
Broadcom	\$384	\$270	\$178	\$216				
% of sales	22.5%	13.1%	9.0%	9.6%				
Top 5 customers	\$953	\$1,082	\$1,007	\$1,181	\$1,591	\$1,594	\$1,552	\$1,514
% of sales	56%	52%	51%	53%	55%	51%	46%	49%
Top 5 YoY	46%	14%	-7%	17%	35%	0%	-3%	-2%
Rest of SMIC	\$749	\$987	\$963	\$1,056	\$1,323	\$1,507	\$1,808	\$1,601
Rest YoY	12%	32%	-2%	10%	25%	14%	20%	-11%
SMIC Total	\$1,702	\$2,069	\$1,970	\$2,236	\$2,914	\$3,101	\$3,360	\$3,116
SMIC YoY	29%	22%	-5%	14%	30%	6%	8%	-7%

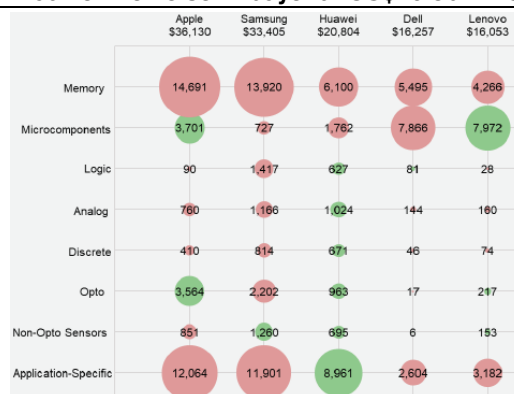
Source: Company data, Credit Suisse estimates

Figure 3: US has 40% market share in fab equipment

Equipment supplier	2018 sales	2018 share	Country	Equipment supplier	2018 sales	2018 share	Country
Applied Materials	\$10,990	18.5%	U.S.	Ebara	\$487	0.8%	Japan
ASML	\$9,743	16.4%	Holland	Murata Machinery	\$441	0.7%	Japan
Lam Research	\$9,001	15.1%	U.S.	Tokyo Seimitsu	\$425	0.7%	Japan
Tokyo Electron	\$8,967	15.1%	Japan	Wonik IPS	\$384	0.6%	Korea
KLA	\$3,264	5.5%	U.S.	NuFlare Technology	\$364	0.6%	Japan
Screen Semi	\$1,799	3.0%	Japan	Veeco	\$359	0.6%	U.S.
Kokusai Electric	\$1,187	2.0%	Japan	Axcelis Technologies	\$292	0.5%	U.S.
Hitachi High-Tech	\$1,166	2.0%	Japan	Others	\$6,458	10.9%	
SEMES	\$1,129	1.9%	Korea	Total (US\$m)	\$59,442	100.0%	
Daifuku	\$930	1.6%	Japan	U.S. suppliers	\$23,906	40.2%	
ASM International	\$745	1.3%	Holland	Japan suppliers	\$17,078	28.7%	
Canon	\$695	1.2%	Japan	Holland suppliers	\$10,488	17.6%	
Nikon	\$618	1.0%	Japan	Korea suppliers	\$1,512	2.5%	

Source: Gartner, Credit Suisse estimates

Figure 5: Huawei the #3 semi buyer at US\$20.8bn in silicon



Source: Company data, Credit Suisse estimates

Figure 7: Removing Huawei from our 2021 TSMC estimate

TSMC Revenue	2015	2016	2017	2018	2019	2020	2021	20%	21%
Apple	\$4,230	\$4,958	\$7,283	\$7,423	\$8,000	\$8,810	\$10,918	22.7%	26.4%
Qualcomm	\$4,232	\$3,335	\$2,211	\$1,969	\$2,463	\$3,710	\$2,827	9.6%	6.8%
Broadcom	\$1,960	\$2,750	\$3,040	\$3,314	\$2,699	\$3,089	\$3,570	8.0%	8.6%
Hi-Silicon	\$1,089	\$1,281	\$1,531	\$2,781	\$4,947	\$3,463	\$0	8.9%	0.0%
AMD	\$1,138	\$1,729	\$1,498	\$1,527	\$1,929	\$3,013	\$3,841	7.8%	9.3%
Mediatek	\$1,772	\$2,693	\$1,740	\$1,424	\$1,043	\$1,914	\$3,399	4.9%	8.2%
NVIDIA	\$1,504	\$1,934	\$2,551	\$2,817	\$2,321	\$2,362	\$2,037	6.1%	4.9%
TSMC sales from its top 30	\$23,445	\$25,340	\$28,442	\$30,706	\$31,440	\$35,629	\$37,711	92%	91%
TSMC YoY at its top 30	5%	11%	10%	8%	2%	13%	6%		
TSMC's share of top customers	39%	40%	39%	38%	38%	41%	40%		
Rest of TSMC/Inventory	\$3,157	\$3,494	\$3,663	\$3,490	\$3,193	\$3,217	\$3,609	8%	9%
Rest of TSMC YoY	14%	11%	5%	-5%	-9%	1%	12%		
TSMC Sales (C/S Estima b)	\$26,606	\$29,434	\$32,105	\$34,196	\$34,633	\$38,846	\$41,320	100%	100%
TSMC Overall YoY	6%	11%	9%	7%	1%	12%	6%		

Source: Company data, Credit Suisse estimates

Figure 9: Huawei has substitutes available for its smartphones

Chipset	Supplier	Supplier region	Shippable or Substitute
Processor	Hi-Silicon Kirin 990	China	Mediatek Dimensity 1000
WiFi Module	Hi-Silicon	China	Mediatek or UnSOC
Power management	Hi-Silicon	China	Mediatek PMIC
RF transceiver	Hi-Silicon	China	Mediatek transceiver
LNA Switch	Hi-Silicon	China	Qorvo, Murata
Audio Codec	Hi-Silicon	China	Cirrus Logic, Mediatek
Audio Amplifier	Cirrus Logic	US	Still shipping
Front-end Modules	Qorvo, Qualcomm, Murata	US/Japan	Still shipping
Envelope Tracker	Mediatek	Taiwan	Okay
PMIC	Silicon Mitus	Korea	Okay
NFC	NXP	Europe	Okay
Wireless charging	ST	Europe	Okay
WiFi Switch	TI	US	Okay
Battery Mgmt	Halo Micro	China	Still shipping
Mobile DRAM	SK Hynix, Micron, Samsung	Korea, US	Okay
NAND	Samsung, Hioxia, Micron	Japan	Okay
OLED Driver IC	Novatek	Taiwan	Okay

Source: Company data, Credit Suisse estimates

US restrictions on Huawei's chip design and manufacturing a deeper supply chain impact

The US Commerce Department published an amendment to its entity list restrictions for Huawei on Friday 15 May in-line with our original fear that restricts use of US EDA design software for Huawei's chip design and use of US equipment by foundries to fab their chipsets. We discuss implications on the group, which we expect would be a direct revenue hit to its semiconductor chain including TSMC (14% of 2019 sales), SMIC (19% of 2019 sales), ASE (8% of 2019 sales) and Chunghwa Precision (20-25% of 2019 sales) but upside to Mediatek.

Restrictions to further impact Huawei's production

Huawei's scale is still large in the chain even after the entity list placement in May 2019, with US\$124 bn sales in 2019, +14% YoY with 29% infrastructure share, 40% routing share, and 18% smartphone share and also #3 largest semiconductor buyer at US\$21bn semiconductor purchases (5% of the industry). Huawei has its own chip design tools but also relies on US EDA with 85% market share in design. If they pass the design threshold, all fabs including TSMC and SMIC will require a license with US tools having 40% share and even higher share in critical etch, implant, deposition and process control. TSMC's announced 20k 5nm fab in Arizona with the Commerce Department on Friday was unable to halt the restriction.

5G infrastructure impacted more than smartphones

We see 5G infrastructure more at risk than smartphones due to less viable replacements for Huawei for its infrastructure silicon. Huawei has 60% share China's 5G infrastructure tenders and most viable alternatives for its own ASIC designs for its base station are US suppliers of FPGAs and networking ASICs including Marvell, Broadcom, Intel and Xilinx. Huawei's 120 day grace period plus its 114 days ending 2019 inventory should allow it to help China achieve its 600k additional base stations in 2020 but puts risk on 2021 coverage pending licenses, a settlement or other vendors ramp. Huawei's smartphones are having a better alternative with Mediatek's main platform and Samsung Exynos and UniSOC as options. We only trim Huawei smartphone estimates modestly from 196mn/205mn to 190mn/180mn but maintain 2020/21 smartphone industry units at -7%/+7% to 1.28 bn and 1.37 bn and 5G from 222/465mn to 228mn/447mn with some impact to 2021 coverage breadth.

Implications as the trade war broadens to a tech war

We expect most meaningful impact to direct suppliers to Huawei's Hi-Silicon division including the foundries, back-end and probe card suppliers, but could see further impact as US-China expands from trade war to technology war. Some further implications include (1) A handicap to TSMC's goal to be everyone's foundry, (2) further efforts by China to step up import substitution and domestic subsidisation, (3) potential China retaliation on US business interests, (4) risk of reimposed tariffs or further equipment restrictions, and (5) further supply chain redundancy and localisation investments needed by the suppliers. One segment benefiting could be Taiwan's IC design if no competitive China substitutes including Mediatek and a lesser extent Realtek.

Lowering estimates for TSMC, SMIC, ASE, Vanguard and CHPT, Raising for Mediatek

We lower estimates for foundry/back-end suppliers unable to be fully recoup the Huawei impact by other customers and impacted by net reduction on 5G deployments into 2020:(1) Downgrade TSMC from Outperform to Neutral and TP from NT\$350 to NT\$300, (2) Downgrade SMIC from Neutral to Underperform and TP from NT\$17.60 to NT\$16.00, (3) Maintain CHPT Underperform but lower our TP from NT\$510 to NT\$480, (4) Maintain ASE Outperform but lower our TP from NT\$84 to NT\$75, (5) Maintain Vanguard Neutral but lower our TP from NT\$70 to NT\$66.50. For one positive change, we maintain Mediatek Outperform but raise our TP from NT\$420 to NT\$500 as they should gain into Huawei.

US restriction on Huawei's design and fabrication to impact the Asian foundry sales

Huawei is the industry's #3 semiconductor buyer at 5% of chip consumption; its production will have difficulty designing around US license restrictions with US EDA at 85% share and fab equipment at 40% share

Huawei's infrastructure silicon does not have many viable non US alternatives; smartphones should be able to source from Mediatek

Further escalation may cause further collateral damage to semiconductor suppliers

Downgrading TSMC and SMIC, lowering targets on CHPT, ASE and Vanguard, raising our target on Mediatek

Restrictions to further impact Huawei's production

The US Commerce Department published an amendment to its entity list restrictions for Huawei on Friday 15 May, in-line with our [original view](#) but worse than our recent expectation following TSMC's [US fab announcement](#) that it may delay or lessen risk of a Huawei restriction with the US gaining access to domestic leading edge foundry capacity.

The new restriction looks to close the loophole for Huawei in designing its own chips to replace banned US components by restricting use of US EDA design software for Huawei's design of its chips and use of US equipment for the fabbing of their IC designs into finished chipsets. We discuss implications on the group, which we expect would be a direct revenue hit to its semiconductor chain including TSMC (14% of 2019 sales), SMIC (19% of 2019 sales), ASE (8% of 2019 sales) and Chunghwa Precision (20-25% of 2019 sales).

Commerce Dept. license needed to use US EDA for Huawei's IC design and US equipment for fabrication

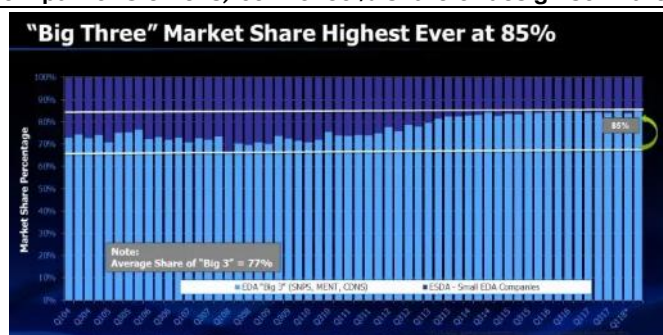
The US Commerce Department's Bureau of Industry and Security (BIS) posted a [press release](#) and document that restricts Huawei's ability to use US EDA software to design its chips or have US semiconductor equipment used by foreign foundries like TSMC and SMIC in the fabrication of its chips. The BIS noted that Huawei's use of EDA software and commissioning of overseas foundries has allowed it to continue to design semiconductors, effectively making its smartphones and infrastructure with aid of US fab and design software technology but at the same time effectively substituting out US semiconductor suppliers for its own chipsets.

The targeted restrictions that now will be prohibited without a US license:

- 1) Semiconductor designs when produced by Huawei or HiSilicon that are the product of US software and technology (EDA design tools – where US suppliers Cadence and Synopsys lead), and
- 2) Chipsets produced from the design specifications of Huawei or Hi Silicon that are the direct product of semiconductor manufacturing equipment located outside the US. The foreign produced chips would need a license if shipping to Huawei or its affiliates.

The rules are designed to close Huawei's loophole both for design and manufacturing equipment so it is unable to produce its own chips substituting out restricted US semiconductor suppliers. Huawei has its own design tools but also like other IC designers rely on US EDA, with the leaders Cadence, Synopsys and Mentor (recently acquired by Siemens) having 85% market share. If they pass that threshold on design, the fabrication from any possible foundry including TSMC and SMIC would be prohibited without a license to use the US fab tools.

Figure 10: The US EDA leaders Cadence, Synopsys and Mentor (now part of Siemens) control 85% share of design software



Source: Semi Wiki

Figure 11: US has 40% market share in fab equipment

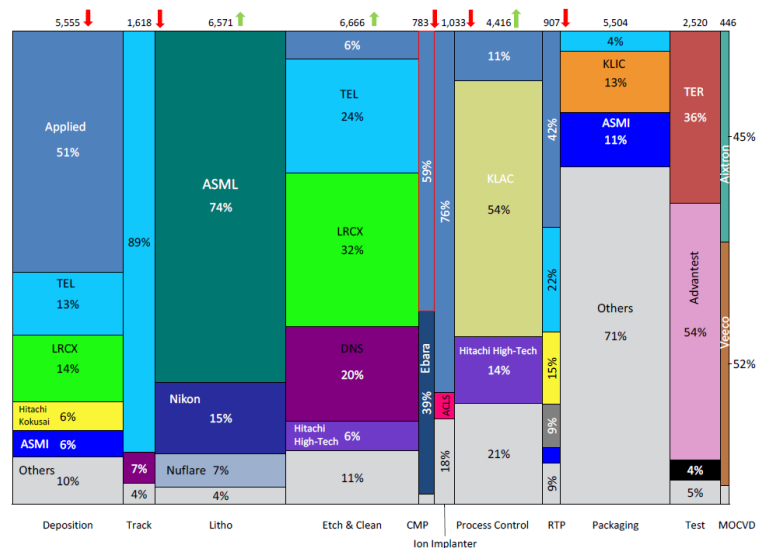
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Source: Gartner, Credit Suisse estimates

US equipment too difficult to work around - TSMC and SMIC will likely stop shipping

The US fab equipment work-around for the foundries is too difficult with US semiconductor suppliers having 40% overall market share including AMAT/LRCX with 65% deposition share, AMAT at 59% CMP and 76% ion implant share, and KLAC with 54% in process control and metrology followed by Applied Materials at 11%. An advanced foundry would not be competitive without the use of leading US suppliers across important process steps. Even an attempt to build a non-US equipment line for Huawei would require years to ramp the process and reach competitive yields but at the sacrifice of efficiency and best in class tools to maintain the foundry model requiring high quality, competitive cost production, time to market and a diversified customer base.

Figure 12: US suppliers (AMAT, LRCX, and KLAC) critical in Deposition, Etch, CMP, Implant and Process Control



Source: Gartner, Credit Suisse estimates

Huawei's foundries for its production are TSMC (14% of 2019 sales) and SMIC (19% of 2019 sales). We expect both to halt their production of Huawei unless a resolution, settlement or loophole is found after a 120 day grace period that allows the foundries to finish the 3-4 month cycle time of in-process wafers as of 15 May.

For TSMC, it has increased its sales to Huawei from 4-5% from 2015-2017 to 14.3% in 2019 at US\$4.95 bn sales (12.6% if we hold Huawei inventory flat YoY), making it the company's #2 customer after Apple at 23% of sales. Huawei's procurement at TSMC grew 82% YoY in 2019 driven by its smartphone shipments by replacing external vendors with in-house silicon, ramping aggressively infrastructure to prepare for 5G deployments in China and inventory builds to build up ahead of potential further US restrictions. The revenue contribution from Huawei would still be growing from 8% to 13% even without considering the company's effort to pre-build inventory. TSMC has noted on its earnings calls that it will comply with US regulations.

