

Consumer Electronics/Flat Panel Display Industry

- What is the outlook for turbulent 2021-2022? -

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Mizuho Securities

1. Valuechain Outlook for 2021

Market outlook for key finished products: opportunities and risks, reasons behind shortage of semiconductors

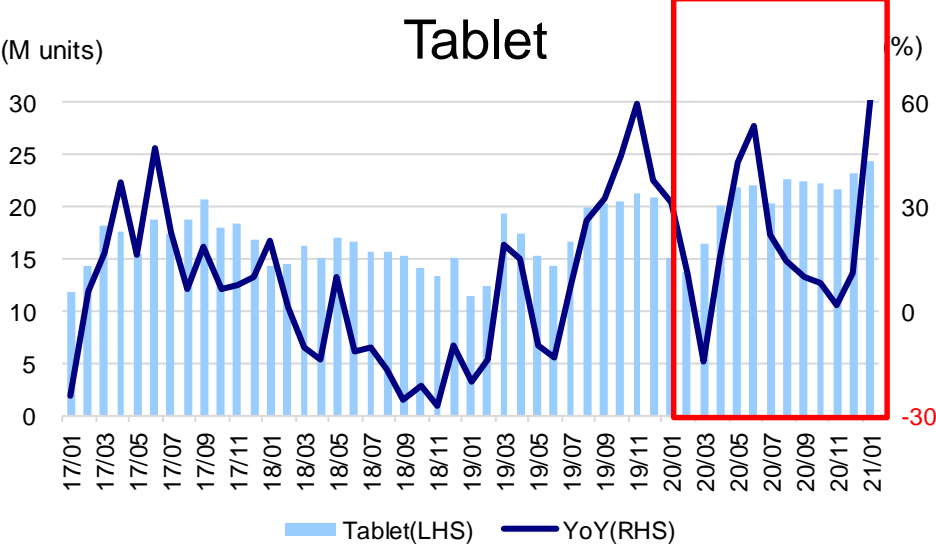
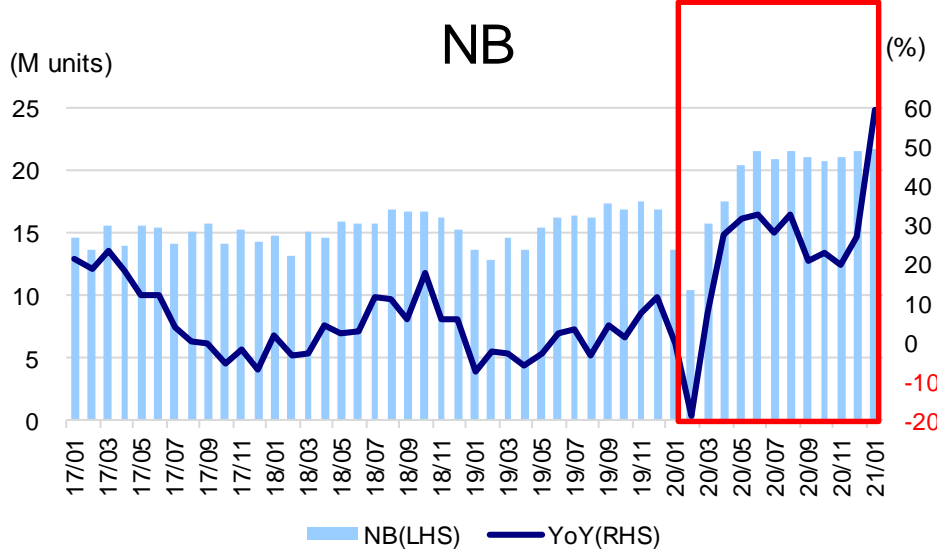
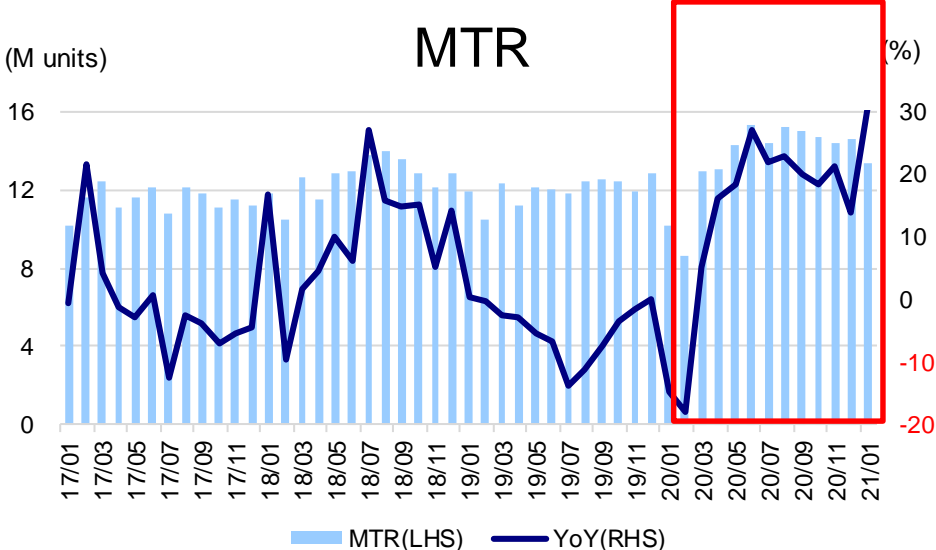
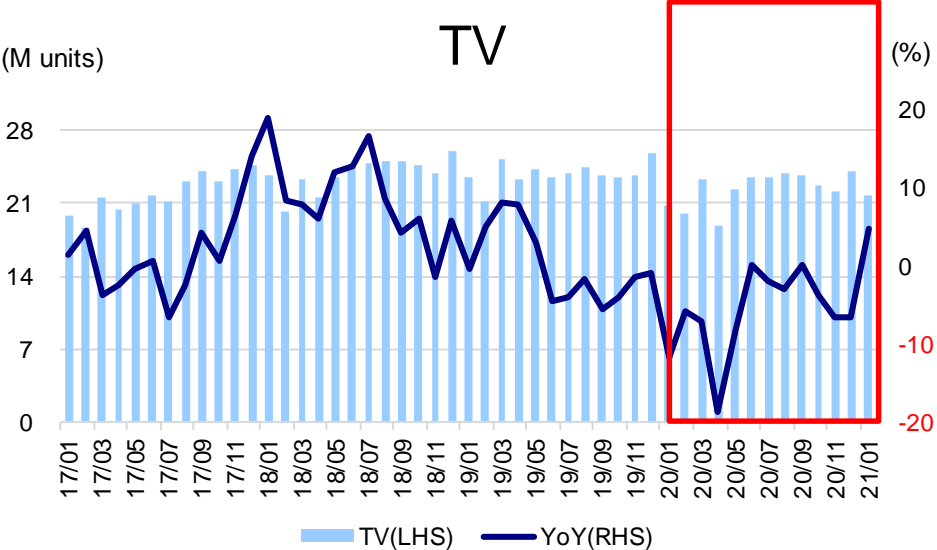
Market outlook for major finished products

Item	Replaced in	2020	2021	Vs. pre-COVID outlook	Positive factors	Concerns
Smartphone	3-4 years	-10%	+8%	↓	Autonomous recovery phase	Overproduction due to competition. 5G traction
NBPC	4-6 years	+30%	+6%	↑	Educational demand (Chromebook), WFH, gaming	Peak-out of WFH, replacement demand
Tablet	4-6 years	+10%	+7%	↑	WFH, Educational demand, for entertainment	Peak-out of stay-at-home demand
PC Monitor	4-6 years	+8~10%	+5~7%	↑	WFH, gaming	Peak-out of WFH, replacement demand
TV	8-10 years	-0% (slightly-)	+0% (slightly+)	→	Autonomous recovery phase. Gaming, internet	Rising panel prices, peak-out of stay-at-home demand
PS4/5	7 years	Flat	+30%	↑	2 yrs past launch. Utilize big titles, network services	None
Airpods	3-4 years	+45%	+10~15%	↑	More models, better functions, promotional activity	competition with low-end products
Apple Watch	3-4 years	+26%	+22%	↑	More models, better functions	Competition with other firms

- 1H 2020: Demand outlook plunged in March due to the COVID-19 outbreak but rebounded strongly on the back of stay-at-home demand.
- 2H 2020: Channel/maker inventory in shortage due to insufficient supply. Demand volume up, demand mix down.
- Demand varies by region: US strong, Japan/Europe/China firm, emerging markets weak.
- Current outlook for 2021: Expect increased volume for most products; our estimates are now higher than pre-COVID-19 levels.
- Distributors & brands: Likely remain bullish at least until 1H given low inventory levels. Securing component materials.
- Supply outlook: 8-inch foundries, no increase in capacity for part of commodity components, tight demand to continue. Inflation concerns.
- Demand points: US(possible to lose the momentum), China and emerging countries(upside), Strong Japan and Europe(Upside/downside).
- Expected scenario: Either our best-case scenario (demand as expected & tight supply) or worst-case scenario (demand plunges while supply/inventory increase, leading to major production cutbacks) will likely materialize. The supply chain cannot stop abruptly. If there is adjustment, it would be in May-June, but no sign for now.

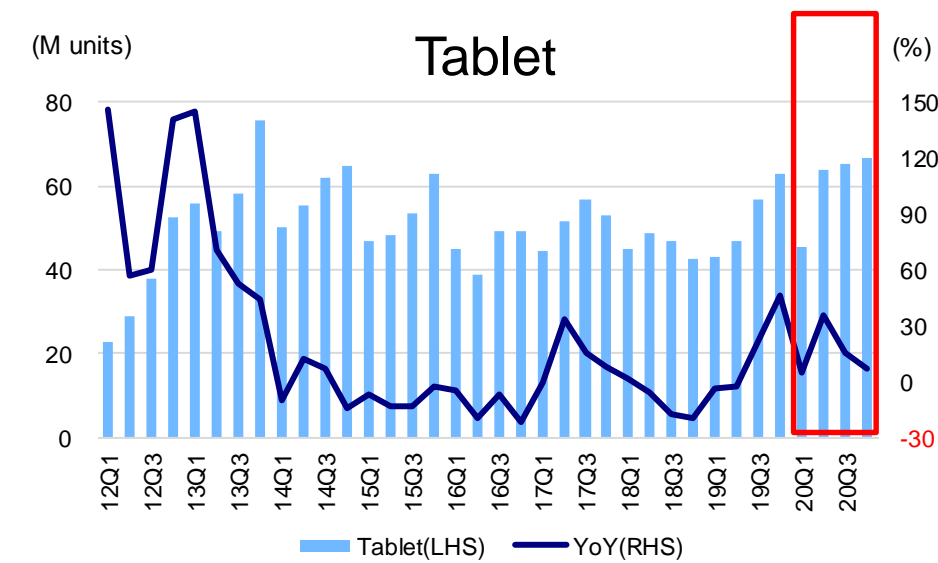
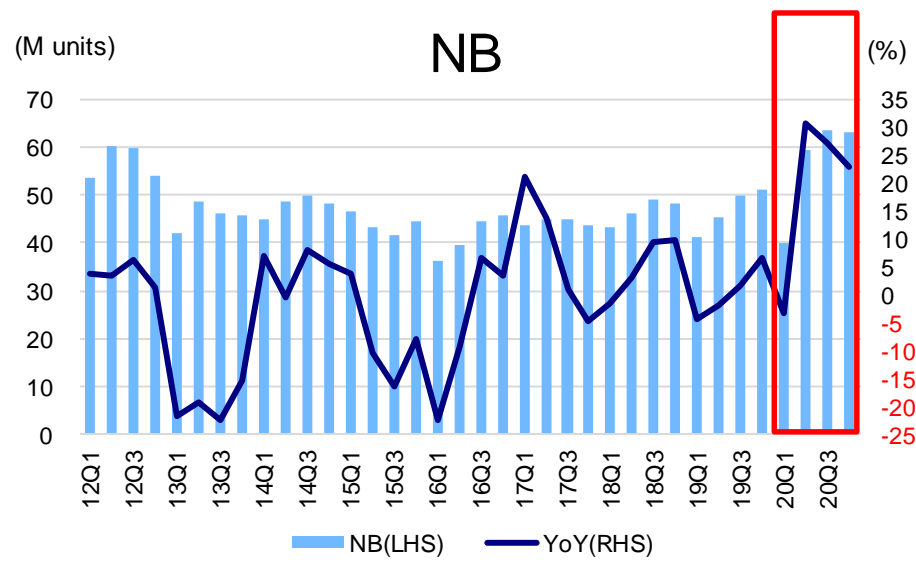
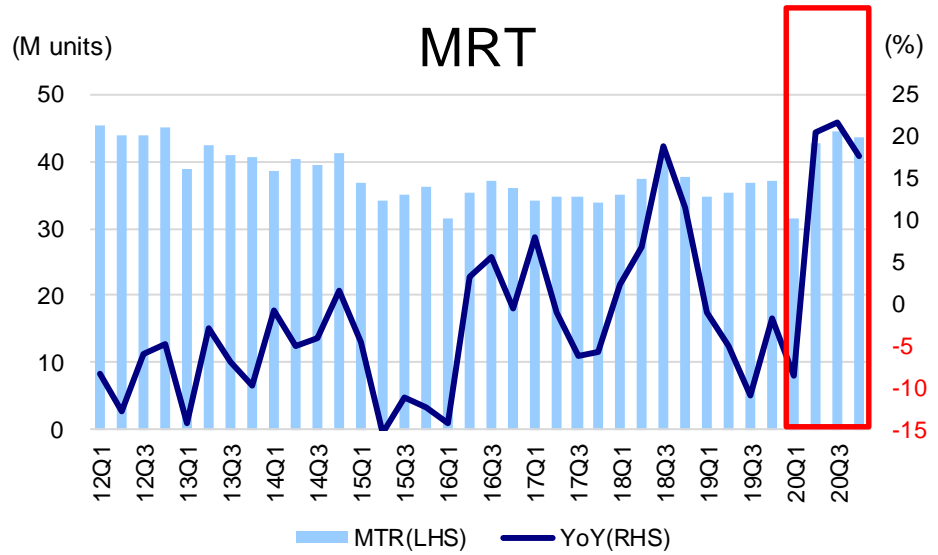
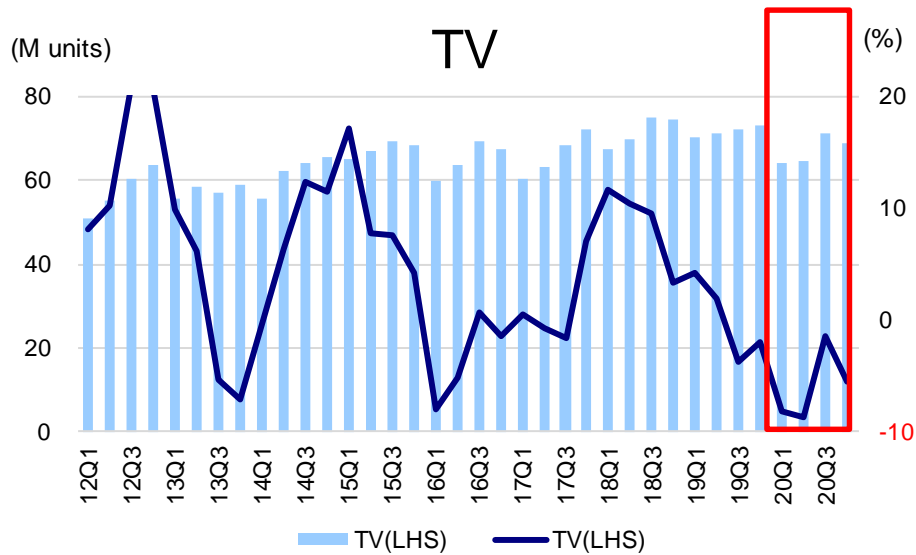
Source: Mizuho Securities Equity Research

Monthly panel shipment volume(especially strong for NB/MT)



Source: Mizuho Securities Equity Research from Trendforce

Quarterly panel shipment volume (momentum sharply recovered in 2Q and through 3Q except TAB)

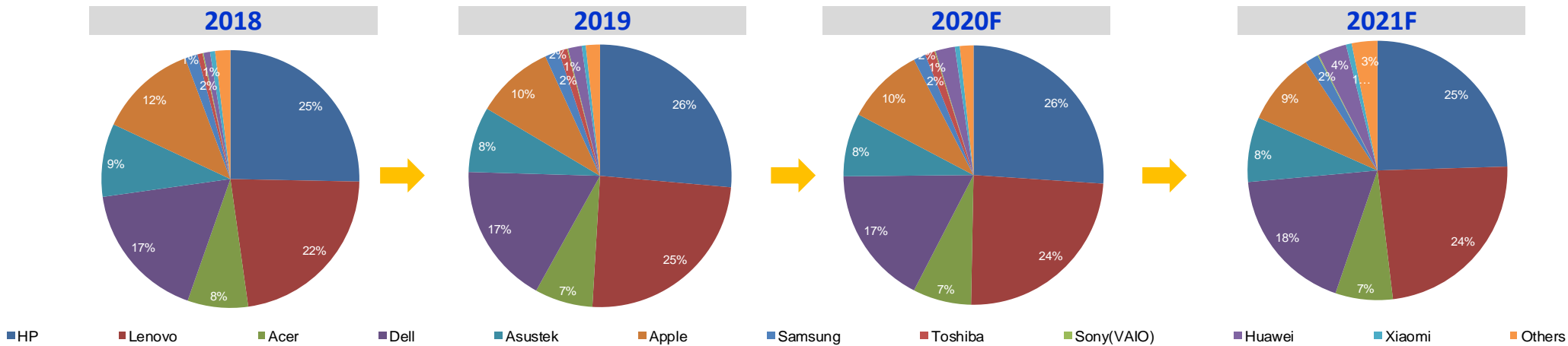


Source: Mizuho Securities Equity Research from Trendforce

Notebook PC Forecast By Brand: +26% YoY in 2020 and further rise in 2021?

(in mm)	2011	2012	2013	2014	2015	2016	2017	2018	YoY	2019	YoY	2020 Plan	2020 F	YoY	2021 F	YoY	
HP	35.0	33.0	28.0	32.0	32.0	34.6	38.2	40.0	+5%	42.5	+6%	43.0	51.5	+21%	54.0	+5%	HP
Lenovo	22.0	27.0	26.5	31.5	32.0	32.5	35.5	35.5	0%	39.5	+11%	40.0	49.5	+25%	52.5	+6%	Lenovo
Acer	27.0	25.0	17.0	18.0	14.8	12.5	12.0	12.0	0%	11.5	-4%	12.0	15.0	+30%	16.0	+7%	Acer
Dell	26.0	21.0	19.0	20.5	19.5	21.5	24.0	27.5	+15%	28.0	+2%	28.5	38.5	+38%	40.5	+5%	Dell
Asustek	17.5	19.5	16.0	18.5	18.0	16.0	15.5	14.5	-6%	13.0	-10%	13.0	17.0	+31%	17.5	+3%	Asustek
Apple	14.5	15.5	12.5	15.5	17.5	14.5	16.5	19.5	+18%	15.5	-21%	16.0	19.0	+23%	21.5	+13%	Apple
Samsung	12.5	14.0	10.0	4.5	3.5	3.0	2.8	2.5	-11%	2.8	+12%	2.5	3.5	+25%	4.0	+14%	Samsung
Toshiba	16.0	14.5	12.5	11.0	6.1	2.0	1.0	1.0	0%	1.7	+70%	2.0	0.0	-100%	0.0	-	Toshiba
Sony(VAIO)	8.7	7.3	5.5	1.4	0.3	0.2	0.2	0.2	0%	0.2	0%	0.2	0.3	+50%	0.3	0%	Sony(VAIO)
Huawei/Honor	-	-	-	-	-	-	0.1	1.3	+1200%	2.7	+108%	4.0	7.5	+178%	8.0	+7%	Huawei/Honor
Xiaomi	-	-	-	-	-	0.2	0.7	1.0	+43%	0.8	-20%	1.0	1.5	+88%	2.0	+33%	Xiaomi
Others	24.8	25.2	15.0	14.0	14.0	18.2	11.5	3.0	-74%	2.8	-7%	2.8	6.7	+139%	5.7	-15%	Others
Total	204.0	202.0	162.0	166.9	157.7	155.0	158.0	158.0	0%	161.0	+2%	165.0	210.0	+30%	222.0	+6%	Total

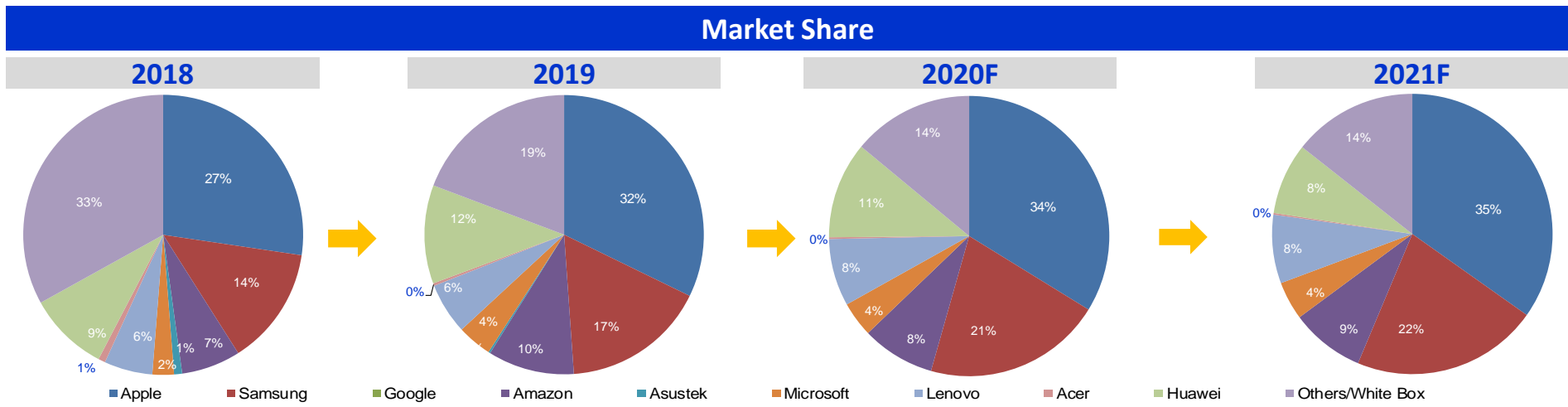
Market Share



Source: Mizuho Securities Equity Research

Tablet PC Forecast By Brand: strong for iPad/Samsung/Surface!

(in mm)	2012	2013	2014	2015	2016	2017	2018	YoY	2019	YoY	2020 Plan	2020 F	YoY	2021 F	YoY	
Apple	67	74	65	50	40	46	44	-4%	43.5	-1%	43	50.0	+15%	55.0	+10%	Apple
Samsung	14	41	39	35	25	25	22	-12%	22.5	+2%	21	30.5	+36%	34.0	+11%	Samsung
Google	5	7	5	3	1	0	0	-	0	-	0	0.0	-	0.0	-	Google
Amazon	11	8	4	10	11.5	12.4	11	-11%	13.5	+23%	10	12.5	-7%	13.5	+8%	Amazon
Asustek	3	6	9	6	4.2	3.4	1.5	-56%	0.3	-80%	0	0.0	-100%	0.0	-	Asustek
Microsoft	1.5	4	4	6	4.2	4	4	0%	5.4	+35%	5	6.0	+11%	7.0	+17%	Microsoft
Lenovo	2	7	12	13	12.1	11	9	-18%	8.0	-11%	8	11.5	+44%	12.5	+9%	Lenovo
Acer	1	5	6	3	3.7	2.6	1.3	-50%	0.4	-69%	0.2	0.3	-25%	0.3	0%	Acer
Huawei/Honor	1.1	1.5	3.0	6.5	9.6	12.5	15	+20%	15.4	+3%	17	16.5	+7%	13.0	-21%	Huawei/Honor
Others/White Box	30 - 40	71.5	83.0	70.5	74.7	58.1	53.2	-8%	26.0	-51%	20.8	20.7	-20%	22.7	+10%	Others/White Box
Total	145	225	230	203	186	175	161	-8%	135	-16%	125	148	+10%	158	+7%	Total



Source: Mizuho Securities Equity Research

Updates on SAS fab shutdown : Risk factors at supply side

Progress of SAS fab shutdown

- Samsung Electronics (SEC) has temporarily shut down its foundry plant (S2) at Samsung Austin Semiconductor (SAS), primarily due to a power outage in the region following a snowstorm.
 - ✓ At round 07:00 on 2/16, Austin Energy power utility asked SAS to pull power of S2 fab from 10:00 for three day, but SAS asked to delay power-off timing to minimize wafer damage. Our checks indicate that S2 fab's electricity supply was out from 13:10 on 2/16.
 - ✓ Electricity has been gradually recovered from 2/19 but SAS was not able to normalize fab operation due to water shortage. Computing system was recovered on 2/23 and PCW (process cooling water) was recovered from 2/26.
- Although S2 fab started to resume wafer loading from 3/2, it will take considerable time for SAS to fully normalize its S2 facility given various challenges (especially time required to replace pumps).
 - ✓ Our checks suggest that SAS currently targets to achieve 90% tool recovery by 3/20 and 90% wafer moving recovery by 3/27.



Source: Mizuho Securities Equity Research from Company data

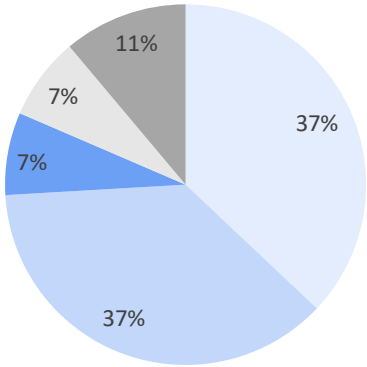
Timeline of SAS fab shutdown						
2/15	✓ 2/16	2/17	✓ 2/18	2/19	2/20	2/21
	S2 Shutdown			Power recovery		
2/22	✓ 2/23	2/24	2/25	✓ 2/26	✓ 2/27	✓ 2/28
	Computing system recovery			PCW recovery		1st target for 100% recovery
3/1	✓ 3/2	3/3	3/4	3/5	3/6	3/7
	Resumed wafer loading					
✓ 3/8	3/9	3/10	3/11	3/12	3/13	3/14
2nd target for 100% recovery						
3/15	3/16	3/17	3/18	3/19	✓ 3/20	3/21
					Current target for 90% tool recovery	
3/22	3/23	3/24	3/25	3/26	✓ 3/27	3/28
					Current target for 90% wafer-moving recovery	

SAS : presence due to 40% of total capacity, smartphone chipset and OLED DIC

S2 fab capacity analysis

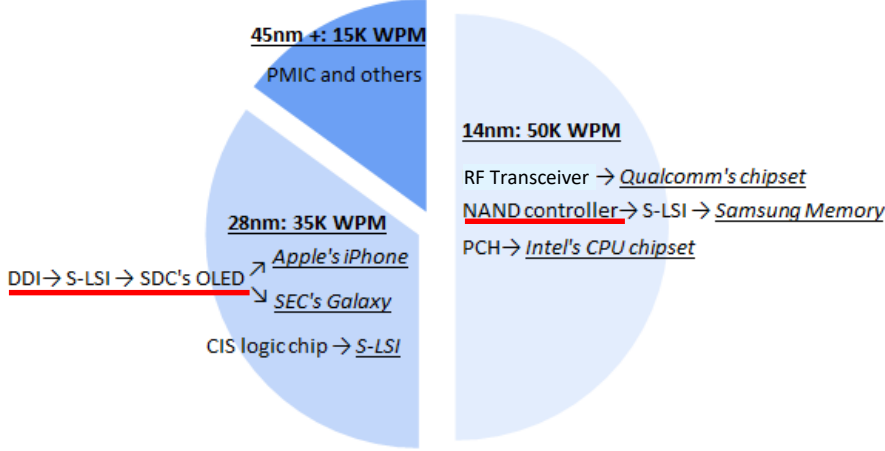
- We view that S2 had approximately 100K WPM capacity at the end of 2020, accounting for 37% of Samsung Foundry's 12-inch capacity.
 - ✓ We estimate that roughly 50% of S2 fab capacity is based on 14nm, primarily producing RF front-end (RFFE) for mobile applications, NAND controller, and platform controller hub (PCH) for CPU. We also believe that 28nm represents around 35% of capacity at S2, chiefly for display driver IC (DDI) used in OLED panels and logic chips for CIS (i.e. lower-stack of CIS). Most of the remaining S2 capacity is allocated to fabricate power management IC (PMIC) and other legacy chips.
- We project that the shutdown of S2 will likely lead to a temporary disruption in supply chains for consumer IT products, especially for smartphones.

Samsung Foundry's 12-inch capacity by fab



■ S1 (Giheung) ■ S2 (Austin) ■ S3 (Hwaseong) ■ S4 (Hwaseong) ■ L-11 (Hwaseong)

Samsung Foundry's S2 wafer mix

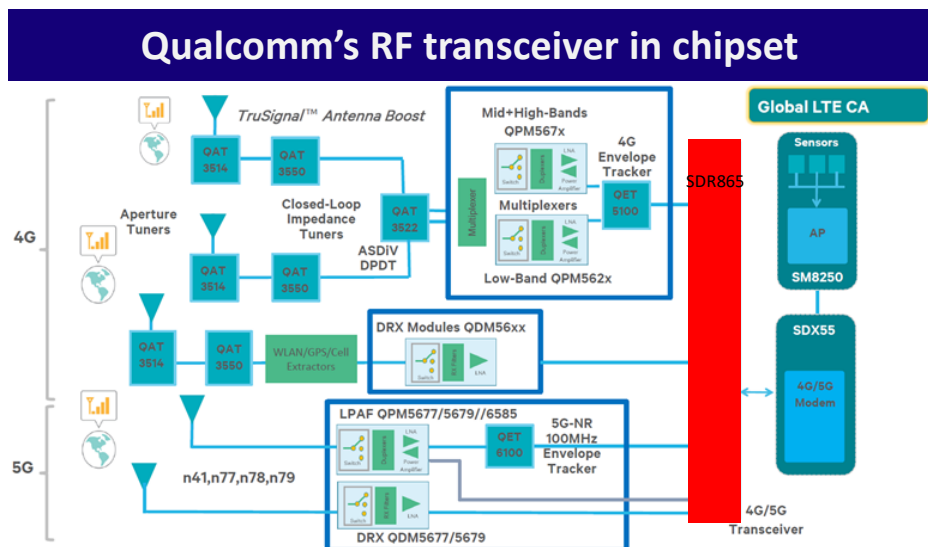


Source: Mizuho Securities Equity Research from Company data

Updates on SAS fab shutdown : Impact on Qualcomm RF Transceiver

Analysis of the potential impact on RF transceivers

- RF transceiver is one of critical building blocks for mobile chipsets.
 - ✓ Mobile chipset is composed of AP, modem, PMIC, and RF transceiver. RF transceivers are modules that contain both a transmitter and a receiver which is used for paths communicating modem and antenna signals.
- Qualcomm's SDR series transceivers are widely adopted chipsets for not only flagship APs (i.e. Snapdragon 800 series) but also mid/high-end APs (i.e. Snapdragon 400/600 series).
- We believe the shutdown will likely have the highest impacts on the global smartphone supply chain given that: 1) Qualcomm's SDR transceiver series is mostly fabricated on the 14nm node at S2 fab; and 2) transceivers are one of the critical components for Qualcomm's chipsets.



Qualcomm's RF transceiver product roadmap

800	SDM845	SDR855	SDM855+	SDM865	SDM888			
	SDR845	SDR8150/SDR8154	SDR865					
700	SDM710	SDM730	SDM730G	SDM720G	SDM750G	SDM765	SDM765G	SDM768G
	SDR660		SDR675		SDR865			
600	SDM630	SDM632	SDM665	SDM670	SDM675	SDM662	SDM690	
	SDR660				WTR3925	SDR735		
400	SDM429	SDM439	SDM450	SDM460				
	WTR2965							
200	QM215							
	WTR2965							
	LTE AP							
	LTE+5G AP							
	RF Transceiver: SDR series							
	RF Transceiver: WTR series							

Source: Mizuho Securities Equity Research from Company data

Updates on SAS fab shutdown : Impact on Qualcomm RF Transceiver

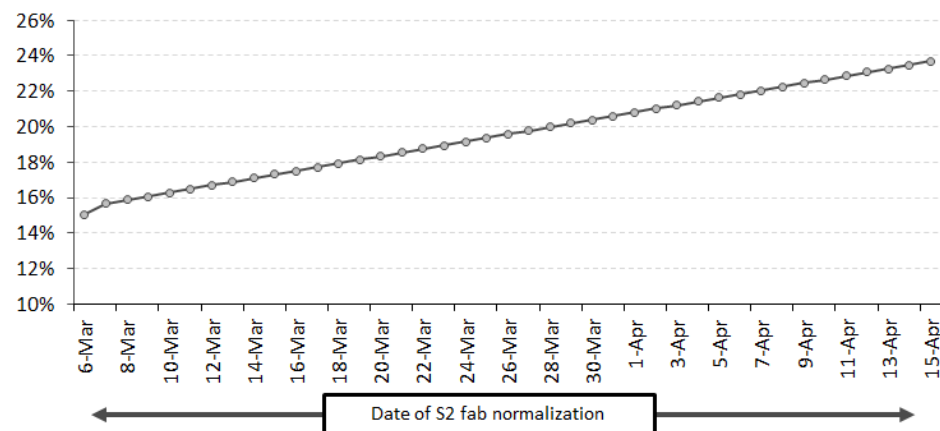
Analysis of the potential impact on RF transceivers

- Based on our analysis including both wafer damage and production loss, we project that the shutdown will potentially lower Qualcomm's transceiver production by 60m, which is equivalent to 19% of global smartphone production in 2Q21, assuming that S2 fab will be fully recovery from 3/25.
- Our scenario analysis indicates that if the SAS fab has fully recovered from the middle of April, the number of RF transceiver lost would reach 73m, which represents roughly 24% of global smartphone production in 2Q21.
- Accordingly, we see downside risks to smartphone makers' production targets in 2Q21, especially considering the tight supply/demand balance for RF transceivers even prior to the shutdown.
- On the flip side, we also believe potential downward revisions in smartphone production for 2Q21 will eventually lower inventory adjustment risks (especially from Chinese smartphone makers) for 2H21.

RF transceiver loss estimates (3/25 recovery case)

Analysis on S2 fab shutdown impacts on Qualcomm's RF transceiver	
% of wafer allocation for Qualcomm's RF	30%
# of RF wafer loss from S2 fab shutdown (wafer damage + production loss)	47,077
Average net die for Qualcomm's RF	1,500
14nm production yields at S2	85%
# of RF chip loss due to S2 fab shutdown (mn)	60
# of smartphone production in 2Q21 (mn)	310
RF chip loss as % of global smartphone shipment in 2Q21	19%

RF transceiver loss as % of smartphone in 2Q21



Source: Mizuho Securities Equity Research from Company data

Updates on SAS fab shutdown : Impact on OLED DDIC

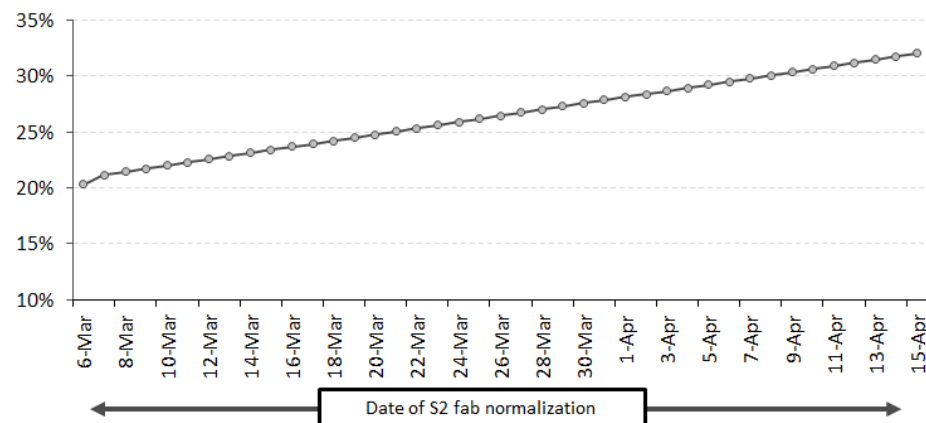
Analysis of the potential impact on DDI

- We also believe the shutdown will potentially impact smartphone production for Samsung Mobile and Apple as the S2 fab manufactures DDI based on the 28nm node, mostly for Samsung Display's (SDC) OLED panels.
- Our analysis suggests that the S2 fab shutdown will potentially lead to DDI chip loss of around 28m (or approximately 26% of SDC's OLED panel production target for 2Q21), assuming that S2 fab will be fully recovery from 3/25.
- According to our scenario analysis, OLED panel DDI supply from Samsung LSI to SDC could decline approximately by 35m, which accounts for roughly 32% of SDC's OLED panel production target in 2Q21, if the normalization of the S2 fab is completed at the middle of April.
- Given that iPhone production was originally expected to decrease from March/April 2021, potential impact from a shortage of SDC's OLED panel production will be relatively higher for Samsung Mobile than Apple, in our view.

DDI loss estimates (3/25 recovery case)

Analysis on S2 fab shutdown impacts on SDC's DDI	
% of wafer allocation for Samsung LSI's DDI	20%
# of DDI wafer loss from the shutdown (wafer damage + production loss)	31,385
Average net die for Samsung LSI's DDI	1,000
28nm production yields at S2	90%
# of DDI chip loss due to S2 fab shutdown (mn)	28
# of SDC's OLED panel production in 2Q21 (mn)	108
DDI loss as % of SDC's OLED panel production in 2Q21	26%

DDI loss as % of SDC's OLED panel in 2Q21



Source: Mizuho Securities Equity Research from Company data

Updates on SAS fab shutdown : Impact on NAND

Our view on the potential impact on NAND

- Given that the S2 fab fabricates NAND controllers based on the 14nm node for SEC, we believe SEC's NAND shipments will be negatively impacted by the shutdown. As a result of various die sizes and well-diversified application for NAND controllers, it is challenging for us to accurately estimate potential downside risks to SEC's NAND shipments from the S2 fab shutdown.
- We anticipate the following three possible consequences from the S2 fab shutdown.
 - 1) We project that SEC may try to leverage limited NAND controller supply to raise NAND prices from 2Q21 to compensate downside in NAND shipments on account of NAND controller shortages. While we believe some set makers may accept higher NAND prices in 2Q21 with higher priority on securing NAND volume than pricing, we also expect higher NAND prices due to controller shortage in 2Q21 to increase downward pressure on NAND pricing from end-2021/beginning-2022.
 - 2) We anticipate that low-density NAND products will likely show even stronger upward pricing trends compared to high density NAND products due to potential decrease in low-density NAND supply as SEC will intentionally increase shipments of high-density NAND products in order to compensate for lower NAND shipments due to shortage of NAND controllers with incremental contribution from high-density NAND products.
 - 3) We believe that limited NAND controller supply due to the S2 fab shutdown will eventually trigger SEC's potential diversification in NAND controller sourcing. We believe SEC was trying to seek alternative supply for NAND controllers even prior to the shutdown in order to lower costs. In our view, limited NAND controller supply due to the S2 fab shutdown will eventually drive SEC to diversify its NAND controller suppliers more aggressively in order to not only lower costs but also reduce sourcing risks.

US sanctions on SMIC: halting product migrations under great uncertainty

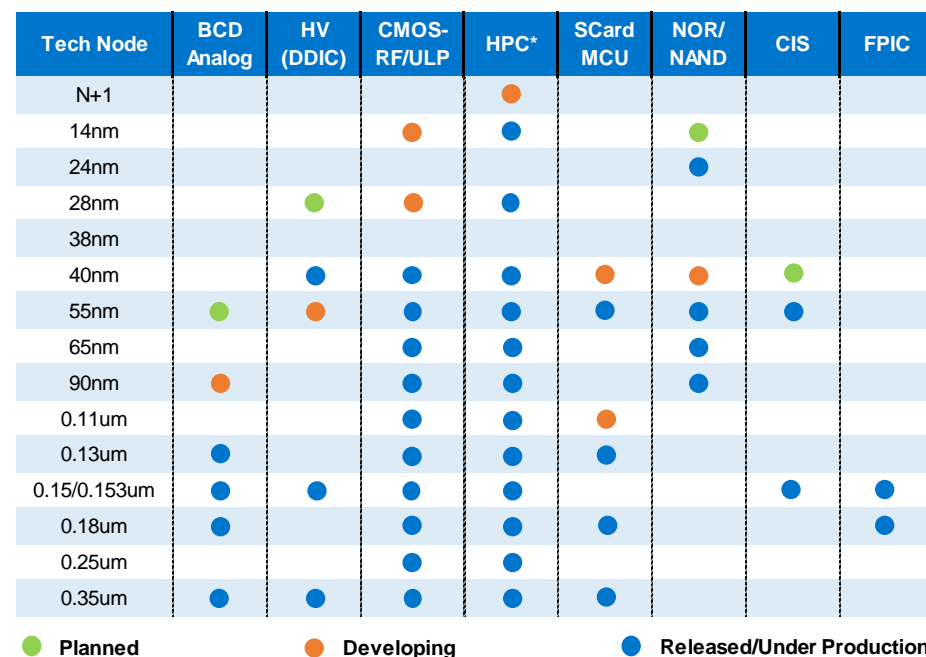
KNOW: *On 4th Oct 2020*, SMIC announced that US suppliers will need prior permission from the US government when exporting SPE and raw materials to SMIC, and that a long-term imposition of this rule could have a serious impact on the company's production. **US suppliers have no equipment shipments to SMIC since October.** *On 18th Dec 2020*, The US Bureau of Industry and Security in the Department of Commerce added SMIC to the Entity List, which limits SMIC's ability to acquire certain U.S. technology if no license. 10nm or below is subject to a presumption of denial.

WATCH: SMIC's customers will be immediately impacted since SMIC's production is under certainties of equipment and component supply. For China fables (66% of SMIC sales), except from Huawei (no more wafer shipment from Sep), the largest direct impacts would be 8" products (0.11nm and below) and 55/65nm (NOR, CIS logic). US customers (Qualcomm, Broadcom) are likely to shift further orders to TSMC/UMC.

SMIC: sales breakdown by markets and top customers, 2020

Region	Customer	% of sales	Products
China 67%	Huawei	16%	Smartphone AP/cellular, SoC
	UniSOC	8%	Smartphone cellular/RF, SoC
	GigaDevice	8%	NOR flash, MCU, fingerprint
	GalaxyCore	8%	CIS
	Allwinner	4%	Chromebook, tablet SoC
	Rockchip	4%	Chromebook, tablet SoC
	Others	19%	
	US 21%	Qualcomm	12%
Broadcom	5%	Networking	
Omnivision (Will Semi)	2%	CIS	
Others	2%		
Asia/EU 12%	MTK	2%	
	Realtek	2%	
	Orise (FocalTech)	1%	Display driver IC
	Elan	1%	Touch IC
	Fingerprint Card	1%	Fingerprint sensor
	Sony	1%	CIS (Logic)
	Others	5%	

SMIC: technology roadmap, 2020



*Source: Mizuho Securities Equity Research from Company data

US sanctions on SMIC: Tightening 8” foundry supply with price hike

KNOW: SMIC accounts for 10-11% of global 8” foundry wafer capacity, and 7-15% of matured 12” foundry capacity. The gap, if SMIC delays wafer production due to US sanction uncertainties, appears very positive to other vendors under tight supply conditions in the next 6-12 months. 8-inch wafer prices have increased by 10% in 4Q20, likely further increase in 2H21 if demand remains strong and supply increase remains limited.

8” foundry – demand/supply model

	2016	2017	2018	2019	2020E	2021E
Major foundries capacity (K 8-inch equiv.)						
TSMC	5,985	6,105	6,245	6,495	6,695	6,962
UMC	3,460	3,547	3,686	3,858	3,970	4,084
SMIC	2,118	2,271	2,392	2,661	2,858	3,048
% of industry 8" capacity	9%	9%	10%	10%	11%	11%
Vanguard	2,246	2,343	2,392	2,493	2,877	2,994
Hua Hong	1,815	1,944	2,058	2,109	2,136	2,157
TowerJazz	1,916	1,935	1,974	2,013	2,044	2,064
GlobalFoundries	1,716	1,716	1,733	1,773	1,353	1,367
Dongbu HiTek	1,344	1,386	1,428	1,489	1,550	1,597
X-Fab	792	1,032	1,135	1,169	1,204	1,240
Others	1,836	1,873	1,910	1,948	1,968	2,007
Total 8-inch foundry supply	23,228	24,152	24,953	26,009	26,655	27,521
Supply YoY	12%	4%	3%	4%	2%	3%
Wafer demand (K 8-inch equiv.)						
	2016	2017	2018	2019	2020E	2021E
Analog/Mixed Signal/discrete (incl. power IC)	13,586	14,565	15,736	16,124	17,513	18,812
Display driver IC	4,080	3,936	3,709	3,227	3,227	3,066
Fingerprint sensor	1,416	1,586	1,796	1,954	1,925	1,887
Smart card IC	1,270	1,266	1,311	1,305	1,252	1,227
MCU	534	550	572	587	601	617
Others	940	959	988	1,008	1,010	1,060
Total 8-inch foundry demand	21,828	22,863	24,112	24,204	25,529	26,668
Demand YoY	7%	5%	5%	0%	5%	4%
Supply/Demand ratio for 8-inch foundries	106%	106%	103%	107%	104%	103%
300mm kw/yr	Annual capacity	TSMC	UMC	GF	Samsung LSI	SMIC
2020	90nm	73%	13%	7%	0%	7%
	65/55nm	29%	15%	14%	27%	15%
	45/40nm	49%	16%	8%	14%	12%

SMIC's
Market share

•Source: Mizuho Securities Equity Research from Company data

US sanctions on SMIC: : Capacity increase to slow-down; capex to decline meaningfully in 2021-22

KNOW: Before US restrictions of equipment and materials, we estimate SMIC's capacity increase on the annual basis would grow by 15% YoY from 2019 to 2023. From sales perspective, given much higher ASP on advanced nodes, the 14nm (and below; N+1 and N+2) will contribute 30% of the total incremental sales in the next 3 years, and matured technology (28nm and above) will contribute another 50-60% supported by localization trend.

WATCH: We NOW expect SMIC's capacity expansion plan would be meaningfully impacted by a few years without sufficient local equipment supports. We forecast SMIC's capex to be USD3.5bn in 2021 and USD3.0bn in 2022, large YoY decline in 2021-22 (USD5.9bn in 2020) due to US equipment constraint. At Japanese SPE makers, we estimate that sales to SMIC are likely to account for about 10% (a significant proportion) of Screen's FY3/21 SPE sales and roughly 5% of Tokyo Electron's.

SMIC – capacity/capex and fab details

	2016	2017	2018	2019	2020E	2021E	2022E
SMIC Total Capacity (8" equivalent)	4,059	5,249	5,397	5,525	5,959	6,453	6,709
YoY	35%	29%	3%	2%	8%	8%	4%
SMIC Capex (USD mn)	2,695	2,300	1,814	2,029	5,900	3,500	3,000

Fab/entity name	Establishment	Ownership	Technology nodes	Capacity in 4Q19 (8"kwpm)	Capacity in 4Q20 (8"kwpm)	Capacity in 4Q21 (8"kwpm)
SMIC Shanghai 中芯上海	Dec-00	100%	0.35um-90nm (8") 14nm & below (12")	115 5	116 3	118 3
SMIC Beijing 中芯北京	Jul-02	100%	0.18um-55nm (12")	117	124	128
SMIC Tianjing 中芯天津	Nov-03	100%	0.35um-90nm (8")	58	79	87
SMIC Shenzhen 中芯深圳	Mar-08	100%	0.35um-0.15um (8")	55	50	51
SMIC Northern 中芯北方	Jul-13	51%	65-28nm (12")	92	125	128
SMIC Southern 中芯南方	Dec-16	50%	FinFET; 14nm & below (12")	7	23	29

Source: Mizuho Securities Equity Research from Company data

2. Smartphones and Small Sized FPDs

Handset/Smartphone shipment forecast by brand

- 2020: Revised downward twice due to the impact of COVID-19. From +4% to -1% (after factoring in China impact) then to -10% (on lower worldwide demand). Volume strong but high-end business struggling
- 2021 and 2022?: Forecasting a return to cruising speed over two years at 1.40b (up 8%) in 2021 and 1.47b (up 5%) in 2022
- Huawei's movements: High-end business (P/Mate) spun off, middle-end and below sold as Honor. Production volume for new products in 2021: 25m/40m
- Oppo/Vivo/Xiaomi aggressively fill Huawei gaps. Eye on divergence from actual demand and adjustment risk from 2Q FY21
- 2021 total: If forecast figures are correct, volume may overshoot 1400m. But in reality we expect an undershoot in total for Chinese brands and forecast just 1400m.

(M units)

	2011		2012		2013		2014		2015		2016		2017	2018	2019	2020 F Smartphone			Latest forecast	2021F Smartphone Preliminary		Target for 2021 ↓	
	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Smart-phone	Smart-phone	Smart-phone	as of Jan2020	After outbreak of COVID-19	before 17-Aug					
Samsung	315	94	400	200	460	300	450	330	400	315	370	310	310	295	295	300	275	255	260	300	Samsung		
Apple	90	90	135	135	155	155	193	193	232	232	215	215	217	208	190	205	205	190	205	230	Apple		
LGE	86	19	58	27	65	44	67	57	70	57	69	52	50	46	36	35	35	28	28	30	LGE		
Sony	33	19	34	34	40	40	38	38	30	30	17	17	13	7	4	4	4	3	3	4	Sony		
Nokia/MS	423	77	340	33	280	27	210	35	150	30	110	10	9	14	11	10	9	7	7	8	Nokia/MS		
HTC	43	44	32	31	20	20	22	22	15	15	10	10	7	3	2	2	2	1	1	1	HTC		
ASUS	0	0	0	0	0	0	8	8	20	20	17	17	12	10	4	4	3	2	2	2	ASUS		
Motorola	40	17	29	16	30	25	34	34	21	21	11	11	27	35	33	30	35	32	32	35	Motorola		
Blackberry	51	51	29	29	20	20	9	9	8	8	5	5	2	2	2	2	2	1	1	1	Blackberry		
Huawei	41	15	55	40	65	45	80	65	102	102	135	135	157	202	240	225	200	180	190	35	Huawei	50	
Honor																				50	Honor	100	
Lenovo	16	2	28	16	44	44	65	65	44	44	27	27	17	5	2	1	1	1	1	1	Lenovo		
Xiaomi	n/a	n/a	7	7	18	18	61	61	67	67	60	60	95	120	120	125	117	106	135	195	Xiaomi	250	
ZTE	57	11	69	25	65	40	65	45	57	47	45	45	45	25	10	12	12	10	10	10	ZTE		
Coolpad	n/a	n/a	n/a	n/a	40	40	44	44	29	29	15	15	9	6	4	0	0	0	0	0	0	Coolpad	
TCL	34	1	40	10	45	15	50	35	65	45	60	37	30	20	16	20	15	13	13	18	TCL		
Oppo	n/a	n/a	7	7	13	13	28	28	40	40	92	92	115	112	135	135	127	118	143	190	Oppo	260	
Vivo	n/a	n/a	6	6	12	12	26	26	42	42	73	73	90	92	110	115	103	98	110	160	Vivo	180	
Transsion	n/a	n/a	4	0	21	0	38	5	46	14	78	17	35	40	43	50	50	50	50	70	Transsion		
Gionee	n/a	n/a	n/a	n/a	18	18	18	15	18	18	27	27	23	12	3	0	0	0	0	0	0	Gionee	
LeEco	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	4	19	19	10	0	0	0	0	0	0	0	0	LeEco	
Meizu	n/a	n/a	2	2	3	3	5	5	21	21	18	18	19	12	2	2	2	1	1	1	Meizu		
Others	571	11	575	62	516	161	429	130	440	130	407	218	228	244	178	223	234	199	108	TBD	Others		
Total	1,800	450	1,850	680	1,930	1,040	1,940	1,250	1,920	1,330	1,880	1,430	1,520	1,510	1,440	1,500	1,430	1,295	1,300	1,400	Total		



Source: Mizuho Securities Equity Research

HOVX production: Focus on Honor/Huawei's attitude after short break of O/V/X

*** The Latest Forecasts ***

↑↓: Change from the previous forecasts (m units)

	2016	2017	2018	2019	2020	2018				2019				2020				2021	2021	2021
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1QE	2QE	3QE
Huawei	135	157	202	230	186	37-39	52-54	57-59	50-52	59-61	58-60	63-65	46-48	38-40	56-58	66-68	26-28	16-19	10-14	10-14
Honor																		9-12	12-16	12-16
Oppo	92	115	112	130	151	23-26	30-32	32-34	23-25	26-28	33-35	39-41	33-35	19-21	38-40	42-44	50-52	41-44	45-49	52-56
Vivo	73	90	92	110	120	18-20	23-25	25-27	21-23	25-27	25-27	30-32	26-28	16-18	30-32	32-34	39-41	27-30	35-39	40-44
Xiaomi	60	95	120	120	143	27-29	32-34	34-36	25-27	28-30	30-32	32-34	26-28	19-21	37-39	38-40	45-47	40-43	46-50	55-59
					YoY	13%	30%	23%	-5%	30%	6%	11%	10%	-32%	10%	8%	21%	47%	-4%	-2%
					QoQ	-16%	29%	8%	-19%	15%	6%	12%	-20%	-29%	72%	10%	-10%	-14%	12%	13%

Total change from the previous fcsts 7↑ 6↑ 16.5↑

*** Forecasts as of Oct.2020 ***

	2016	2017	2018	2019	2020				2021
					1Q	2Q	3QE	4QE	1QE
Huawei	135	157	202	230	38-40	53-55	62-64	23-25	10-15
Oppo	92	115	112	130	19-21	30-32	40-42	46-50	42-46
Vivo	73	90	92	110	16-18	26-28	30-32	38-43	33-38
Xiaomi	60	95	120	120	19-21	28-30	32-34	45-49	40-45
				YoY	-32%	-6%	0%	18%	40%
				QoQ	-29%	47%	19%	-5%	-16%

19.5↑ 21.5↑



3Q CY20 : Huawei bringing production forward to 3Q due to sanctions. O/V/X to increase production and fill in gaps. Production to outweigh sales.
4Q CY20 : Huawei to produce some high-end and ODM models only. O/V/X to further accelerate production.
1Q CY21 : O/V/X to continue procurement. Huawei focus on 4G due to regulation. Honor to start.
2Q-3Q CY21 : O/V/X to accelerate production, but short break of parts procurement? How act Huawei and Honor?

Note: Actual figures are estimated by Mizuho Securities.
 Source: Mizuho Securities Equity Research

5G smartphone forecasts by major brands: Chinese Sub6 models to be driver, 2022 5G weighting to top 50%, delayed inroads of mmW-device

As of Jan.26, 2021

5G smartphone shipments	2019	2020	2021E	2022E	2023E
Apple	0	75	159	190	205
Samsung	7	29	70	140	180
Huawei(Shanghai P/Mate+Part of Xi'An)	6	65	25	47	67
Honor	0	0	35	50	70
Xiaomi	1	20	80	105	135
OPPO	1	24	90	120	150
VIVO	1	25	80	105	135
Others	1	7	27	40	68
Total	17	245	566	797	1,010
% of adoption rate	1%	19%	40%	55%	67%

SoC & modem forecast	2019	2020	2021E	2022E	2023E
Apple	0	85	175	207	223
Apple - QCOM modem	0	85	175	207	223
Qualcomm - excl. Apple	9	61	199	276	354
HiSilicon	7	57	25	29	41
MediaTek	2	45	160	245	340
Samsung	2	24	60	106	140
Spreadtrum	0	0	5	15	25
Total	20	272	624	878	1,124

Breakdown

5G smartphone - Sub-6Ghz only	2019	2020	2021E	2022E	2023E
Apple	0	51	107	124	125
Samsung	5	21	50	94	108
Huawei(Shanghai P/Mate+Part of Xi'An)	6	65	25	47	65
Honor	0	0	35	50	68
Xiaomi	1	20	80	105	128
OPPO	1	24	90	120	143
VIVO	1	25	80	105	128
Others	1	7	27	38	64
Total	15	213	494	682	829
Sub-6Ghz % of 5G	90%	87%	87%	86%	82%

(M units)

5G smartphone - mmWave	2019	2020	2021E	2022E	2023E
Apple	0	24	52	67	80
Samsung	2	8	20	46	72
Huawei(Shanghai P/Mate+Part of Xi'An)	0	0	0	0	2
Honor	0	0	0	0	2
Xiaomi	0	0	0	0	7
OPPO	0	0	0	0	8
VIVO	0	0	0	0	7
Others	0	0	0	2	4
Total	2	32	72	115	181
mmWave % of 5G	10%	13%	13%	14%	18%

[Current view] Including former Huawei (base operations in Shanghai/Xi'an and new entity Honor). We assume Shanghai base (P/Mate) will be independent and launch new products in 2H.

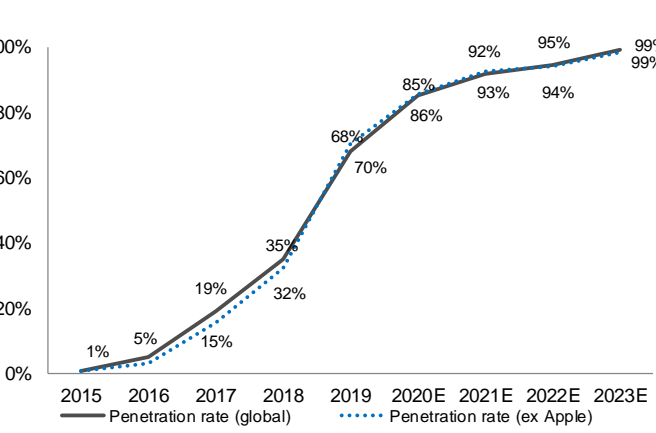
- (1) Market continues to expand rapidly led by Chinese Sub6 models, 5G-device will be nearly 70% of all sales volume in 2023, but we expect full mmW-device uptake to be from 2023.
- (2) Sub6 risks: Difficult to fill the Huawei vacuum in base stations and network equipment if Huawei doesn't return; depleting inventories in 2021? How about after that?
- (3) Milliwave models: AAPL at 100% for the US market though the outlook from 2021 is unclear; what happens if US carriers (Verizon, etc.) deploy Sub6?
- (4) Milliwave risks: Possibility of delayed inroads in the US, Soth Korea, and Japan; urgent need to establish the B2B business model
- (5) Smartphone brands: AAPL and Chinese firms are proactive, Samsung is cautious

Note: Actual figure are estimated by Mizuho Securities.