Figure 13: TSMC generated 14.3% of sales from Huawei in 2019

TSMC - Huawei (US\$)	2012	2013	2014	2015	2016	2017	2018	2019
TSMC Total Sales	\$17,195	\$20,082	\$25,109	\$26,525	\$29,421	\$32,291	\$34,200	\$34,627
TSMC Sales from Huawei COGs	\$394	\$651	\$779	\$1,029	\$1,224	\$1,519	\$2,660	\$4,380
TSMC Sales from Huawei Inventory	-\$10	\$15	\$102	\$56	\$33	\$13	\$122	\$567
TSMC Sales from Huawei	\$384	\$667	\$881	\$1,085	\$1,257	\$1,531	\$2,781	\$4,947
TSMC % of Huawei Production	1.9%	2.8%	3.0%	2.9%	2.7%	2.7%	4.1%	5.7%
TSMC % of Sales from Huawei	2.2%	3.3%	3.5%	4.1%	4.3%	4.7%	8.1%	14.3%
TSMC % of Sales if no inventory builds	2.3%	3.2%	3.1%	3.9%	4.2%	4.7%	7.8%	12.6%

Source: Company data, Credit Suisse estimates

TSMC's US fab unable to halt the restrictions

TSMC announced on Friday morning Asia time ahead of the Commerce Department amendment on Huawei that it had intention to build a 20,000 wafer per month fab to produce advanced 5nm chips in Arizona. The fab would have US\$12 bn spending for the capex and opex over the next decade and was put out jointly with an Arizona [news release](#) citing collaboration between TSMC, the US Commerce Department and Trump Administration. The announcement to aid US interests for advanced domestic capacity for national security and to solidify its industry position ended up unconnected or unable to change the US drafting of the entity list amendment noted in our TSMC [earnings report](#) from going ahead. For TSMC, we still view this fab helping it with a source of localisation for its 60% customer base in the US while appeasing US government interests for domestic self-sufficiency in production.

Though some are nervous about TSMC taking sides with the US fab announcement and upsetting its position in China, it also has similar 20k 12" capacity in Nanjing with expansion capability to 80k WPM and have four year lead in process technology to SMIC, leaving no other options for domestic suppliers for the most advanced chips for 5G smartphones and networking, data center, and advanced AI and ADAS applications.

SMIC likely stops shipping – 19% of sales to Huawei

SMIC also has grown its importance to Huawei, up slightly to US\$590 mn sales last year and representing 18.9% of its sales, around the range of its 15-21% from 2015-2018. Some investors and press have speculated the TSMC ban would shift business to SMIC as a China foundry, but we expect SMIC will also comply which it also noted on its last call it has maintained compliance since its founding as an International company. SMIC also relies on on-going US equipment service and spares and new tools for its fab expansion so needs to maintain compliance on this regulation to keep competitive as a foundry and avoid any further restrictions on US support or ability to supply its US customers (25% of sales).

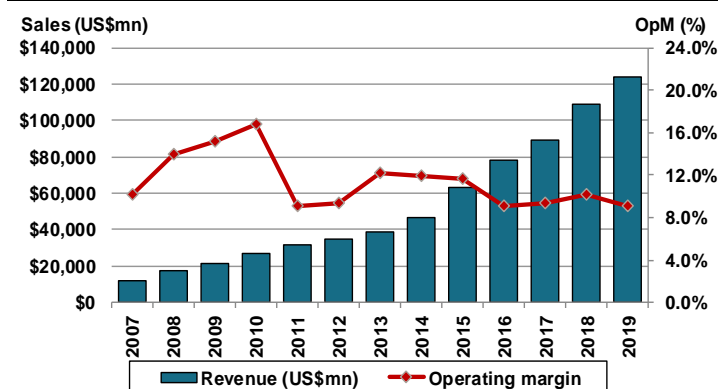
Figure 14: SMIC generated 18.9% of sales from Huawei in 2019

Top customers	2012	2013	2014	2015	2016	2017	2018	2019
Hi-Silicon				\$324	\$610	\$538	\$582	\$590
% of sales				14.5%	20.9%	17.4%	17.3%	18.9%
Qualcomm	\$283	\$474	\$483	\$367	\$383	\$637	\$528	\$398
% of sales	16.6%	22.9%	24.5%	16.4%	13.1%	20.5%	15.7%	12.8%
Broadcom	\$384	\$270	\$178	\$216				
% of sales	22.5%	13.1%	9.0%	9.6%				
Top 5 customers	\$953	\$1,082	\$1,007	\$1,181	\$1,591	\$1,594	\$1,552	\$1,514
% of sales	56%	52%	51%	53%	55%	51%	46%	49%
Top 5 YoY	46%	14%	-7%	17%	35%	0%	-3%	-2%
Rest of SMIC	\$749	\$987	\$963	\$1,056	\$1,323	\$1,507	\$1,808	\$1,601
Rest YoY	12%	32%	-2%	10%	25%	14%	20%	-11%
SMIC Total	\$1,702	\$2,069	\$1,970	\$2,236	\$2,914	\$3,101	\$3,360	\$3,116
SMIC YoY	29%	22%	-5%	14%	30%	6%	8%	-7%

Source: Company data, Credit Suisse estimates

Huawei has a huge scale in the supply chain

The further restrictions on Huawei would have a further impact on the supply chain depending on ability for it to continue to ship products. The company is one of the largest technology companies in China with US\$124 bn in 2019 (+14% YoY) with a net profit of US\$9 bn (+6% YoY) from its annual report. The company derived 35% of its 2019 sales from the carrier business (mainly telecom equipment), 54% from the consumer business (largely smartphones) and 10% from the enterprise business (switches, routers). By geography, China was 59% of sales, EMEA 24%, Americas 6% and Asia Ex-China 8% of sales.

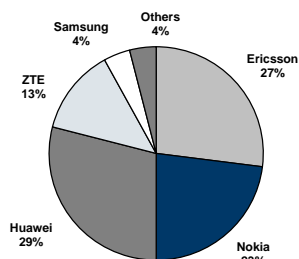
Figure 15: Huawei sales up 6x to >US\$120 bn the past decade

Source: Company data, Credit Suisse estimates

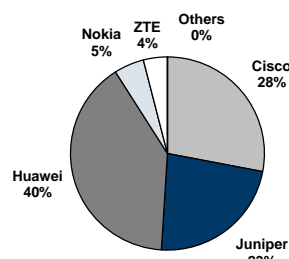
Figure 16: Huawei the #3 semi buyer at US\$20.8 bn in silicon

Source: Gartner

Gartner estimates Huawei in 2019 was the #3 largest OEM semiconductor buyer with US\$20.8 bn of semiconductor purchases (5% of the semiconductor industry), with largest purchases in application specific ICs (US\$9.0 bn) and memory (US\$6.1 bn), lagging only Apple's US\$36 bn and Samsung's US\$33 bn. In 2019, the vendor had to cut back production of many US semiconductor suppliers after the May entity list placement, lowering shipments from Qualcomm, Broadcom, Skyworks, Qorvo, Xilinx, ADI and Micron and ramping up internal silicon. Its own chips included the main smartphone processor, TV/set-top, AI accelerators, ARM server chip, RF front-end module, connectivity chips and Bluetooth IoT chips.

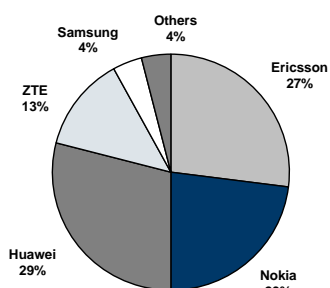
Figure 17: Huawei at 29% wireless radio share in '18

Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

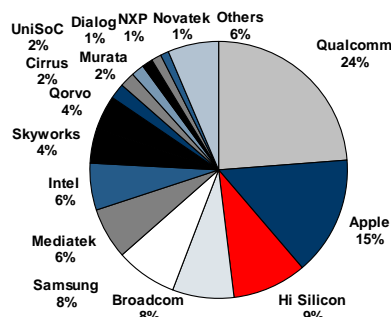
Figure 18: Huawei had 40% core routing share in '18

Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

The company has strong share in wireless and network infrastructure with 29% in wireless radio access and 40% in core routing, leading Nokia (27%), Ericsson (23%) and ZTE (13%). In smartphones, it was #2 in 2019, growing its shipments +17% to 240mn units and increasing its share from 15% to 18% Huawei also has 9% share in mobile phone semiconductors, with 18% application processor share, 7% wireless connectivity share and 3% RF share.

Figure 19: Huawei at 29% wireless radio share in '18

Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

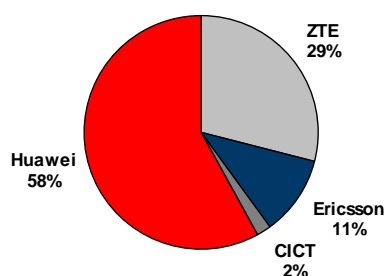
Figure 20: Hi Silicon has 9% share in mobile phone chips

Source: Gartner

5G infrastructure impacted more than smartphones

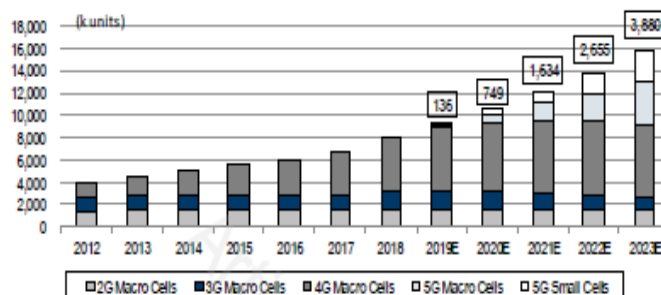
Huawei is a critical portion of China's infrastructure build-out, having secured 58% market share in the second phase of China Mobile's 5G base station tender. Huawei is a key piece in reaching our estimate of 613k base station adds in 2020 and 885k in 2021.

Figure 21: Huawei won 58% of China Mobile's tender



Source: IHS, Credit Suisse European Telecom Equipment (Achal Sultania)

Figure 22: Hi Silicon has 9% share in mobile phone chips



Source: Company Data, Credit Suisse Estimates

For Huawei infrastructure, its ability to make base stations could be difficult as it sources its own ASICs for the main networking processing and communications fabbed at TSMC. Likely alternatives are still banned under the entity list restriction including Xilinx FPGAs and ASICs from infrastructure suppliers Marvell, Broadcom, and Intel. A redesign with another non-US vendor could take another year similar to Nokia's delay shifting to a new ASIC architecture.

We also view it unlikely Huawei can shift the existing design through another chip company or separate distributor, as the US will be monitoring for these alternative arrangements as it did with Huawei and ZTE trying to set up alternative mechanisms to still supply Iran. TSMC has also noted it will have to comply with US regulations and in design verification likely would need to decline a similar template from another company destined for Huawei infrastructure. The lack of alternatives with Huawei could slow China's build after Huawei's inventory runs out by year-end.

Figure 23: US chip suppliers aside from Huawei lead in wired infrastructure ICs

Company Name	Country	2018	2019	YoY	Share
Broadcom	US	5,552	5,468	-1.5%	27.6%
Intel	US	1,386	1,441	4.0%	7.3%
Texas Instruments	US	1,510	1,339	-11.3%	6.8%
HiSilicon Technologies	China	930	1,020	9.7%	5.2%
Marvell Technology Group	US	846	936	10.6%	4.7%
Micron Technology	US	1,264	797	-36.9%	4.0%
Xilinx	US	503	604	20.1%	3.1%
Realtek Semiconductor	Taiwan	308	418	35.7%	2.1%
Analog Devices	US	376	406	8.0%	2.1%
Mellanox Technologies	US	280	364	30.0%	1.8%

Source: Gartner

Huawei's inventory should help it supply through 2020

For this year, we believe the 120-day grace period for the foundry to complete in process wafers through mid-September and its existing balance sheet inventory (114 days as of the end of 2019) should allow the base station ramp, but 2021 would have risk if Huawei does not have a work-around to replace its own chips with competitive base station ASICs.

According to Huawei's annual report, the company has been more aggressively building inventory since 2018 following ZTE's ban, with its inventory up 27% YoY in 2018 and 71% YoY in 2019. The tighter control from the US government and the growing demand for 5G infrastructure builds in China prompted the company to pull in inventory from the tech supply chain through 2019, with raw material inventory up 65% YoY, finished goods up 95% YoY and WIP up 60%. Despite fast sales growth from both mobile and infrastructure business in the past few years, the company's aggressive approach to build inventory on the fear of more stringent ban by the US government lifted the inventory days to 114 days exiting 2019. Huawei would sustain 1-2 quarters beyond a ban in infrastructure with pre-built components, buying time to negotiate a settlement with China's backing and retaliation.

Figure 24: Huawei has been building inventory in 2019 ahead of potential US ban

Huawei Inventory (US\$)	2012	2013	2014	2015	2016	2017	2018	2019
Raw materials	\$1,013	\$989	\$1,009	\$1,681	\$2,479	\$2,918	\$5,163	\$8,401
Manufacturing work in progress	\$395	\$686	\$842	\$888	\$1,603	\$1,655	\$2,486	\$3,891
Finished goods	\$920	\$1,004	\$1,872	\$2,471	\$2,636	\$2,605	\$3,832	\$7,500
Contract work in progress	\$1,240	\$1,439	\$3,784	\$4,295	\$3,493	\$3,331	\$1,660	\$2,947
Other inventories	\$0	\$0	\$0	\$115	\$434	\$601	\$922	\$1,292
Huawei Inventory	\$3,569	\$4,118	\$7,507	\$9,450	\$10,645	\$11,111	\$14,062	\$24,031
% YoY	-13%	15%	82%	26%	13%	4%	27%	71%
Huawei Revenue	\$35,343	\$39,483	\$46,453	\$60,831	\$75,052	\$92,694	\$105,044	\$123,295
Huawei Cost of sales	\$21,269	\$23,292	\$25,910	\$35,468	\$44,815	\$56,124	\$64,528	\$76,969
% YoY	5%	10%	11%	37%	26%	25%	15%	19%
Huawei Procurement (COGs + Chg Inv)	\$20,727	\$23,840	\$29,300	\$37,410	\$46,010	\$56,590	\$67,480	\$86,938
COGs % of Procurement	103%	98%	88%	95%	97%	99%	96%	89%
Inventory Build % of Procurement	-3%	2%	12%	5%	3%	1%	4%	11%

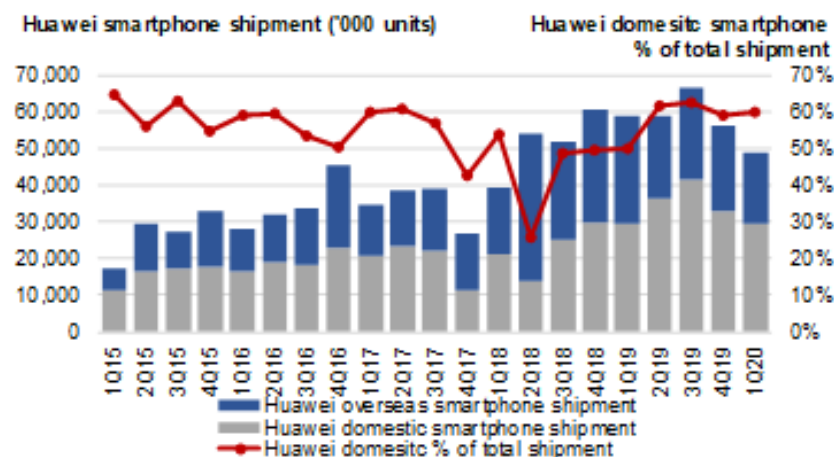
Huawei Inventory Days	2012	2013	2014	2015	2016	2017	2018	2019
Raw materials	17	16	14	17	20	19	29	40
Manufacturing work in progress	7	11	12	9	13	11	14	18
Finished goods	16	16	26	25	21	17	22	36
Contract work in progress	21	23	53	44	28	22	9	14
Other inventories	0	0	0	1	4	4	5	6
Huawei Inventory Days	61	65	106	97	87	72	80	114

Source: Company data, Credit Suisse estimates

Huawei's smartphone shipments should fare better

Huawei's smartphone business should fare better as it could still source merchant baseband chips as well as other Asian suppliers and less sensitive chips from US suppliers. The company's volume has not slipped much and still increased from 206 mn units to 240 mn units in 2020. The company would still be somewhat limited competitively in smartphones relative to its pre-entity list position without the Google license as lack of these Google services and application store has impacted it in export markets. Its China position is intact with its own app store and a number of popular 3rd party application stores available in China.

Figure 25: Huawei has been increasing its domestic exposure since the trade ban



Source: Company data, Credit Suisse estimates

Maintain industry units, but 5G slightly lower in 2021

With Huawei not too impacted in smartphones with use of alternate chipsets and other vendors able to pick up the slack, we maintain 2020/21 smartphone units at -7%/+7% to 1.28 bn and 1.37 bn units in 2020/21 following a 3% decline in 2019. Our team is revising 5G smartphone units for 2020/21 from 222/465 mn to 228 mn/447 mn, with this year's volume unaffected and tracking ahead post 1Q20 as China build-outs can progress with inventory and WIP but next year may see a bit less penetration in Tier 3-5 cities and lower price points if Huawei's restrictions slow the 5G build.

Figure 29: Total smartphones: CS revisions by region/vendor

Total Smartphones		1Q 20	2Q 20E	3Q 20E	4Q 20E	2019	2020E	2021E
Total	New - May'20	275.1	276.1	350.6	374.9	1,371.9	1,276.7	1,369.6
	YoY (%)	-11.9%	-16.7%	-2.2%	1.4%	-2.2%	-6.9%	7.3%
	Old - Apr'20	-	301.9	351.7	372.4	-	1,284.4	1,372.6
	Chg (%)	-	-8.5%	-0.3%	0.7%	-	-0.6%	-0.2%
Regional split (new)								
China (new fcst)	New - May'20	66.6	83.7	97.1	98.7	366.6	346.1	-
	YoY (%)	-20.3%	-14.5%	-1.9%	14.5%	-7.6%	-5.6%	-
	Old - Apr'20	-	93.6	99.6	98.7	-	347.5	-
	Chg (%)	-	-10.5%	-2.5%	0.0%	-	-0.4%	-
RoW (new fcst)	New - May'20	208.5	192.4	253.6	276.2	1,005.4	930.7	-
	YoY (%)	-8.8%	-17.6%	-2.3%	-2.6%	-0.1%	-7.4%	-
	Old - Apr'20	-	208.4	252.2	273.7	-	936.9	-
	Chg (%)	-	-7.7%	0.6%	0.9%	-	-0.7%	-
Operating System								
iOS	New - May'20	36.7	26.1	44.7	72.5	191.0	180.0	193.5
	YoY (%)	-0.3%	-22.8%	-4.0%	-1.7%	-8.5%	-5.7%	7.5%
	Old - Apr'20	-	26.1	44.7	72.5	-	180.4	193.5
	Chg (%)	-	0.0%	0.0%	0.0%	-	-0.2%	0.0%
Android	New - May'20	238.4	250.0	305.9	302.4	1,181.0	1,096.7	1,176.1
	YoY (%)	-13.5%	-16.0%	-1.9%	2.2%	-1.1%	-7.1%	7.2%
	Old - Apr'20	-	275.8	307.0	299.9	-	1,104.0	1,179.1
	Chg (%)	-	-9.4%	-0.4%	0.8%	-	-0.7%	-0.3%
Brands								
		1Q 20E	2Q 20E	3Q 20E	4Q 20E	2019	2020E	2021E
Samsung	New - May'20	58.4	52.0	69.0	71.0	295.8	250.4	295.5
	Old - Apr'20	-	70.0	77.0	71.0	-	281.0	306.3
Huawei	New - May'20	49.0	44.5	49.0	47.0	240.6	189.5	180.0
	Old - Apr'20	-	49.0	54.5	53.0	-	195.5	205.3
Oppo	New - May'20	22.8	32.0	40.5	37.0	114.3	132.3	146.8
	Old - Apr'20	-	32.0	38.5	37.0	-	129.5	143.7
Vivo	New - May'20	24.8	26.0	33.0	30.5	110.1	114.3	123.5
	Old - Apr'20	-	27.5	30.0	29.5	-	106.5	114.0
Xiaomi	New - May'20	29.5	30.0	41.4	40.5	125.6	141.4	161.9
	Old - Apr'20	-	32.0	39.0	35.0	-	132.0	146.5

Source: IDC, Credit Suisse estimates

Figure 30: 5G smartphones: CS revisions by region/vendor

5G Smartphones		1Q 20	2Q 20E	3Q 20E	4Q 20E	2020E	2021E
Total	New - May'20	21.3	32.0	62.8	112.2	228.3	446.8
	Old - Apr'20	-	33.8	63.1	114.7	221.8	464.8
	Chg (%)	-	-5.5%	-0.6%	-2.2%	2.9%	-3.9%
Region							
China	New - May'20	14.5	21.8	32.8	45.5	114.6	193.4
	Old - Apr'20	-	24.4	34.6	48.3	114.4	199.4
	Chg (%)	-	-10.7%	-5.2%	-5.9%	0.2%	-3.0%
RoW	New - May'20	6.8	10.2	30.0	66.8	113.7	253.4
	Old - Apr'20	-	9.4	28.5	66.5	107.3	265.3
	Chg (%)	-	7.9%	5.1%	0.5%	5.9%	-4.5%
Operating System							
iOS	New - May'20	0.0	0.0	12.5	51.3	63.8	139.8
	Old - Apr'20	0.0	0.0	12.5	51.2	63.8	139.7
	Chg (%)	0.0%	0.0%	0.0%	0.2%	0.1%	0.1%
Android	New - May'20	21.3	32.0	50.3	60.9	164.5	307.1
	Old - Apr'20	10.0	33.8	50.6	63.5	158.0	325.1
	Chg (%)	112.1%	-5.5%	-0.7%	-4.1%	4.1%	-5.5%
Key Brands							
		1Q 20E	2Q 20E	3Q 20E	4Q 20E	2020E	2021E
Samsung	New - May'20	6.4	-	-	-	40.1	74.7
	Old - Apr'20	0.0	-	-	-	36.3	80.7
Huawei	New - May'20	8.1	-	-	-	56.5	96.1
	Old - Apr'20	0.0	-	-	-	55.8	100.4
Oppo	New - May'20	2.1	-	-	-	19.5	36.6
	Old - Apr'20	0.0	-	-	-	19.2	38.4
Vivo	New - May'20	2.1	-	-	-	18.9	35.2
	Old - Apr'20	0.0	-	-	-	18.6	36.9
Xiaomi	New - May'20	2.0	-	-	-	16.7	34.1
	Old - Apr'20	0.0	-	-	-	16.2	36.0

Source: IDC, Credit Suisse estimates

Implications as the trade war broadens to a tech war

Huawei as #3 global chip buyer and its leverage of Taiwan's advanced foundry and back-end and selectively in IC design, memory and RF makes it a significant customer that will impact the chain following the latest restriction. We expect most meaningful impact to direct suppliers to Huawei's Hi-Silicon division, including foundries in our coverage TSMC at 14% of sales, SMIC at 19% of sales, back-end test and packaging supplies including ASE at 7% of sales and King Yuan at 15-20% of sales and probe cards from CHPT at 20-25% of sales.

On the flip side, some IC design companies should benefit as they can stand in as alternative suppliers to Huawei's smartphones as the license requirement should require Huawei to source externally to replace its own chips. Mediatek has only 15% allocation of Huawei's chipsets so it would benefit as the most viable non-US application processor and connectivity supplier. We also could see Realtek pick up some IoT, Wifi and networking business into Huawei.

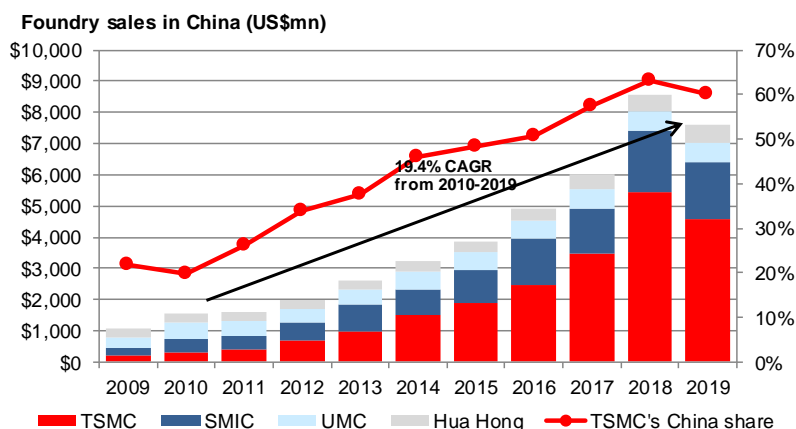
Figure 31: Asian foundry, memory makers and back-end suppliers have ~5-10% Huawei exposure

Semiconductors	Stock ticker	Sector Analyst	Parts/service supplied	Huawei % of sales
Semiconductor Foundry				
AWSC	8086.TWO	Not Covered	Foundry for RF in handsets	10-15%
GCS	4991.TWO	Jerry Su	Foundry for RF in fiber optics	5-10%
Sanan	600703.SZ	Kyna Wong	Foundry for RF in fiber optics	<5%
SMIC	0981.HK	Randy Abrams	Foundry for consumer, IoT, and mobile RF/Wifi	19%
TSMC	2330.TW	Randy Abrams	Foundry for mobile, IoT and HPC applications	14%
Vanguard	5347.TWO	Randy Abrams	Foundry for Power Management	5%
Win Semi	3105.TWO	Jerry Su	Foundry for RF/VCSEL in handsets and infrastructure	15-20%
Back-end packaging				
ASE	3711.TW	Randy Abrams	Packaging and testing for mobile, IoT and HPC applications	7%
Chipbond	6147.TWO	Jerry Su	Wafer bumping for touch driver IC and driver IC	8-10%
Inari Amertron	INRI.KL	Danny Chan	RF filter package and test and fiber optic module assembly	1-2%
King Yuan	2449.TW	Not Covered	Testing for mobile, IoT and HPC	15-20%
JCET	600584.SS	Chaolien Tseng	Packaging and testing for mobile, IoT and HPC applications	5-10%
Huatian	002185.SZ	Chaolien Tseng	Packaging and testing for mobile, IoT and HPC applications	~5%
Tongfu	002156.SZ	Chaolien Tseng	Packaging and testing for mobile, IoT and HPC applications	~5%
Memory				
Nanya	2408.TW	Haas Liu	Memory manufacturing for IoT, mobile and infrastructure	Limited exposure
Samsung	005930.KS	Keon Han	Limited mobile DRAM, higher server exposure	Limited exposure
SK Hynix	000660.KS	Keon Han	Memory manufacturing for IoT, mobile and infrastructure	10-12% DRAM; 12% NAND
Toshiba	6502.T	Hideyuki Maekawa	Memory manufacturing for IoT, mobile and infrastructure	7% of memory business
Fabless IC Design				
Focaltech	3545.TW	Jerry Su	Smartphone touch IC, driver IC, touch driver IC	15-20%
Goodix	603160.SZ	Chaolien Tseng	Fingerprint sensors	20%
Will Semi	603501.SZ	Chaolien Tseng	CIS	10-20%
Mediatek	2454.TW	Randy Abrams	Mobile devices and IoT chipsets	4%
Novatek	3034.TW	Jerry Su	Smartphone touch driver IC / driver IC	15-20%
Egis	6462.TWO	Jerry Su	Fingerprint sensors	10%
Elan	2458.TW	Harvie Chou	Fingerprint sensors, stylus, touchpad	2-3%
Parade	4966.TWO	Jerry Su	NB/tablet T-Con / driver IC	3-5%
Realtek	2379.TW	Randy Abrams	Networking chipsets for infrastructure and IoT devices	2%

Source: Company data, Credit Suisse estimates

Restriction handicaps TSMC as everyone's foundry

One impact of this US restriction will be on TSMC's ability to be everybody's foundry, risking TSMC now of losing its China growth both from Huawei directly from the US restrictions and also indirectly. The China supply chain and national policy we expect would further encourage local design and manufacturing and less reliance on overseas following this additional restriction. China overall is 20% of TSMC's sales and could face lower growth over time from nationalization and the Huawei ban.

Figure 32: TSMC has led growth in its China sales the past decade, helped by Huawei

Source: Company data, Credit Suisse estimates

We estimate TSMC's China story was still led by Huawei's growth, representing 70% of TSMC's China sales in 2019 and growing at a 40% CAGR the past 6 years versus 17% CAGR for the other China customers to lift TSMC's China growth to a 32% pace. Crypto was a short-term driver but has now largely corrected.

TSMC's relative loss from this restriction is limited with SMIC also not able to supply Huawei and also TSMC's 4-5 year lead over SMIC on process development on 5nm now vs. SMIC still just starting 14nm still implies that gap does not narrow much if at all and would still require China customers requiring the advanced nodes to source at TSMC. At the same time, TSMC's US fab should help secure its position at US customers (60% of sales) where it now can plug a competitive gap with a fab with rivals Intel, Samsung and GlobalFoundries having US fabs.

Figure 33: TSMC's growth in China is mainly driven by Huawei

China Mix	2013	2014	2015	2016	2017	2018	2019	YoY	% of TSMC	13-19 CAGR
Hi-Silicon	19,825	26,751	34,509	40,492	46,356	83,886	152,877	82.2%	14.3%	40.6%
Crypto	0	0	2,862	3,866	27,243	44,788	9,734	-78.3%	0.9%	NM
Other China Customers	17,821	23,763	30,291	38,275	36,603	47,121	45,491	-3.5%	4.3%	16.9%
Total	39,659	52,528	69,677	84,650	112,218	177,812	210,120	18.2%	19.6%	32.0%

Source: Company data, Credit Suisse estimates

China's domestic localisation efforts to continue

China will use the ban as justification to increase its subsidisation and import substitution for its domestic industry, further ramping SMIC subsidies which have been scaling up dramatically in the past five years from about \$30-35 mn recognised in 2012-13 to over US\$200 mn in 2018 and now grants on the balance sheet for future recognition expanding from US\$150 mn in 2012 to US\$639 mn.

Figure 34: China industry support rising – SMIC grants up 4-5x since 2012

Balance sheet grants & government projects	2012	2013	2014	2015	2016	2017	2018
Deferred gov't funding: Non-Current	150,347	209,968	184,174	175,604	265,887	299,749	393,902
Deferred gov't funding: Current	0	26,349	62,609	79,459	116,021	193,158	244,708
Total gov't grants on the balance sheet	150,347	236,317	246,783	255,063	381,908	492,907	638,610
New gov't funding of specific R&D projects	54,100	145,800	57,300	40,200	181,100	178,300	265,000

P&L recognition of grants each year	2012	2013	2014	2015	2016	2017	2018
P&L grants - R&D expenses	31,000	26,900	37,400	34,300	52,517	82,245	150,258
P&L grants - interest expense	1,200	7,100	21,400	4,895	11,639	24,182	19,446
P&L grants - other operating income	200	0	0	2,697	9,542	27,444	32,198
Total P&L gov't grants recognized	32,400	34,000	58,800	41,892	73,698	133,871	201,902
SMIC Net Income	15,856	103,807	152,968	253,411	368,380	170,179	129,845
Grants as % of Net Income	204%	33%	38%	17%	20%	79%	155%

Source: Company data, Credit Suisse estimates

Huawei triggered some de-Americanization by China suppliers, with China suppliers electing to source locally first followed by Asia/Europe before considering the US for sourcing, although this restriction may extend Taiwan suppliers into that camp over time as China tries to build up its own reliance. TSMC still has 4-5 year process lead and substantial capacity and R&D scale lead (10x over SMIC) to address high-end infrastructure, data centre servers, graphics, AI, and 5G mobile so at least that will continue to mitigate the risk.

In the meantime, some companies that may see some local sourcing would include Hua Hong (localized MCUs and analog), Silergy (localized analog), Mediatek (China business against Qualcomm), Maxscend and Richwave (RF business in China), Advantest (local test business) and Anritsu (China 5G test business).

Huawei represents 70% of TSMC's China business

China retaliation and US further actions can follow

According to Global Times [reports](#), China is likely to retaliate with countermeasures including use of its unreliable entity list which can impose restrictions or investing US companies such as Qualcomm, Cisco and Apple and may also suspend purchases of Boeing aircraft. The Chinese Ministry of Commerce last May indicated China will have its own list targeting foreign entities that undermine the interest of Chinese companies which can include foreign organisations and companies that block or shut supply chains or take discriminatory measures for non-commercial reasons or when their actions endanger Chinese companies, global consumers or companies.

Beyond targets on existing companies, China could proceed with other measures including backing down from its trade deal commitments including agricultural purchases, reinstating tariff escalation, and putting restrictions on some medical gear exports.

The US also does have a range of further restrictions it could still take including withholding advanced semiconductor manufacturing to domestic China foundry and memory, restricting EDA design software to emerging fables, and moving ahead with previously threatened tariffs. The US can also still tighten the squeeze further on Huawei, as this restriction stopped at requiring Huawei to have a license for EDA and fabs to have a license for equipment, but could go a step further to require all chip companies supplying Huawei to have a license to use EDA software, which would also cut off baseband alternatives such as Mediatek.