Source: Mizuho Securities Equity Research

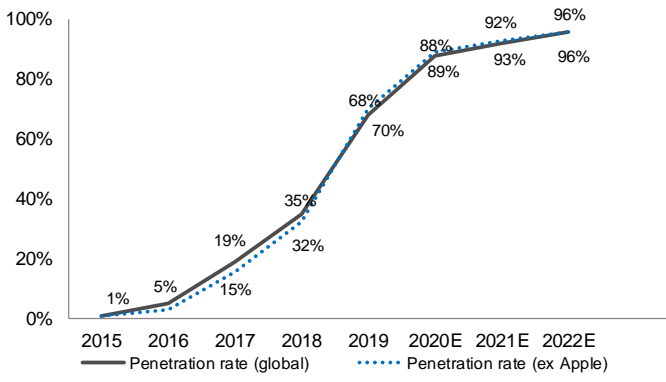
Dual Camera(incl. triple and more camera): Production volume estimates for smartphones equipped with dual camera

Forecast as of Dec.8th, 2020									
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Apple	0	33	90	113	108	173	202	230	245
Samsung	0	0	15	44	236	247	300	300	300
Huawei	9	20	50	107	200	180	45	50	65
Honor							55	110	120
XIAOMI	0	0	10	41	78	122	195	204	215
OPPO	0	0	30	53	100	136	196	198	210
VIVO	0	0	25	45	78	105	162	160	170
Other OEMs	2	17	70	126	184	145	135	115	120
total	11	70	290	529	984	1,107	1,289	1,367	1,445
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Penetration rate (global)	1%	5%	19%	35%	68%	85%	92%	95%	99%
Penetration rate (ex Apple)	1%	3%	15%	32%	70%	86%	93%	94%	99%



Smartphone estimated total volume
CY2020: 1,300m, CY2021: 1,400m

Forecast as of Oct. 1st, 2020								
	2015	2016	2017	2018	2019	2020E	2021E	2022E
Apple	0	33	90	113	108	173	197	225
Samsung	0	0	15	44	236	247	300	300
Huawei	9	20	50	107	200	180	40	20
XIAOMI	0	0	10	41	78	122	195	200
OPPO	0	0	30	53	100	136	196	198
VIVO	0	0	25	45	78	105	132	136
Other OEMs	2	17	70	126	184	183	230	305
total	11	70	290	529	984	1,145	1,290	1,383
	2015	2016	2017	2018	2019	2020E	2021E	2022E
Penetration rate (global)	1%	5%	19%	35%	68%	88%	92%	96%
Penetration rate (ex Apple)	1%	3%	15%	32%	70%	89%	93%	96%

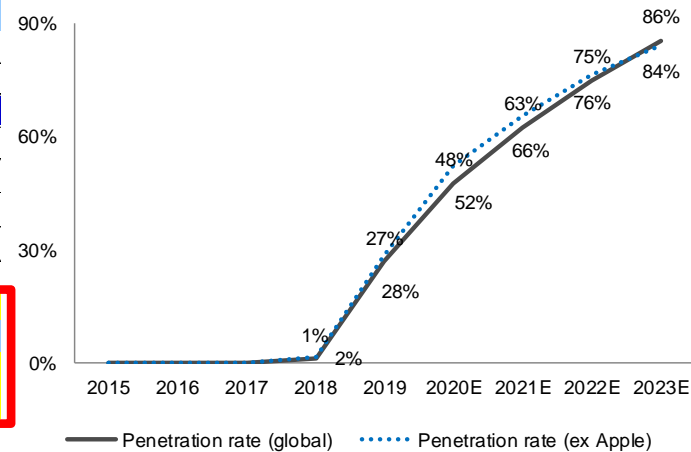


- ◆ The volume likely to rise due to increased brands
- ◆ Major brand products: no single lenses in 2022 (except AAPL)

Source: Mizuho Securities Equity Research

Triple Camera(incl. quadruple & more cameras): Production volume estimates for smartphones (volume likely to increase)

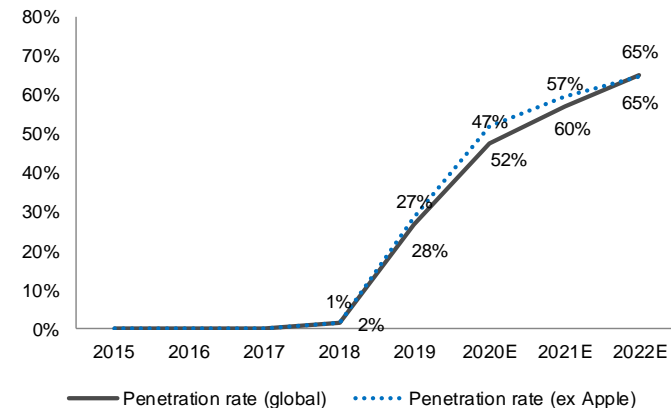
Forecast as of Dec. 8th, 2020									
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Apple	0	0	0	0	33	51	105	160	220
Samsung	0	0	0	2	130	170	230	240	240
Huawei	0	0	0	15	110	155	40	50	65
Honor							45	100	120
XIAOMI	0	0	0	1	25	58	120	160	180
OPPO	0	0	0	2	35	80	150	160	185
VIVO	0	0	0	0	30	66	130	145	155
Other OEMs	0	0	0	1	24	40	55	65	80
total	0	0	0	21	387	620	875	1,080	1,245
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Penetration rate (global)	0%	0%	0%	1%	27%	48%	63%	75%	86%
Penetration rate (ex Apple)	0%	0%	0%	2%	28%	52%	66%	76%	84%



Smartphone estimated total volume
CY2020: 1,300m, CY2021: 1,400m

- ◆ Before: Mix deterioration was assumed though expecting volume to rise by exclusion of Huawei
- ◆ Middle/low-end models and above: at least three lenses
- ◆ Now: Expect volume to rise from 2021 as Huawei and Honor are added

Forecast as of Oct. 1st, 2020								
	2015	2016	2017	2018	2019	2020E	2021E	2022E
Apple	0	0	0	0	33	51	100	160
Samsung	0	0	0	2	130	170	240	255
Huawei	0	0	0	15	110	150	40	10
XIAOMI	0	0	0	1	25	58	100	120
OPPO	0	0	0	2	35	75	130	145
VIVO	0	0	0	0	30	58	110	125
Other OEMs	0	0	0	1	24	55	80	125
total	0	0	0	21	387	617	800	940
	2015	2016	2017	2018	2019	2020E	2021E	2022E
Penetration rate (global)	0%	0%	0%	1%	27%	47%	57%	65%
Penetration rate (ex Apple)	0%	0%	0%	2%	28%	52%	60%	65%



Source: Mizuho Securities Equity Research

Huawei: US Dept of Commerce announces additional sanctions on 17 Aug

- **New sanctions (17 August): Huawei suppliers will also need to acquire licenses**
 - **Even if Huawei is the purchaser, suppliers using US-based technology or manufacturing equipment must acquire licenses from the Department of Commerce**
- **Impact: From 15 September most semiconductors will be unpurchaseable without a license. Ripple effect will go beyond semiconductors.**
 - **Procurement challenges: Almost all areas, including Taiwanese IC design products, memory, logic, CMOS sensors, analog.**
 - **Outside of semiconductors: Components and parts that use US-based technology, including camera lenses.**
 - **Huawei's reaction: Requests additional provisions and licenses from major suppliers before the deadline**
 - **Smartphone business in 2020:190m output, 50m max in 2021, beyond that depends on procurements and ODM.**
 - **Suspend development?: Release Mate40 with limited volume (below 7m), limited volume for one P50 model? Recover with Mate50?**
 - **Stagnation risk for high-end smartphones: Others will struggle to fill gap left by Huawei; wait for Huawei recovery**
 - **Infrastructure: If base station/network equipment production is suspended (from 2022 onwards taking stock into consideration), China 5G will be affected.**
- **Will licenses be issued?: US/China talks could make breakthrough, but hard to see a compromise**
 - **Challenges: Depts of Commerce, Dept of Defense are enactors while party/military are behind the measures**
 - **What about PCs?: Intel/AMD approved but only past products? US intentions are unclear.**
 - **Approval for smartphone-related?: Approval began to appear around October 22nd → 5G wiped out → only 4G seems to be OK?**
 - **US semiconductor sector: Organizations express their surprise and concern**
 - **Any movement will come after US new government post is confirmed: Possible stalling until around February. Is compromise possible?**

Huawei in 2021: Fight for survival of smartphone business (After 18 August)

- **US allowed companies to supply Huawei with components:** only for non-5G businesses; 5G approval essential for business to survive.
- **Will smartphone business survive?:** If the US targets semiconductors (HiSilicon) and 5G infrastructure (base stations, NW facilities)...
 - Possible relaunch as a separate company (introducing non-Chinese capital, listing in the US, etc.) → Flagship model (Shanghai: P/Mate)
 - Selling a business to another Chinese company: Honor (Beijing: middle-end) to a second-tier brand or channel for a relaunch?
 - → Both scenarios are feasible, but risks remain for the buyer since everything depends on the US's interpretation

Also...

- **On 17 Nov, Huawei announced it would sell Honor to Shenzhen Zhixin New Information Technology, which was formed by Huawei's distributors**
 - Huawei will sell all assets related to Honor and have no stake or involvement in Honor afterward
 - Honor's brand value: specs, cost effectiveness, status as a Huawei company. The former seems worth fighting for.
 - 3,000 developers may move (all of Beijing and almost half of Xi'an).
 - Realistically, Honor likely to work on current development projects for now and on new development projects when the new company is formed. Production volume may be around 60m max in 2021. New company likely to mainly focus on Chinese market and gradually strengthen international business
 - Utilize ODM? +30m–40m possible if low-end models introduced using Xi'an team + ODM
 - US response is unknown but Qualcomm should be safe and is key for Huawei's future in Shanghai (P/Mate).
 - Value chain: Procurement yet to fully start. Demand for parts may exceed actual demand → possible corrections.

Huawei: Shipment volume forecast by device (Divided into Honor and Huawei in 2021)

Shipment in 2019 and breakdown by device: 240M (Sales:145m in China, 95m overseas)

- Shanghai (P/Mate: flagship devices) : 60m
- Beijing (middle-end phones such as Honor/Nova): 85m
- Xi'an (middle/low-end phones, ODM devices): 95m

Shipment in 2020: 240m down to 190m due to COVID-19/US sanction

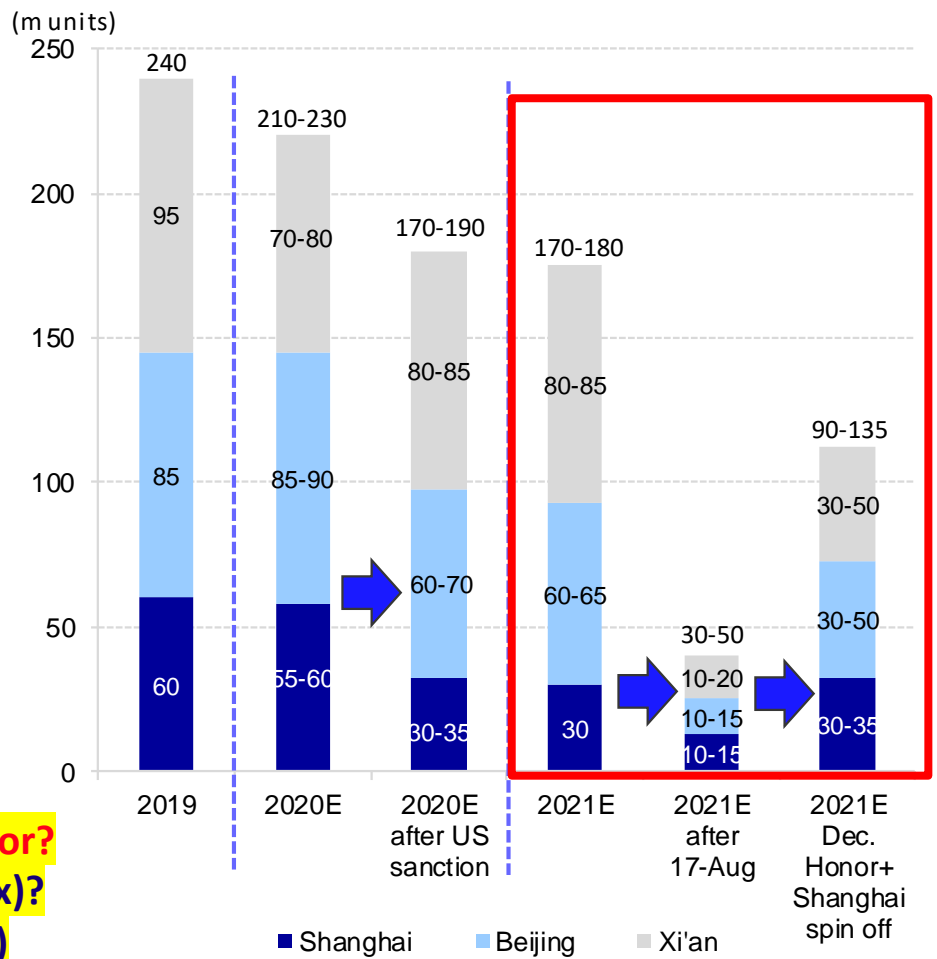
1. Domestic sales focus (145m-155m. M/S: 45%-50%)
2. Overseas sales: Focusing on emerging markets other than western Europe (25m-45m)

Rough estimate by device (2020)

- Shanghai: 55m-60m → after COVID-19 45m-55m → After US sanction 30m-35m
- Beijing: 85m-90m → 75m-85m → 60m-70m
- Xi'an: 70m-80m → 50m-70m → 80m-85m

Rough estimate by device (2021):

- Shanghai: 30m → 10m-15m → Revive by spin-off (20m max)?
- Beijing: 60m-65m → 10m-15m → to Honor (60m-70m max)
- Xi'an: 80m-85m → 10m-20m → Divided into Honor(30m max) and former HW(30m max)?



Source: Mizuho Securities Equity Research from Company data

Sony CMOS sensors sales: estimated breakdown (assumes zero shipments to Huawei from 2H)

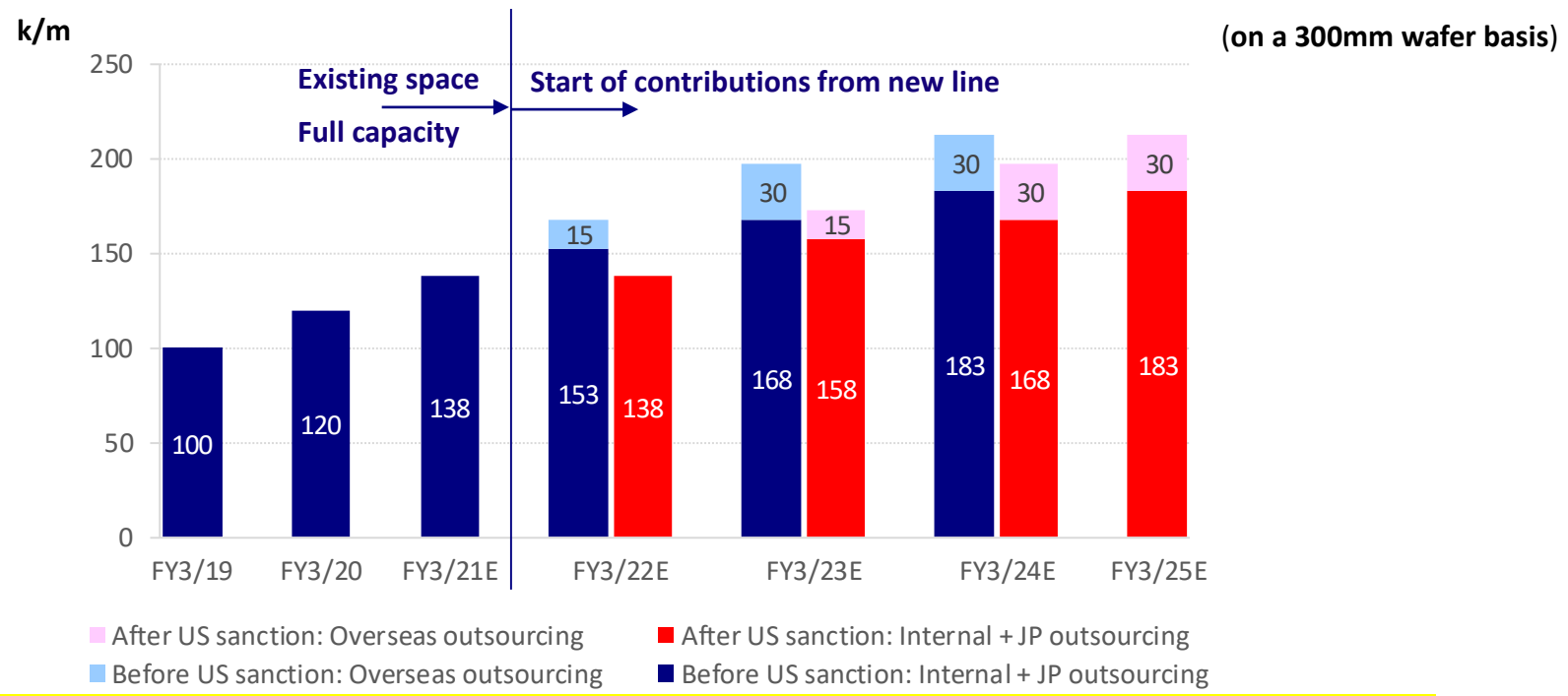
- Huawei sanctions→around ¥130b in 1H (up to 14 Sep). Receives US approval; assume a small sales booking in 2H also. Estimate around ¥45.0b for Honor and Shanghai (P/Mate).
- OP: We forecast ¥118.4b in FY3/21(company guidance is ¥81b), ¥161.3b in FY3/22 and ¥203.8b in FY3/23.
- Who will step in? → Limits to growth in AAPL/Samsung demand, increased sales to OVX. Some earnings impact unavoidable.
- FY3/22: Lift from growth in AAPL/SS demand, increased sales to OVX expected. Sales toward former Huawei depends on revival/timing/re-launch speed of Honor and Shanghai (P/Mate).

(JPYb)

	FY3/19	FY3/20	FY3/21F					FY3/22			M/S (Vol)
			as of Nov. (Before COVID-19)	as of Apr. (After COVID-19)	as of Jun.	as of Sep.	as of Dec. (Latest)	as of Jun.	as of Sep.	as of Dec. (Latest)	
Apple	270	310	380	355	355	355	365	390	410	430	100%
Huawei	150	290	360	320	280	130	135	260	0	0	45~50%
P + Mate										30	
Honor										15	
Oppo	40	55	80	40	40	50	60	50	95	95	30~35% ↑
Vivo	5	10	40	10	20	20	20	25	40	40	5~10% ↑
Xiaomi	50	40	50	40	50	40	45	60	65	65	25~30%
Samsung	55	90	90	100	95	105	100	115	140	150	20%
Others	5	5	0	5	10	10	15	15	30	30	
Non Mobile	135	130	140	115	109	101	108	119	129	113	
Total Sales	710	930	1,140	985	959	811	848	1,034	909	968	
I&SS segment OP	144	236	257	184	166	63	118	201	142	161	

Source: Mizuho Securities Equity Research

Forecast of Sony CMOS sensor capacity expansion(Nagasaki: postponement shortened from one year to six months)



- ★ Depends on trends at Huawei: Construction of new wing in Nagasaki in FY3/21, +15K investment; mass production was expected to be postponed from spring 2021 to spring 2022 (roughly one year) due to delivery delays, etc., but could be brought forward slightly to autumn 2021
- ★ Nagasaki new building Phase 2 and 3: Likely to implement with an interval of a year or longer after conducting Phase 1
- ★ Foundry: First sensor (Master) outsourcing is expected to be a small-scale operation after April 2022
- ★ Longer-term demand outlook unchanged, but difficult to decide because in the best case investment would have to be sped up, while in the worst case you may have excess capacity.

Note: Overseas outsourcing shows the maximum production capacity that can be captured by foundries
 Source: Mizuho Securities Equity Research

iPhone production forecast: Expecting 236m in 2021, production to match demand

Revised on January 29. Raising 2020 production forecast from 218m units to 221m (+13%YoY). Expect shipment of 205m. Outperform the market.

1. 2020: Production (+13%)>shipment(+5%)>sell-through(+slightly), inventory seemed to have slightly increased. We expect production to match actual demand in 2021.
2. 4Q 2020: 91M→94M(+31%). New models 2H: 75M→77M). Lost ground made up mostly, production close to level of typical years.
3. 2020: 218M→221M(+13%). 11: 64M, SE2: 35M; Older models healthy; New models: 77M same as usual.
4. 1Q 2021: 62M→60M(+58%). Apple's assumption of 70M+ seemed to have decreased to the realistic level. Strong sales for older models and Pro/ProMax.
5. 2Q 2021: 44M(+1%). Weak sales for Mini, we suppose there would be a break in good sales of Pro/ProMax.
6. 2021: 235M→236M(+7%). There would be a chance to be 240M-245M. Assumption of 225M shipment. Apple's assumption of 270M is too bull
7. SCM (2Track Strategy) : Increasing adoption by Chinese firms + requesting non-China base for Japan/South Korea/Taiwan firms?

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities

Source: Mizuho Securities Equity Research

iPhone production forecast

iPhone	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19	1Q20	2Q20	3Q20	4Q20	1Q21	2Q21
													E	E
6+6S+7(4.7")	14	10	6	4	9	7	5	3	1	1	1	-	-	-
6plus+6Splus+7plus (5.5")	3	4	2	1	1	0	0	1	0	-	-	-	-	-
iPhone8(4.7" LCD)	9	10	8	7	6	6	6	9	3	3	0	-	-	-
iPhone8plus(5.5"LCD)	10	8	6	5	4	2	2	1	0	0	-	-	-	-
iPhoneX(5.85"OLED)	12	9	7	2	1	0	-	-	-	-	-	-	-	-
iPhoneXR(6.06"LCD)	-	-	1	29	11	10	13	6	4	5	3	3	3	2
iPhoneXS(5.85"OLED)	-	-	9	11	2	3	3	-	-	-	-	-	-	-
iPhoneXS Max(6.46"OLED)	-	-	10	18	3	3	3	-	-	-	-	-	-	-
iPhone11(6.06"LCD)	-	-	-	-	-	-	12	30	19	17	20	8	9	10
iPhone11 Pro(5.85"OLED)	-	-	-	-	-	-	5	10	4	3	2	0	-	-
iPhone11 Pro Max(6.46"OLED)	-	-	-	-	-	-	6	12	5	3	2	0	-	-
iPhone12Mini(5.42"OLED)	-	-	-	-	-	-	-	-	-	-	-	17	3	2
iPhone12(6.06"OLED)	-	-	-	-	-	-	-	-	-	-	2	24	12	13
iPhone12 Pro(6.06"OLED)	-	-	-	-	-	-	-	-	-	-	2	14	12	5
iPhone12 Pro Max(6.67" OLED)	-	-	-	-	-	-	-	-	-	-	0	17	14	7
5S+5C+5+SE (4.0") + SE2 (4.7"LCD)	4	2	2	1	0	0	-	-	1	13	12	10	8	6
Total iPhone	51	43	51	78	37	32	55	72	38	44	46	94	60	44
YOY	9%	18%	2%	-13%	-27%	-26%	8%	-9%	2%	39%	-17%	31%	58%	1%
QOQ	-43%	-17%	19%	54%	-52%	-16%	73%	31%	-47%	16%	3%	106%	-36%	-26%

(M units)

iPhone	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20	CY21E	CY21E	CY21E	FY16	FY17	FY18	FY19	FY20
								median	bull	bear						E
6+6S+7(4.7")	-	59	150	108	71	34	24	3	-	-	-	107	63	29	17	2
6plus+6Splus+7plus (5.5")	-	27	63	58	46	10	2	0	-	-	-	67	31	8	1	-
iPhone8(4.7" LCD)	-	-	-	-	25	34	27	6	-	-	-	-	33	32	24	3
iPhone8plus(5.5"LCD)	-	-	-	-	23	29	9	1	-	-	-	-	33	23	5	0
iPhoneX(5.85"OLED)	-	-	-	-	40	30	1	-	-	-	-	-	51	19	0	-
iPhoneXR(6.06"LCD)	-	-	-	-	-	30	40	15	7	8	5	-	-	41	33	14
iPhoneXS(5.85"OLED)	-	-	-	-	-	19	9	-	-	-	-	-	-	22	7	-
iPhoneXS Max(6.46"OLED)	-	-	-	-	-	28	8	-	-	-	-	-	-	31	6	-
iPhone11(6.06"LCD)	-	-	-	-	-	-	42	64	37	38	35	-	-	-	61	54
iPhone11 Pro(5.85"OLED)	-	-	-	-	-	-	15	9	-	-	-	-	-	-	19	5
iPhone11 Pro Max(6.46"OLED)	-	-	-	-	-	-	18	10	-	-	-	-	-	-	22	5
iPhone12Mini(5.42"OLED)	-	-	-	-	-	-	-	18	7	8	6	-	-	-	-	21
iPhone12(6.06"OLED)	-	-	-	-	-	-	-	26	27	28	25	-	-	-	-	38
iPhone12 Pro(6.06"OLED)	-	-	-	-	-	-	-	15	21	22	20	-	-	-	-	28
iPhone12 Pro Max(6.67" OLED)	-	-	-	-	-	-	-	18	24	25	22	-	-	-	-	31
iPhone13Mini(5.42"OLED)	-	-	-	-	-	-	-	-	18	20	16	-	-	-	-	-
iPhone13(6.06"OLED)	-	-	-	-	-	-	-	-	25	28	22	-	-	-	-	-
iPhone13 Pro(6.06"OLED)	-	-	-	-	-	-	-	-	22	25	19	-	-	-	-	-
iPhone13 Pro Max(6.67" OLED)	-	-	-	-	-	-	-	-	20	22	17	-	-	-	-	-
5S+5C+5+SE (4.0") + SE2 (4.7"LCD)	-	-	36	37	18	9	0	35	31	32	29	38	16	5	1	42
iPhone4S	31	24	3	-	-	-	-	-	-	-	-	0	-	-	-	-
Total iPhone	155	193	252	203	223	223	195	221	236	256	216	211	227	209	196	243
YOY	15%	25%	31%	-19%	10%	0%	-13%	13%	7%	16%	-2%	-9%	7%	-8%	-6%	24%

Total Volume of New Models

CY	m units
CY17	87
CY18	77
CY19	75
CY20	77
CY21	85

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities, Source: Mizuho Securities Equity Research

2020 iPhone: Content roughly in line with expectations

2020 New iPhones

	EMS	Casing	Size	Display	TP	5G	Rear Cam	ToF Camera	DRAM	NAND	Price
iPhone 12 Pro Max	Hon Hai	Stainless (HH)	6.67"	OLED (SDC)	Y-Octa	mmW+Sub6 (US), Sub6	Triple (1.7µm, 7p, SensorShift, LGI)	Yes (LGI)	6GB	128GB 256GB 512GB	\$1,099~
iPhone12 Pro	Hon Hai	Stainless (HH/Jabil)	6.06"	OLED (SDC)	ITO Film	mmW+Sub6 (US), Sub6	Triple (1.4µm, same as 11Pro, LGI)	Yes (LGI)	6GB	128GB 256GB 512GB	\$999~
iPhone12	Pegaton/ Hon Hai	Aluminium (Catcher /HH)	6.06"	OLED (SDC+LGD +BOE)	ITO Film	mmW+Sub6 (US), Sub6 only	Dual (1.4µm, same as 11, SH)	No	4GB	64GB 128GB 256GB	\$799~
iPhone12 mini	Pegatron / Hon Hai / Wistron	Aluminium (HH/Jabil)	5.42"	OLED (SDC)	Y-Octa	mmW+Sub6 (US), Sub6 only	Dual (1.4µm, same as 11, SH)	No	4GB	64GB 128GB 256GB	\$699~

- **Four models: 2020 production volume outlook (from top): 18m/15m/26m/18 for a total of 77m. Lost ground made up mostly.**
- **All 5G: mmW+Sub6 for all models in the US (inexpensive despite these capabilities), Sub6 for others, lack of mmW models in Japan and Korea seems unusual.**
- **Display: OLED. SDC supplies Y-Octa panels for the first time. BOE couldn't start shipments by end-2020. Hoping for 1Q 2021.**
- **Camera: Great changes to Pro Max only. Sensor enlargement, 7p lens, SensorShift, etc. Two ToF models**
- **Memory: NAND capacity slightly suppressed.**
- **Price is the key: In line with above-mentioned anticipated pricing, neutral.**

Source: Mizuho Securities Equity Research

2021~2022 iPhone: Display and camera changes

2021 New iPhones

	Size	Display	TP	5G	Rear Cam	ToF Camera	Face ID
iPhone 13 Pro Max	6.67"	OLED (SDC)	Y-Octa	TBD	Triple (1.9µm, SensorShift)	Yes	Yes
iPhone13 Pro	6.06"	OLED (SDC)	Y-Octa	TBD	Triple (1.9µm, SensorShift)	Yes	Yes
iPhone13	6.06"	OLED (LGD+BOE+SDC)	Y-Octa	TBD	Dual (1.7µm, Sensorshift)	No	Yes
iPhone13 mini	5.42"	OLED (SDC+LGD)	Y-Octa	TBD	Dual (1.7µm, Sensorshift)	No	Yes
iPhone SE2 5G (22 Spring)	4.7"	LCD (Sharp>JDI)	In-Cell	Sub6 only	Single	No	No (Fingerprint Sensor)
iPhone SE3 (23 Spring)	5.7"	LCD (Sharp>JDI)	In-Cell	Sub6 only	Dual (1.4µm, same as 11)	No	No (Fingerprint Sensor)

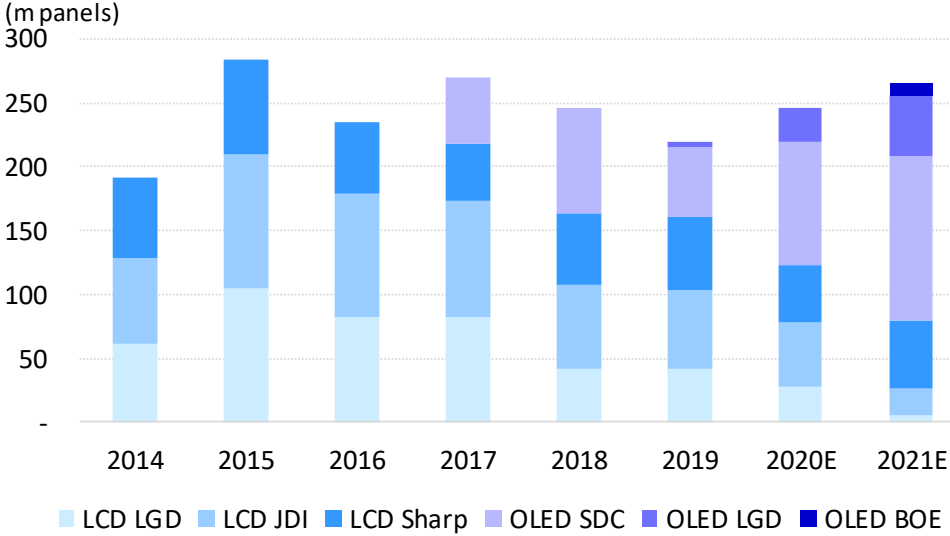
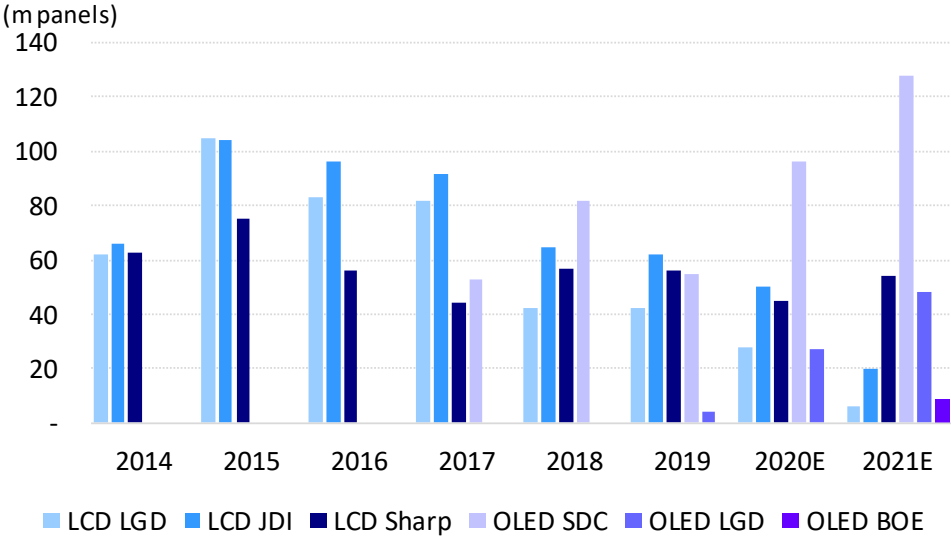
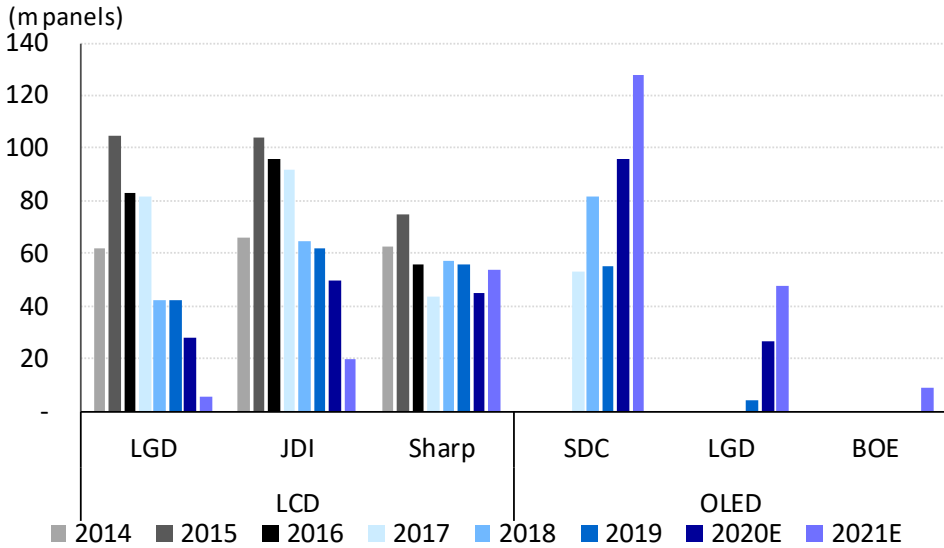
- Four models except SE: All OLED, basically all the same size. Pro Series with LTPO substrate. All TP to shift to Y-Octa. Eye on BOE share.
- SDC production capacity: Y-Octa eats up TFT capacity with four extra masks. **Capacity could tighten if SDC share is high (A5 investment?).**
- **5G: Content is unclear, focus on whether it releases Sub6 only models in the US and whether it offers mmW models in Japan, Korea, etc.**
- Rear camera (1): New modules for Pro Max and Pro. Larger sensor, 7p lens, sensor shift.
- Rear camera (2): 13 (two models) upgraded using 2020 Pro Max (sensorshift). Triple camera and ToF will be probably adopted for 2 models.
- Rear camera (3): **Ultra wide for Pro Max/Pro with Auto Focus(VCM).**
- **Possible adoption of AF (VCM) on front camera and periscope structure for the second lens (Tele) on rear camera from 2022 onward.**
- SE3: New LCD models. May use iPhone 11 camera. No Face ID for LCD. Side finger-print sensor?