The case is set-up now for escalation which if carrying a range of restrictions and tariffs would put a tax on the tech supply chain so way out would be a similar reconciliation and settlement similar to the trade deal in December 2019.

Further redundancy built into supply chains, though short-term impacted by feared tariffs/restrictions

The combined COVID-19 and US/China tariffs and retaliations likely leads to a push for more domestic self-sufficiency in the supply chains. TSMC's fab in the US was motivated in part by its customers' desire for some local diversification also in the more charged political climate and rising national interest for advanced domestic production. Additional investment in local capacity and inventory should benefit the equipment industry and automation longer-term, though will still need to monitor offsets from demand destruction from tariffs, restrictions on certain companies or fear of tariffs which can impact investment in the near-term.

Lowering estimates for TSMC, SMIC, ASE, Vanguard and CHPT, Raising for Mediatek

We factor in the further restrictions on Huawei into our coverage, with negative impact largest for companies with the highest Huawei exposure including TSMC (14% of sales), SMIC (19% of sales), CHPT (20-25% of sales), ASE (7% of sales) and Vanguard (5% of sales), with opportunity for Mediatek to step in to supply Huawei's smartphones.

The following are key revisions:

- 1) Downgrade TSMC from Outperform to Neutral and TP from NT\$350 to NT\$300,
- 2) Downgrade SMIC from Neutral to Underperform and TP from NT\$17.60 to NT\$16.00,
- 3) Maintain CHPT Underperform but lower our TP from NT\$510 to NT\$480,
- 4) Maintain ASE Outperform but lower our TP from NT\$84 to NT\$75,
- 5) Maintain Vanguard Neutral but lower our TP from NT\$70 to NT\$66.50,
- 6) Maintain Mediatek Outperform and raise our TP from NT\$420 to NT\$500.

TSMC: Downgrade to Neutral, lowering our target from NT\$350 to NT\$300

TSMC had 14% of sales from Huawei in 2019 and should be running near that run rate in 1H20 with that customer building up inventory aggressively in preparation for further restrictions and for the 5G infrastructure build-out and smartphone launches in China. TSMC has 120 day period for wafers started by 15 May to ship in process wafers so should have only modest impact on 3Q20 sales. Unless the restriction is changed or TSMC does not receive a license, we expect Huawei sales would fall to zero by 2021.

We revise our estimates by customer taking Huawei out of numbers and lifting Mediatek and UniSOC for some recovery of smartphone units and also factor in iOS Mac launch to lift our Apple 2021 estimate. TSMC's reliance on Apple may rise further to 26% of sales so would have some risk if China retaliates of anti-US sentiment impacts iPhone units in that market.

Figure 35: TSMC revised estimates taking Huawei out of 2021 numbers

TSMC Revenue	2015	2016	2017	2018	2019	2020	2021	20%	21%
Apple	\$4,230	\$4,958	\$7,283	\$7,423	\$8,000	\$8,810	\$10,918	22.7%	26.4%
Qualcomm	\$4,232	\$3,335	\$2,211	\$1,959	\$2,463	\$3,710	\$2,827	9.6%	6.8%
Broadcom	\$1,960	\$2,750	\$3,040	\$3,314	\$2,699	\$3,089	\$3,570	8.0%	8.6%
Hi-Silicon	\$1,089	\$1,281	\$1,531	\$2,781	\$4,947	\$3,463	\$0	8.9%	0.0%
AMD	\$1,138	\$1,729	\$1,498	\$1,527	\$1,929	\$3,013	\$3,841	7.8%	9.3%
Mediatek	\$1,772	\$2,693	\$1,740	\$1,424	\$1,043	\$1,914	\$3,399	4.9%	8.2%
NVIDIA	\$1,504	\$1,934	\$2,551	\$2,817	\$2,321	\$2,362	\$2,037	6.1%	4.9%
TSMC sales from its top 30	\$23,449	\$25,940	\$28,442	\$30,706	\$31,440	\$35,629	\$37,711	92%	91%
TSMC YoY at its top 30	5%	11%	10%	8%	2%	13%	6%		
TSMC's share of top customers	39%	40%	39%	38%	38%	41%	40%		
Rest of TSMC/Inventory	\$3,157	\$3,494	\$3,663	\$3,490	\$3,193	\$3,217	\$3,609	8%	9%
Rest of TSMC YoY	14%	11%	5%	-5%	-9%	1%	12%		
TSMC Sales (CS Estimate)	\$26,606	\$29,434	\$32,105	\$34,196	\$34,633	\$38,846	\$41,320	100%	100%
TSMC Overall YoY	6%	11%	9%	7%	1%	12%	6%		

Source: Company data, Credit Suisse estimates

We reflect our new Huawei estimates at 189.5 mn in 2020 and 180 mn in 2021 supplied by other vendors which should reduce TSMC's content per phone relative to Huawei which was move aggressive moving to 5nm for the high-end and where TSMC had 100% market share. Mediatek's allocation at TSMC has been running closer to 50% although moving up again in advanced 5G mobile. We still view the 5G cycle moving ahead and coupled with the content gains moving mainstream from 12nm to 7nm and high-end Apple to 5nm and adding back the modem through 1H21 have smartphone revenue growing +8%/+8% YoY in 2020/21.

Figure 36: TSMC smartphone estimates based on the new industry model

Smartphone/Tablet Units (mn)	2011	2012	2013	2014	2019	2020E	2021E	15-19 CAGR
Apple	231.5	215.4	215.8	208.8	191.0	180.0	213.5	-5%
Samsung	320.2	311.4	317.7	292.2	295.8	250.4	295.5	-2%
Huawei	107.0	139.3	154.2	206.0	240.6	189.5	180.0	22%
Oppo/Vivo/Xiaomi	151.7	230.1	292.0	333.5	350.0	388.0	432.2	23%
Others	627.1	573.2	485.8	362.1	294.5	268.8	248.4	-17%
Tablets	207.2	174.9	163.8	146.1	134.5	138.6	140.6	-10%
Total smartphone/tablets (mn)	1,644.8	1,644.4	1,629.2	1,548.7	1,506.5	1,415.3	1,510.3	-2%
YoY Growth		0%	-1%	-5%	-3%	-6%	7%	
TSMC content (US\$)	2011	2012	2013	2014	2019	2020E	2021E	15-19 CAGR
Apple	\$17.7	\$24.8	\$32.5	\$32.8	\$37.0	\$43.0	\$47.5	20%
Samsung	\$3.0	\$3.0	\$3.0	\$3.0	\$4.5	\$5.7	\$3.8	11%
Huawei	\$7.0	\$9.0	\$9.5	\$11.0	\$14.0	\$14.4	\$12.9	19%
Oppo/Vivo/Xiaomi	\$7.0	\$7.4	\$6.7	\$6.1	\$6.0	\$8.1	\$8.1	-4%
Others	\$7.0	\$7.8	\$7.5	\$7.5	\$7.5	\$9.0	\$7.2	2%
Tablets	\$8.0	\$8.0	\$7.5	\$6.0	\$6.0	\$6.0	\$6.0	-7%
TSMC content (US\$)	\$7.9	\$9.2	\$10.0	\$10.1	\$11.2	\$12.9	\$13.0	9%
TSMC smartphones (US\$bn)	2011	2012	2013	2014	2019	2020E	2021E	15-19 CAGR
Apple	\$4.1	\$5.3	\$7.0	\$6.8	\$7.1	\$7.7	\$10.1	15%
Samsung	\$1.0	\$0.9	\$1.0	\$0.9	\$1.3	\$1.4	\$1.1	8%
Huawei	\$0.7	\$1.3	\$1.5	\$2.3	\$3.4	\$2.7	\$2.3	46%
Oppo/Vivo/Xiaomi	\$1.1	\$1.7	\$2.0	\$2.0	\$2.1	\$3.2	\$3.5	19%
Others	\$4.4	\$4.5	\$3.6	\$2.7	\$2.2	\$2.4	\$1.8	-16%
Tablets	\$1.7	\$1.4	\$1.2	\$0.9	\$0.8	\$0.8	\$0.8	-16%
TSMC smartphones (US\$bn)	\$12.9	\$15.1	\$16.3	\$15.6	\$16.9	\$18.3	\$19.7	7%
YoY Growth		17%	8%	-4%	8%	8%	8%	
TSMC smartphone share	42%	49%	52%	51%	55%	56%	52%	

Source: Company data, Credit Suisse estimates

By platform, our revised estimates are for 12% growth in USD in 2019 versus TSMC's mid-high teens guidance as the foundry would have impact in both smartphones and also the network infrastructure that is in the HPC category. For 2021, the lower infrastructure and lower content within Huawei devices alongside the already existing lower share at Qualcomm and NVIDIA may keep growth to +6% YoY.

Figure 37: TSMC revised growth drivers by platform

TSMC growth drivers	2016	2017	2018	2019	2020	2021	18-21 CAGR
HPC - TSMC	\$6.1	\$8.1	\$10.9	\$10.3	\$12.6	\$13.3	7%
HPC - Market	\$19.3	\$22.5	\$26.1	\$26.2	\$29.0	\$31.6	7%
TSMC share (%)	31.7%	36.1%	41.9%	39.3%	43.4%	42.0%	
Automotive - TSMC	\$1.3	\$1.4	\$1.7	\$1.5	\$1.46	\$1.6	-2%
Automotive - Market	\$10.8	\$12.2	\$13.4	\$14.5	\$16.1	\$17.9	10%
TSMC share (%)	12.4%	11.4%	12.7%	10.6%	9.1%	9.0%	
IoT - TSMC	\$1.7	\$1.8	\$2.1	\$2.68	\$3.1	\$3.39	18%
IoT - Market	\$5.6	\$7.3	\$9.0	\$11.4	\$14.2	\$17.6	25%
TSMC share (%)	29.7%	24.8%	22.7%	23.6%	21.6%	19.2%	
Mobile - TSMC	\$15.1	\$16.3	\$15.6	\$16.9	\$18.3	\$19.7	8%
Mobile - Market	\$30.9	\$31.3	\$30.7	\$30.5	\$32.7	\$38.1	7%
TSMC Mobile share (%)	48.9%	51.9%	50.9%	55.3%	55.9%	51.7%	
Digital Consumer	\$2.6	\$2.5	\$2.3	\$1.8	\$1.9	\$1.9	-5.4%
Other	\$2.6	\$2.0	\$1.6	\$1.4	\$1.5	\$1.4	
TSMC CS Estimates	\$29.4	\$32.1	\$34.2	\$34.6	\$38.8	\$41.3	6.5%
YoY Growth	10.6%	9.1%	6.5%	1.3%	12.2%	6.4%	

Source: Company data, Credit Suisse estimates

We revise TSMC's estimates to take out 4% of the 14% sales from 3Q20 for Huawei as it would be only running in-process wafers through part of September and should be fading late in the quarter. In 4Q20, we take a further 5% reduction out, assuming only 1/3 of the existing Huawei business is running. The infrastructure and multimedia may be drawing down inventory at Huawei and Mediatek starting to ramp up to replace some of the lost mobile processor units. For 2020, the full year impact is 3.5% on sales and we project a continuing 3.5% revenue impact to 2021. Our view is TSMC would recover most of the smartphone business and some infrastructure though other chip companies (Xilinx, Broadcom, Marvell) but should still be facing a slower China deployment schedule and a net reduction as Huawei's run rate was above its

production to build inventory the past 18 months. We maintain 2020 capex at US\$14.5 bn with this year largely fixed and already below TSMC's \$15-16 bn guidance and lower 2021 from US\$14.5 bn to US\$13.5 bn as it can pull back capacity without Huawei on the advanced nodes. We estimate Huawei at 20-25% of 28nm and below with about that much of TSMC's 16nm and 7nm nodes and 10-15% of its 5nm business with Apple the main early customer.

Figure 38: TSMC estimate revisions factoring in Huawei

	Base Case (After the Huawei restriction)						Prior Estimates (Before the Huawei restriction)						Huawei Impact	
	1Q20	2Q20	3Q20	4Q20	2020	2021	1Q20	2Q20	3Q20	4Q20	2020	2021	2020	2021
Sales	310,597	308,010	295,689	252,500	1,166,796	1,239,597	310,597	308,010	308,010	277,564	1,204,180	1,321,321	-37,385	-81,724
QoQ Growth	-2.1%	-0.8%	-4.0%	-14.6%			-2.1%	-0.8%	0.0%	-9.9%				
YoY Growth	42.0%	27.8%	0.9%	-20.4%	9.0%	6.2%	42.0%	27.8%	5.1%	-12.5%	12.5%	9.7%	-3.5%	-3.5%
Gross Profit	160,777	157,345	134,583	108,624	561,328	578,850	160,777	157,345	143,716	124,900	586,737	631,541	-25,409	-52,691
GM%	51.8%	51.1%	45.5%	43.0%	48.1%	46.7%	51.8%	51.1%	46.7%	45.0%	48.7%	47.8%	-0.6%	-1.1%
Opex	32,255	33,722	33,812	32,798	132,587	139,397	32,255	33,722	33,812	32,967	132,756	141,592	-169	-2,195
Op Profit	128,522	123,623	100,771	75,826	428,742	439,453	128,522	123,623	109,904	91,934	453,982	489,949	-25,240	-50,496
OpM%	41.4%	40.1%	34.1%	30.0%	36.7%	35.5%	41.4%	40.1%	35.7%	33.1%	37.7%	37.1%	-1.0%	-1.6%
Non-Op	3,625	4,067	4,410	4,303	16,405	17,410	3,625	4,067	4,410	4,370	16,473	18,343	-67	-933
Pretax	132,147	127,690	105,181	80,129	445,147	456,863	132,147	127,690	114,314	96,304	470,454	508,292	-25,307	-51,429
Tax	11%	12%	12%	12%	12%	12%	11%	12%	12%	12%	12%	12%	0%	0%
Minority/other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net income	117,063	112,367	92,559	70,514	392,503	402,040	117,063	112,367	100,596	84,747	414,773	447,297	-22,271	-45,258
EPS	4.51	4.33	3.57	2.72	15.14	15.50	4.51	4.33	3.88	3.27	16.00	17.25	-0.86	-1.75
Shares	25,930	25,930	25,930	25,930	25,930	25,930	25,930	25,930	25,930	25,930	25,930	25,930	0	0
EPS vs. base case:	0.0%	0.0%	-8.0%	-16.8%	-5.4%	-10.1%							-5.4%	-10.1%

Source: Company data, Credit Suisse estimates

We reflect the BIS restriction impact in estimates and lower our NT\$ sales growth for 2020/21 from +12.5%/+9.7% to +9.0%/+6.2% and trip our EPS from NT\$16.00/NT\$17.25 to NT\$15.14/NT\$15.50. While the Huawei ban is a setback, we still view the company's position intact due to wide distance for its ecosystem and technology to other foundries, growth drivers from the rest of the industry's move to 5G, high performance computing through AMD, AI accelerator, game console and Mac ramps, and from a low base in advanced auto and IoT.

We downgrade from Outperform to Neutral with TP reduced from NT\$350 to NT\$300 to reflect the impact of the restriction on its #2 customer Huawei alongside overhang from COVID-19 which could dampen the sales outlook after the 1H20 inventory build particularly with QCOM/NVIDIA also diversifying some of their advanced products to Samsung over the next year.

Figure 39: TSMC estimate revisions factoring in Huawei

(NT\$ mn)	2Q20				3Q20			2020			2021		
	CS	CS(old)	Street	Guidance	CS	CS(old)	Street	CS	CS(old)	Street	CS	CS(old)	Street
Sales	308,010	308,010	307,435	US\$10.1-10.4bn/NT\$303.0-312.0bn	295,689	308,010	307,037	1,166,796	1,204,180	1,227,622	1,239,597	1,321,321	1,348,763
Chg (%)	-0.8	-0.8	-1.0	-2.4% to +0.5% QoQ (NT\$)	-4.0	0.0	-0.1	9.0	12.5	14.7	6.2	9.7	9.9
GM (%)	51.1	51.1	50.8	50.0-52.0%	45.5	46.7	47.7	48.1	48.7	49.1	46.7	47.8	48.9
OpM (%)	40.1	40.1	39.7	39.0-41.0%	34.1	35.7	38.0	36.7	37.7	38.6	35.5	37.1	38.5
Net Inc.	112,367	112,367	109,681	NT\$30.0:1 Guide	92,559	100,596	102,070	392,579	414,773	423,652	402,040	489,949	470,097
EPS (NT\$)	4.33	4.33	4.23		3.57	3.88	3.93	15.14	16.00	16.38	15.50	17.25	18.13

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

Mediatek: Maintain Outperform, raising our target from NT\$430 to NT\$500

We view Mediatek as one of the few beneficiaries of the increased restrictions on Huawei, as it supplies only about 30mn of the 190mn smartphone processors for Huawei now but is the most viable alternative to Hi-Silicon for those units. Mediatek has been a longtime supplier to Huawei since 2G and is already qualifying its Dimensity 800 and 600 series for 2H20 models so can have a quick ramp either directly or with fast time to market with ODM designed models.

We estimate the market opportunity for Huawei's application processor bundle which includes processor, modem, connectivity, power management and transceiver would be US\$3 bn, based on 190mn units at about US\$16 ASP. We factor in our base assumption Mediatek's 4G market share increases from current 15% to 30%/60% for 2020/21 and 5G market share from 0 in 1Q20 to 20%/60% for 2020/21.

We keep conservative on modeling even higher market share as Huawei still carries some inventory and has some options to try to design in Samsung Exynos or at the low-end UniSOC's designs. Qualcomm could also be an option with no further tightening of US restrictions, although Huawei after a US ban seems unlikely to raise procurement of US components at the expense of its own chips. One key risk on the upside also with the regulations is that US-China tensions could swing either toward resolution that takes away this opportunity or a further restriction is placed that limit IC design suppliers using US EDA to also supply Huawei.

Figure 40: Huawei processors are a US\$3bn TAM, adding 15-20% to Mediatek's 2021

Huawei Smartphone Application Processor TAM	4G		5G		Total	
	2020	2021	2020	2021	2020	2021
Units (mn)	132.9	83.9	56.5	96.1	189.5	180.0
ASPs (US\$)	\$7.9	\$7.1	\$34.3	\$25.3	\$15.8	\$16.8
Huawei Sales TAM (US\$mn)	\$1,053	\$600	\$1,941	\$2,430	\$2,994	\$3,030
Mediatek Huawei Share	30%	60%	20%	60%	27%	60%
Mediatek Huawei sales (US\$mn)	\$316	\$360	\$388	\$1,458	\$809	\$1,818
Mediatek Smartphone sales (US\$mn)	\$2,520	\$2,202	\$1,327	\$3,009	\$3,880	\$5,230
Huawei % of Mediatek Smartphones	13%	16%	29%	48%	21%	35%
Mediatek Total sales (US\$mn)					\$8,964	\$10,611
Huawei % of Mediatek total sales					9%	17%

Source: Company data, Credit Suisse estimates

We lift our Mediatek 5G units factoring in the Huawei share from 35/80mn to 39/119mn for 2020 and 2021. Within our estimates, we also project Mediatek having 40% share in Oppo, 30% in Vivo and Xiaomi share rising toward 30% in 2021. One potential trade war outcome could also be China vendors sourcing away from Qualcomm although we are not yet factoring in that scenario if vendors still take their same approach to sourcing about 60-70% of their mix with the market leader.

Figure 41: Raising Mediatek 5G units for 2020-21 from 35/80mn to 39/119mn

Credit Suisse	Market 5G volumes (mn)			Mediatek share assumption			Mediatek volumes (mn)		
5G Forecasts	2019E	2020E	2021E	2019E	2020E	2021E	2019E	2020E	2021E
Apple	0.0	63.8	139.8	0%	0%	0%	0.0	0.0	0.0
Samsung	5.6	40.1	74.7	0%	10%	10%	0.0	4.0	7.5
Huawei+Honor	6.9	56.5	96.1	0%	20%	60%	0.0	11.3	57.6
Xiaomi	0.3	16.7	34.1	0%	25%	30%	0.0	4.2	10.2
OPPO	0.6	19.5	36.6	0%	40%	40%	0.0	7.8	14.6
Vivo	1.3	18.9	35.2	0%	30%	30%	0.0	5.7	10.6
Lenovo	0.0	3.0	7.8	0%	30%	40%	0.0	0.9	3.1
ZTE	0.0	1.1	2.2	0%	40%	50%	0.0	0.5	1.1
Others	1.3	8.6	20.4	0%	50%	70%	0.0	4.3	14.3
Total 5G Shipments	16.0	228.3	446.8	0%	17%	27%	0.0	38.6	119.0

Source: Company data, Credit Suisse estimates

We reflect the higher Huawei shipments for Mediatek and lift 2020/21 sales growth from +5%/+10% to +9%/+18% and raise our EPS from NT\$16/NT\$20 to NT\$17.50/NT\$25.00. Our revised estimates still allow Mediatek to scale up some additional R&D for Huawei support and grow opex high single digits in both 2020-21, still delivering operating margin expansion from 11% to 13%. We maintain our Outperform but lift our target from NT\$430 to NT\$500 and view the company well positioned as most viable non-US vendor in smartphones to capitalize on content gains on the move from 4G to 5G with supplementary drivers in non-mobile from networking, IoT, game consoles and analog.

Figure 42: Mediatek 2Q20/3Q20 and 2020/2021 estimates

(NT\$ mn)	2Q20			Guidance	3Q20			2020			2021		
	CS	CS(old)	Street		CS	CS(old)	Street	CS	CS(old)	Street	CS	CS(old)	Street
Sales	\$64,864	\$64,864	\$64,698	NT\$62.1-65.9bn	\$70,129	\$68,059	\$71,999	\$268,934	\$258,933	\$271,012	\$318,344	\$283,607	\$303,678
Chg	6.6%	6.6%	6.3%	Up 2-10% QoQ	8.1%	4.9%	11.0%	9.2%	5.2%	10.1%	18.4%	9.5%	23.4%
GM%	43.0%	43.0%	42.9%	GM: 41-44%	43.0%	43.0%	42.9%	43.0%	43.1%	42.9%	42.9%	43.0%	42.9%
OpM%	10.5%	10.5%	10.6%	OpM: 6.5-13.5%	11.4%	11.1%	12.1%	10.8%	10.1%	10.9%	13.4%	11.9%	12.1%
Net Inc.	6,503	6,503	6,505	FX: 30.0	7,538	7,188	8,448	27,444	25,085	29,070	39,203	31,359	35,385
GAAP EPS	\$4.09	\$4.09	\$4.10		\$4.75	\$4.53	\$5.34	\$17.50	\$16.00	\$18.41	\$25.00	\$20.00	\$22.72

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

By segment, our revised estimates for Mediatek have smartphone sales growing 28%/33% YoY in 2020-21, with the Huawei units now lifting 5G and also helping keep Mediatek 4G more stable even on our more conservative assumption discounting shipment risk from COVID-19 shut-downs in emerging markets. Our mature digital home sales are unchanged and still factor the macro slowdown impact on the TV and set-top to decline -11%/-2% in 2020-21. For the non-mobile growth products, we estimate still mild 6% growth in 2020 and recovery to 13% in 2021 with some revenue resilience from work from home demand in connectivity, routers, networking and from the upcoming PS/XBOX game console launches.

Figure 43: Mediatek estimates raised for 4G and 5G smartphones with the additional Huawei business

NT\$m unless noted	1Q20	2Q20E	3Q20E	4Q20E	2016	2017	2018	2019F	2020F	2020F	2021F	2021F
3G Smartphones (mn)	2.5	2.5	2.5	2.2	167.0	106.3	51.9	17.1	9.7	9.7	6.2	6.2
4G Smartphones (mn)	79.6	79.6	79.6	79.6	336.8	297.5	306.9	331.8	318.2	288.5	308.0	283.6
4G ASPs (US\$)	\$8.22	\$8.02	\$7.82	\$7.62	\$10.98	\$9.59	\$9.04	\$8.61	\$7.92	\$7.94	\$7.15	\$7.14
5G Smartphones (mn)	2.5	6.1	11.3	18.7	0.0	0.0	0.0	0.0	38.6	35.0	119.0	80.0
5G ASPs (US\$)	\$60.00	\$40.20	\$34.17	\$29.04					\$34.34	\$34.91	\$25.29	\$25.35
Smartphones (mn)	84.6	88.1	93.3	100.5	503.8	403.7	358.8	348.9	366.5	333.1	433.2	369.8
ASPs (US\$)	\$9.64	\$10.12	\$10.88	\$11.52	\$9.09	\$8.28	\$8.33	\$8.37	\$10.59	\$10.65	\$12.07	\$11.01
Handset/Tablets	25,785	28,381	32,170	36,323	157,716	109,390	95,354	95,989	122,659	112,658	162,793	128,057
Handset/Tablet YoY					32.1%	-30.6%	-12.8%	0.7%	27.8%	17.4%	32.7%	13.7%
Smartphone % of sales	40.2%	41.2%	43.4%	47.5%	50.2%	42.9%	37.8%	36.8%	43.3%	41.1%	49.3%	43.1%
Feature phones (mn)	29.9	28.4	27.0	25.7	252.4	181.1	156.0	136.2	111.0	111.0	93.0	93.0
ASPs (US\$)	\$1.17	\$1.16	\$1.15	\$1.13	\$1.37	\$1.30	\$1.25	\$1.20	\$1.15	\$1.15	\$1.11	\$1.11
DTV	12,893	11,604	11,604	11,256	49,740	50,217	52,598	52,478	47,357	47,357	47,440	47,440
STB	2,853	2,980	3,114	2,943	9,320	9,969	11,620	12,815	11,889	11,889	11,961	11,961
PC Optical	433	420	429	413	5,377	3,454	2,701	2,194	1,694	1,694	1,357	1,357
Consumer DVD	163	158	150	134	2,049	1,438	1,185	901	605	605	411	411
LCD Monitor	693	831	831	789	2,861	2,850	3,036	3,198	3,144	3,144	3,123	3,123
Digital Home products	18,083	16,979	17,056	16,408	80,484	75,132	77,006	76,646	68,526	68,526	67,378	67,378
Digital Home % of sales	29.7%	26.2%	24.3%	22.5%	29.2%	31.5%	32.3%	31.1%	25.5%	26.5%	21.2%	23.8%
Digital Home YoY		-6.1%	0.5%	-3.8%	9.0%	-6.6%	2.5%	-0.5%	-10.6%	-10.6%	-1.7%	-1.7%
Connectivity (Ralink)	4,946	5,574	5,686	5,509	16,550	18,140	20,094	22,964	21,716	21,716	24,484	24,484
IoT chipsets	1,146	1,187	1,207	1,126	895	3,443	4,276	4,720	4,667	4,667	4,998	4,998
Voice Assistant Devices	2,673	3,059	3,044	3,028	639	6,600	9,622	11,161	11,804	11,804	12,899	12,899
Other (GPS, RFID, Ilitek)	1,853	2,131	2,344	2,344	3,552	4,552	7,272	7,878	8,671	8,671	9,534	9,534
Game console ASIC	1,210	1,597	2,092	1,957	2,646	6,427	7,542	6,271	6,855	6,855	7,728	7,728
Networking	669	784	843	865	0	0	432	2,165	3,160	3,160	5,024	5,024
Richtek	4,497	5,172	5,689	5,518	13,028	14,530	16,460	18,426	20,876	20,876	23,505	23,505
Growth products	16,995	19,503	20,904	20,348	37,310	53,693	65,698	73,585	77,749	77,749	88,173	88,173
Growth Products % of sales	27.9%	30.1%	29.8%	27.8%	13.5%	22.5%	27.6%	29.9%	28.9%	30.0%	27.7%	31.1%
Growth YoY		14.8%	7.2%	-2.7%	86.3%	43.9%	22.4%	12.0%	5.7%	5.7%	13.4%	13.4%
Total Sales	60,863	64,864	70,129	73,078	275,510	238,215	238,057	246,220	268,934	258,933	318,344	283,607
GM %	43.1%	43.0%	43.0%	42.9%	35.6%	35.6%	38.5%	41.9%	43.0%	43.1%	42.9%	43.0%
Op M %	12.5%	18.6%	22.2%	12.1%	8.4%	4.1%	6.8%	9.2%	10.8%	10.1%	13.4%	11.9%
Pro Forma EPS	\$12.81	\$20.13	\$29.67	\$16.74	\$14.47	\$8.49	\$11.05	\$14.65	\$17.50	\$16.00	\$25.00	\$20.00
EPS growth					-13.6%	-41.3%	30.1%	32.6%	19.5%	9.2%	42.8%	25.0%

Source: Company data, Credit Suisse estimates

SMIC: Downgrade to Underperform, lowering our target from HK\$17.60 to \$16.00

SMIC had 19% of sales from Huawei in 2019 and should be expecting further growth from that customer as it has traditionally outsourced its high-end consumer chips, connectivity, and power management and was set to also add its low-end Kirin 710 on 14nm. We maintain our 3Q20 flat QoQ as SMIC would still be shipping with the 120 day grace period for WIP started by 15 May and was running at full capacity so should have other customers to offset the gap from Huawei. We revise down 4Q20 from -5% QoQ to -15% QoQ as shipments would stop and by that point the supply chain could also run the risk of a COVID-19 inventory correction with supply no longer as tight in the foundries post the Huawei restriction.

For 2020-21, we lower our sales from +18%/+14% to +15%/+10% YoY, still outgrowth as we expect localisation to continue at the China design companies but should still have a net impact losing its top customer. On lower sales, we reduce our 2020-21 net income from US\$270/US\$374 mn to US\$238 mn/US\$300 mn and EPS from HK\$0.35/HK\$0.49 to HK\$0.31/HK\$0.39. SMIC would also be losing its lead target on 14nm so may slow down its capex ramp. We trim our capex for 2020 capex from US\$4.3bn to US\$3.8bn as we see higher chance for equipment push-outs to delay depreciation and maintain 2021 capex at US\$3.2 bn.

Figure 44: CS and street estimates for 2020 and 2021

(US\$ mn)	2Q20			3Q20			2020			2021		
	CS	Street	Guidance	CS	Street		CS	CS(old)	Street	CS	CS(old)	Street
Net sales	\$943	\$876	\$932.2-\$950.3mn	\$943	\$914		\$3,592	\$3,687	\$3,547	\$3,935	\$4,213	\$4,063
Change	4.2%	1.4%	+3 to 5% QoQ	0.0%	4.3%		15.3%	18.3%	13.7%	9.5%	14.3%	14.5%
GM %	26.5%	21.0%	26-28%	22.1%	20.1%		22.9%	23.2%	21.0%	20.9%	21.4%	21.0%
OpM %	8.9%	0.7%	Opex \$240-245mn	3.7%	-2.8%		3.4%	4.2%	1.4%	3.6%	5.2%	2.8%
Net income	106	44	Minority: \$0-10mn	70	55		238	270	185	300	374	256
EPS (US\$)	\$0.018	\$0.009		\$0.012	\$0.011		\$0.040	\$0.045	\$0.032	\$0.050	\$0.063	\$0.047
HK EPS (HK\$)	\$0.138	\$0.070		\$0.091	\$0.085		\$0.309	\$0.350	\$0.248	\$0.390	\$0.486	\$0.364

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

We still believe SMIC's Sci-Tech listing should be well received as largest foundry and with the National IC fund and Shanghai/Beijing municipal backing and expect it to raise US\$2.9 bn if at 1.5x P/B and US\$4.4 bn at the median A-Share premium over A-Shares. We trim our target from HK\$17.60 to HK\$16.00 which reflects a more reasonable 1.5x post Star listing P/B valuation, high-end of its historical 1-1.5x range and midpoint of its recent 1-2x range.

Figure 45: SMIC target at NT\$16 based on 1.5x its post Star listing valuation

	Shares	Share price (local currency)	Market cap (US\$mn)	Net cash	Enterprise Value (US\$mn)	P/B	BV/Share	2020 ROE	CS TP Multiple	HK Price
SMIC - Hong Kong listing	5,155	\$13.2	\$8,781	\$431	\$8,350	1.5	\$8.8	3.7%	1.50	\$13
Premium (Parity) A-share issuance	1,686	\$12.02	\$2,858			1.5	\$8.0			
SMIC - Hong Kong if parity	6,841	\$13.2	\$11,638	\$3,288	\$8,350	1.2	\$10.6	2.5%	1.50	\$16
Premium (Median) A-share issuance	1,686	\$18.63	\$4,429			1.2	\$15.0			
SMIC - Hong Kong w/premium	6,841	\$15.0	\$13,210	\$4,860	\$8,350	1.2	\$12.4	2.2%	1.50	\$19

Source: Company data, Credit Suisse estimates

ASE: Maintain Outperform, lowering our target from NT\$84 to NT\$75

We see a modest impact to ASE from the restrictions as the fab restriction ultimately will impact the package and test flows. We estimate Huawei's Hi-Silicon chip division as a 7-8% customer for ASE for the chipsets across smartphones, networking and consumer. We do believe the company's loss at Huawei though should be offset by other baseband suppliers, as it also has good market share at Qualcomm and Mediatek and also has good infrastructure share at other fabless including Broadcom, Xilinx and Marvell.