Source: Mizuho Securities Equity Research

iPhone Panel Supply Forecast (LCD/OLED by supplier)

iPhone Panel Supply Forecast (LCD/OLED)

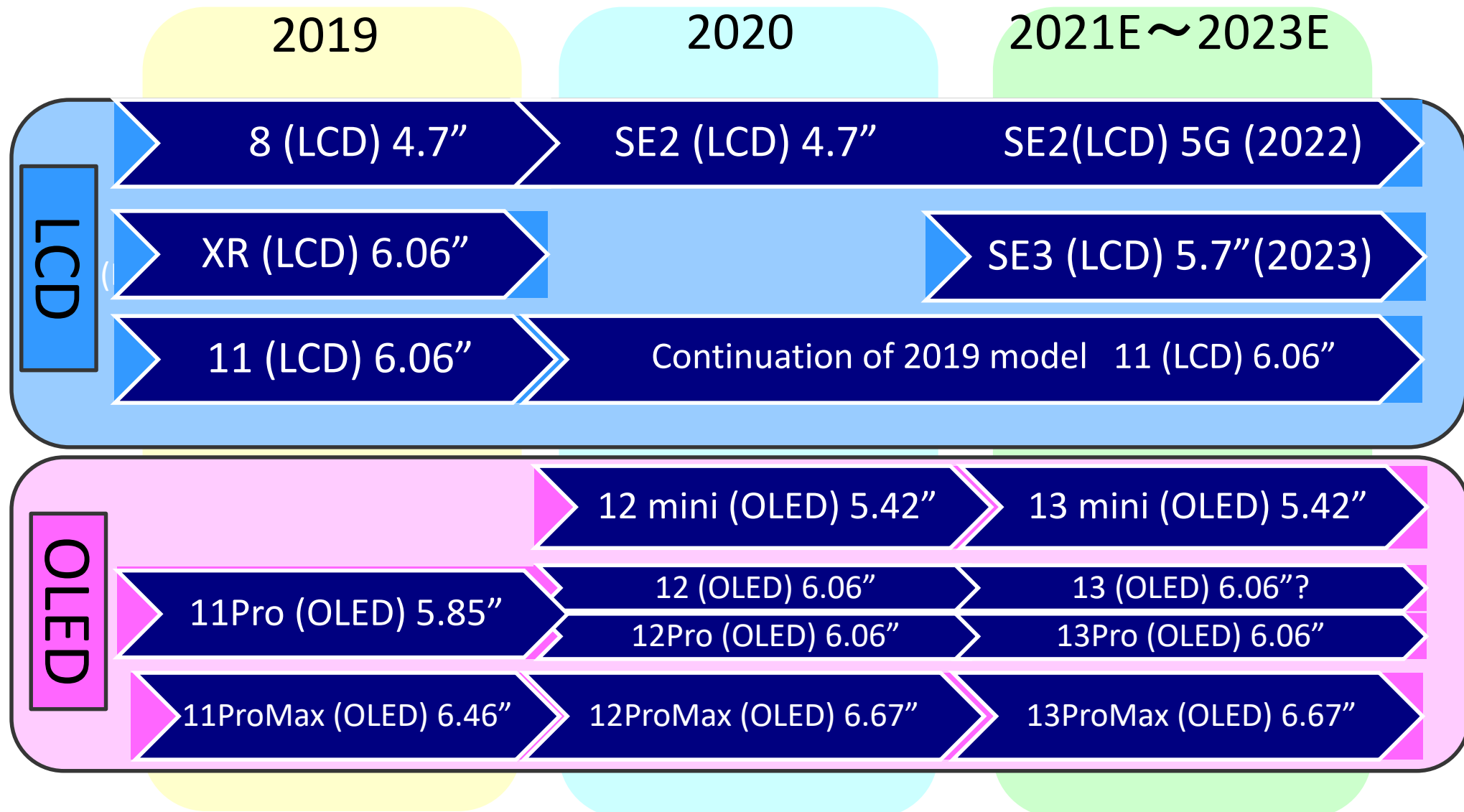
		(m panels)								
Panel	Maker	2014	2015	2016	2017	2018	2019	2020E	2021E	
LCD	LGD	62	105	83	82	43	42	28	6	
	JDI	66	104	96	92	65	62	50	20	
	Sharp	63	75	56	44	57	56	45	54	
OLED	SDC	-	-	-	53	82	55	96	128	
	LGD	-	-	-	-	-	4	27	48	
	BOE	-	-	-	-	-	-	-	9	
LCD + OLED	LGD	62	105	83	82	43	46	55	54	
	JDI	66	104	96	92	65	62	50	20	
	Sharp	63	75	56	44	57	56	45	54	
	SDC	-	-	-	53	82	55	96	128	
	BOE	-	-	-	-	-	-	-	9	
Total		191	284	235	270	246	219	246	265	



Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities

Source: Mizuho Securities Equity Research

iPhone Display Roadmap: differentiate high-end model from mid-end clearly?



Source: Mizuho Securities Equity Research

Market Cap Top10 in Chinese Market (Technology-related stocks)

- 6 companies are Apple suppliers → Locking Apple out of China market likely difficult?

中国市場(上海+深セン) 社名		時価総額 (USD bn)			法人登録年	CAGR	
		10年前	5年前	直近		10Y	5Y
杭州海康威視数字技術	HANGZHOU HIKVI-A	-	14.3	64.1	2001		+16%
立訊精密工業	LUXSHARE PRECI-A	-	3.7	56.4	2004		+31%
Foxconn Industrial Internet	FOXCONN INDUST-A	-	-	41.7	2015		
WILL SEMICONDUCTOR LTD	WILL SEMICONDU-A	-	-	28.7	2007		
京東方科技集團	BOE TECHNOLOGY-A	5.8	12.1	27.7	1993	+17%	+9%
用友網絡科技	YONYOU NETWORK-A	2.5	4.4	23.0	1988	+25%	+18%
藍思科技[レンズ・テクノロジー]	LENS TECHNOLOG-A	-	-	22.4	2006		
深セン市中興通訊 [ZTE]	ZTE CORP-A	11.3	9.5	21.9	1997	+7%	+9%
聞泰科技	WINGTECH TECH-A	0.4	1.1	21.2	1993	+47%	+35%
Avary Holding Shenzhen Co Lt	AVARY HOLDING -A	-	-	19.7	1999		
三安光電	SANAN OPTOELEC-A	2.1	5.5	19.6	1993	+25%	+14%
歌爾	GOERTEK INC -A	1.0	6.0	18.9	2001	+35%	+12%

- (2nd) Luxshare: The largest supplier of AirPods. Acquired Wistron's iPhone assembly plant.
- (3rd) Foxconn Industrial Internet: iPhone/iPad assembly (Hon Hai Group)
- (5th) BOE: supply of LCD panels for IT industry. Supply of OLED panels for iPhone (from 2021)
- (7th) Lens: Supply of cover glass for iPhones and TP for iPad. Acquired Catcher's housing factory.
- (10th) Avary: Hon Hai(ZDT)'s subsidiary and PCB manufacturer. Key supplier to Apple.
- (12th) Goertek: Major in VR. Produces AirPods.

Source: Mizuho Securities Equity Research from Bloomberg

Flat Panel Display Industry: Small/medium panels; Can Chinese companies stop SDC's runaway?

■ Finished products (smartphones): Samsung, Apple, Chinese brands are well established

- 6 major brands: HHOVX for volume, Apple for high-end/APP, Samsung Electronics (wireless) for overall strength
- Display: Both OLED adoption expanding. Samsung wireless also uses Chinese OLED for cost control, Apple extends LCD life
- Foldable OLED: Galaxy Flip (Samsung) popular. Can it work closely with Samsung Display to rapidly expand the business?
- Peripheral equipment: Product strength of watches, earphones, AR/VR, and speakers etc., and smartphone compatibility are key factors
- Apps: Focus on games that utilize cameras and sensors (ToF, etc.), e-Commerce, etc. What will platformers such as Sony and Nintendo do?

■ Finished products (tablet/PC/MNT): HP, Dell, Lenovo strong with BtoB. Focus on Dell, Apple, Asus for displays

- HP/Dell/Lenovo: BtoB (PC/Server) is strength, especially for HP and Dell. Eye on Dell/Lenovo from a display perspective (OLED/flexible)
- Apple: Eye on displays (mini LED/OLED) for MNT/notebooks/tablets
- Taiwanese companies such as Asus, Acer, Microstar: survival through gaming. Asus does not have a weak financial base. Eye on Asus for displays.
- GGL/MSFT/Amazon/Samsung/Huawei: A certain amount of presence in tablet market

■ Small/medium-sized display industry: The key to LCD is whether or not it can be made into cash cow. SDC victory would be pitfall for OLED

- OLED and LCD: Smartphones shifting toward OLED, tablets/laptops/MNT in high-end battle between OLED and LCD+Mini LED. LCD is strong for automotive applications
- South Korea: SDC overwhelms with OLED technology, increasing functions, and aims for victory with foldable + IT application increase. LG Display's strategy after reaching OLED BEP is to expand again.
- China: LTPS-LCD (BOE/Tianma) to become cash cow. OLED has sufficient scale; issues are yield and development capability. Cash from large LCDs is also a positive
- Taiwan: LCDs have no edge. Expected to develop AUO's IJ OLED and mini/ μ LED, and collaborate with other Taiwanese companies (LED/semi). Cash from large LCDs is also a positive
- Japan: OLED is lagging behind. LCDs for Apple, automotive, and industrial use are key to survival. IT (oxide) is key to survival for SH. Can it just do its own thing?

★ Will SDC win in the shift to OLED?: There is risk that Samsung Group's profit-focused strategy will become useless. Originally, it would be about time to make A5/A6 factory investment decisions to expand foldable/IT business and introduce new technologies. Hesitation provides an entry point for Chinese firms. Apple's adoption strategy also has a big impact

3. Large sized FPDs

Flat Panel Display Industry: Hegemony for large panels?

- **Large LCD/OLED supply/demand:** Tight for LCD in 2021. Shift in industry power balance? OLED depends on LGD pricing strategy
 - LCD supply/demand: Prices tight 2H 2020–2021. LCD area growth has peaked. Rising influence of Chinese panel makers, prices to rise
 - TV brands: China brands in particular cannot allow significant price increases. Risk of decline in demand. What will panel makers do?
 - **Shift in power balance?: Reorganization to boost position of LCD makers. Building an environment that allows for stable OPM of 10%.**
 - LCD or OLED or μ LED: OLED is the favorite, but cost competitiveness is an issue. Gives room for LCD (+Mini LED) and μ LED. Focus on LG Display's pricing strategy.
 - Components: Needs to reconsider strategy for LCD. Large growth potential for OLED, Mini LED (BL), and μ LED
- **Finished products (TV):** Battle between Korea and China. Will Korea evade or will China catch up?
 - Samsung, LGE: Is it possible to maintain a presence in M/S volume, high-end market? Differentiating technology is OLED for LGE, and MiniLED or OLED for Samsung?
 - Samsung Electronics (VD): Favors QD technology + Mini LED or μ LED. **No intention to adopt QD-OLED. → change their strategy to adopt it in 2022.**
 - TCL/Hisense/Skyworth/Xiaomi/Huawei: How much US/Europe market share can they take with lower prices + rising quality?
 - Japanese brands: Even Sony is in a difficult situation. Differentiated technology and regionally specialized strategy are required.
 - Others: Paying attention to ODM + economy of scale for brands (TPV), asset-light brands (Vizio etc.), low costs + high quality (Funai).
- **Large display industry:** LCDs distributed to China. Concerned about Korea's lag.
 - Era of Chinese hegemony for LCD: Reorganization in China to focus on BOE/CSOT, further strengthening constitution and solidifying foothold.
 - **South Korea: Focus on next-generation displays such as OLED and QNED. Common issues include cost, reliability, and 8K. Challenges include finance for LGD and inconsistent group strategy for SDC.**
 - Taiwan: Both AUO and INX to benefit due to focus on LCD. In medium to long term, it will be necessary to reorganize the LCD plant and invest in new technologies.
 - Japan: JOLED impacts the proliferation of OLED. **Sharp is focusing on IT applications and giant-sized TV (over 80").**
- ★ **South Korea is lagging behind in new technology investment in terms of financial strength and investment recovery. The interests of the finished product divisions and display divisions of Samsung and LG Group do not match (i.e. in the case of OLED, module-added value is on the panel side and not so much on the TV side). South Korea's sluggishness works in China's favor.**

Current and short-term panel demand estimates by size and application (as of March 2021)

- Lengthening of the tight supply-demand period driven by demand recovery and glass tightness, sustained rise in prices and completely overshooting.

Major LCD panels's S/D and price trends by size(↑up, ↓down, in the next 3month)

	Current demand	Future supply	S/D Balance	Price trend	Expected balance:
NBPC					
15.6"W	↑	↑	Tight	Up→Flat	Tight/Shortage
>17"W	→	→	Tight	Up→Flat	
Monitor					
18.5"W/19"W	↑	→	Tight	Up→Flat	Tight/Shortage
21.5"W/22"W	↑	↑	Tight	Up→Flat	
23"/23.6"/24"W	↑	↑	Tight	Up→Flat	
TV					
32"W	↑	→	Tight	Up→Flat	Tight/Shortage
40"/42"/43"W	↑	→	Tight	Up→Flat	
48"/49"/50"W	↑	→	Tight	Up→Flat	
55"W	↑	→	Tight	Up→Flat	
65"W	↑	→	Tight	Up→Flat	
75"W	↑	→	Tight	Up→Flat	

Expected balance:
■ Oversupplied
■ Balanced
■ Tight/Shortage

- NB/MNT/TV demand rebound stronger than expected in Europe/US: Retail and brand inventories low
- Stay-at-home trend: Upbeat sales of all TV sizes (rather than just 43" and smaller), IT strong overall
- Continued supply-demand tightness: Tight conditions expected through 21Q1-Q2 due to glass supply issue. Cautious of a pullback (impact by price hike) in 2H.

Source: Mizuho Securities Equity Research

Panel prices: unprecedented rate-of-climb from July 2021. Pay close attention to the impact on demand.

Recent Panel Prices -US\$-

Appli	Size	Actual Price									
		Jan.2014	Mar.2015	Apr.2016	Apr.2017	Jul.2018	Jan.2019	Jan.2020	Mar.2020	Jun.2020	Mar.2021
Notebook	15.6"W (ELED)	36	37.5	28	31	28	27	24	26	26	38
Monitor	21.5"W (ELED)	70	72	48	53	46	45	41	41	41	59
TV	32"HD (Open cell)	78-80	94-98	50-55	68-73	44-47	39-45	30-32	35-40	30-33	73-78
	43"FHD (Open cell)	140-145	143-147	86-96	147-155	77-80	77-82	66-69	73-79	65-68	124-129
	50"FHD/4K(Open cell)	201-205	195-205	130-145	165-180	100-105	95-100	82-87	90-97	83-88	168-173
	55"4K (Open cell)	n/a	290-310	n/a	210-220	145-155	138-148	99-103	107-112	103-108	189-199
	65"4K (Open cell)	n/a	540-560	n/a	390-410	210-235	200-225	160-165	170-180	160-170	230-250
	75"4K (Open cell)	n/a	n/a	n/a	n/a	n/a	n/a	280-300	295-305	270-300	330-360

- Supply/demand was tight until March and prices rose due to the closing of South Korean factories, the creation of new TV models and the impact of COVID-19 (concerns over a decrease in supply).
- Drop from April: TV production has fallen short of expectations and final demand has dropped sharply. Supply/demand for panels will turn to excess and prices will drop.
- Increase from July: Final demand unexpectedly strong, demand increasing for TV brand panels. Supply unchanged as supply/demand balance tightens
- Current price: much higher than the level 2 ½ years ago (July 2018) for 55"and below!
- In future?: expected to be slow down once and drop, but the prices might to keep hiking till May due to Corning + NEG glass supply issue.
- Around May is the key?:There is a risk that the demand decreases after TV prices hike. It could affect panel demand-prices in 2H 2021.

Source: Mizuho Securities Equity Research

Flat Panel Display Industry : Outlook and focus points

■ **Large panels:** 2021 positive for LCDs. Longer term, negative surface-area growth in LCDs. After that, OLED or LCD+Mini LED?

– Demand: For IT applications, favorable trend through 2Q 2021; continued recovery for TVs also. However, risk of a pullback from latter part of 2Q 2021 onward.

– Supply: New G10.5 lines behind schedule, on the other hand, LGD's P7 pushed from June 2021 to end-2022, SDC's T8 pushed from March to December 2021. Production capacity to increase drastically from +2.3%(estimated before COVID-19) to +9.4%.

– SDC startup delay: Capacity utilization depends on whether for Samsung VD only or not, but impact on total demand/supply will amount to a few percent.

– Glass/DDIC supplies: Glass supply shortage due to furnace issues at Corning's Hefei plant, power outage at NEG and accident at ACG. Driver IC shortage is getting even more severe.

– Supply/demand + prices: Some tightening in 2021, but monitor impact of higher prices on demand. Relatively expensive at 2x+ for 32" and 1.8x for 55"; 20-25% decline would actually be preferable.

– LCD valuations: In the near term, positive for both panel makers (prices and surface area both up) and materials suppliers (surface area up).

– Longer-term outlook: Chinese to lead in LCDs (status up). LCD surface area to decline in the medium to long term. Materials suppliers is harsh (by varying degrees).

– Migration to OLED: LGD struggling on price gap with LCD; invest in SDC (QDOLED) G8 Phase2 CSOT's entrance (w/ JOLED) is positive. Demand for materials is trending upward.

– Mini LED (BL+LCD): Opportunity if migration to OLED stalls. 2021-23 is window of opportunity. Business opportunities in LED, film, and sheets.

Flat Panel Display Industry : Factors behind changes in large FPD surface area (supply-demand)

	Capacity	Change factors (equipment)	Change factors (materials)	Demand	Change factors
2020	+3.6%	Delays in G10.5 equipment deliveries, startup↓	From 3Q glasss and DDIC constraints↓	+4.0%	From 2Q, NB/MNT↑ From 3Q, TV↑
2021	+9.4%	Same as above↓ continued SDC T8 operations↑	Glass tight through 2Q DDIC tight all year ↓	+7.3%	Through 2Q: NB/MNT↑; level from 3Q From 2Q: higher TV picks↓, US(↓), others(↑)
2022	+8.9%	G8 used equipment plants↑ Continued operation of LGD LCD↑	DDIC, Polarizer etc	+3.2%	Depens on TVs (continued replacement demand in developed markets, recoveries in emerging markets)
2023	+4.8%	Same as above↑ CSOT t9↑, LGD G10.5↓	DDIC, Polarizer etc	+1.0%	Depens on TVs (continued replacement demand in developed markets, recoveries in emerging markets)

- ◆ 2H20: Supply-demand tighter on supply constraints + rebound in demand; prices up sharply.
- ◆ 1H21: Production capacity likely to increase more than expected due to postponed SDC operation and other reasons, on the other hand, the supply side is severer because of materials shortage. Possibly to be further tight supply-demand balance and price hike. As for demand, NB/MNT are fine, but TV demand might be impacted by price increases (particularly in the US/China).
- ◆ 2H21: Supply-side risks other than DDIC likely to ease. On the demand side, depends on COVID-19, impact of TV price increases, and status of recoveries in markets other than the US.
- ◆ Panel prices: Best-case scenario for industry as a whole is if prices decline through May-Jul 2021 on TV demand contraction, and then stabilize in 2H on a subsequent recovery in demand.
- ◆ Worst-case scenario: Panel prices keep rising through 1H, resulting in a rapid decline in TV demand and inventory accumulation, culminating in severe price and production corrections from July onward.

Source: Mizuho Securities Equity Research

Reorganization of large-panel LCD industry in China

Through series of transactions, BOE acquires VA and oxide (IGZO) technologies. Through t9 investment, CSOT enters IPS, oxide-TFT markets.

With the closure of the Korean LCD plant and start of the new Chinese plant, we expect China's market share in large LCDs to exceed 50% by end-2021.

Among the four major Chinese makers (BOE, CSOT, CEC, HKC) the gap between the top two and the rest will likely widen.

Large-area FPD production capacity share (excluding OLED)

(Before transaction)	2020/2QE	Effects of transaction		(Including transaction)	2020/2QE	(Including transaction)	2021/4QE		
Latest	(K sq.m)	(M/S)	(K sq.m)	Latest	(K sq.m)	(M/S)	as of the end of 2021		
							(K sq.m)		
							(M/S)		
1 BOE	5,381	20.8%	+1,290	1 BOE	6,671	25.7%	1 BOE	7,838	29.0%
2 Innolux	3,500	13.5%		2 Innolux	3,500	13.5%	2 TCL-CSOT	4,556	16.8%
3 LG Display	3,096	11.9%		3 TCL-CSOT	3,416	13.2%	3 Innolux	3,500	12.9%
4 AUO	3,003	11.6%		4 LG Display	3,096	11.9%	4 AUO	3,003	11.1%
5 Samsung Display	2,858	11.0%	-715	5 AUO	3,003	11.6%	5 LG Display	2,049	7.6%
6 TCL-CSOT	2,701	10.4%	+715	6 Samsung Display	2,143	8.3%	6 HKC	2,018	7.5%
7 CEC Panda	2,424	9.3%	-1,290	7 CEC Panda	1,134	4.4%	7 CEC Panda	1,134	4.2%
8 HKC	1,112	4.3%		8 HKC	1,112	4.3%	8 Samsung Display	165	0.6%
- Other	1,852	7.1%		- Other	1,852	7.1%	Other	2,776	10.3%
Total	25,927	100.0%	+0	Total	25,927	100.0%	Total	27,040	100.0%
China - subtotal	11,618	44.8%	+715	China - subtotal	12,333	47.6%	China - subtotal	15,546	57.5%

Source: Mizuho Securities Equity

Flat Panel Display Industry : Glass (pre-process) and driver IC (post process) shortage!

■ **FPD glass circuit board sector:** Dominated by Corning/AGC/NEG. LGC/Chinese firms have not grown.

- **Share: Corning (GLW): 55%-, AGC: 25%, NEG: 20%-.** Dongxu, Caihong, AvanStrate make up the rest.
- **GLW: G10.5 (BOE/SIO+SDP) 100% share.** High share (>50%): SDC/SH/BOE/CHOT/INX/AUO, etc.
- **AGC: G10.5 (CSOT) 100% share.** High share: CSOT/HKC/Tianma/JDI, etc.
- **NEG: LGD is basically a partner (share>80%).** Other key clients include IVO (>70%)/AUO/HKC/BOE/CEC/SH, etc.

■ **Shortage of glass circuit board supply (pre-process):** Supply very tight until first half of 2Q, especially for G7 and above, may ease but then tighten again throughout 2021.

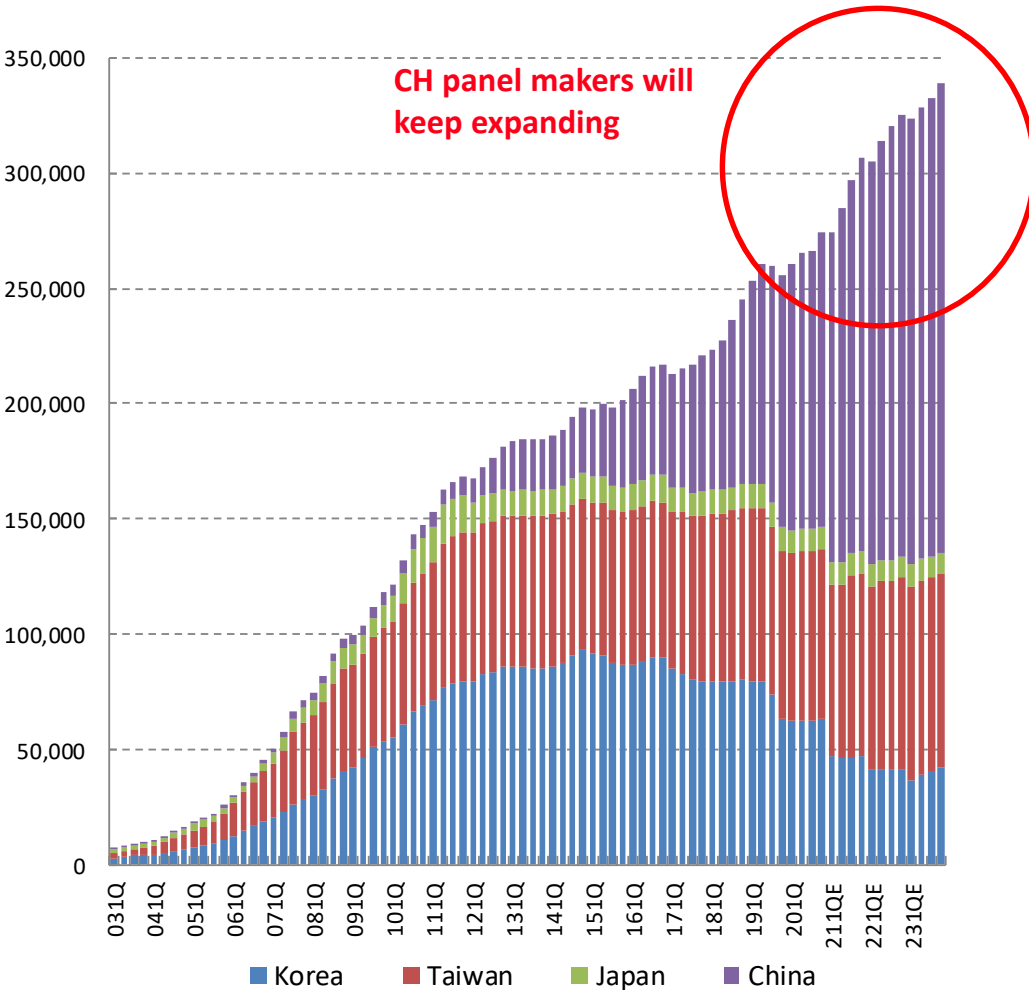
- **GLW: Some G10.5 kilns (Hefei) failing.** Kilns: 5 in Hefei + 4 in Wuhan (BOE), 3 in Guangzhou (SIO), 4 in Sakai (SDP). 1%+ impact per kiln. Full recovery in March?
- **NEG: Power cut at Takatsuki plant: kiln and Feeder (5) need repair.** Roughly 20% of companywide capacity affected until March.
- **AGC: Accident at South Korean plant.** Repair works at kiln set to supply CSOT t7 (April) (impact to affect non-CSOT). Expecting impact to continue until September.
- **Panel makers: Inventory low, 1Q–2Q production/shipment<client (set brands) demand<retail demand.**
- **FPD sector impact: Opportunity losses overall in 1H. LCD supply/demand deterioration risk lower in 2021 but panel price hikes may affect demand.**

■ **Semiconductor supply shortage:** for large DDIC, T-Con, power-source IC. Balance tight throughout 2021.