Factoring in Huawei's ban, we still reflect a bit of output that may not be fully recouped and trim 2% from the back-end IC ATM business in 2H20, with full year sales now up 5% YoY. The company should see Huawei's share shift to its other customers in 2021 so only trimming 1% impact from a bit lower 5G forecast in China as the lower infrastructure builds impact some of the penetration into lower price bands. We trim our 2020/21 EPS from NT\$5.50/NT\$6.00 to NT\$5.30/NT\$5.80, reflecting the lower sales and lower our TP from NT\$84 to NT\$75 based on same 13x 2021 P/E.

Figure 46: ASE 2Q20-3Q20 and 2020-21 estimates CS vs. Street

	2Q20					Guidance	3Q20					2020					2021				
	ATM	USI	CS	CS(Old)	Street		ATM	USI	CS	CS(Old)	Street	ATM	USI	CS	CS(Old)	Street	ATM	USI	CS	CS(Old)	Street
Sales	67,861	35,345	102,706	102,706	102,471	ATM -NT\$7.9bn, +2.5% QoQ	67,183	49,483	115,366	116,044	112,226	263,732	176,935	435,689	438,695	429,530	267,789	194,894	458,282	463,499	470,618
Chg (%)	2.5	8.0	5.5	5.5	5.3	EMS: >NT\$35bn, >+7% QoQ	-1.0	40.0	12.3	13.0	9.5	4.9	6.7	5.4	6.2	4.0	1.5	10.1	5.2	5.7	9.6
GAAP GM (%)	21.7	8.8	17.4	17.4	17.0	ATM GAAP GMs ~21.7%	20.6	8.7	15.7	15.7	16.6	20.1	8.9	15.7	15.9	15.9	20.5	9.1	15.9	15.9	15.9
GAAP OpM (%)	10.2	2.2	7.5	7.5	7.2	EMS OpM >2.1%	9.0	3.5	6.7	6.8	7.2	8.2	3.4	6.3	6.5	6.5	8.6	3.7	6.6	6.7	6.7
Net Inc.			4,911	4,911	5,064				5,299	5,390	5,794			17,886	18,752				20,182	21,030	
GAAP EPS (NT\$)			1.15	1.15	2.23				1.24	1.26	2.72			4.19	4.39				4.73	4.92	
Pro Forma GM (%)	23.0		18.2	18.2			22.0		16.5	16.5		21.5		16.6	16.7	16.4	21.8		16.6	16.7	16.7
Pro Forma OpM (%)	11.9		8.6	8.6			10.7		7.7	7.8		10.0		7.4	7.6	7.2	10.3		7.6	7.7	7.6
Pro Forma Net Inc.			6,057	6,057					6,445	6,536				22,626	23,492	20,593			24,758	25,606	25,210
Pro Forma EPS			1.42	1.42					1.51	1.53				5.30	5.50				5.80	6.00	

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

Vanguard: Maintain Neutral, lowering our target from NT\$70 to NT\$66.5

We estimate mobile-related applications are 1/3 of Vanguard's power management business, representing 15-20% of its total sales. The 5G smartphone and infrastructure builds have been one of the main drivers for power management IC growth for the company in the past few quarters in a slow demand environment for broad based automotive/industrial applications. We believe Vanguard had a project to ramp up Huawei power management so may see a modest impact from the lost additional opportunity.

With slower 5G infrastructure builds in China following the Huawei foundry restriction and loss of the smartphone PMIC business there, we estimate Vanguard's power management IC could slow down from 3Q20 and modeling 2%/1% sales impact in 2020/21 and lower 2020/21 EPS from NT\$3.35/NT\$3.75 to NT\$3.20/NT\$3.50 and lower our target from NT\$70 to NT\$66.5 based on same 19x 2021 P/E and 16x ex-cash.

Figure 47: Vanguard 2Q20-3Q20 and 2020-21 estimates CS vs. Street

	1Q20	2Q20				3Q20			2020			2021		
(NT\$ mn)	Actual	CS	CS Old	Street	Guidance	CS	CS(Old)	Street	CS	CS Old	Street	CS	CS Old	Street
Sales	7,844	8,209	8,209	8,232	NT\$8.0-8.4bn	8,085	8,209	8,302	31,011	31,731	32,626	32,154	33,298	35,115
QoQ (%)	6.9%	4.6%	4.6%	4.9%	+2.0% to +7.1%	-1.5%	0.0%	0.9%	9.6%	12.2%	15.3%	3.7%	4.9%	7.6%
GM (%)	31.0%	32.1%	32.1%	32.1%	31-33%	32.3%	32.5%	32.3%	31.1%	31.4%	31.7%	33.0%	33.4%	33.4%
OpM (%)	19.2%	20.5%	20.5%	20.2%	19-21%	20.4%	20.7%	20.7%	18.9%	19.5%	19.7%	20.7%	21.5%	21.0%
Net Inc:	1,476	1,458	1,458	1,390	NT\$30:1	1,431	1,475	1,425	5,287	5,543	1,425	5,785	6,200	1,425
EPS (NT\$)	0.89	0.88	0.88	0.86		0.87	0.89	0.87	3.20	3.35	3.48	3.50	3.75	4.04

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

CHPT – Maintain Underperform, lowering our target from NT\$510 to NT\$480

Huawei has been the #2 customer for Chunghwa Precision's probe card business with business across smartphones, infrastructure and consumer multimedia representing the company's 20-30% sales. With the fab license restriction announced, we see another impact to the company's business outlook in 2020 and 2021 in addition to its potential loss in the US flagship smartphone business in 2021. CHPT does have good diversification across the other chip companies including Qualcomm, Mediatek and Samsung, although we do not expect them to fully offset the lost Huawei probe card business particularly as Huawei doubled last year adding more projects to CHPT and aggressively building up its own inventory.

With the reduction of Huawei's business from 3Q20, we factor CHPT's sales to be impacted by 10% in 2H20 and a milder 3-4% in 2021 with its other mobile customers' additional business. On the lower sales, we revise down our 2020/21 EPS from NT\$24.69/25.56 to NT\$23.68/NT\$24.00 and lower our target from NT\$510 to NT\$480.

Figure 48: CHPT 2Q20-3Q20 and 2020-21 estimates CS vs. Street

	2Q20			3Q20			2020			2021		
(NT\$ mn)	CS	CS(prior)	Street	CS	CS(prior)	Street	CS	CS(old)	Street	CS	CS(old)	Street
Sales	1,035	1,035	1,061	963	1,035	1,141	3,737	3,872	4,161	3,750	3,959	4,344
Chg (%)	15%	15%	18%	-7%	0%	10%	10%	14%	23%	0%	2%	4%
GM (%)	54.3%	54.3%	53.3%	54.5%	54.5%	53.4%	54.0%	54.0%	53.0%	53.9%	53.9%	52.9%
OpM (%)	27.0%	27.0%	25.7%	26.0%	26.4%	26.5%	25.6%	25.8%	25.5%	26.0%	26.3%	25.8%
Net Inc.	225	225	216	202	220	239	776	809	850	787	838	906
EPS (NT\$)	6.85	6.85	6.51	6.16	6.71	7.31	23.68	24.69	25.99	24.00	25.56	27.64

Source: Company data, Credit Suisse estimates, the BLOOMBERG PROFESSIONAL™ service

Table of Huawei's Asian supply chain

Figure 49: Asian supply chain for Huawei (Semiconductors)

Semiconductors	Stock ticker	Sector Analyst	Parts/service supplied	Huawei % of sales
Semiconductor Foundry				
AWSC	8086.TWO	Not Covered	Foundry for RF in handsets	10-15%
GCS	4991.TWO	Jerry Su	Foundry for RF in fiber optics	5-10%
Sanan	600703.SZ	Kyna Wong	Foundry for RF in fiber optics	<5%
SMIC	0981.HK	Randy Abrams	Foundry for consumer, IoT, and mobile RF/Wifi	19%
TSMC	2330.TW	Randy Abrams	Foundry for mobile, IoT and HPC applications	14%
Vanguard	5347.TWO	Randy Abrams	Foundry for Power Management	5%
Win Semi	3105.TWO	Jerry Su	Foundry for RF/VCSEL in handsets and infrastructure	15-20%
Back-end packaging				
ASE	3711.TW	Randy Abrams	Packaging and testing for mobile, IoT and HPC applications	7%
Chipbond	6147.TWO	Jerry Su	Wafer bumping for touch driver IC and driver IC	8-10%
Inari Amertron	INRI.KL	Danny Chan	RF filter package and test and fiber optic module assembly	1-2%
King Yuan	2449.TW	Not Covered	Testing for mobile, IoT and HPC	15-20%
JCET	600584.SS	Chaolien Tseng	Packaging and testing for mobile, IoT and HPC applications	5-10%
Huatian	002185.SZ	Chaolien Tseng	Packaging and testing for mobile, IoT and HPC applications	~5%
Tongfu	002156.SZ	Chaolien Tseng	Packaging and testing for mobile, IoT and HPC applications	~5%
Memory				
Nanya	2408.TW	Haas Liu	Memory manufacturing for IoT, mobile and infrastructure	Limited exposure
Samsung	005930.KS	Keon Han	Limited mobile DRAM, higher server exposure	Limited exposure
SK Hynix	000660.KS	Keon Han	Memory manufacturing for IoT, mobile and infrastructure	10-12% DRAM; 12% NAND
Kioxia	Japan	Hideyuki Maekawa	Memory manufacturing for IoT, mobile and infrastructure	10% of memory business
Fabless IC Design				
Focaltech	3545.TW	Jerry Su	Smartphone touch IC, driver IC, touch driver IC	15-20%
Goodix	603160.SZ	Chaolien Tseng	Fingerprint sensors	20%
Will Semi	603501.SZ	Chaolien Tseng	CIS	10-20%
Mediatek	2454.TW	Randy Abrams	Mobile devices and IoT chipsets	4%
Novatek	3034.TW	Jerry Su	Smartphone touch driver IC / driver IC	15-20%
Egis	6462.TWO	Jerry Su	Fingerprint sensors	10%
Elan	2458.TW	Harvie Chou	Fingerprint sensors, stylus, touchpad	2-3%
Parade	4966.TWO	Jerry Su	NB/tablet T-Con / driver IC	3-5%
Realtek	2379.TW	Randy Abrams	Networking chipsets for infrastructure and IoT devices	2%
PA & MLCCs				
ACX	3152.TWO	Not Covered	RF filters/passive components	1-2%
Hirose	6806.T	Akinori Kanemoto	Connectors	3-5%
Murata	6981.T	Akinori Kanemoto	RF filters/passive components/batteries	5-10%
SEMC	009150.KS	Sang Uk Kim	Passive components	<5%
Taiyo Yuden	6976.T	Akinori Kanemoto	RF filters/passive components	5-10%
TDK	6762.T	Akinori Kanemoto	Battery, passive components	5-10%
Universal Microwave	3491.TWO	Not Covered	Microwave/mmWave backhaul components	21%
Substrates				
Kinsus	3189.TW	Pauline Chen	IC substrates for infrastructure and smartphone ICs	0-5%
Nanya PCB	8046.TW	Pauline Chen	IC substrates for infrastructure and smartphone ICs	10-15%
Unimicron	3037.TW	Pauline Chen	IC substrates for infrastructure and smartphone ICs	5-10%
Wafer				
IET	4971.TW	Not Covered	Epi wafers for mobile devices and infrastructure	10%
Landmark Optoelectronics	3081.TW	Not Covered	Epi wafers for optical communications	15-20%
Visual Information (Epi wafers)	2455.TW	Jerry Su	Epi wafers for mobile devices and infrastructure	7-10%

Source: Company data, Credit Suisse estimates

Figure 50: Asian supply chain for Huawei (device and infrastructure)

Infrastructure	Stock ticker	Sector Analyst	Parts/service supplied	Huawei % of sales
Test equipment				
Anritsu	6754.T	Hideyuki Maekawa	Mobile + network infrastructure	<5%
Chroma	2360.TW	Jerry Su	VCSEL and fiber optic testing	4%
Fiber optics/Backhaul				
Accelink	002281.SZ	Not Covered	Fiber optic modules for backhaul	30%
FIT	6088.HK	Kyna Wong	Connector/cable, Fiber optic modules for backhaul	<5%
Hengtong	600487.SZ	Not Covered	Fiber optic modules for backhaul	<5%
Innolight	300308.SZ	Not Covered	Fiber optic modules for backhaul	c.10%
Luxshare	002475.SZ	Kyna Wong	Long haul optics cables and transceivers	5%
O-Net	877.HK	Not Covered	Optical networking components	5-10%
YOFC	601869.SZ	Not Covered	Fiber optic modules for backhaul	<5%
Data Center Equipment				
FII	601138.SS	Pauline Chen	Data center switches and routers	<10%
Hon Hai	2317.TW	Pauline Chen	Data center switches and routers	<5%
Inventec	2356.TW	Pauline Chen	Data center switches and routers	< 3-4% smartphone
Power supply				
Delta	2308.TW	Pauline Chen	Networking equipment and power supplies	<5%
Mobile Devices				
Casing				
Biel Crystal	Private	Not Covered	Cover glass and back glass casings	10%
BYDE	0285.HK	Kyna Wong	Casing, EMS	40%
Lens Technology	300433.SZ	Kyna Wong	Cover glass and back glass casings	20%
Tongda	0698.HK	Kyna Wong	Casing	2%
Acoustics				
AAC	2018.HK	Kyna Wong	MEMS microphone	15-20%
Goertek	002241.SZ	Kyna Wong	MEMS microphone	10-20%
Crystal				
TXC	3042.TW	Pauline Chen	Crystals and oscillators in mobile devices	15-20%
LCP Antenna				
Luxshare	002475.SZ	Kyna Wong	Connector/cable, antenna, wireless charging	5%
Sunway	300136.SZ	Kyna Wong	Antennas, wireless charging	5-10%
Copper Clad Laminate				
Elite Materials	2383.TW	Not Covered	Copper clad laminate for small cells and data center PCBs	5-10%
ITEQ	6213.TW	Not Covered	Copper clad laminate for small cells and data center PCBs	5-10%
TUC	6274.TW	Not Covered	Copper clad laminate for small cells and data center PCBs	5-10%
Display				
BOE	000725.SZ	Kyna Wong	OLED	5-7%
Innolux	3481.TW	Jerry Su	Smartphone TFT panel	7-10%
Tianma	000050.SZ	Kyna Wong	LCD	20-25%
Camera				
Largan	3008.TW	Pauline Chen	Lens, mostly in high end smartphones	15-20%
LG Innotek	011070.KS	Sang Uk Kim	Camera modules (multi-cam)	<10%
O-film	002456.SZ	Kyna Wong	Camera modules	20-30%
Q Tech	1475.HK	Kyna Wong	Camera modules	10-20%
Sony	6758.T	Mika Nishimura	Image sensor	15% image sensor; 1-2% total
Sunny Optical	2382.HK	Kyna Wong	Camera modules and lens	25-30%
Probe PCB / PCB				
CHPT	6510.TWO	Randy Abrams	Probe PCB for mobile devices and RF chipsets	20%
Compeq	2313-TW	Not Covered	PCBs in smartphones	5%
Gold Circuit Electronics	2368.TW	Not Covered	PCBs in base stations and networking	0-5%
Tripod	3044.TW	Pauline Chen	PCB and HDI for low/mid end smartphones	0-5%
Smartphone ODM				
Hon Hai	2317.TW	Pauline Chen	Smartphone assembly (mfg by FIH, consolidated by HH)	<5%
Inventec	2356.TW	Jerry Su	Smartphone assembly	0%