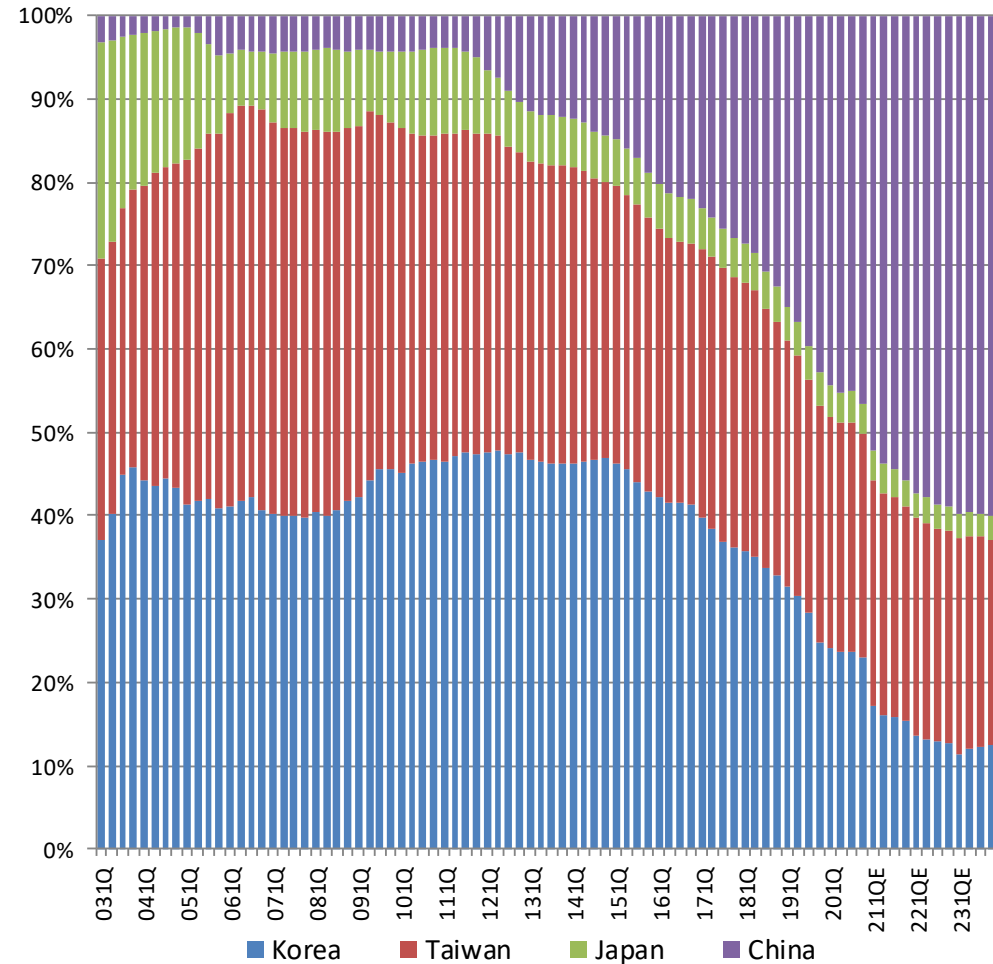
- **Background: Demand increase (tablet/laptop PC/MNT/TV), supply capacity stalls (especially tight for 8" Foundry), DDIC priority low (less profitable)**
- **Large DDIC (8"110-180nm): Fabless strong (Novatek: 25%, Himax/Siliconworks: 15%, Raydium: 10%).** Foundry competes with power supply IC, fingerprint sensors. Samsung (in house): 15%
- **Small/med DDIC (LCD: 12"55-110nm): High share of fabless (Ilitek: 25%, Novatek: 20%, Focahtech/Synaptics: 15%).** Competes with CMOS sensors, etc.
- **Small/med DDIC (OLED:12"):** Samsung (40%). Magnachip (30%), Novatek (15%), Siliconworks (5%)
- **Conclusion: Balance will be tight. Price hikes (25%–30%) needed, switch to 12" necessary to secure capacity**

Large LCD capacity(by region): grow and accelerate by investment in G10.5, China set to overtake South Korea

Yielded Production Capacity forecast by Region (K/M, 15inch equiv.)



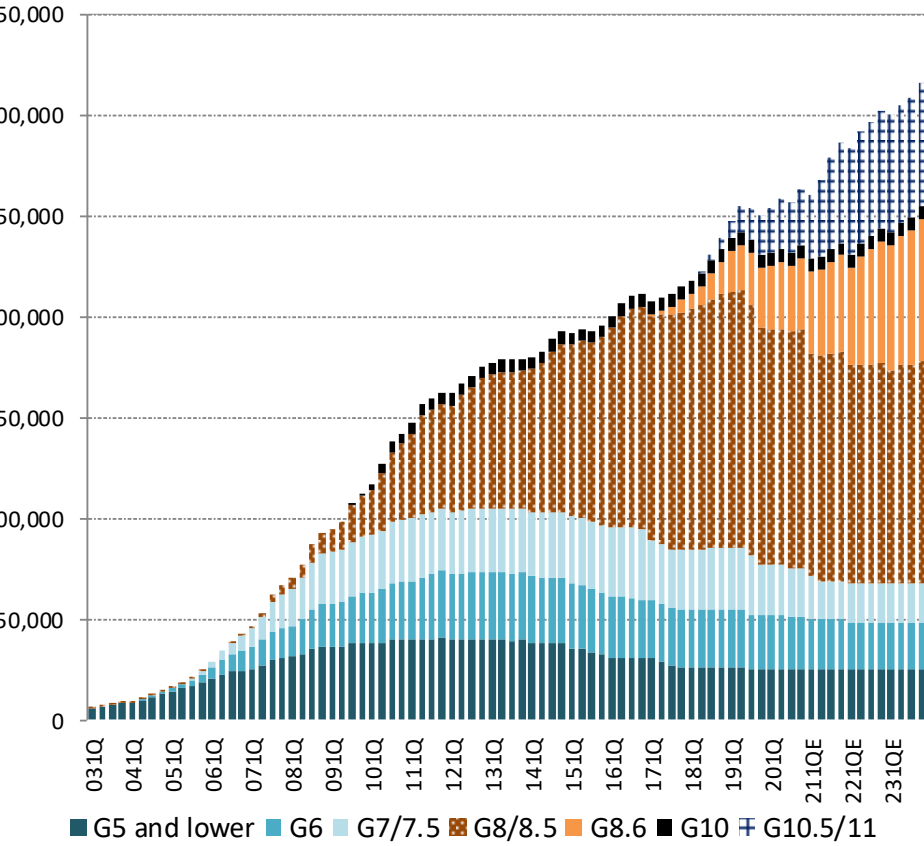
Yielded Production Capacity forecast by Region (area basis)



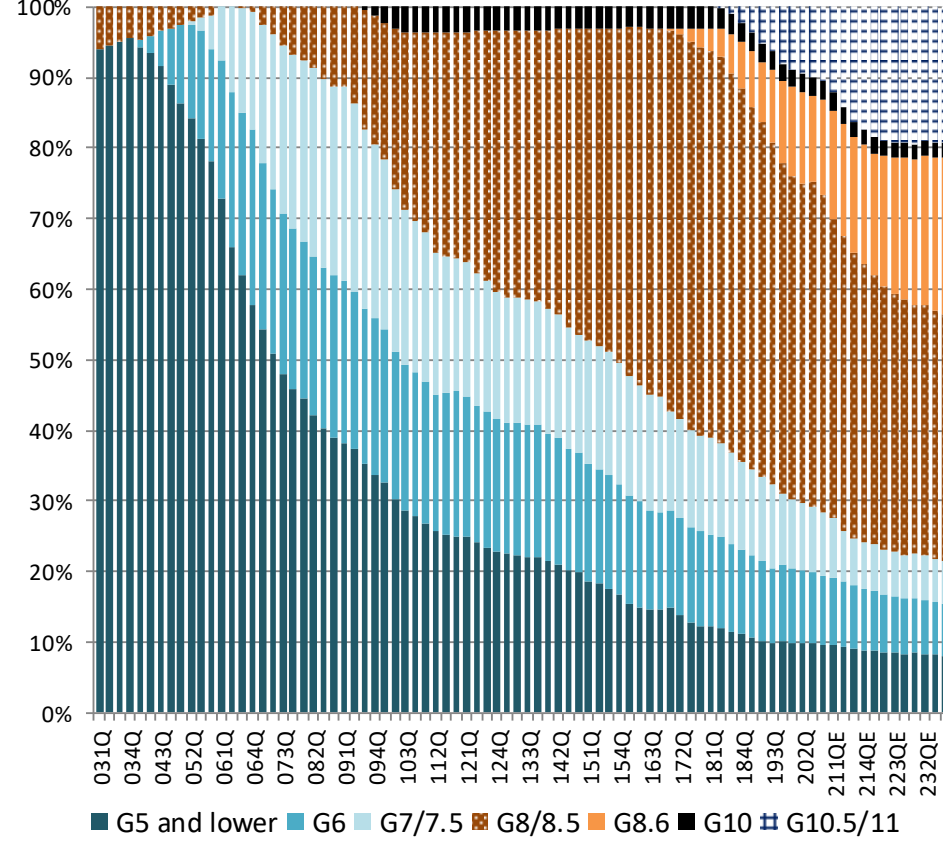
Source: Mizuho Securities Equity Research

Large LCD capacity(by generation)

Yielded Production Capacity forecast by Generation (K/M, 15inch equiv.)



Yielded Production Capacity forecast by Generation (area basis)

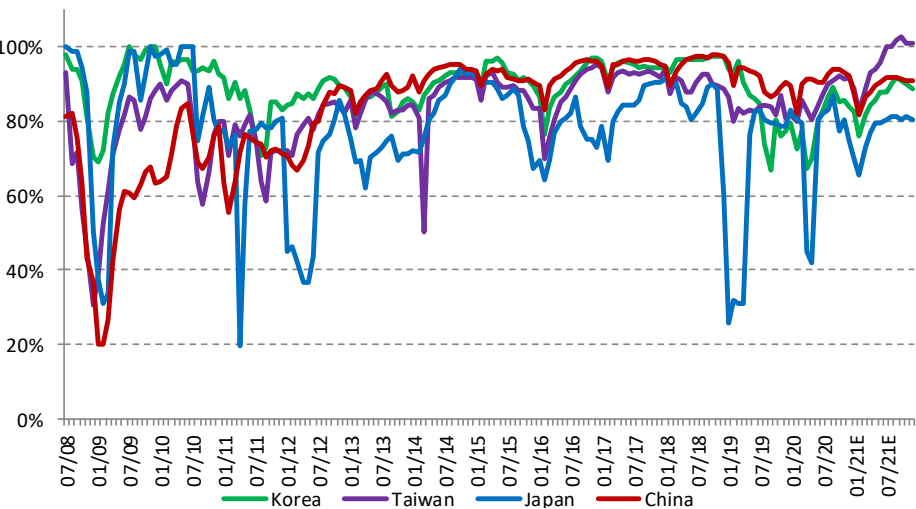


➤ G7 and lower plants to be converted for IT or closed?

Source: Mizuho Securities Equity Research

Panel supply-and-demand balance outlook assumptions:

Estimated utilization ratio for each country (The ratio of actual production amount to total capacity)



2013: Surface area output +7.6% YoY > demand of +5.2%
Utilization rates: 1Q 83%, 2Q 86%, 3Q 86%, 4Q 84%

2014: Production capacity +4.6%, Surface area output +8.8% YoY < demand of +10.7%
Utilization rates: 1Q 80%, 2Q 89%, 3Q 92%, 4Q 93%

2015: Production capacity +6.3%, Surface area output +6.2% YoY < demand of +7.3%
Utilization rate: 1Q 91%, 2Q 94%, 3Q 90%, 4Q 88%

2016: Production capacity +7.5%, Surface area output +4.5% YoY > demand of +4.7%
Utilization rates: 1Q 80%, 2Q 87%, 3Q 92%, 4Q 95%

2017: Production capacity +1.4%, surface area output +6.9% > demand +6.3%
Utilization rates: 1Q 92%, 2Q 94%, 3Q 94%, 4Q 94%

2018: Production capacity +7.9%, surface area output +7.9% < demand +8.6%
Utilization rates: 1Q 93%, 2Q 93%, 3Q 95%, 4Q 94%

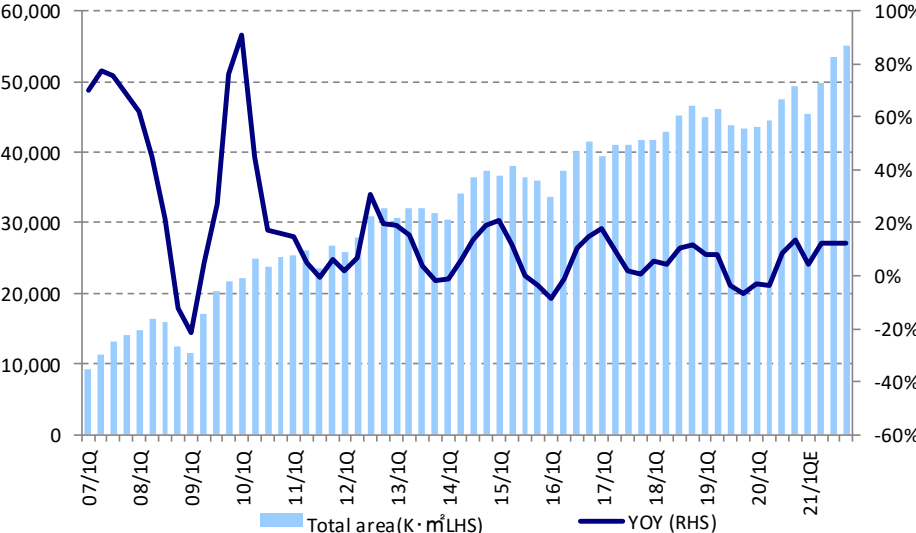
2019: Production capacity +11.2%, surface area output +1.5% < demand +5.0%
Utilization rates: 1Q 88%, 2Q 88%, 3Q 84%, 4Q 85%

2020: Production capacity +3.6%, surface area output +4.0% > demand +4.0%
Utilization rates: 1Q 83%, 2Q 83%, 3Q 89%, 4Q 89%

2021: Production capacity 9.4%, surface area output +11.0% > demand +7.3%
Utilization rates: 1Q 80%, 2Q 88%, 3Q 90%, 4Q 90%

2022: Production capacity +8.9%, surface area output +3.8% > demand +3.2%

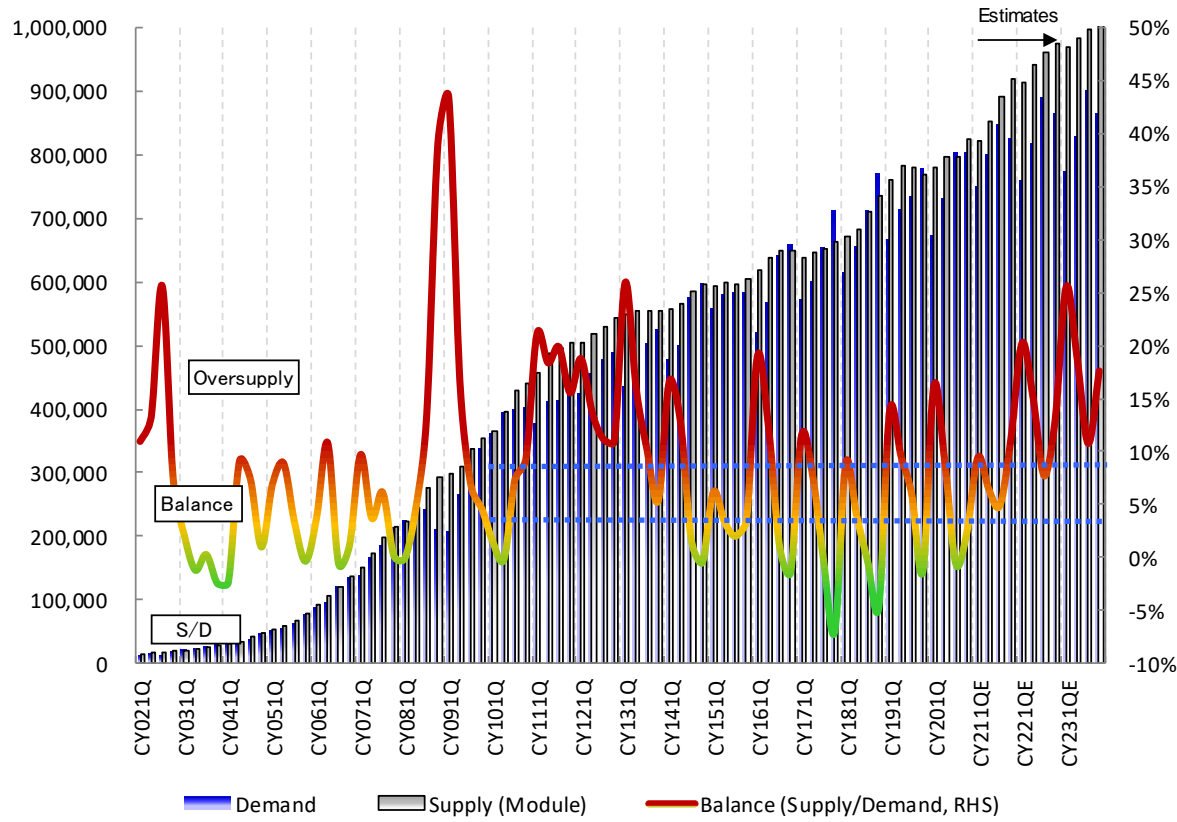
Estimated area production of large TFT panels for each quarter (K m²)



Source: Mizuho Securities Equity Research

Large FPD S/D forecast (Latest), likely to be balance easing in 2H 2021 due to increasing capacity

(15-inch equivalent)



Note: Yield considered but shortage of components and material is not considered based on the assumption of 100% utilization ratio components and material is not considered based on on the assumption of 100% utilization ratio.

Full production capacity vs demand forecasts: Fundamentally, 1H surplus followed by 2H tightening. Having said that, psychological factors such as the consensus outlook of panel manufacturers, set manufacturers and distributors, as well as general market speculation, may also play a role in determining 'acceptable' inventory level, and may also significantly impact panel demand.

See flat or slightly tighter demand in 2H if 1H production levels are appropriate (scenario 1); excess 1H production suggests 2H oversupply (scenario 2). Supply/demand balance to improve in 2H after zigzagging in 2020 due to COVID-19. In 2021 production capacity > demand due to postponement of SDC/LGD fabs and Chinese improving capabili, but shortage of glass substrate and semicon such as could be hindrance.

Source: Mizuho Securities Equity Research

Assumptions underlying panel supply-demand forecasts: changes in demand forecasts

	2011	2012	2013	2014	2015	2016	2017	2018		2019		2020 Forecast			2021 Forecast			2022 Forecast	
	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	YOY	Actual	YOY	As of			As of			As of	
												20/07	21/01	YOY	20/07	21/01	YOY	21/01	YOY
Tablet	61M	145M	225M	230M	203M	186M	175M	161M	-8%	135M	-16%	160M	140M	+4%	157M	152M	+9%	140M	-8%
NBPC	204M	202M	162M	167M	1557M	155M	158M	158M	+0%	162M	+3%	166M	203M	+25%	166M	215M	+6%	215M	+0%
Monitor	180M	168M	150M	142M	130M	129M	125M	124M	-1%	125M	+1%	131M	152M	+22%	132M	156M	+3%	155M	-1%
TV	205M	207M	209M	223M	223M	223M	217M	220M	+1%	222M	+1%	209M	222M	+0%	216M	223M	+0%	224M	+0%

↑Demand growth on a surface area basis was +38% YoY in 2010, +5.3% in 2011, +12.5% in 2012, +5.2% in 2013, +10.7% in 2014, +7.3% in 2015, +3.5% in 2016, +6.3% in 2017, +8.6% in 2018, +5.0% in 2019, +4.0% in 2020 and forecast that it will be at +7.3% in 2021, +3.2% in 2022 and +1.0% in 2023

- NB: Short break of tailwind from Win10 replacement, but demand likely to be strong due to WFH, gaming, education(Chromebook), etc.
- Tablets: Demand is getting to be strong due to WFH and educational needs.
- Monitors: Shift towards added value including WFH demand, large screen (over 24 inch), Hi-def (4K), monitors for game, curved screen, 21:9 etc.
- TVs: In 2020 strong sales in US due to stay-at-home demand, but weak in developing countries. The keys in 2021 are US trends, recovery in emerging countries and accelerating replacement in Japan/Europe. Positive impact by government payment likely to continue till April in US, but risk in 2H2021.

Source: Mizuho Securities Equity Research

Panel supply/demand assumption: focus on the trend after stay-at-home demand

Panel Supply demand (estimate / forecast)

2015		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	203M	-12%	232M	-16%
	NB	157M	-6%	165M	-10%
	Monitor	130M	-8%	144M	-6%
	TV	223M	+0%	264M	+7%

2019		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	135M	-16%	165M	-5%
	NB	162M	+3%	172M	+2%
	Monitor	125M	+1%	142M	+3%
	TV	222M	+1%	278M	+1%

2016		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	186M	-8%	191M	-18%
	NB	155M	-1%	163M	-1%
	Monitor	129M	-1%	141M	-2%
	TV	223M	+0%	261M	-1%

2020E		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	140M	+4%	187M	+13%
	NB	203M	+25%	210M	+22%
	Monitor	152M	+22%	162M	+14%
	TV	222M	-0%	263M	-5%

2017		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	175M	-6%	179M	-6%
	NB	158M	+2%	167M	+2%
	Monitor	125M	-3%	140M	-1%
	TV	217M	-3%	265M	+2%

2021E		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	152M	+9%	191M	+2%
	NB	215M	+6%	228M	+9%
	Monitor	156M	+3%	173M	+7%
	TV	223M	+0%	272M	+3%

2018		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	161M	-8%	174M	-3%
	NB	158M	+0%	169M	+1%
	Monitor	124M	-1%	138M	-1%
	TV	220M	+1%	275M	+4%

2022E		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	140M	-8%	178M	-7%
	NB	215M	+0%	227M	-0%
	Monitor	155M	-1%	172M	-1%
	TV	224M	+0%	276M	+1%

Source: Mizuho Securities Equity Research

Flat Panel TV market outlook: forecast increasing volume due to stay-at-home = accelerating replacement and peak out in 2022

Total FPTV Market (M Units)		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Flat TOTAL		4	6	10	19	33	65	89	115	152	207	221	220	218	229	225	223	217	223	222	222	222	224	221	217
CRT TOTAL		140	143	152	164	155	133	106	85	52	37	23	16	10	6	2	2	0	0	0	0	0	0	0	0
FlatTV Ratio		3%	4%	6%	10%	18%	33%	46%	57%	74%	85%	91%	93%	96%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
30-39inch		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	2	7	22	33	45	60	78	86	93	97	84	81	73	71	69	62	58	51	49	44	40
	PDP	0	0	0	0	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-49inch		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	0	1	7	17	25	34	54	63	67	65	75	77	84	78	72	62	56	52	49	46	44
	PDP	0	0	1	2	5	7	7	8	9	11	9	5	2	1	0	0	0	0	0	0	0	0	0	0
	RPTV	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OLED																				0.2	0.7	0.7	1.3	1.4
50-59inch		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	0	0	0	1	2	4	8	10	11	18	28	32	36	37	48	61	67	72	74	76	76
	PDP	0	0	0	0	1	2	3	3	4	6	6	6	5	4	2	0	0	0	0	0	0	0	0	0
	RPTV	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OLED														0.0	0.3	0.5	1.0	1.6	1.9	1.9	2.7	2.9	3.0	3.1
60-69 +larger		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	0	0	0	0	0	0	1	2	3	5	8	10	12	15	19	27	32	37	41	42	46
	PDP	0	0	0	0	0	0	0	0	1	1	1	2	1	1	0	0	0	0	0	0	0	0	0	0
	RPTV	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OLED															0.3	0.6	0.6	1.0	1.2	1.5	2.7	3.8	5.3	6.7

2024 Forecast-

Cross Over point

- a) Break in increasing size: The plan of stimulating demand of 75"/80" and over is required.
- b) OLED: Expecting 11m. price competition with mini LED LCD, shift to 8K, and developing panels under 48" are the key.

Source: Mizuho Securities Equity Research

TV/FPD shipment forecast by brand/Panel maker: expect only a small decline for 2020 and a recovery in 2021

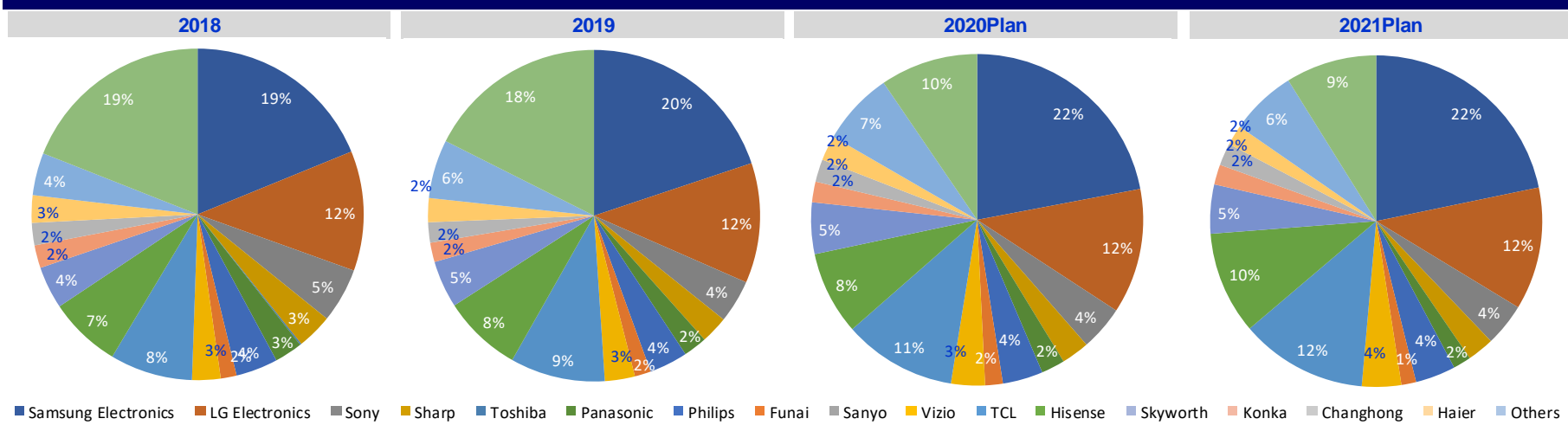
LCD TV Shipment forecast by brands

(mn units)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020 Plan	2020 F	2021 Plan
Samsung Electronics	36.5	40.0	43.0	48.0	47.0	47.0	43.1	41.4	44.1	46.0	49.4	50.0
LG Electronics	23.8	26.7	29.0	31.0	28.0	27.0	26.0	25.7	26.0	25.5	25.1	27.5
Sony	17.5	14.9	12.5	13.5	12.5	12.5	12.5	11.7	9.3	9.1	9.0	9.6
Sharp	10.0	8.3	7.5	7.0	6.9	4.7	8.9	7.6	5.9	5.7	6.0	6.0
Toshiba	14.5	12.0	7.8	6.3	3.7	0.9	0.7	0.3	0.0	0.0	0.0	0.0
Panasonic	9.8	8.0	7.0	5.8	6.7	5.7	6.1	6.0	5.1	4.8	4.8	4.0
Philips / AOC	7.0	7.3	7.2	7.3	7.5	7.5	8.5	9.0	8.3	8.2	8.6	9.0
Funai	5.9	6.6	6.0	5.2	4.1	3.7	3.0	3.4	3.5	3.6	3.1	3.3
Sanyo	4.2	2.7	2.2	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vizio	5.3	5.5	6.5	7.5	7.8	8.4	5.8	6.1	6.5	6.9	8.1	8.8
TCL	10.0	11.1	12.3	12.0	13.0	13.7	15.4	17.7	20.5	23.0	24.0	28.5
Hisense	9.3	9.5	9.8	11.0	12.4	13.5	12.9	15.5	17.1	17.0	19.6	23.0
Skyworth	7.3	8.5	9.0	11.5	10.4	11.0	9.5	9.1	10.2	10.5	10.8	11.0
Konka	4.7	5.7	6.2	9.3	5.3	5.5	5.3	4.9	4.2	4.2	4.2	4.5
Changhong	5.0	5.6	5.8	5.7	6.8	7.3	5.9	4.8	4.4	4.6	4.3	5.0
Haier	5.2	5.5	5.4	4.9	6.4	6.4	6.5	5.9	5.2	5.1	4.5	4.5
Xiaomi	0.0	0.0	0.0	0.0	0.9	1.0	2.4	9.1	12.7	14.9	14.0	14.9
Others	29.0	29.1	31.8	35.5	43.6	47.2	44.5	41.8	39.0	19.9	24.5	20.4
Total	205.0	207.0	209.0	223.0	223.0	223.0	217.0	220.0	222.0	209.0	220.0	230.0

TV Panel shipment forecast by panel makers

(mn units)	2013	2014	2015	2016	2017	2018	2019	2020 Plan	2020 F	YoY	2021 Plan	YoY
Samsung Display	50	55	53	47	40	39	32	20	20	-38%	6	-68%
LG Display	53	52	54	51	51	43	43	26	24	-40%	26	-1%
AUO	31	29	27	28	27	26	24	22	20	-8%	20	-9%
Innolux	40	48	50	41	42	43	41	41	42	0%	41	0%
Sharp	13	14	11	8	8	9	6.5	7	9	8%	16	129%
Panasonic	4	5	7	5	1	1	0	0	0	-	0	-
BOE	13	14	35	44	44	52	53	54	51	2%	55	2%
CSOT	20	24	27	33	39	38	41	40	41	-2%	40	0%
CEC Group			0	3	7	10	23	27	28	17%	29	7%
HKC			0	0	6	11	18	32	31	78%	40	25%
Others	5	3	4	3	0	3	0.5	0	0	-	0	-
Total	229	244	268	263	265	275	282	269	265	-5%	273	1%

Market Share



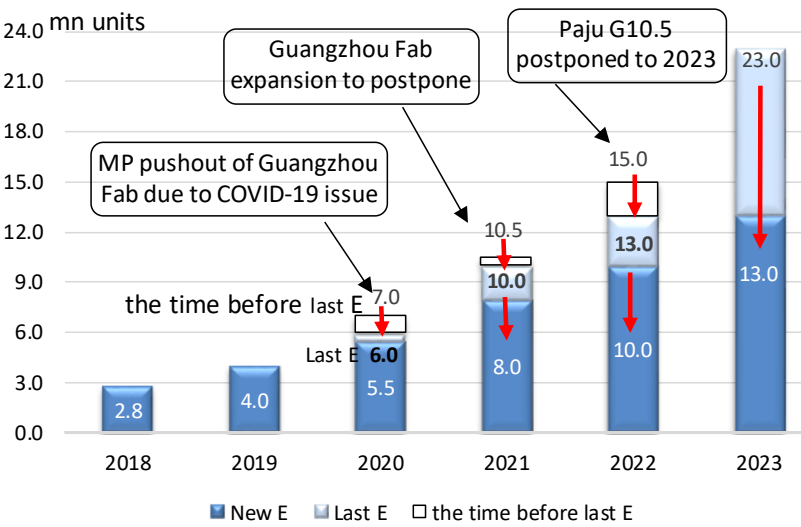
Source: Mizuho Securities Equity Research

OLED TV Panel Shipment Forecast By Brand: downturn in 2020 and possible to recovery by price stay in 2021?

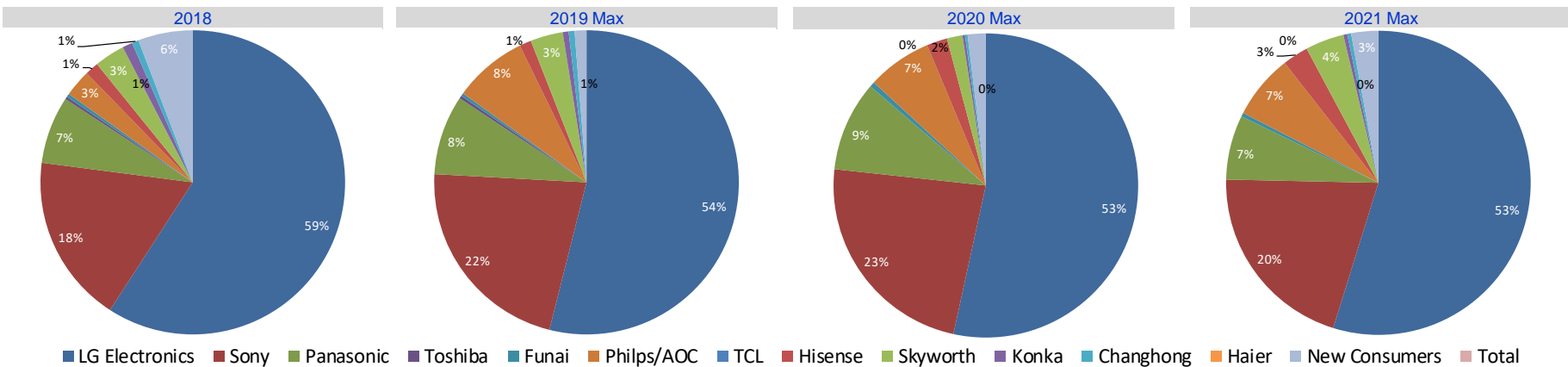
OLED TV Shipment forecast by brands

(mn units)	2014	2015	2016	2017	2018	2019	2020F Max	2020F Max (Revised)	2021F Max
LG Electronics	0.1	0.3	0.7	1.2	1.7	1.7	2.1	2.0	4.0
Sony				0.2	0.5	0.7	0.9	0.9	1.5
Panasonic				0.1	0.2	0.3	0.4	0.4	0.5
Toshiba				0.0	0.0	0.0	0.0	0.0	0.0
Funai				0.0	0.0	0.0	0.0	0.0	0.0
Sharp				0.0	0.0	0.0	0.1	0.1	0.2
Philps/AOC			0.0	0.0	0.1	0.3	0.4	0.3	0.5
TCL									
Hisense					0.0	0.0	0.2	0.1	0.2
Skyworth		0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.3
Konka			0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changhong			0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haier									
New Consumers	0.0	0.0	0.0	0.1	0.2	0.0	0.4	0.1	0.2
Total	0.1	0.4	0.7	1.7	2.8	3.2	4.7	3.7	7.5

LG Display OLED panel capacity forecast



Market Share



Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2020 – as of Dec.2020)

(M Units)

	Sharp SDP-SIO	Pana- LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/ CCPD	CSOT	HKC	TTL panel demand	TTL production
Samsung	1.4		12.8	0.3	6.4	5.1	6.4	4.4	8.1	5.2	50.1	49.4
Sony			1.7	2.6	0.8	0.2	3.1		0.8		9.2	9.0
Sharp	2.2			0.1		1.9					4.2	6.0
Philips/TPVision				0.7	1.2	1.0	2.7	5.2		0.7	11.5	8.6
LGE	1.4			11.1		2.7	10.3			3.1	28.6	25.4
Panasonic				1.4		2.4	1.4				5.2	4.8
Vizio	0.4				1.9	4.0	1.9				8.2	8.1
Funai(+Sanyo/Philps US)			0.4	0.4		1.1	1.5				3.4	3.1
Hisense	0.4		0.5	0.1	5.3	2.7	6.2	2.9	4.2	0.4	22.7	19.6
Skyworth				3.2		4.8	4.1		1.1	1.1	14.3	10.8
TCL			1.6	1.0	1.9	5.7		3.4	18.0	0.6	32.2	24.0
Haier			0.5			1.4	3.0				4.9	4.5
Konka			0.2	0.3			2.9	0.6		2.1	6.1	4.2
Changhong			0.2			1.8	0.7	0.8	2.6	0.4	6.5	4.3
Other(Vestel, BB, CNC, TPV etc)	3.2		1.9	4.4	2.0	6.9	6.6	10.9	6.2	17.4	59.5	38.2
FCST Total	9.0	0.0	19.8	25.6	19.5	41.7	50.8	28.2	41.0	31.0	266.5	220.0
Panel Makers' Capacity	9.0	0.0	20.0	26.0	19.5	42.0	51.0	28.5	41.5	32.0	269.5	

151M
57% of TOTAL 267M

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2021 – as of Dec.2020)

(M Units)

	Sharp SDP-SIO	Pana- LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/ CCPD	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung	5.4		6.4	0.8	6.5	6.1	8.6	6.2	9.8	7.8	57.6	50.0	52.0
Sony				1.9	0.9	0.2	3.9		2.1		9.0	9.6	10.5
Sharp	3.2			0.2		2.7					6.1	6.0	6.5
Philips/TPVision				1.2	1.1	1.0	2.1	5.2		0.8	11.4	9.0	9.5
LGE	1.4			11.5		3.0	10.9	0.8		5.8	33.4	27.5	29.0
Panasonic				1.0		2.1	1.4				4.5	3.5	4.5
Vizio	0.3				1.9	4.0	2.1				8.3	8.1	9.0
Funai(+Sanyo/Philps US)				0.2		1.0	1.7				2.9	3.3	3.5
Hisense	0.4			0.1	5.9	2.7	6.6	4.8	3.1	1.7	25.3	23.0	25.0
Skyworth				3.8		4.7	4.6		0.4	1.6	15.1	11.0	12.0
TCL					2.0	6.4		2.5	17.5	2.5	30.9	28.5	30.5
Haier						1.2	2.9				4.1	4.5	5.0
Konka				0.2			3.5	1.0		2.5	7.2	4.5	5.0
Changhong						2.2	2.0	1.6	3.2	1.8	10.8	5.0	5.5
Other(Vestel, BB, CNC, TPV etc)	5.3			4.8	1.7	3.6	4.6	6.9	3.9	15.5	46.3	35.8	40.0
FCST Total	16.0	0.0	6.4	25.7	20.0	40.9	54.9	29.0	40.0	40.0	272.9	229.3	247.5
Panel Makers' Capacity	16.0	0.0	8.0	26.0	20.0	41.0	54.5	29.0	41.0	40.0	275.5		

← 163M →
61% of TOTAL 267M

BP = capacity
Source: Mizuho Securities Equity Research

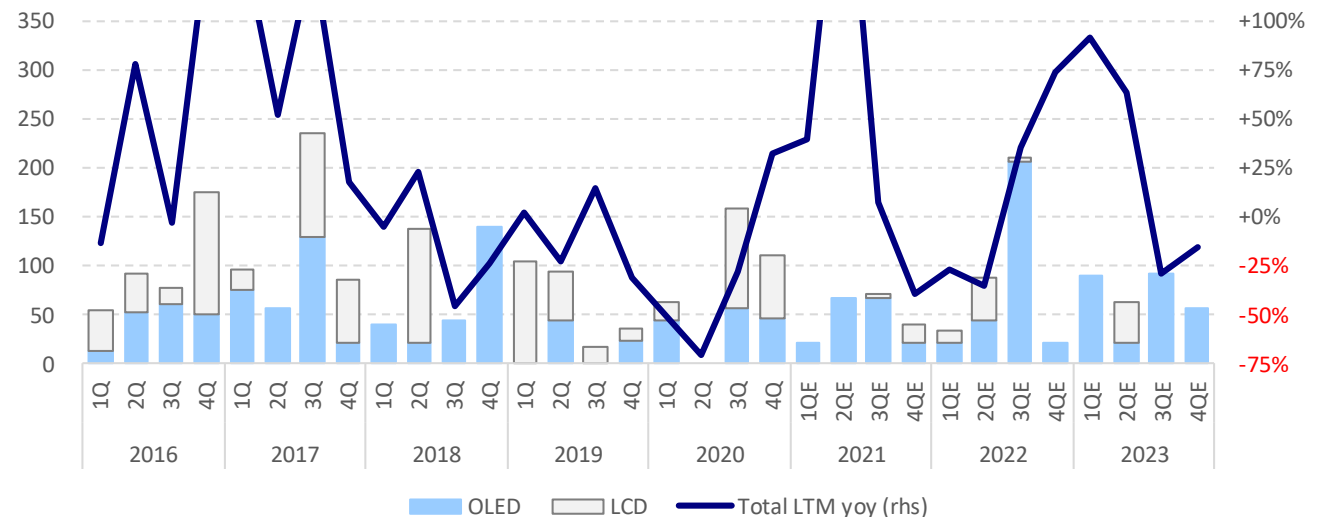
4. Capex Forecast

Flat Panel Display Industry : Capex outlook

- **Capex:** Some big LCD projects floated . Expecting to increase projects for large/small-mid sized OLED and getting active again.
- **LCD:** Sustainability doubtful, but increasing projects due to tight supply/demand.
- 1) CSOT t9(deliver in 2022- : high probability) : G8.6 for IPS/monitor. 90K × 2. Against BOE.
- 2) BOE B17(2022-~ : high probability) : Additional investment in G10.5+15K(might not increase production capacity due to transfer to Oxide)
- 3) SIO(SDP)Guangzhou(2022- : TBD) Additional investment in G10.5+7K
- 4) HKC H6(2022- : low probability) : around 150K at G8.6. Possible locations are Guangzhou, Zhengzhou, and Beihai, etc.
- 5) AUO L8B(2022- : TBD) : around 25K at G8.6 +15K
- 6) INX Fab9(2022- : high probability) : around 15K at G8.6
- **OLED:** No surprises; in line with expectations. However, increase of projects can be expected in future.
- 1) LGD E6-3/4(2021- : rising probability) : for AAPL, G6H increased OLED production(Mobile)
- 2) SDC A4(2022- : rising probability) : G6H increased LED production(Mobile)
- 3) SDC QD-OLED (2022- : TBD/around June) : G8 QD-OLED+30K, for TV(Samsung, Sony and TCL) and MNT(Dell, Asus and others)
- 4) LGD Guangzhou G8(2022~ : TBD) : G8 OLED +30K or 60K(TV)
- 5) LGD P10 or P7/8(2023~ : TBD) : Competitiveness in 75" improve by G10.5? Develop mid-sized panel (<45") by remodeling G7.5/8 OLED
- 6) CSOT t8(2023- : TBD)G8, Inkjet OLED(TV). Depending on the results of collaboration with JOLED and the timing
- 7) BOE B18(2023- : TBD) : G8, Inkjet or Evapo OLED(TV). Issues in development.
- **Implications(momentum recovered):** In the near term, focus on upside in the LCD space. Over the longer term, focus mainly on the OLED-related space.

FPD Capex Index (CY basis, new capacity only; indexed at 2016=100)

FPD capex trend (indexed, equipment move-in basis)
(2016 quarter average = 100)



- Calculated quarterly starting at equipment delivery (move-in)
- Equipment order timing (meaning equipment manufacturer's order) is earlier, with said timing depending on the type of equipment (deposition devices: earlier; inspection equipment: later, etc.)
- Sales booking depends on each company's revenue recognition standards (construction progress, shipping, installation completion standards, etc.)
- Timing of payment collection also differs depending on the device/customer (high/low/payment not received, etc.)

Processes needed for LCD

TFT(array)/color filters
Cell (bonding)
Module

Processes needed for OLED

TFT(array)/color filters (White OLED only)
OLED (deposition of ink jet), sealant
Module

Yearly trend (CY2016 = 100)	CY15	CY16	CY17	CY18	CY19	CY20	CY21E	CY22E	CY23E
LCD	42	55	47	29	46	46	5	14	10
(yoy)	-8%	+31%	-15%	-39%	+58%	+1%	-88%	+161%	-31%
G6 or below	8	16	9	4	4	0	0	1	0
G8.5/G8.6	34	39	21	16	10	33	1	11	10
G10.5	0	0	18	9	31	13	4	2	0
OLED	0	45	71	62	17	37	45	75	66
(yoy)	-100%	-	+59%	-13%	-72%	+114%	+22%	+64%	-12%
G6 or below	0	38	71	34	17	23	45	40	51
G8.5/G8.6	0	7	0	25	0	15	0	26	9
G10.5	0	0	0	3	0	0	0	9	6
FPD total	42	100	118	91	63	83	51	89	76
(yoy)	-28%	+137%	+18%	-23%	-31%	+32%	-39%	+74%	-15%

Note: Does not include maintenance investment or debottlenecking investment

Projected schedule of FPD capacity expansion (China1)

Company	Fab	Gen.	substrate size	Designed Capacity/M	Phase	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024		2025							
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
China BOE-OT	B4: Beijing Fab2	8.0	2200x2500mm	140K	Phase2				MI→ MP→ +30K																												
	B5: Anhui -Hefei (OXIDE/A-Si)	8.0	2200x2500mm	140K	Phase1				MI MP +30K Push out(+9Q)																												
					Phase2				MI MP +90K Push out(+11Q)																												
	B6: Ordos Fab1 (LTPS)	5.5	1300x1500mm	50K	Phase1-1				MI MP +15K Push out(+2Q)																												
					Phase1-2				MI MP +10K Push out(+4Q)																												
					Phase2								MI MP +25K																								
	B8: Chongqing Fab1 (OXIDE/A-Si)	8.0	2200x2500mm	140K	Phase1					MI MP +70K																											
					Phase2								MI MP +70K Push out(+3Q)																								
	B7: Chengdu Fab3 (Flex OLED)	6.0	1500x1850mm	15K	Phase1										MI MP +15K Push out(+5Q)																						
					Phase2													MI MP +15K Pull in(-1Q)																			
					Phase3														MI MP +15K Pull in(-2Q)																		
	B9: Hefei Fab3	10.5	2940x3370mm	120K (A-Si) 30K (OXIDE)	Phase1										MI MP +120K Push Out(+3Q)																						
	Phase2																																				
	B10: Fuzhou Fab1	8.0	2200x2500mm	150K										MI MP +140K Pull in(-1Q)																							
B11: Mianyang Fab1 (Flex OLED)	6.0	1500x1850mm	45K														MI MP +15K Pull in(-2Q)																				
B12: Chongqing Fab2 (Flex OLED)	6.0	1500x1850mm	45K	Phase1																MI MP +15K Push Out(+7Q)																	
Phase2																					MI MP +15K Push Out(+7Q)																
Phase3																						MI MP +15K Push Out(+7Q)															
B15: Fuzhou Fab4 (Flex OLED)	6.0	1500x1850mm	45K	Phase1																																	
				Phase2																																	
				Phase3																																	
B16: Chengdu (Flex OLED)	6.0	1500x1850mm	90K																																		
B17: Wuhan	10.5	2940x3370mm	120→90K (A-Si)	Phase1															MI MP +120K																		
			30K (OXIDE)	Phase2																																	
B20: Hefei Fab4 (OXIDE / OLED)	10.5 or 8.0	TBD	60K	Phase1																																	

LCD / LTPS OLED / LTPS
 LCD / OXIDE OLED / OXIDE

G7.5 ≤
 G6.0 ≥

Source: Compiled by Mizuho Securities Equity Research from company data

Projected schedule of FPD capacity expansion (China2)

Company	Fab	Gen.	substrate size	Designed Capacity/M	Phase	2013				2014				2015				2016				2017				2018				2019				2020				2021				2022				2023				2024				2025			
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q								
CEC group	Incoflex	Xian(OLED)	6.0	1500x1800mm	30K	Suspended																																																			
	Nanjing Fab2 (OXIDE/A-Si)	8.0	2200x2500mm	90K	MI→ MP→ +60K Pull In(-1Q) 2016 TBD (+30K)																Sold to BOE as B18																																				
	Xianyang (CHOT) (A-Si)	8.6	2250x2610mm	120K	Phase1	MI MP +60K Pull in(-2Q)																MI MP +60K																																			
	Chengdu (CCPD) (OXIDE/A-Si)	8.6	2290x2620mm	140K	Phase2	MI MP +70K																MI MP +70K																																			
	Jinan (OXIDE)	10.5	2940x3370mm	120K	2021-2022 TBD																																																				
Chinastar (TCL)	Shenzhen T1	8.0	2200x2500mm	130K	MI MP +20K																																																				
	Wuhan T3 (LTPS)	6.0	1500x1850mm	60K	Phase1	MI MP +30K																																																			
	Shenzhen T2	8.0	2200x2500mm	100K	Phase1	MI MP +100K Push out(+1Q)																																																			
				30K	Phase2	MI MP +30K																																																			
	Wuhan T4 (Flex OLED)	6.0	1500x1850mm	45K	Phase1	MI MP +15K Push out(+6Q)																																																			
	Wuhan T5 (Flex OLED)	6.0	1500x1850mm	45K	Phase2	MI MP +15K Push out(+12Q)																																																			
					Phase3	MI MP +15K Push out(+12Q)																																																			
	Shenzhen T6	10.5	2940x3370mm	120K	Phase1	MI MP +60K Push out(+1Q)																																																			
	Shenzhen T7 (OXIDE/A-Si)	10.5	2940x3370mm	120K	Phase2	MI MP +60K Push Out(+1Q)																																																			
					Phase1	MI MP +90K Push out(+1Q)																																																			
Guangzhou T8 (OXIDE/OLED)	6.0	1500x1850mm	30K	Suspended→R/D with JOLED																																																					
Guangzhou T8 (OXIDE/OLED)	8.0	2200x2500mm	60K	MI MP +30K Push out(+6Q)																																																					
New Project →	Guangzhou T9 (OXIDE/A-Si)	8.6	2250x2600mm	180K	Phase1	MI MP +90K Pull in(-1Q)																																																			
HKC New Project →	Chongqing H1	8.6	2250x2600mm	90K	Phase2	MI MP +90K																Cancelled																																			
	Chuzhou H2	8.6	2250x2600mm	150K	Phase1	MI MP +150K																																																			
	Mianyang H4	8.6	2250x2600mm	150K	Phase1	MI MP +150K Push out(+3Q)																Risk of delay?																																			
	Changsha H5 (OXIDE/A-Si)	8.6	2250x2600mm	150K	Phase1	MI MP +150K Pull in(-3Q)																																																			
	Location TBD	8.6	2250x2600mm	90K	2023 TBD																																																				

LCD / LTPS OLED / LTPS G7.5 ≤
 LCD / OXIDE OLED / OXIDE G6.0 ≥

Source: Compiled by Mizuho Securities Equity Research from company data

Projected schedule of FPD capacity expansion (China3)

Company	Fab	Gen.	substrate size	Designed Capacity/M	Phase	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024		2025						
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q
New Project → Tianma	Xiamen (LTPS)	5.5	1300x1500mm	35K	Phase1+2	MI→		MP→	+35K Push out(+5Q)																											
		6.0	1500x1850mm	40K	Phase3							MI	MP	+30K Push out(+3Q)																						
	Xiamen (LTPS/OLED)	6.0	1500x1850mm	45K	Phase1																	MI	MP	+15K												
	Phase2																								MI	MP	+15K	+15K Push out(+2Q)								
	Phase3																										MI	MP	+15K	+15K						
Shanghai (OLED process)	5.5	1300x1500mm	4K									MI	MP	+4K Push out(+2Q)																						
Wuhan (Flex OLED)	6.0	1500x1850mm	38K	Phase1																	MI	MP	+15K Push out(+8Q)													
				38K	Phase2																															
				38K	Phase3																															
Visionox	Kunshan(LTPS/OLED)	5.5	1300x1500mm	15K	Phase1/2																															
	Guan V2 (Flex OLED)	6.0	1500x1850mm	30K	Phase1																															
	Phase2																																			
	Phase3																																			
	Hefei V3 (Flex OLED)	6.0	1500x1850mm	30K	Phase1																	MI	MP	+15K Push out(+1Q)												
				30K	Phase2																	MI	MP	+15K Push out(+2Q)												
New Project →	Guangzhou or Chengdu V4 (Flex OLED)	6.0	1500x1850mm	30K																																
Ever display	Shanghai Fab1 (LTPS/OLED)	4.5	730x920mm	15K																																
	Shanghai Fab2 (LTPS/OLED)	6.0	1500x1850mm	45K	Phase1																															
	Phase2																																			
				45K	Phase3																															
Truly	Huizhou (A-Si)	4.5	730x920mm	60K																																
	Huizhou (LTPS/OLED)	4.5	730x920mm	30K																																
	Shanwei (A-Si)	5.0	1100x1300mm	90K																																
	Meishan (LTPS)	5.0	1100x1300mm	50K																																
	Meishan (LTPS/OLED)	6.0	1500x1850mm	30K																																
Infintech	Jian Fab1 (A-Si)	5.5	1300x1500mm	50K																																
CPTT (CMDT)	Putian (OXIDE/A-Si)	6.0	1500x1850mm	90K	Phase1																															
Royole	Shenzhen Fab1 (Flex OLED)	5.5	1300x1500mm	15K																																
	Shenzhen Fab2 (Flex OLED)	6.0	1500x1800mm	30K																																

LCD / LTPS OLED / LTPS
 LCD / OXIDE OLED / OXIDE
 G7.5 ≤
 G6.0 ≥

Source: Compiled by Mizuho Securities Equity Research from company data

Sony (6758)

(JPY mn)	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Sales	7,603,250	8,543,982	8,665,687	8,259,885	8,611,201	9,128,311	9,646,957
Operating profit	288,702	734,860	894,235	845,459	780,745	933,351	1,101,103
Net profit	73,289	490,794	916,271	582,191	881,531	707,240	835,304
EBITDA	615,750	1,096,304	1,268,261	1,262,101	1,195,710	1,358,346	1,561,959
EPS	119.4	58.1	723.4	471.6	722.5	579.6	684.6
EPS_diluted			707.7	461.2	705.0	565.6	668.0
BPS	1,977.7	2,345.0	2,995.3	3,381.0	4,264.8	4,785.0	5,405.0
DPS	20.0	20.0	35.0	45.0	55.0	60.0	65.0
PER	31.5	88.6	6.4	13.6	18.7	23.3	19.7
PER_diluted			6.6	13.9	19.1	23.9	20.2
PBR	1.90	2.19	1.55	1.90	3.17	2.82	2.50
EV/EBITDA	7.4	5.3	4.0	5.2	12.3	10.4	8.7

Investment Rating.....Buy
 Price Objective.....**¥13,500**
 Valuation method FY3/22 SOTP (diluted)

Share Price Drivers

- COVID-19 impact (finished product demand; content production)
- AAPL/Samsung/OVX smartphone production(CMOS sensors)
- PS5 hardware/software demand, PS Plus/Now membership
- Progress in pictures, mobile structural reforms
- US-China relations, and impact on Sony's related businesses
- Share prices and valuations of Sony's competitors
- Forex (dollar depreciation a plus, euro/emerging market currency depreciation a minus)

Note: Valuation based on Price Objective.

Medium-to long-term perspective: Earnings growth and higher valuation multiples likely to lift the share price. Price objective: ¥13,500.

- Price objective SOTP on FY3/22 (EV/EBITDA, PER for Financial Services only): The current share price is around 10x of EV/EBITDA.
- Key point of COVID-19: (1) Sustainability of stay-at-home demand (for games and consumer electronics), (2) Impact on pictures (production/release) and electronics supply-chain
- OP: Expect ¥1.1t in FY3/23. Game/Music/ Sensor are drivers. Pictures to undershoot underlying the segment's OP capacity till FY3/23 due to COVID-19.
- US-China trade relations: Keep an eye on the impact on sensor and entertainment (Pictures/Music/Game).
- Expectations for next MTP (higher valuations): Will it define roadmap for synergies and earnings growth through collaboration among different businesses?
- Scope for share buybacks: Capacity to generate stable OP cash flow. Capacity for at least ¥100b/year consistently.

Sony: Earnings estimates by segment (half year, full year)

Sales revenue	FY3/20		FY3/21		FY3/22		FY3/23		FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	FY3/21
	1H	2H	1H	2HE	1HE	2HE	1HE	2HE						
Consolidated	4,048.0	4,211.9	4,082.4	4,528.8	4,258.0	4,870.3	4,503.5	5,143.5	8,259.9	8,611.2	9,128.3	9,647.0	8,500.0	8,800.0
	yoy	-2%	-7%	+1%	+8%	+4%	+8%	+6%	-5%	+4%	+6%	+6%	+3%	+7%
Game & Network Services(G&NS)	911.9	1,065.7	1,112.7	1,509.2	1,283.4	1,589.8	1,350.5	1,711.7	1,977.6	2,621.9	2,873.2	3,062.2	2,600.0	2,630.0
Music	421.5	428.4	408.0	468.1	463.3	495.4	492.7	522.0	849.9	876.0	958.7	1,014.7	850.0	900.0
Pictures	446.7	565.2	367.4	410.2	416.9	481.3	456.2	519.2	1,011.9	777.7	898.2	975.5	760.0	750.0
Electronics Products & Solutions(EP&S)	977.4	1,013.9	836.5	1,061.9	930.8	1,087.2	939.4	1,101.8	1,991.3	1,898.4	2,018.0	2,041.2	1,870.0	1,890.0
TV	314.2	332.3	311.2	376.1	340.7	377.4	343.9	376.7	646.5	687.3	718.1	720.6	n/a	n/a
Audio & Video	162.5	183.6	131.0	193.8	148.3	198.9	154.3	205.9	346.1	324.8	347.3	360.2	n/a	n/a
Still and Video Cameras	199.9	184.3	136.6	177.9	149.8	184.0	149.6	187.0	384.1	314.5	333.8	336.6	n/a	n/a
Mobile Communications(MC)	178.3	183.9	173.4	191.4	185.7	201.6	186.1	207.9	362.1	364.7	387.4	394.0	n/a	n/a
Other	122.6	129.9	84.3	122.8	106.3	125.2	105.5	124.3	252.4	207.2	231.6	229.8	n/a	n/a
Imaging & Sensing Solution(I&SS)	541.4	529.2	513.3	461.6	513.5	582.7	600.6	640.0	1,070.6	974.9	1,096.2	1,240.7	960.0	1,010.0
Financial Services	714.1	593.6	820.7	613.1	624.1	634.7	646.3	657.6	1,307.7	1,433.8	1,258.8	1,303.9	1,460.0	1,600.0
All Other	138.5	112.9	103.3	101.6	100.2	98.6	97.2	95.6	251.4	204.9	198.8	192.8	0.0	20.0
Corporate and elimination	-103.5	-96.9	-79.5	-97.0	-74.1	-99.4	-79.5	-104.4	-200.4	-176.5	-173.6	-183.9		
Operating profit	FY3/20	FY3/21	FY3/21	FY3/22	FY3/22	FY3/23	FY3/23	FY3/23	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	FY3/21
	1H	2H	1H	2HE	1HE	2HE	1HE	2HE	E	E	E	E	CoE as of 2Q	CoE as of 3Q
Consolidated	509.9	335.6	546.2	234.6	454.6	478.8	547.3	553.8	845.5	780.7	933.4	1,101.1	700.0	940.0
	yoy	+17%	-27%	+7%	-30%	-17%	+104%	+20%	-5%	-8%	+20%	+18%	-17%	+11%
Game & Network Services(G&NS)	138.8	99.6	229.0	85.9	184.0	181.7	225.9	209.0	238.4	314.9	365.7	434.9	300.0	340.0
Music	75.8	66.6	87.7	74.5	83.6	86.9	91.9	94.8	142.3	162.2	170.5	186.7	152.0	180.0
Pictures	39.7	28.5	56.5	-1.4	0.6	52.1	14.3	49.4	68.2	55.1	52.7	63.6	48.0	72.0
Electronics Products & Solutions(EP&S)	66.5	20.8	44.9	33.5	68.7	62.3	77.1	69.6	87.3	78.3	131.0	146.7	67.0	125.0
TV	13.5	4.3	23.5	4.0	24.2	6.0	27.6	4.7	17.8	27.5	30.2	32.3	n/a	n/a
Audio & Video	14.5	18.7	5.0	17.7	10.9	21.1	13.1	22.7	33.2	22.7	32.0	35.8	n/a	n/a
Still and Video Cameras	38.3	25.4	6.0	22.9	14.8	32.0	15.7	33.5	63.8	28.9	46.8	49.2	n/a	n/a
Mobile Communications(MC)	1.7	-22.7	20.5	3.5	18.6	8.5	19.4	10.9	-21.1	24.0	27.1	30.3	n/a	n/a
Other	-1.6	-4.9	-10.1	-14.6	0.3	-5.4	1.3	-2.3	-6.4	-24.7	-5.1	-1.0	n/a	n/a
Imaging & Sensing Solution(I&SS)	125.9	109.7	75.3	43.1	76.7	84.6	91.5	112.3	235.6	118.4	161.3	203.8	81.0	136.0
Financial Services	84.9	44.7	90.9	67.3	80.1	78.7	83.8	82.3	129.6	158.2	158.8	166.1	155.0	170.0
All Other	-0.2	16.5	6.7	-6.3	-1.0	-8.5	-1.0	-7.5	16.3	0.4	-9.5	-8.5	-103.0	-83.0
Corporate & Elimination	-21.4	-50.8	-44.8	-62.1	-38.1	-59.0	-36.2	-56.0	-72.2	-106.9	-97.1	-92.2		
(Total restructuring costs / included in the above)	-9.9	-15.1	-4.4	-23.5	-2.0	-18.0	-2.0	-14.0	-25.0	-27.9	-20.0	-16.0	-25.0	-27.0
Non-operating income/losses	-16.8	-29.2	73.4	-13.4	-10.0	-10.0	-10.0	-10.0	-46.0	68.0	-20.0	-20.0	65.0	180.0
Pretax profit	493.1	306.3	619.5	221.2	444.6	468.8	537.3	543.8	799.5	848.7	913.4	1,081.1	765.0	1,120.0
Net income attributable to Sony's stockholders	340.0	242.2	692.9	119.1	281.2	304.2	351.8	357.1	582.2	881.5	707.2	835.3	800.0	1,085.0
Capital expenditures (consolidated)									513.1	480.0	500.0	500.0	480.0	460.0
Capital expenditures (Sony without Financial Services)									491.4	460.0	481.3	481.3	460.0	440.0
Depreciation & amortization (consolidated)									416.6	415.0	425.0	460.9	415.0	400.0
Depreciation & amortization (Sony without Financial Services)									310.0	335.0	343.7	376.9	335.0	330.0
R&D expenses (incl. fin)									499.3	515.0	510.0	510.0	530.0	530.0

Note: Actual sales figures are adjusted to reflect new segments, subsegment breakdown of actual operating profit are Mizuho Securities estimates

Source: Mizuho Securities Equity Research

Sony: Earnings estimates by segment (quarter)

(JPY bn)