Source: Company data, Credit Suisse estimates

Companies Mentioned *(Price as of 15-May-2020)*

AAC Technologies (2018.HK, HK\$42.65)
ACX (3152.TWO, NT\$294.0)
ADLINK (6166.TW, NT\$65.5)
AIC (3693.TWO, NT\$49.85)
ALi (3041.TW, NT\$17.05)
ASE Industrial Holdings (3711.TW, NT\$66.4, OUTPERFORM, TP NT\$75.0)
ASM Pacific Technology Ltd (0522.HK, HK\$78.5)
AU Optonics (2409.TW, NT\$7.61)
AVC (3017.TW, NT\$38.4)
AcBel (6282.TW, NT\$19.95)
Accelink (002281.SZ, Rmb30.9)
Accton (2345.TW, NT\$209.0)
Acer Group (2353.TW, NT\$16.25)
Advanced Wireless Semiconductor Company (8086.TWO, NT\$91.1)
Advantech Co., Ltd. (2395.TW, NT\$278.0)
Airtac (1590.TW, NT\$555.0)
Alpha Networks (3380.TW, NT\$26.0)
Amkor Technology Inc. (AMKR.OQ, \$9.39)
Amtran (2489.TW, NT\$7.05)
Anritsu (6754.T, ¥2,184)
Axiomtek (3088.TWO, NT\$53.5)
BOE (000725.SZ, Rmb3.93)
BYD Electronic (0285.HK, HK\$17.56)
CMC Magnetics (2323.TW, NT\$8.65)
COMPEQ MFG. (2313.TW, NT\$42.0)
Cameo (6142.TW, NT\$7.0)
Career Tech. (6153.TW, NT\$26.6)
Casetek Holdings Limited (5264.TW, NT\$42.4)
Catcher Technology (2474.TW, NT\$232.5)
Chaun-Choung (6230.TW, NT\$238.5)
Chenbro (8210.TW, NT\$91.4)
Cheng Uei Precision Industry Co. (2392.TW, NT\$36.35)
Chicony (2385.TW, NT\$80.6)
Chicony Power (6412.TW, NT\$62.6)
Chin-Poon Industrial Co., Ltd. (2355.TW, NT\$22.5)
Chinasoft (0354.HK, HK\$4.66)
Chipbond (6147.TWO, NT\$58.9)
Chroma (2360.TW, NT\$135.5)
Chunghwa Precision (6510.TWO, NT\$623.0, UNDERPERFORM[V], TP NT\$480.0)
Compal Electronics (2324.TW, NT\$18.45)
Coretronic Corp (5371.TWO, NT\$30.8)
CyberPower (3617.TW, NT\$79.6)
CyberTAN Technology Inc. (3062.TW, NT\$14.6)
Cyberlink (5203.TW, NT\$115.0)
D-Link (2332.TW, NT\$12.5)
Darfon (8163.TW, NT\$35.8)
Delta Electronics (2308.TW, NT\$138.5)
Dynapack (3211.TWO, NT\$72.4)
E Ink Holdings Inc (8069.TWO, NT\$35.8)
E-Tron (096040.KQ, W168)
EDOM (3048.TW, NT\$17.15)
Edison Opto (3591.TW, NT\$12.1)
Egis Technology Inc. (6462.TWO, NT\$180.0)
Elan Microelectronics Corp (2458.TW, NT\$91.5)
Elite Material (2383.TW, NT\$144.0)
Elitegroup Comp (2331.TW, NT\$11.3)
Ennoconn (6414.TW, NT\$184.0)
Epistar Corporation (2448.TW, NT\$35.7)
Eson Precision (5243.TW, NT\$30.4)
Etron (5351.TWO, NT\$6.22)
Everlight Electronics Co Ltd (2393.TW, NT\$32.1)
FIT Hon Teng (6088.HK, HK\$2.08)
Faraday Technology Corporation (3035.TW, NT\$41.35)
Flytech (6206.TW, NT\$67.5)
FocalTech Corporation, Ltd. (3545.TW, NT\$31.2)
Foxconn Industrial Internet (601138.SS, Rmb13.79)
Foxconn Technology Corp (2354.TW, NT\$54.8)
G-Tech (3149.TW, NT\$7.11)
GCE (2368.TW, NT\$34.1)
GCS Hldg (4991.TWO, NT\$52.8)
GTK (2441.TW, NT\$44.1)
GUC (3443.TW, NT\$216.0)
Gemtek Technology Co Ltd (4906.TW, NT\$21.1)
Giantplus Technology (8105.TW, NT\$8.92)
Gigabyte Technology Co., Ltd (2376.TW, NT\$62.4)
Global Mixed-Mode Technology (8081.TW, NT\$139.0)
GoerTek (002241.SZ, Rmb21.16)
HOLY STONE (3026.TW, NT\$127.5)
HTC Corp (2498.TW, NT\$28.3)
Hannstar Display (6116.TW, NT\$6.0)
Hirose Electric (6806.T, ¥12,070)
Hiwin (2049.TW, NT\$283.5)
Hon Hai Precision (2317.TW, NT\$77.1)
Hua Hong Semiconductor Limited (1347.HK, HK\$16.5, NEUTRAL[V], TP HK\$17.5)
Huatian (002185.SZ, Rmb14.66)
I Chiun (2486.TW, NT\$7.38)
IBASE (8050.TWO, NT\$37.65)

IEI (3022.TW, NT\$40.1)
ITEQ CORP (6213.TW, NT\$142.0)
Ichia (2402.TW, NT\$12.4)
Infortrend (2495.TW, NT\$11.25)
Innolux Corporation (3481.TW, NT\$6.22)
Intel Corp. (INTC.OQ, \$58.28)
IntelliEPI (4971.TWO, NT\$54.6)
Inventec Co Ltd (2356.TW, NT\$23.6)
JCET (600584.SS, Rmb31.21)
KINPO (2312.TW, NT\$11.6)
KYEC (2449.TW, NT\$35.55)
King Slide (2059.TW, NT\$301.0)
Kinsus Interconnect Tech (3189.TW, NT\$50.7)
LG Innotek (011070.KS, W146,000)
LPI (2369.TW, NT\$9.41)
LandMark (3081.TWO, NT\$281.5)
Lanner Elec (6245.TWO, NT\$55.3)
Largan Precision (3008.TW, NT\$4065.0)
Ledlink (5230.TWO, NT\$23.2)
Lens Technology (300433.SZ, Rmb18.66)
Lite-On Technology (2301.TW, NT\$46.1)
Luxshare (002475.SZ, Rmb48.23)
Macronix (2337.TW, NT\$32.5)
MediaTek Inc. (2454.TW, NT\$411.0, OUTPERFORM, TP NT\$500.0)
Merry Electronics Co. Ltd (2439.TW, NT\$131.5)
MiTAC Holdings Corporation (3706.TW, NT\$29.75)
Micro-Star International Co., Ltd (2377.TW, NT\$103.5)
Min Aik (3060.TW, NT\$12.9)
Motech Industries (6244.TWO, NT\$7.3)
Murata Manufacturing (6981.T, ¥6,122)
Nan Ya Printed Circuit Board (8046.TW, NT\$69.9)
Nanya Technology (2408.TW, NT\$60.1)
Nissin Foods (1475.HK, HK\$6.61)
Novatek Microelectronics Corp Ltd (3034.TW, NT\$204.0)
O-film (002456.SZ, Rmb16.06)
On-Bright Elec (4947.TWO, NT\$228.5)
Orient Semicon (2329.TW, NT\$11.5)
Pan Jit (2481.TW, NT\$23.25)
Parade Technologies (4966.TWO, NT\$892.0)
Pegatron (4938.TW, NT\$62.6)
Posiflex (8114.TW, NT\$88.1)
Promate (6189.TW, NT\$33.7)
Promise (3057.TW, NT\$4.55)
QUALCOMM Inc. (QCOM.OQ, \$75.77)
Qisda (2352.TW, NT\$16.25)
Quanta Computer (2382.TW, NT\$65.2)
Radiant Opto-Electronics (6176.TW, NT\$97.3)
Realtek Semiconductor (2379.TW, NT\$245.5)
Ritek (2349.TW, NT\$7.1)
SENAO (2450.TW, NT\$27.7)
SK Hynix Inc. (000660.KS, W81,900)
SZS (3376.TW, NT\$127.5)
Samsung Electro-Mechanics (009150.KS, W119,500)
Samsung Electronics (005930.KS, W47,850)
Semiconductor Manufacturing International Corp. (0981.HK, HK\$19.16, UNDERPERFORM, TP HK\$16.0)
Sercomm (5388.TW, NT\$72.1)
Silergy (6415.TW, NT\$1470.0)
Silitech Technology Corp (3311.TW, NT\$27.5)
Sino-American Silicon Products (5483.TWO, NT\$87.0)
Sony (6758.T, ¥6,865)
Sunny Optical (2382.HK, HK\$122.5)
Sunway Communication (300136.SZ, Rmb44.52)
Syncomm (3150.TWO, NT\$9.1)
Synnex Technology International Corp (2347.TW, NT\$42.4)
Systex (6214.TW, NT\$77.6)
TDK (6762.T, ¥9,440)
TPK Holdings (3673.TW, NT\$40.0)
TXC Corp. (3042.TW, NT\$57.0)
Taiwan Semiconductor Manufacturing (2330.TW, NT\$298.0, NEUTRAL, TP NT\$300.0)
Taiyo Yuden (6976.T, ¥3,085)
Teco (1504.TW, NT\$26.95)
Tianma (000050.SZ, Rmb14.25)
TongFu (002156.SZ, Rmb25.76)
Tongda (0698.HK, HK\$0.51)
Toshiba (6502.T, ¥2,691)
Transcend (2451.TW, NT\$69.0)
Tripod Technology (3044.TW, NT\$109.5)
UDE (3689.TWO, NT\$23.15)
UMT (3491.TWO, NT\$72.7)
Unimicron Technology Corp (3037.TW, NT\$43.9)
United Microelectronics (2303.TW, NT\$15.4)
Unity Opto Tech (2499.TW, NT\$4.12)
Vanguard International Semiconductor (5347.TWO, NT\$70.1, NEUTRAL, TP NT\$66.5)
Visual Photonics Epitaxy Co., Ltd (2455.TW, NT\$90.9)
WT (3036.TW, NT\$38.75)
Win Semiconductors Corp (3105.TWO, NT\$268.5)
Wistron (3231.TW, NT\$28.1)
YTEC (6261.TWO, NT\$57.9)

ZHONGJINNOLIGHT (300308.SZ, Rmb64.43)
eMemory (3529.TWO, NT\$297.5)
tuc (6274.TWO, NT\$144.0)

Disclosure Appendix

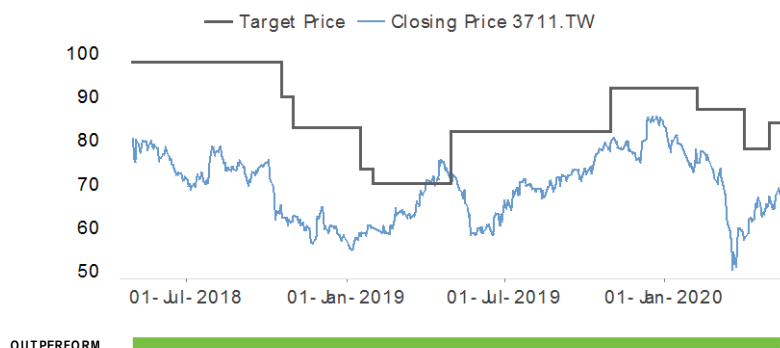
Analyst Certification

Randy Abrams, CFA, and Haas Liu each certify, with respect to the companies or securities that the individual analyzes, that (1) the views expressed in this report accurately reflect his or her personal views about all of the subject companies and securities and (2) no part of his or her compensation was, is or will be directly or indirectly related to the specific recommendations or views expressed in this report.

3-Year Price and Rating History for ASE Industrial Holdings (3711.TW)

3711.TW	Closing Price	Target Price	
Date	(NT\$)	(NT\$)	Rating
30-Apr-18	80.30	98.00	O *
18-Oct-18	63.20	90.00	
31-Oct-18	62.40	83.00	
17-Jan-19	58.10	73.50	
31-Jan-19	60.00	70.00	
01-May-19	71.70	82.00	
31-Oct-19	79.50	92.00	
08-Feb-20	74.80	87.00	
02-Apr-20	57.20	78.00	
30-Apr-20	67.10	84.00	

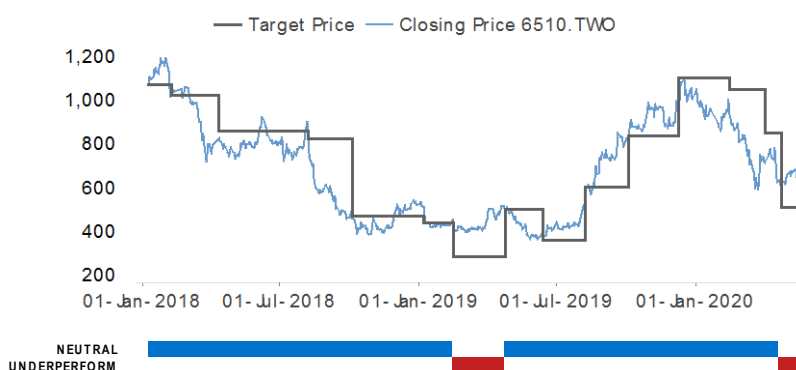
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Chunghwa Precision (6510.TWO)

6510.TWO	Closing Price	Target Price	
Date	(NT\$)	(NT\$)	Rating
09-Jan-18	1080.00	1070.00	N *
08-Feb-18	1050.00	1020.00	
11-Apr-18	820.00	860.00	
08-Aug-18	794.00	825.00	
05-Oct-18	459.00	470.00	
07-Jan-19	509.00	440.00	
15-Feb-19	419.00	285.00	U
25-Apr-19	490.00	500.00	N
13-Jun-19	382.00	360.00	
08-Aug-19	585.00	600.00	
04-Oct-19	835.00	835.00	
09-Dec-19	983.00	1100.00	
14-Feb-20	941.00	1050.00	
02-Apr-20	715.00	850.00	
23-Apr-20	671.00	510.00	U

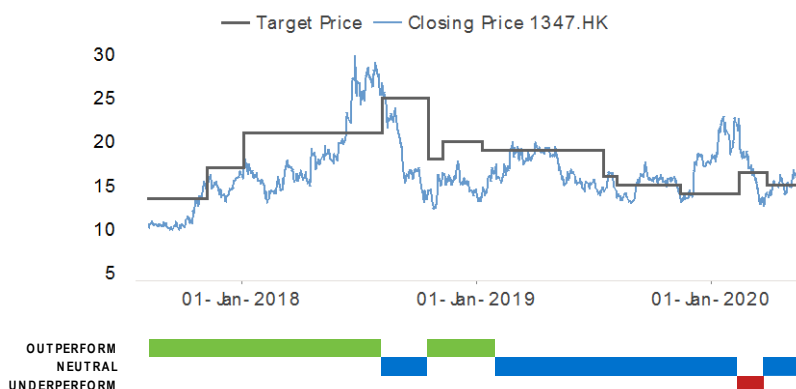
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Hua Hong Semiconductor Limited (1347.HK)

1347.HK	Closing Price	Target Price	
Date	(HK\$)	(HK\$)	Rating
15-May-17	11.38	13.50	O
08-Nov-17	14.72	17.00	
04-Jan-18	17.60	21.00	
08-Aug-18	25.70	25.00	N
18-Oct-18	14.40	18.00	O
09-Nov-18	16.36	20.00	
10-Jan-19	14.46	19.00	
01-Feb-19	15.80	19.00	N
17-Jul-19	14.58	16.00	
07-Aug-19	13.64	15.00	
14-Nov-19	13.48	14.00	
14-Feb-20	19.32	16.50	U
27-Mar-20	14.10	15.00	N

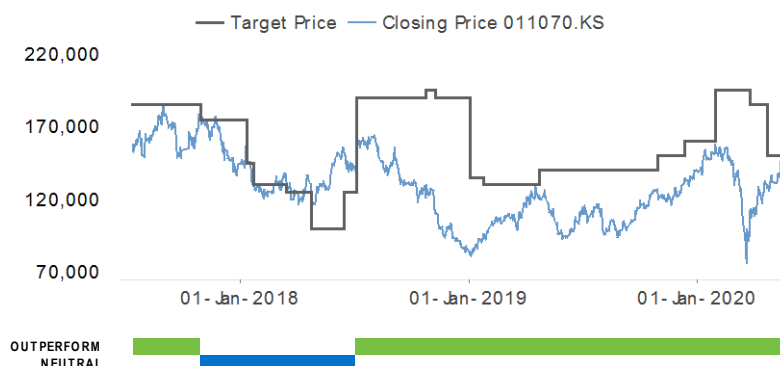
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for LG Innotek (011070.KS)

011070.KS	Closing Price	Target Price	
Date	(W)	(W)	Rating
13-Jul-17	157,500	185,000	O
30-Oct-17	178,000	175,000	N
11-Jan-18	150,500	145,000	
23-Jan-18	130,500	130,000	
15-Mar-18	133,500	125,000	
24-Apr-18	125,000	100,000	
15-Jun-18	153,500	125,000	
05-Jul-18	145,500	190,000	O
24-Oct-18	121,500	195,000	
08-Nov-18	111,500	190,000	
03-Jan-19	81,700	135,000	
25-Jan-19	96,100	130,000	
23-Apr-19	122,000	140,000	
29-Oct-19	126,500	150,000	
11-Dec-19	133,500	160,000	
29-Jan-20	158,000	195,000	
25-Mar-20	113,500	185,000	
22-Apr-20	129,500	150,000	

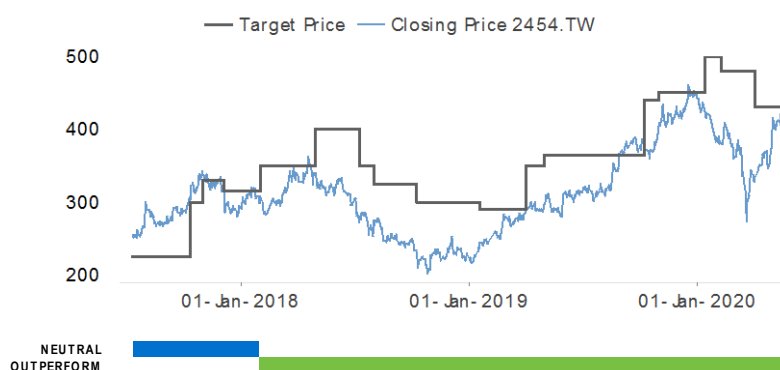
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for MediaTek Inc. (2454.TW)