Sales revenue	FY3/20				FY3/21				FY3/22				FY3/23				
	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	
Consolidated	1,925.7	2,122.3	2,463.2	1,748.7	1,968.9	2,113.5	2,487.6	2,041.2	2,068.3	2,189.7	2,676.5	2,193.8	2,191.2	2,312.3	2,840.6	2,302.9	
	yoy	-1%	-3%	+3%	-18%	+2%	-0%	+1%	+17%	+5%	+4%	+8%	+7%	+6%	+6%	+5%	
Game & Network Services(G&NS)	457.5	454.4	632.1	433.6	606.1	506.6	832.7	676.4	660.8	622.6	883.5	706.4	705.8	644.7	970.9	740.8	
Music	202.3	219.3	216.9	211.4	177.1	230.9	235.8	232.3	216.2	247.1	249.1	246.3	230.7	262.0	262.5	259.5	
Pictures	186.1	260.6	236.0	329.1	175.1	192.3	186.4	223.8	203.5	213.4	220.4	260.9	223.1	233.1	238.9	280.3	
Electronics Products & Solutions(EP&S)	483.9	493.5	650.4	363.4	331.8	504.7	638.6	423.4	426.2	504.6	673.6	413.6	427.7	511.8	682.5	419.3	
TV	147.8	166.5	235.9	96.4	106.6	204.6	227.4	148.6	149.1	191.6	245.2	132.2	152.2	191.7	245.0	131.7	
Audio & Video	78.7	83.8	121.7	61.8	47.1	83.9	127.7	66.1	59.9	88.4	131.5	67.4	62.3	91.9	136.1	69.8	
Still and Video Cameras	100.3	99.6	122.0	62.3	46.4	90.2	113.2	64.6	63.6	86.2	117.7	66.4	62.6	87.0	118.5	68.5	
Mobile Communications(MC)	100.6	77.7	113.5	70.4	94.2	79.1	118.1	73.3	102.8	82.9	124.1	77.5	100.0	86.1	128.2	79.6	
Other	56.6	65.9	57.3	72.6	37.6	46.8	52.1	70.7	50.9	55.4	55.1	70.2	50.5	55.0	54.7	69.7	
Imaging & Sensing Solution(I&SS)	230.7	310.7	298.0	231.2	206.2	307.1	274.6	187.0	224.6	288.9	320.7	262.0	258.7	341.9	349.8	290.2	
Financial Services	336.9	377.2	407.2	186.4	446.8	373.9	305.3	307.8	310.7	313.3	316.0	318.7	321.8	324.5	327.4	330.2	
All Other	69.6	68.9	72.3	40.7	54.1	49.2	65.0	36.6	52.5	47.7	63.1	35.5	50.9	46.3	61.2	34.4	
Corporate and elimination	-41.2	-62.3	-49.9	-47.1	-28.3	-51.2	-51.0	-46.0	-26.2	-48.0	-49.9	-49.5	-27.6	-52.0	-52.5	-51.9	
Operating profit	FY3/20	FY3/20	FY3/20	FY3/20	FY3/21	FY3/21	FY3/21	FY3/21	FY3/22	FY3/22	FY3/22	FY3/22	FY3/23	FY3/23	FY3/23	FY3/23	
	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	
Consolidated	230.9	279.0	300.1	35.4	228.4	317.8	208.4	26.2	214.3	240.3	296.4	182.4	250.9	296.4	336.3	217.5	
	yoy	+18%	+16%	-20%	-57%	-1%	+14%	-31%	-26%	-6%	-24%	+42%	+598%	+17%	+23%	+13%	+19%
Game & Network Services(G&NS)	73.8	65.0	53.5	46.2	124.0	104.9	52.4	33.5	96.5	87.5	87.4	94.3	114.6	111.3	104.7	104.3	
Music	38.3	37.5	36.3	30.3	34.9	52.9	39.0	35.4	39.3	44.3	44.9	42.0	43.3	48.6	48.9	45.9	
Pictures	0.4	39.3	5.4	23.0	24.7	31.8	6.0	-7.3	-1.8	2.4	16.4	35.7	1.8	12.5	17.8	31.6	
Electronics Products & Solutions(EP&S)	25.1	41.4	80.3	-59.5	-9.1	54.0	54.2	-20.7	24.3	44.4	62.7	-0.5	30.0	47.1	65.3	4.3	
TV	1.0	12.5	23.6	-19.3	-2.0	25.5	8.8	-4.8	7.7	16.5	10.2	-4.3	10.9	16.7	8.5	-3.7	
Audio & Video	5.0	9.5	19.4	-0.7	-3.0	8.0	16.2	1.5	2.2	8.7	18.2	2.9	3.7	9.4	19.4	3.3	
Still and Video Cameras	18.5	19.9	29.2	-3.8	-8.0	14.0	21.7	1.2	3.6	11.2	25.6	6.4	3.9	11.8	26.5	7.0	
Mobile Communications(MC)	1.0	0.6	7.0	-29.7	11.0	9.5	6.5	-3.0	10.8	7.8	7.1	1.3	11.0	8.4	9.0	1.9	
Other	-0.4	-1.1	1.1	-6.0	-7.2	-3.0	0.9	-15.6	0.0	0.3	1.5	-6.9	0.5	0.8	2.0	-4.3	
Imaging & Sensing Solution(I&SS)	49.5	76.4	75.2	34.5	25.4	49.8	30.6	12.6	34.7	42.0	51.6	33.1	37.0	54.4	66.2	46.2	
Financial Services	46.1	38.8	32.6	12.1	47.2	43.7	34.3	33.0	40.7	39.4	40.0	38.7	42.6	41.2	41.8	40.5	
All Other	-2.6	2.4	20.7	-4.2	3.5	3.2	-0.8	-5.5	-0.5	-0.5	-0.5	-8.0	-0.5	-0.5	-2.5	-5.0	
Corporate and elimination	0.4	-21.8	-3.8	-46.9	-22.3	-22.5	-7.2	-54.8	-19.0	-19.1	-6.2	-52.8	-18.0	-18.2	-5.9	-50.2	
(Total restructuring costs / included in the above)	-3.6	-6.3	-4.2	-10.9	-0.5	-3.9	-1.0	-22.5	-1.0	-1.0	-3.0	-15.0	-1.0	-1.0	-4.0	-10.0	
Non-operating income/losses	0.1	-16.9	10.2	-39.4	91.5	-18.2	-6.5	-6.9	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	
Pretax profit	231.0	262.1	310.3	-4.0	319.9	299.6	201.9	19.3	209.3	235.3	291.4	177.4	245.9	291.4	331.3	212.5	
Net income attributable to Sony's stockholders	152.1	187.9	229.5	12.6	233.3	459.6	129.2	-10.1	127.7	153.5	209.2	95.0	153.3	198.5	238.1	119.0	

Note: Actual sales figures are adjusted to reflect new segments, subsegment breakdown of actual operating profit are Mizuho Securities estimates

Source: Mizuho Securities Equity Research

Flat Panel Display Industry / Consumer Electronics

- Large panels: heading to long-term supply surplus/in China, victor determined based on quantity, opposition with OLED & μ LED in South Korea, LCD production capacity to fall on plant closures
- Small/mid-size panels: Smartphones to continue adopting OLED. Apple making progress on OLED, but could also keep LCD for the foreseeable future. The mid-size panel battle front to center on.
- Capex: Expecting increased investment in new OLED production capacity for both large and small/mid-size products.
- FPD industry consolidation: Battle between panel makers to emerge in 2020. Focus should also be on brands and components & equipment trends.

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Points (1)

■ LCD to OLED : Acceleration in OLED adoption (positive on OLED materials, negative on LCD materials)

- Small/medium sizes: Demand Pull. OLED to make up over half the volume demand for smartphones in 2024, but AAPL is variable. OLED the top choice for PCs and tablets, while LCD for in-car displays.
- Large sizes: Supply driven. LGD and Samsung Display (SDC) focusing on strengthening OLED operations to differentiate themselves from Chinese competition, but financial strength and integrating the intentions within the group are issues.
- New technology: Focus on SDC's QD-OLED/QNED. μ LED not used for small/medium sizes, but possible for large sizes. μ OLED(VR/AR) to be a prime figure.
- How about LCDs?: China gains the ascendancy for large/medium/small screens. Pressure on material prices growing. South Korea/Taiwan/Japan converting to OLED+LCD fabs closing.
- Components: OLED components as tailwind over med to long term. Headwind for LCD components. Shift to OLED overall tailwind for equipment makers (excluding equipment specifically for LCD).

■ Smartphone : Recovery trend with 5G in 2021, upbeat on cameras, 3D sensing, external design, memory and display to be subjects for cost reduction

- Volume: -5% in 2019, -10% in 2020 by the impact of COVID-19; then it will be on a recovery trend; +8% in 2021 and +4% in 2022.
- 5G: Expecting 566m in 2021. Ex-Apple brands to focus on Sub6 GHz. China is strong, but milliwaves (US, Japan etc.) slightly delayed.
- Huawei: We expect 190m in 2020 affected by US sanctions. Production limited mostly to 4G devices in 2021, 5G difficult with Huawei's AP inventory.
- Apple: We expect 221m in 2020, focus on further upgrade of camera, ToF sensors and related apps in 2021.
- Samsung: Differentiation via the development of foldable phones. 0.5m in 2019, over 3m in 2020. Can it break the 10m mark in 2021. Impact SDC's investment in A5 plant.
- Higher functionality: camera(triple cam, 5x zoom, larger sensor), 3D sensing(rear camera) and related apps, outward appearance(OLED, full screen, casing).
- Displays: Focus on acceleration in OLED shift, TP functions for OLED, speakers, and haptics. Possibly use more OLED capacity than expected.

Points (2)

- **Large LCD supply and demand: Plant closures likely to continue in 2020, mainly in Korea, though possibly in Taiwan too**
 - Supply-demand conditions: Chinese firms should offset a decline in supply (-6%) due to SDC and LG plant closures. However, SDC and LGD might conduct further plant closures in 2020. Possibility of closures in Taiwan too in 2021?
 - Pricing: Prices for 65” and smaller LCDs will likely rebound modestly through May, but the risk of downward pressure on demand (lower prices in 2H) merits caution.
 - Outcome of SDP+SIO Guangzhou (HonHai): What becomes of the 7M inventory? What if Hon Hai Group and Samsung VD settle?
 - Pressure on parts/materials: Price-driven selection of parts and materials is strengthening with the increased presence of Chinese panels. These conditions might lead to an adverse cycle of decline in parts/materials costs and further decline in panel prices.
- **FPD Capex: Forecasting bottom in 1H 2020, recovery in 2021 (upbeat on OLED, downbeat on LCD)**
 - Overall outlook: weak in 2019, 2020, thorough recovery likely in 2021. OLED to be key driver for both small/medium panels and large panels.
 - LCD: Decline over medium to long term. We viewed Infintech G5.5, HKC G8.6, and Hon Hai Guangzhou’s G10.5 as risks, but HKC and Hon Hai now look realistic.
 - OLED: Turn upwards from 2020 on an orders basis. Phase 2/3 investment to increase for mid to small-sized G6 at Visionox, EDO, CSOT. Plus, new plans are emerging for Tianma (new G6 in Xiemen), CSOT (G6-OLED, G8-OLED plant in GZ or SZ). However, BOE may temporarily suspend B12.
 - South Korean companies: LGD(G10.5) plan could be delayed depending on the financial situation. On the other hand, growth potential for SDC order in G8 QD-OLED Phase2 and G6 new plant (A5) from 2021 on.
- **Individual companies: Buy Sony, Sharp and Yamaha; we see no reason to be bullish on Panasonic**
 - Sony (Buy): earnings growth + valuation rising. Limited downside due to share buy-back. Profit growth next FY, as mobile, semicon, and pictures segments should compensate for lower profits in games.
 - Investment in new CMOS sensor plant yet still outsourcing? What about PS5 in games? Are TV and mobile businesses OK?
 - Panasonic (Neutral): No signs of headcount reductions or other cuts in fixed costs; business portfolio restructuring will also take time. Hard to be bullish with profits expected to decline in FY20.
 - Sharp (Buy): Focus on disparity in market’s perception. Market is undervaluing LCDs and camera modules. Need to reappraise Sharp as an “Apple stock”.
 - Yamaha (Buy): Solid reputation as a blue-chip stock. Yen appreciation (EUR) and US-China tariff issues are moderating, but Chinese economic sentiment merits caution. Focus on FA floor and growth in emerging markets.

Current state of US tariffs on China and Mexico → Higher tariffs on Chinese imports of TVs, electronic instruments starting Sep

Tariffs on China

- ◆ The United States announced on 10 May 2019 that it increased the tariff on list 3 items (imports from China of 5,745 items totaling \$200b in annual value) from 10% to 25%.
- ◆ List 4 (\$300b worth of goods) tariff hike (to 25%) announced on 13 May. Almost all Chinese-made goods, TVs, cell phones, national brands, wearable devices, game consoles, electronic instruments, will have additional tariffs imposed on them.
- ◆ 15% tariff was imposed on TVs, wearable devices, and electronic instruments starting 1 Sep, then it declined to 7.5% on Feb.14, 2020, 15% was supposed to be imposed to rest of the items starting 15 Dec, but it is still postponed.

Tariffs on Mexico

The United States announced a plan on 30 May to apply a 5% tariff on Mexico from 10 June and incrementally increase it to as much as 25% on the basis that Mexico was not taking sufficient measures to halt the flow of illegal immigrants.

However, President Trump announced on 7 June that the United States reached an agreement with Mexico on measures to stop immigrants and indefinitely suspended the tariff on Mexico that had been slated to begin on 10 June.

In a joint declaration from the two countries, Mexico explained that it intends to take “unprecedented measures” and expressed its intent to strengthen efforts to curtail illegal immigration.

(USDb)

	US Market		US Import Data				
	US market share to global market	US market size	Total imports	Value of imports from China	Import ratio from China in total imports	Value of Imports from Mexico	Import ratio from Mexico in total imports
Mobile phone	19.1%	492.1	52.8	43.2	81.8%	0.1	0.3%
TV	19.5%	115.5	24.1	12.4	51.7%	9.0	37.5%
PC	24.3%	55.7	39.7	37.5	94.4%	0.1	0.2%
Gaming dev	31.9%	28.6	5.5	5.4	97.6%	0.0	0.8%
Musical inst	6.3%	1.9	1.4	0.6	41.6%	0.1	6.1%
Camera	25.2%	1.7	3.4	1.7	50.9%	0.0	0.1%

Source: US market data from IHS for televisions, IDC for mobile phones and PCs, CIPA for cameras, WePC and statista for gaming devices, and statista for musical instruments; US import data from USA trade online with Hs codes for televisions, mobile phones, PCs, cameras, gaming devices, and musical instruments as 8528, 851712, 847130, 852880400, 950450000 and 92 respectively

End-use product trends: Current focus points

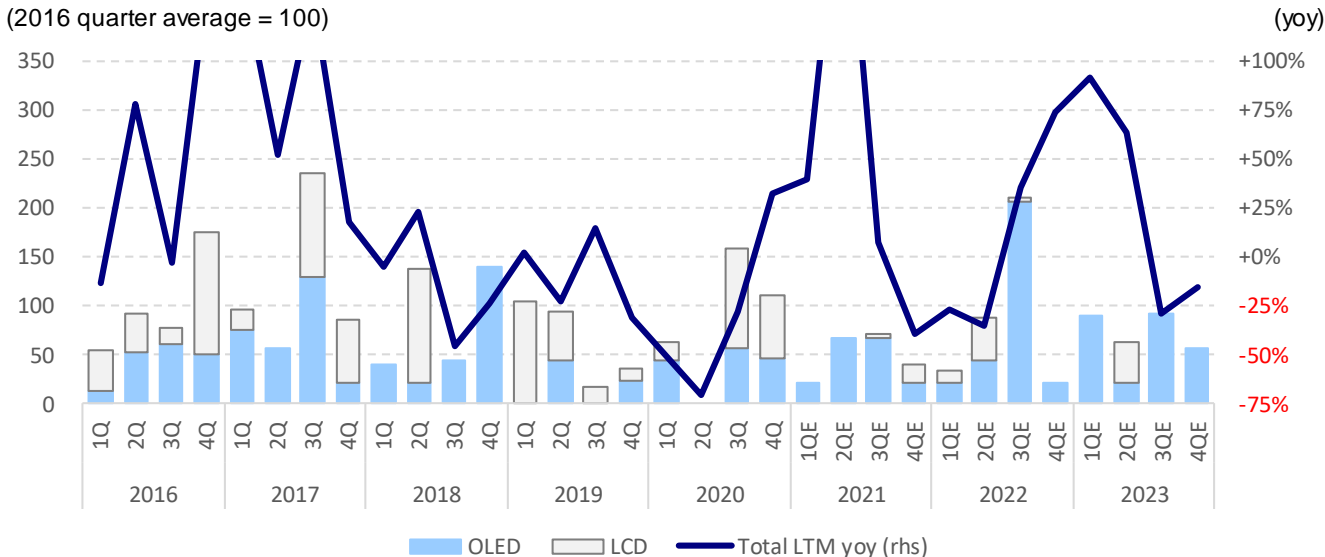
- **Smartphones:** Sharp decline in 2020 from COVID-19, rebound in 2021. 5G+cameras+3D sensing+exterior design
 - Overview (2019): -5% YoY. Broad inroads by cameras(dual, triple, quad) and full screens (OLEDs, camera hole, embedded fingerprint authentication)
 - Overview (2020): **+4% YoY → -10% from COVID-19. Anticipate demand for 5G, cameras, 3D sensing. Recovery to 1500m over 2 years.**
 - Chinese brands ups and downs: Four majors settled—Huawei+Honor, Oppo, Vivo, and Xiaomi. Eye on future direction of Huawei+Honor.
 - Apple: Eye on proposals for using rear 3D sensing (ToF); no noteworthy apps at present.
 - Samsung: Significantly improved features, but did not achieve much sales growth. Faced tough income results with series A. Accelerating use of Chinese ODMs and focus on foldable products.
- **Tablet PC:** Continued negative growth, but revival from online lessons demand?
 - 7-8" class: Pressured by 5.5"+ phone models; market will continue to contract.
 - 10" class: iPad Pro, Surface, Galaxy Tab Pro, and other products are well outfitted, but volume is not growing much
 - Focus from here: Major brands shifting to 10" and up, planning NB replacements. Even over US\$500 ASP acceptable if NB replacement.
 - NB replacements: Light weight (10": 300g, 13": 500g) is important. Business
- **NBPC:** 20% growth YoY in 2020 on stay-at-home trend, growth to continue in 2021. Strong trends for gaming, Chromebooks for education.
 - Market: Was expected to remain flat in 2020, but rose 20% thanks to COVID-19 impact. Growth set to continue in 2021.
 - Brands: In addition to Lenovo, Asus, HP and Dell also being aggressive (i.e., improving features). Proactive use of OLED/LTPS.
- **FPTVs:** Strong in US in 2020 thanks to stay-at-home demand, but ultimately flat. May remain flat in 2021–2022.
 - Finished product demand: Expected 5% volume decline for 2020 on COVID-19 impacts → Recovers to almost flat trends thanks to stay-at-home demand, especially in US.
 - Weakening market?: Expect 220m level until 2022, but a steady weakening after.
 - Migration to larger displays: Average growth of 1.5" / year to date, but gradual slowdown from 2018. A ceiling at 50"?
 - OLED running out of steam?: Steady growth on high-end models, but now struggling due to widening price gap with LCD. Impact of Samsung's QD-OLED use will be key.
 - LCD's comeback: Delay in OLED and μ LED development could increase opportunities for LCD+Mini LED

Flat Panel Display Industry: Outlook and focus Points

- **Large displays:** Supply-demand conditions likely to improve again in 3Q, expecting negative growth in LCD surface area over the longer term; OLED vs. LCD thereafter
 - Demand: Upbeat IT demand until Lunar New Year, recovery trend in TV demand too. But cautious of reflexive decline risk in 2021. Inventory level is still low.
 - Supply: Delay in equipment delivery delays new G10.5 factory. Extending LGD:P7 to end-2021 and SDC:T7/T8 to Mar.2021→Oct.2021? due to strong demand.
 - Glass/DDIC supply: Malfunction at Corning's Hefei kiln. Affects Oct–Dec glass supply→ Serious driver IC shortage
 - Supply-demand conditions and price outlook: tight in 2021, eye on impact of price hikes on demand. 2x for 32", 1.5x for 55"; expensive. A 30% drop would be desirable.
 - LCD value chain: Positive for panels (higher prices, more area) and component manufacturers in short term
 - From 2021: Led by Chinese panel firms, possible decline in LCD output surface area as soon as 2022 and difficult conditions at part/material suppliers (although this will vary by company)
 - OLED shift (slightly delayed): How about LGD's attack by price? SDC (QD-OLED) delayed to 2022? Positive on CSOT (with JOLED). Components demand continues to grow.
 - Mini LED (BL+LCD): Opportunities if OLED shift does not advance. Window in 2021–2023.
- **Small/medium display:** Demand of automotive panels hit the bottom, volatility in smartphone panels, healthy tablet panels
 - Demand: Steep declines in existing and new auto business, moderate recovery from 3Q; tablet and game business is upbeat and smartphone business is recovering now after a downturn
 - Supply: VC bottleneck removed; smartphone LTPS led by Chinese firms (Tianma, BOE, and CSOT), Japan/Korea depend on AAPL-Samsung.
 - OLED shift: Supply rising with higher outputs at Chinese firms as expected, though LTPS preference in some cases due to weaker smartphone mix, focus on OLED-side price decline
 - Part/material demand: Continuing growth in unique OLED materials (metal mask, emission materials, etc.), growth room in optical films and other areas too
 - Return to LCDs at AAPL?: Strong possibility that iPhone LCD models will continue to around 2025. However, 2021 is a difficult in-between period leading up to the launch of SE3.
- **Capex:** Ongoing installation delays. New LCD projects, but are they sustainable? Investment focus on OLED (TFT backplane+OLED)
 - LCDs: Supply/demand tight; additional 10.5 (BOE/SIO), CSOT: t9 (G8: IPS MNT) projects emerge but unsustainable
 - OLED: BOE finally orders B12 followed by a lull; next major project is SDC's A5, but it hasn't been decided yet, multiple plans under consideration for large panels (G8/10)

FPD Capex Index (CY basis, new capacity only; indexed at 2016=100)

FPD capex trend (indexed, equipment move-in basis)
(2016 quarter average = 100)



- Calculated quarterly starting at equipment delivery (move-in)
- Equipment order timing (meaning equipment manufacturer's order) is earlier, with said timing depending on the type of equipment (deposition devices: earlier; inspection equipment: later, etc.)
- Sales booking depends on each company's revenue recognition standards (construction progress, shipping, installation completion standards, etc.)
- Timing of payment collection also differs depending on the device/customer (high/low/payment not received, etc.)

- Processes needed for LCD

TFT(array)/color filters
Cell (bonding)
Module

- Processes needed for OLED

TFT(array)/color filters (White OLED only)
OLED (deposition of ink jet), sealant
Module

Yearly trend (CY2016 = 100)	CY15	CY16	CY17	CY18	CY19	CY20	CY21E	CY22E	CY23E
LCD	42	55	47	29	46	46	5	14	10
(yoy)	-8%	+31%	-15%	-39%	+58%	+1%	-88%	+161%	-31%
G6 or below	8	16	9	4	4	0	0	1	0
G8.5/G8.6	34	39	21	16	10	33	1	11	10
G10.5	0	0	18	9	31	13	4	2	0
OLED	0	45	71	62	17	37	45	75	66
(yoy)	-100%	-	+59%	-13%	-72%	+114%	+22%	+64%	-12%
G6 or below	0	38	71	34	17	23	45	40	51
G8.5/G8.6	0	7	0	25	0	15	0	26	9
G10.5	0	0	0	3	0	0	0	9	6
FPD total	42	100	118	91	63	83	51	89	76
(yoy)	-28%	+137%	+18%	-23%	-31%	+32%	-39%	+74%	-15%

Note: Does not include maintenance investment or debottlenecking investment

1. Impact of accelerated OLED adoption

From LCD to OLED

- **Small/mid-size:** New JDI→requires huge reorganization/cutback of production site, start of decline in demand for LCD components
 - Smartphone OLED switch progress: **yield, supply volume and price** of Chinese panel makers are key (in 2020-2022).
 - Adoption of OLED in small/mid-size notebooks/tablets: Production and price are issue. **SDC strategy, how many notebook brands adopt it, iPad adoption are key.**
 - Automotive application: European OEM and Denso are aggressive, but have issues with costs, heat resistance, product life spans. **Serious adoption likely from 2023 onward.**
 - Closing plants: plants for G4.5 LCD and below(A-Si, LTPS) is expected to be closed. Production of A-Si is expected to concentrate on G5 and above, and LTPS/OLED's will do on G6.
- **Large-scale:** Finally SDC confirmed investment in QD-OLED. Avoiding LCD competition with China, focusing on OLED. Large LCD panel capacity declines, LCD component demand declines.
 - Large TV market: Samsung Display joins what used to be LG Display's solo battle, **may push OLED to mainstream in super high-end TV market**
 - However...There are strategies dissidence in Samsung group. SDC longs to focus on QD-OLED→expand or QNED, VD wants to focus on μ LED/Mini LED.
 - What about China? : **BOE, CSOT and others may convert one of their G10.5 plants to OLED.** The results of collaboration with JOLED is key. CSOT planning OLED plant construction in Guangzhou for G8 (2023). BOE Possibly BOE might invest in another G10.5 OLED fab in Hefei.
 - LCD plants?: **The existing value of plant G6 and below is expecting to decline for large panel and those plants is highly likely to be closed.** Regarding G7/G7.5 and G8 for TV, LCD capacity will be reduced due to some plants closure and conversion to IPS-mode. The 1st Tier incl. Focus on Taiwanese manufactures action.
- **Risk scenarios:** LED, μ LED, LCD Dual Cell, etc.
 - Small/medium: May need to co-exist with LTPS for mid-end smartphones if yield improvement at Chinese OLED manufacturers is delayed
 - Large: The more OLED penetration is delayed, the more progress is made in improving quality and cost of Local Dimming LCD panels (that use mini LEDs as BL) and the shift to OLED is suppressed.
 - Large: μ LED needs be over 100" to be competitive, but as mentioned above, delay in OLED penetration is providing tailwind.
 - Dual Cell: BOE may be rolled out and become eye of the storm. However, there are many problems. Major TV brands excl. Hisense are reluctant to the adoption.

Samsung's next-Gen display investment: accelerating shift to OLED in large-scale sector, unpredictable from Phase2 onwards

- Investing KRW13.1t (about ¥1.2t) in next-gen displays by 2025. VC Jae-Yong Lee, president Jae-In Moon attended in the presentation session.
- South Korean government support: KRW400b for next-gen display R&D over the next seven years
- What are next-gen displays? Basically QD-OLED (SDC), but with the option of μ LED(Samsung VD)
- KRW13.1t investment: KRW10t for capex, the rest for R&D; expecting roughly 80,000 new jobs
- QD-OLED: G8 LCD plant (T8) to steadily shift to QD-OLED lines

■ Our view: issues and focus points

- Production capacity(Phase1): 30K/M (investment of KRW2.5t), delivery in 3Q20, volume production in 2Q21. →Delayed to 4Q 2021, expecting finished product rollout in spring 2022
- From Phase1: Expanding QD-OLED (+30k a year from now; 150k after intermittent investments) or shifting to QNED? Depends on phase 1 results (functions, costs)
- Background: **QD-OLED has many issues with functions. Samsung confirms VD use but outlook uncertain. Samsung is not monolithic.**
- Products: First 65"4K(TV), 31.5" 4K and 34" QHD(monitor), and 77"4K afterward. 8K monitors over 65"/77" will launch in 2023?
- Difference with LGD(White OLED): 8K (use of Top Emission) and color fidelity (QD-CF), and smallness of color shift.
- Technology: Oxide substrates, QD-CF (inkjet, QD dispersion, reflected light control) difficult. Luminous efficiency, cost, lifespan challenging for OLED layers
- Cost: likely 20%–30% higher than LG Display's White OLED due to mask numbers, yield control
- Brightness: LCD has no peak brightness limit, high-end TVs go for over 2000cd. Targets 1000cd for OLED for now
- **Samsung Group strategy: VD lacks incentive to adopt QD-OLED. Balancing and marketing QLED (LCD) and QD-OLED are difficult. Mass adoption of QD-OLED leads to loss of added-value in its own LCD module lines and BL designs. VD focuses on the development of μ LED, targets BtoB + 75 "TV. Eye on Samsung Group's conclusion. Use in 2022 models confirmed at present. QD-OLED investment outlook, possibility of shift to QNED (uses blue LED as light source) depends on VD's intentions.**

Source: Mizuho Securities Equity Research

Reorganization of large-panel LCD industry in China (1)

Reorganization of large-panel LCD industry in China has been accelerating since the end of August 2020. Samsung Display (SDC) sold its Suzhou LCD plant to CSOT, a panel unit of TCL, and CEC Group company CEC Panda sold two plants to BOE. The panel market is becoming increasingly dominated by the two major players BOE and CSOT.

	Samsung Display (Suzhou G8.5) → CSOT		CEC Panda (Nanking G8.5 + Chengdu G8.6) → BOE	
Disclosure Date	August 29, 2020		September 24, 2020	
Capacity etc.	Suzhou G8.5 A-Si 120K/m, Polymer Sustained Alignment (PSA), VA type , Mass production from 2014		Nanking Panda G8.5 Oxide 60K/m Ultraviolet induced multi-domain Vertical Alignment(UV2A), IPS/VA type, Mass production from 2015 Chengdu Panda G8.6 Oxide 120K/m, UV2A, VA type, Mass production from 2018	
Transaction	SDC transferred its entire stake in the Suzhou plant (subsidiary of SDC and JV with TCL) to CSOT (subsidiary of TCL). CSOT also acquired a 100% stake in Samsung Suzhou.		Nanking Panda(南京中電熊貓平板顯示科技) : BOE acquired a 80.83% stake from the top 3 shareholders (excluding Sharp). Chengdu Panda(成都中電熊貓顯示科技) : BOE acquired a 51% stake from the top 2 shareholders	
Transfer value	RMB7.622b (USD1.08b)		Nanking Panda : Undecided (expected to be at least CNY5.5b or 80.83% of CNY6.8b) Chengdu Panda : Undecided (company value is CNY12.8b, but will be negotiated)	
Change in ownership ratio etc.	(Change in shareholder structure) TCL CSOT 10% → 70% Samsung Display 60% → 0% 蘇州工業園區國有資產管理發展 30% (FY12/19) Sales RMB8.4b NP ▲RMB30m Total assets RMB10.9b Net assets RMB7.1b		(Change in shareholder structure : Nanking Panda) BOE 0% → 80.83% Nanjing Huadong Electronic Information & Technology 57.65% → 0% China Electronics Corporation 17.17% → 0% Nanjing New Industrial Investment 11.45% → 0% Sharp 7.72% Nanjing China Electronics Panda Group 6.02% (FY12/19) Sales RMB4.4b NP ▲RMB9.5b Total assets RMB20.5b Net assets RMB6.9b	
	After the transaction, SDC will invest in TCL CSOT and acquire a 12.33% equity stake at 5.213m CNY (\$739m). TCL CSOT's shareholder breakdown is expected to change as follows: TCL Group 80.28%, SDC 12.33%, National Development Fund 5.18%		(Change in shareholder structure : Chengdu Panda) BOE 0% → 約51% 成都先進製造產業投資 30.71% → 0% 成都空港興城投資集團 21.43% → 0% Nanjing China Electronics Panda Group 17.14% 成都空港興城建設管理 14.29% Nanjing Huadong Electronic Information & Technology 11.43% 四川省集成電路和信息安全產業投資 5.00% (FY12/19) Sales RMB3.6b NP ▲RMB1.0b Total assets RMB34.2b Net assets RMB13.1b	

Reorganization of large-panel LCD industry in China (2)

Through series of transactions, BOE acquires VA and oxide (IGZO) technologies. Through t9 investment, CSOT enters IPS, oxide-TFT markets.