2454.TW	Closing Price	Target Price	
Date	(NT\$)	(NT\$)	Rating
12-Jul-17	254.50	225.00	N
12-Oct-17	303.50	300.00	
01-Nov-17	338.00	330.00	
05-Dec-17	318.00	315.00	
01-Feb-18	307.00	350.00	O
30-Apr-18	340.00	400.00	
09-Jul-18	272.50	350.00	
01-Aug-18	275.00	325.00	
09-Oct-18	228.50	300.00	
17-Jan-19	237.00	290.00	
01-Apr-19	285.50	350.00	
01-May-19	295.50	365.00	
08-Oct-19	384.50	440.00	
31-Oct-19	408.00	450.00	
13-Jan-20	422.00	500.00	
07-Feb-20	381.00	480.00	
02-Apr-20	334.00	430.00	

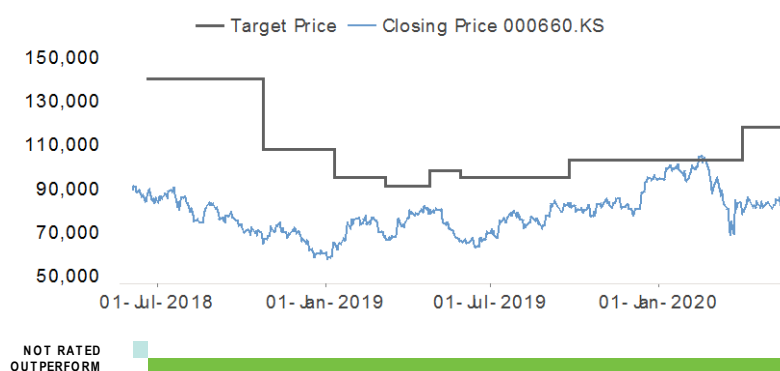
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for SK Hynix Inc. (000660.KS)

000660.KS	Closing Price	Target Price	
Date	(W)	(W)	Rating
04-Jun-18	89,800		NR
21-Jun-18	88,500	140,000	O
25-Oct-18	64,700	108,000	
11-Jan-19	65,100	95,000	
08-Mar-19	66,700	91,000	
25-Apr-19	80,200	98,000	
29-May-19	66,100	95,000	
25-Sep-19	81,900	103,000	
02-Apr-20	80,000	118,000	

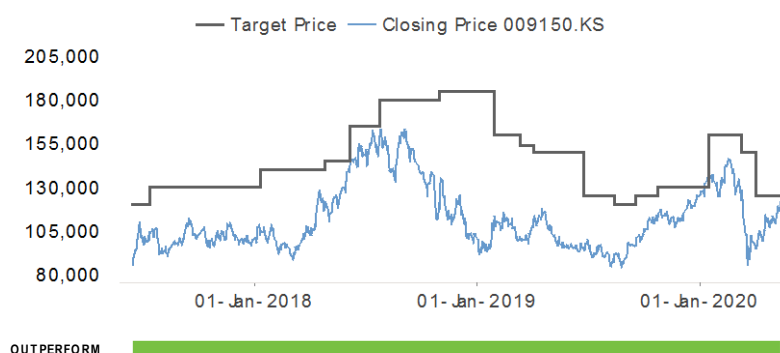
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Samsung Electro-Mechanics (009150.KS)

009150.KS	Closing Price	Target Price	
Date	(W)	(W)	Rating
15-Jun-17	86,000	120,000	O *
13-Jul-17	104,500	130,000	
11-Jan-18	105,000	140,000	
27-Apr-18	121,500	145,000	
07-Jun-18	145,000	165,000	
25-Jul-18	158,500	180,000	
31-Oct-18	118,000	185,000	
29-Jan-19	113,500	160,000	
13-Mar-19	100,500	154,000	
03-Apr-19	111,000	150,000	
24-Jun-19	95,500	125,000	
14-Aug-19	91,800	120,000	
18-Sep-19	97,100	125,000	
24-Oct-19	113,000	130,000	
15-Jan-20	133,500	160,000	
10-Mar-20	128,500	150,000	
02-Apr-20	96,800	125,000	

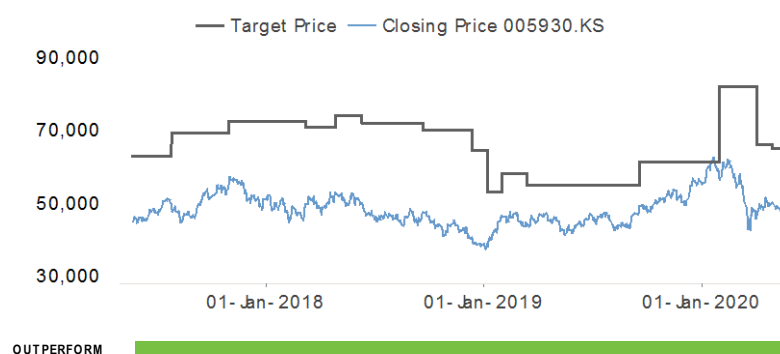
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Samsung Electronics (005930.KS)

005930.KS	Closing Price	Target Price	
Date	(W)	(W)	Rating
23-May-17	44,920	63,000	O
27-Jul-17	49,800	69,200	
31-Oct-17	55,080	72,400	
09-Mar-18	49,740	70,800	
27-Apr-18	53,000	74,000	
11-Jun-18	49,900	72,000	
21-Sep-18	47,400	70,000	
13-Dec-18	40,000	64,500	
08-Jan-19	38,100	53,000	
31-Jan-19	46,150	58,000	
15-Mar-19	44,200	54,800	
19-Sep-19	49,150	61,300	
31-Jan-20	56,400	82,000	
02-Apr-20	46,800	66,000	
29-Apr-20	50,000	65,000	

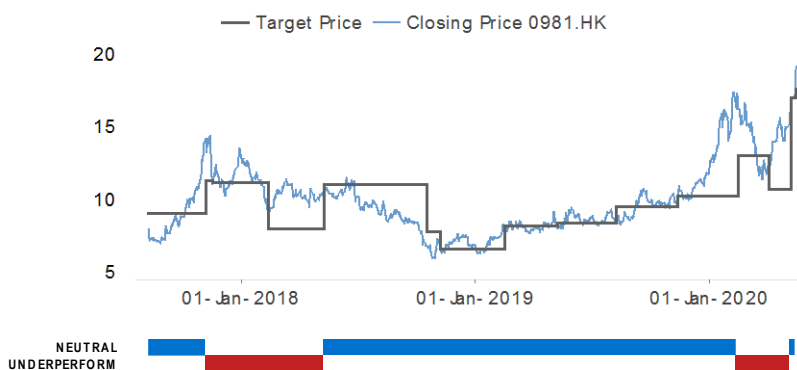
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Semiconductor Manufacturing International Corp. (0981.HK)

0981.HK	Closing Price	Target Price	
Date	(HK\$)	(HK\$)	Rating
09-Aug-17	7.96	9.05	N
07-Nov-17	13.80	11.30	U
17-Nov-17	11.08	11.15	
12-Feb-18	8.86	8.00	
10-May-18	10.78	11.00	N
18-Oct-18	6.76	7.80	
08-Nov-18	6.56	6.60	
15-Feb-19	8.03	8.20	
09-May-19	8.03	8.35	
09-Aug-19	8.91	9.50	
13-Nov-19	10.34	10.20	
14-Feb-20	16.26	13.00	U
02-Apr-20	12.46	10.70	
07-May-20	16.94	17.00	N
14-May-20	18.84	17.60	

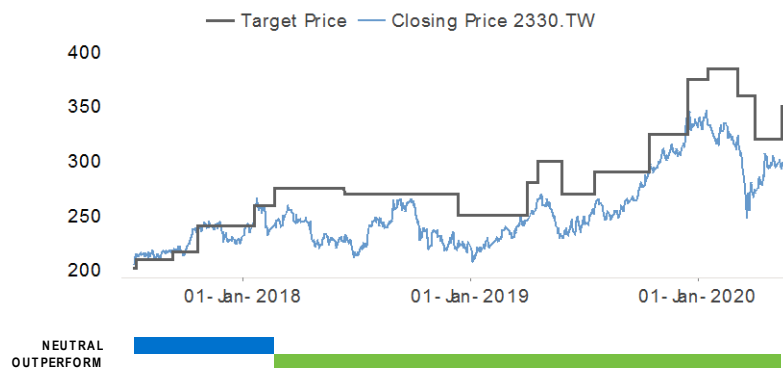
* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Taiwan Semiconductor Manufacturing (2330.TW)

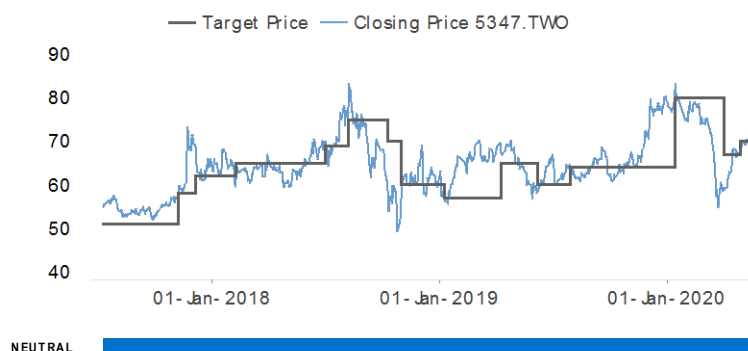
2330.TW	Closing Price	Target Price	
Date	(NT\$)	(NT\$)	Rating
15-May-17	206.00	202.00	N
13-Jul-17	214.50	210.00	
10-Sep-17	218.00	217.00	
20-Oct-17	237.50	241.00	
19-Jan-18	255.50	259.00	
20-Feb-18	236.50	275.00	O
12-Jun-18	229.00	270.00	
12-Dec-18	226.50	250.00	
01-Apr-19	245.50	280.00	
19-Apr-19	264.50	300.00	N
27-May-19	231.00	270.00	
19-Jul-19	259.00	290.00	
14-Oct-19	290.00	325.00	
16-Dec-19	336.00	375.00	
17-Jan-20	333.00	385.00	
04-Mar-20	320.50	360.00	
02-Apr-20	271.50	320.00	
15-May-20	298.00	350.00	

* Asterisk signifies initiation or assumption of coverage.



3-Year Price and Rating History for Vanguard International Semiconductor (5347.TWO)

5347.TWO	Closing Price	Target Price	
Date	(NT\$)	(NT\$)	Rating
10-Jul-17	55.00	51.00	N
07-Nov-17	57.60	58.00	
05-Dec-17	68.70	62.00	
08-Feb-18	61.60	65.00	
02-Jul-18	69.80	69.00	
08-Aug-18	83.10	75.00	
09-Oct-18	60.00	70.00	
31-Oct-18	57.00	60.00	
09-Jan-19	58.00	57.00	
10-Apr-19	67.20	65.00	
07-Jun-19	58.20	60.00	
30-Jul-19	63.50	64.00	
13-Jan-20	79.80	80.00	
02-Apr-20	58.90	67.00	
28-Apr-20	68.40	70.00	



* Asterisk signifies initiation or assumption of coverage.

As of December 10, 2012 Analysts' stock rating are defined as follows:

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Neutral (N) : The stock's total return is expected to be in line with the relevant benchmark* over the next 12 months.

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Target Price and Rating

Valuation Methodology and Risks: (12 months) for ASE Industrial Holdings (3711.TW)

Method: Our target price of NT\$75 for ASE is based on 14x 2021 P/E (price-to-earnings) consolidated earnings contribution from SPIL, following the approval of its acquisition by anti-trust regulators and shareholders at both companies. The consolidation gives the new ASE 30% global outsourced packaging and test market share, and half of advanced packaging, also a favourable scale advantage to #2 player Amkor at 15% market share. We thus rate the stock OUTPERFORM. We view the merger as a necessary counter-balance to China's aggressive M&A and expansion strategy, and also the ability to invest in advanced packaging to keep the foundry entry limited to high-end and more customised projects.

Risk: Risks to our target price of NT\$75 and OUTPERFORM rating for ASE would be an escalating trade war that places tariffs on imports to China or the US limiting tech demand, a recession and semiconductor downturn, or a rise in competitive pricing from Chinese suppliers.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Chunghwa Precision (6510.TWO)

Method: We rate Chunghwa Precision UNDERPERFORM with a target price of NT\$480, based on 20x 2021 P/E, in line with its growth peers, as we believe the company's sales will moderate in 2021E due to market share loss in application processors, offsetting growth in full-solution business. In addition, the company's opportunity in satellite PCB is also more moderate with lower content from spec downgrade.

Risk: Upside risks to our UNDERPERFORM rating and TP of NT\$480 for Chunghwa Precision include faster-than-expected full-solution ramp-up at high margin from key customers and the satellite project's opportunity delivering well.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Hua Hong Semiconductor Limited (1347.HK)

Method: Our target price of HK\$17.5 for Hua Hong Semiconductor Limited is based on 1.5x P/B (price-to-book), which is its mid cycle valuation and reflecting only low single digits ROE (return on equity) in the next 1-2 years. Hua Hong will still benefit from the China localization but in the next 2 years will face margin pressure from ramping new capacity for its 12" fab and higher depreciation, dragging its profitability, offsetting the premium the company benefits from China semiconductor localization. We therefore rate the stock NEUTRAL.

Risk: Hua Hong faces several risks that could impact its business outlook and our HK\$17.5 target price, and could cause us to change our NEUTRAL rating including better China semiconductor demand and more disciplined capacity expansion from its major foundry competition on 8" and mature 12" nodes.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for MediaTek Inc. (2454.TW)

Method: Our target price of NT\$500 for Mediatek is based on 15x 2021E ex-cash EPS (earnings per share), in line with global peers. We have a more positive outlook as the company is now bottoming out and set for share gain in the core mobile business with improving margins and thus have an OUTPERFORM rating on Mediatek.

Risk: Risks that could impede achievement of our NT\$500 target price and cause us to change our OUTPERFORM rating for Mediatek include the impact of competitive products and pricing, timely design acceptance by its customers, timely introduction of new technologies, ability to ramp new products into volume, industry-wide shifts in supply and demand for semiconductor products, industry overcapacity, availability of manufacturing capacity, and financial stability in end markets.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Semiconductor Manufacturing International Corp. (0981.HK)

Method: Our HK\$16 target price for Semiconductor Manufacturing International Corp. is based on 1.5x P/B (price-to-book), at the low end of its 1-1.4x past three-year range. We have an UNDERPERFORM rating on SMIC due to profitability upside being limited by its investment.

Risk: Risks to our HK\$16 target price and UNDERPERFORM rating for SMIC include: (1) the global semiconductor cycle picks up stronger than expected especially for China smartphones in 2020 from 5G ramps (being an upstream company, SMIC tends to be more cyclical than other tech plays). (2) Price competition from peers is less severe than expected. (3) Its advanced technology development is faster than expected, allowing the company to penetrate into new markets at better pricing and profitability.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Taiwan Semiconductor Manufacturing (2330.TW)

Method: Our NT\$300 target price for TSMC is based on 18.5x 2021E EPS (earnings per share), implying 3.2x P/B (price-to-book), near the midpoint of its average 11-15x and 2.5-3.5x range. We see its business outlook improving, and technology leadership should keep its market share and profitability intact; dividends will likely rise again as capex moderates. We therefore have a NEUTRAL rating on the stock.

Risk: Risks that could impede achievement of our NT\$300 target price and NEUTRAL rating for TSMC would include: fierce competition, demand failing to pick up, or Apple orders not being as strong as expected.

Target Price and Rating

Valuation Methodology and Risks: (12 months) for Vanguard International Semiconductor (5347.TWO)

Method: Our target price of NT\$66.5 and NEUTRAL rating for Vanguard International Semiconductor are based on 16x 2021E P/E estimate, which is the mid-cycle valuation for the company, to reflect a more muted business outlook. While ROE (return on equity) looks modest at 15%, RONA (return on net assets), excluding the cash, is a healthy 32%. Thus, we have a NEUTRAL rating on Vanguard.

Risk: Upside risk to our NT\$66.5 target price and NEUTRAL rating for Vanguard International Semiconductor is a growing fingerprint business and continued healthy growth for its power management IC business from both fabless and IDM customers. Downside risk is weaker-than-expected driver IC demand and more competition from its China peers for power management IC business.

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This research report is authored by:

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