With the closure of the Korean LCD plant and start of the new Chinese plant, we expect China's market share in large LCDs to exceed 50% by end-2021.

Among the four major Chinese makers (BOE, CSOT, CEC, HKC) the gap between the top two and the rest will likely widen.

Large-area FPD production capacity share (excluding OLED)

(Before transaction)	2020/2QE	Effects of transaction		(Including transaction)	2020/2QE	(Including transaction)	2021/4QE		
Latest	(K sq.m)	(M/S)	(K sq.m)	Latest	(K sq.m)	(M/S)	as of the end of 2021		
							(K sq.m)		
							(M/S)		
1 BOE	5,381	20.8%	+1,290	1 BOE	6,671	25.7%	1 BOE	7,838	29.0%
2 Innolux	3,500	13.5%		2 Innolux	3,500	13.5%	2 TCL-CSOT	4,556	16.8%
3 LG Display	3,096	11.9%		3 TCL-CSOT	3,416	13.2%	3 Innolux	3,500	12.9%
4 AUO	3,003	11.6%		4 LG Display	3,096	11.9%	4 AUO	3,003	11.1%
5 Samsung Display	2,858	11.0%	-715	5 AUO	3,003	11.6%	5 LG Display	2,049	7.6%
6 TCL-CSOT	2,701	10.4%	+715	6 Samsung Display	2,143	8.3%	6 HKC	2,018	7.5%
7 CEC Panda	2,424	9.3%	-1,290	7 CEC Panda	1,134	4.4%	7 CEC Panda	1,134	4.2%
8 HKC	1,112	4.3%		8 HKC	1,112	4.3%	8 Samsung Display	165	0.6%
- Other	1,852	7.1%		- Other	1,852	7.1%	Other	2,776	10.3%
Total	25,927	100.0%	+0	Total	25,927	100.0%	Total	27,040	100.0%
China - subtotal	11,618	44.8%	+715	China - subtotal	12,333	47.6%	China - subtotal	15,546	57.5%

Source: Mizuho Securities Equity

Flat Panel Display Industry: Hegemony for large panels?

- **Large LCD/OLED supply/demand:** Tight for LCD in 2021. Shift in industry power balance? OLED depends on LGD pricing strategy
 - LCD supply/demand: Prices tight 2H 2020–2021. LCD area growth has peaked. Rising influence of Chinese panel makers, prices to rise
 - TV brands: China brands in particular cannot allow significant price increases. Risk of decline in demand. What will panel makers do?
 - **Shift in power balance?: Reorganization to boost position of LCD makers. Building an environment that allows for stable OPM of 10%.**
 - LCD or OLED or μ LED: OLED is the favorite, but cost competitiveness is an issue. Gives room for LCD (+Mini LED) and μ LED. Focus on LG Display's pricing strategy.
 - Components: Needs to reconsider strategy for LCD. Large growth potential for OLED, Mini LED (BL), and μ LED
- **Finished products (TV):** Battle between Korea and China. Will Korea evade or will China catch up?
 - Samsung, LGE: Is it possible to maintain a presence in M/S volume, high-end market? Differentiating technology is OLED for LGE, and MiniLED or OLED for Samsung?
 - Samsung Electronics (VD): Favors QD technology + Mini LED or μ LED. **No intention to adopt QD-OLED. → change their strategy to adopt it in 2022.**
 - TCL/Hisense/Skyworth/Xiaomi/Huawei: How much US/Europe market share can they take with lower prices + rising quality?
 - Japanese brands: Even Sony is in a difficult situation. Differentiated technology and regionally specialized strategy are required.
 - Others: Paying attention to ODM + economy of scale for brands (TPV), asset-light brands (Vizio etc.), low costs + high quality (Funai).
- **Large display industry:** LCDs distributed to China. Concerned about Korea's lag.
 - Era of Chinese hegemony for LCD: Reorganization in China to focus on BOE/CSOT, further strengthening constitution and solidifying foothold.
 - **South Korea: Focus on next-generation displays such as OLED and QNED. Common issues include cost, reliability, and 8K. Challenges include finance for LGD and inconsistent group strategy for SDC.**
 - Taiwan: Both AUO and INX to benefit due to focus on LCD. In medium to long term, it will be necessary to reorganize the LCD plant and invest in new technologies.
 - Japan: JOLED impacts the proliferation of OLED. **Sharp is focusing on IT applications and giant-sized TV (over 80").**
- ★ **South Korea is lagging behind in new technology investment in terms of financial strength and investment recovery. The interests of the finished product divisions and display divisions of Samsung and LG Group do not match (i.e. in the case of OLED, module-added value is on the panel side and not so much on the TV side). South Korea's sluggishness works in China's favor.**

Flat Panel Display Industry: Small/medium panels; Can Chinese companies stop SDC's runaway?

■ Finished products (smartphones): Samsung, Apple, Chinese brands are well established

- 6 major brands: HHOVX for volume, Apple for high-end/APP, Samsung Electronics (wireless) for overall strength
- Display: Both OLED adoption expanding. Samsung wireless also uses Chinese OLED for cost control, Apple extends LCD life
- Foldable OLED: Galaxy Flip (Samsung) popular. Can it work closely with Samsung Display to rapidly expand the business?
- Peripheral equipment: Product strength of watches, earphones, AR/VR, and speakers etc., and smartphone compatibility are key factors
- Apps: Focus on games that utilize cameras and sensors (ToF, etc.), e-Commerce, etc. What will platformers such as Sony and Nintendo do?

■ Finished products (tablet/PC/MNT): HP, Dell, Lenovo strong with BtoB. Focus on Dell, Apple, Asus for displays

- HP/Dell/Lenovo: BtoB (PC/Server) is strength, especially for HP and Dell. Eye on Dell/Lenovo from a display perspective (OLED/flexible)
- Apple: Eye on displays (mini LED/OLED) for MNT/notebooks/tablets
- Taiwanese companies such as Asus, Acer, Microstar: survival through gaming. Asus does not have a weak financial base. Eye on Asus for displays.
- GGL/MSFT/Amazon/Samsung/Huawei: A certain amount of presence in tablet market

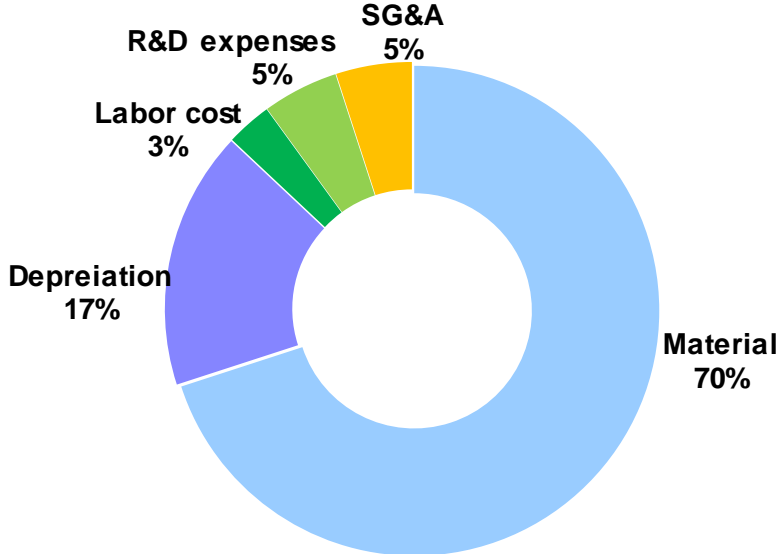
■ Small/medium-sized display industry: The key to LCD is whether or not it can be made into cash cow. SDC victory would be pitfall for OLED

- OLED and LCD: Smartphones shifting toward OLED, tablets/laptops/MNT in high-end battle between OLED and LCD+Mini LED. LCD is strong for automotive applications
- South Korea: SDC overwhelms with OLED technology, increasing functions, and aims for victory with foldable + IT application increase. LG Display's strategy after reaching OLED BEP is to expand again.
- China: LTPS-LCD (BOE/Tianma) to become cash cow. OLED has sufficient scale; issues are yield and development capability. Cash from large LCDs is also a positive
- Taiwan: LCDs have no edge. Expected to develop AUO's IJ OLED and mini/ μ LED, and collaborate with other Taiwanese companies (LED/semi). Cash from large LCDs is also a positive
- Japan: OLED is lagging behind. LCDs for Apple, automotive, and industrial use are key to survival. IT (oxide) is key to survival for SH. Can it just do its own thing?

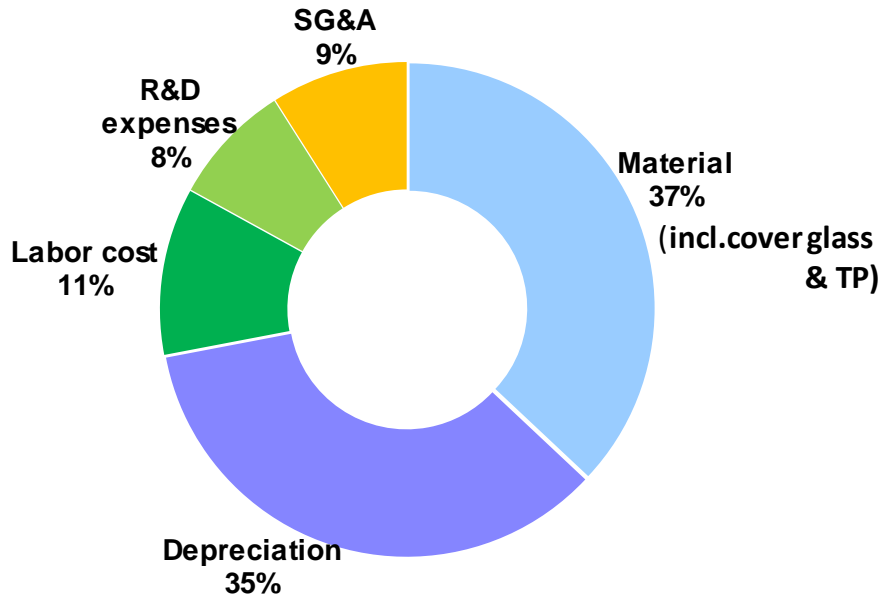
★ Will SDC win in the shift to OLED?: There is risk that Samsung Group's profit-focused strategy will become useless. Originally, it would be about time to make A5/A6 factory investment decisions to expand foldable/IT business and introduce new technologies. Hesitation provides an entry point for Chinese firms. Apple's adoption strategy also has a big impact

Cost structure comparison: LCD(high variable cost) vs OLED(high fixed cost)

LCD panel (small/mid size)



OLED panel (small/mid size)

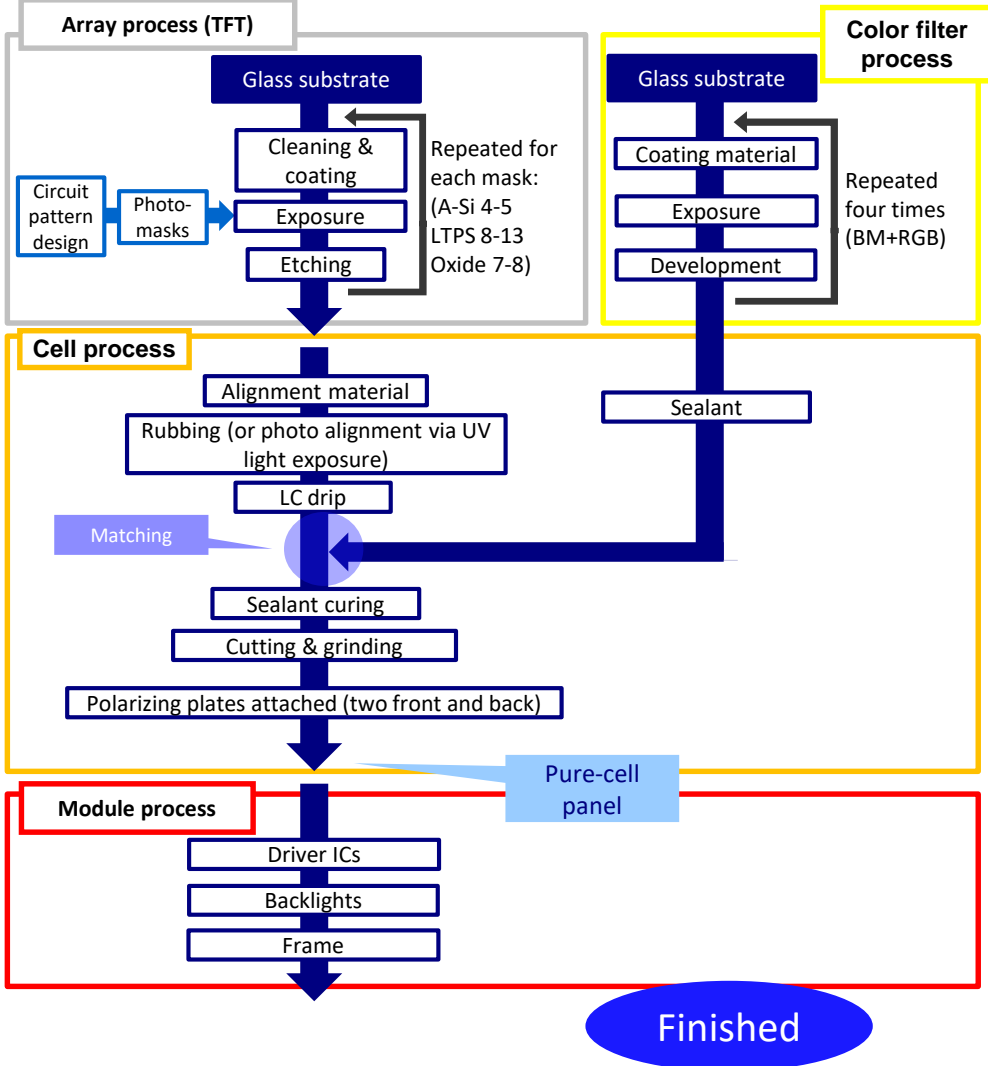


- LCD: Material costs highest, but depreciation surprisingly low.
- OLED: Depreciation high, cost structure like that of semiconductors. Materials costs to decline thanks to higher yields and utilization efficiency, economies of scale. Similar story for R&D and SG&A costs. But able to squeeze the investment and depreciation if the existing LTPS line is diverted.
- Industry impact of shift from LCD to OLED: Most positive for devices, depends on utilization for materials.

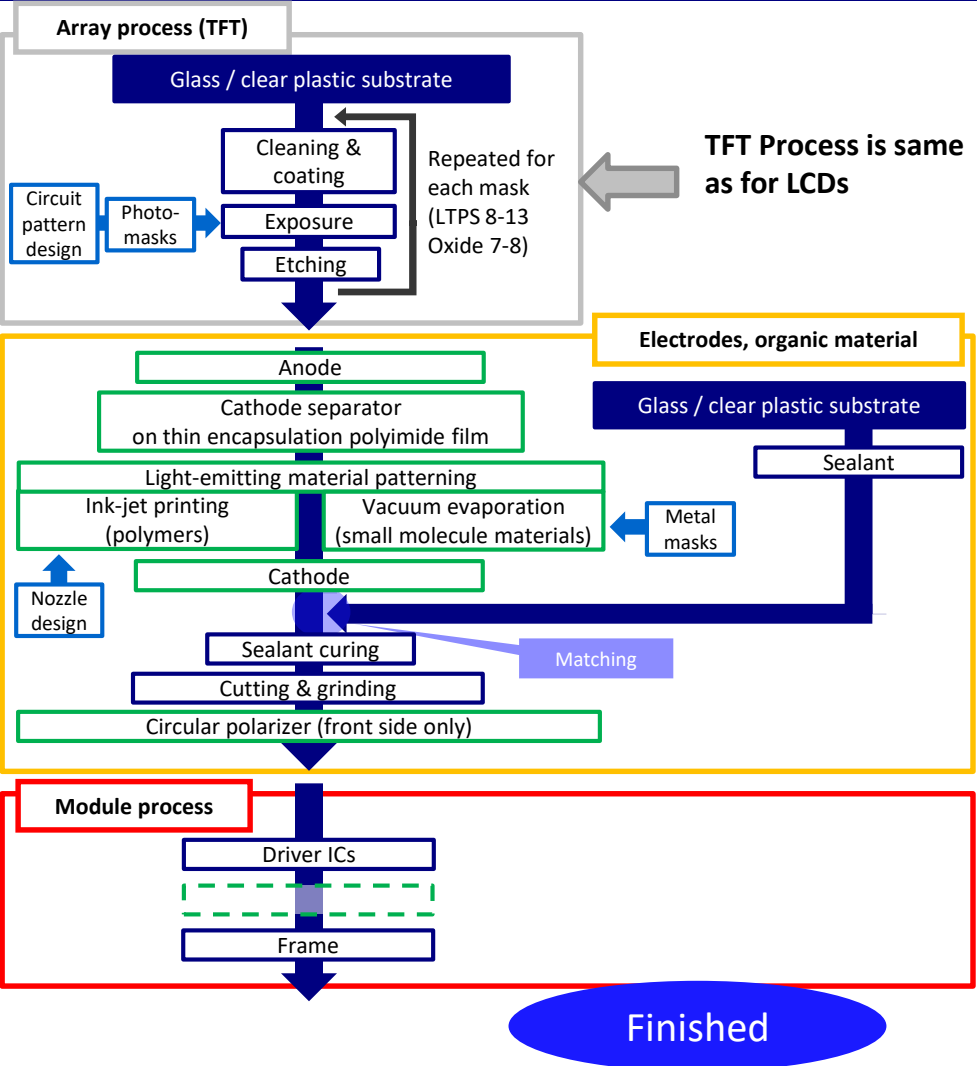
Source: Compiled by Mizuho Securities Equity Research from company data

Comparing the LCD and OLED manufacturing processes

LCD manufacturing process

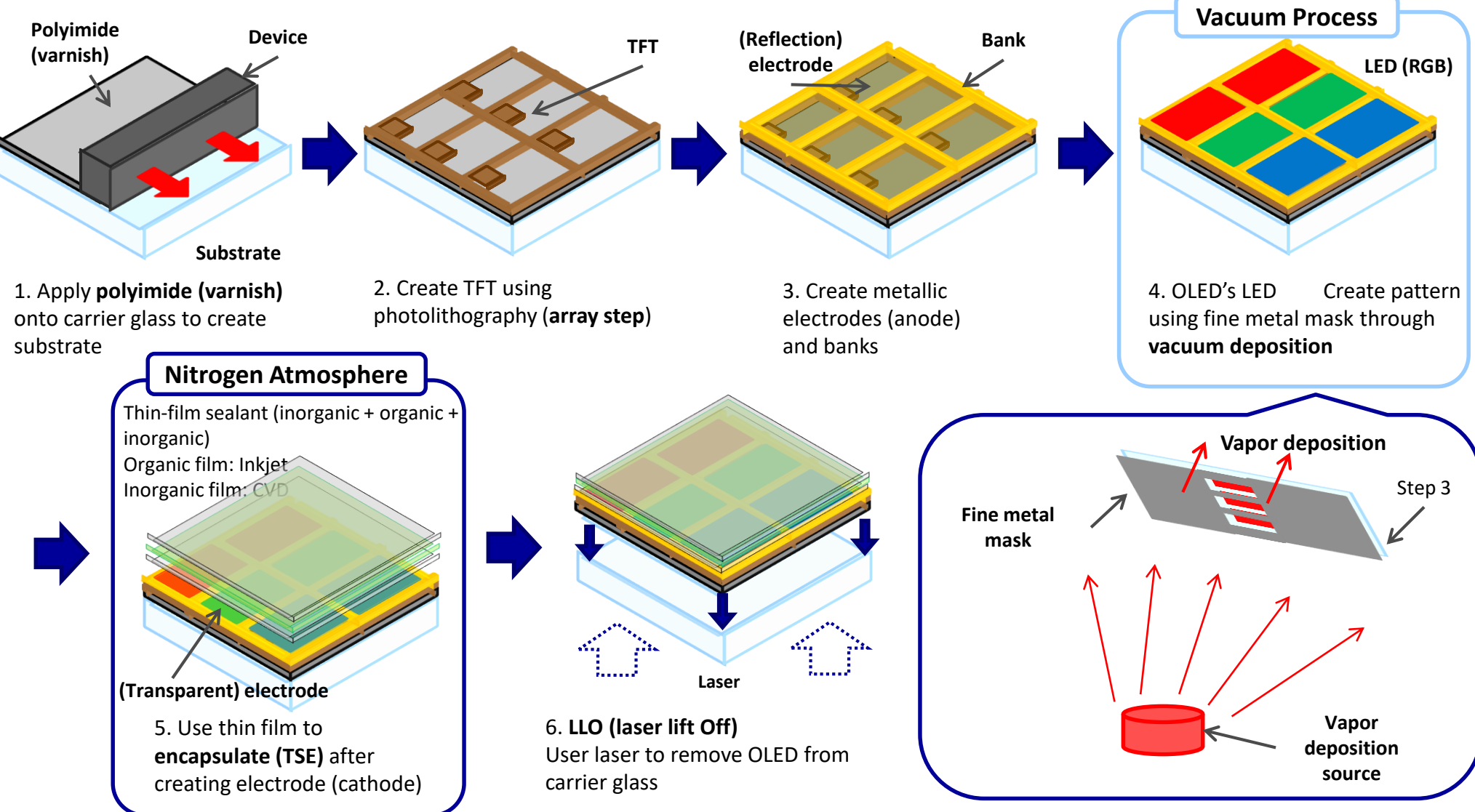


OLED manufacturing process



Source: Mizuho Securities Equity Research

Flexible OLED manufacturing process (RGB coating / top emission)



Source: Mizuho Securities Equity Research

LCD / OLED : Key value chain companies

Only used in LCD

Components / Equipment	Name / parent (Ticker)		
Color filters	Toppan (7911 JT)	Dai Nippon Printing (7912 JT)	
Cell process	JSR (4185 JT)	Komura Tech / Kuroda Electric (7517 JT)	
	Shin-Etsu Engineering / Shin-Etsu Chemical (4063 JT)	Ushio (6925 JT)	
	V Technology (7717 JT)	Shibaura Mechatronics (6590 JT)	Nissan Chemical (4021 JT)
	Ishii Hyoki Co (6336 JT)	Nakan Corp / Helios Techno Holdings (6927 JT)	
Liquid crystal	Merck (MRK GR)	JNC (Chisso) (4006 JT)	DIC (4631 JT)
Backlight	Radiant (6176 TT)	Coretronic (5371 TT)	Hansol technics (004710 KS)
	Omron (6645 JT)	MinebeaMitsumi (6479 JT)	
	Heesung Elec (Private)		
Light guide plate	Chimei Material (4960 TT)	Mitsubishi Chemical (4188 JT)	
	Kuraray (3405 JT)	Sumitomo Chemical (4005 JT)	Asahi Kasei (3407 JT)
LED	Nichia Corp. (Private)	Samsung (005930 KS)	Osram (OSR GR)
	LG Innotek (011070 KS)	Seoul Semi (046890 KS)	Cree (CREE US)
	Everlight (5334 TT)	Epistar (2448 TT)	
	Toyoda Gosei (7282 JT)	Lexter (3698 TT)	

Used in both LCD & OLED (but less volume in OLED vs LCD)

Components / Equipment	Name / parent (Ticker)		
Glass substrate / cover glass	Corning (GLW US)	Nippon Electric Glass (5214 JT)	AGC (5201 JT)
OCA / OCR / bonding material	Kyoritsu Chemical (Private)	Dexerials (4980 JT)	Lintec (7966 JT)
		Hitachi Chemical (4217 JT)	
Polarizer related	Nitto Denko (6988 JT)	Sumitomo Chemical (4005 JT)	LG Chem (051910 KS)
	Sanritz Corp. (Private)	Optimax (3051 TT)	BenQ Materials (8215 TT)
	Chimei Material (4960 TT)	Polatechno(4239 JT)	Cheil / Samsung SDI (006400 KS)
	FUJIMORI KOGYO (7917 JT)	TOYOBO (3101 JT)	
TAC film	Fujifilm (4901 JT)	Konica Minolta (4902 JT)	Hyosung (004800 KS)
	SK Innovation (096770 KS)	TacBright (6434 TT)	
PVA (Poly-vinyl alcohol)	Kuraray (3405 JT)	Mitsubishi Chemical (4188 JT)	

Only used in OLED

Components / Equipment	Name / parent (Ticker)		
Polyimide (flexible substrate)	Ube (4208 JT)	Toray (3402 JT)	Kaneka (4118 JT)
metal masks	Toppan (7911 JT)	Dai Nippon Printing (7912 JT)	Maxell Holdings (6810 JT)
	V Technology (7717 JT)		
Evaporation	Canon Tokki / Canon (Private)	Sunic Sytem (Private)	
	SFA Engineering (056190 KS)	Ulvac (6728 JT)	YAS (Private)
Organic layer	LG Chem (051910 KS)	Idemitsu Kosan (5019 JT)	Dow chemical (DOW US)
	Universal Display (OLED US)	Novaled (Private)	SAES Getters (SG IM)
	Toray (3402 JT)	Hodogaya (4112 JT)	Doosan (000150 KS)
	Duksan (077360 KS)	Nippon Steel Chemical & Material / Nippon Steel (5401 JT)	
Encapsulation	Kateeva (Private)	Wonik IPS (240810 KS)	AP Systems (054620 KS)
	SFA Engineering (056190 KS)	Top Engineering (065130 KS)	
Ink-jet printing	Kateeva (Private)	Panasonic (6752 JP)	
Other equipment	Hirano Tecseed (6245 JT)	Chugai Ro (1964 JT)	

Used in both LCD & OLED (same volume)

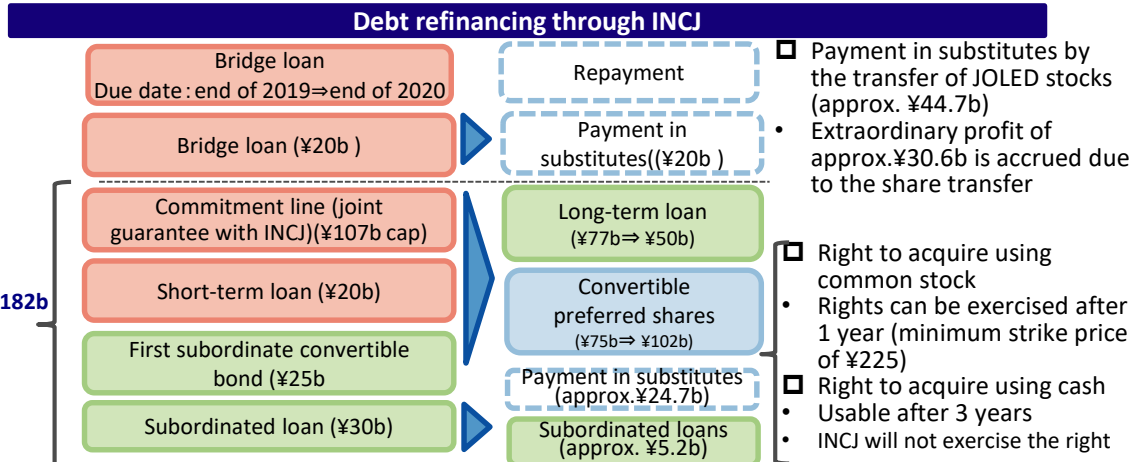
Components / Equipment	Name / parent (Ticker)		
Substrate handler	Hirata (6258 JT)	Daifuku (6383 JT)	Tatsumo(6266 JT)
	NIDEC Sankyo / NIDEC (6594 JT)		Rorze(6323 JT)
Sputtering target (ITO etc.)	JX holdings (5020 JT)	Mitsui Mining & Smelting (5706 JT)	Tosoh (4042 JT)
Photo masks	HOYA (7741 JT)	SK Electronics (6677 JT)	Dai Nippon Printing (7912 JT)
Array process equipment	Nikon (7731 JT)	Canon (7751 JT)	Nisshin (6641 JT)
	V technology (7717 JT)	Screen Holdings (7735 JT)	
	Tokyo Electron (8035 JT)	Orbotech (ORBK US)	AKT (AMAT US) (AMAT)
	Ulvac (6728 JT)	Canon Anelva / Canon (CANONZ.JP)	
	YAC (6298 JT)	Japan Steel Works (5631 JT)	AP Systems (054620 KS)
	Viatron (141000 KS)	Toray Engineering / Toray (3402 JT)	
	TAZMO (6266 JT)		
Other equipment	SEMES/Samsung (005930 KS)	Wonik IPS (240810 KS)	Lasertec (6920 JT)
Optical film (PET / COP etc.)	Toyobo (3101 JT)	Toray (3402 JT)	Zeon Corp. (4205 JT)
	JSR (4185 JT)	Nissha (7915 JT)	Fujimori Kogyo (7917 JT)
Driver IC	Novatek (3034 TT)	Samsung Elec (005930 KS)	Silicon Works (108320 KS)
	Synaptics (SYNA US)	Himax (3222 TT)	Vanguard (5347 TT)
Timing controller	Thine Electronics (6769 JT)	Megachips (6875 JT)	Novatek (3034 TT)
Touch IC	Synaptics (SYNA US)	Goodix (303160 CH)	Focaltech (3545 TT)
	Parade (4966 TT)	Atmel (ATML US)	

Source: Mizuho Securities Equity Research (Tickers from Bloomberg)

Japan Display: Capital injection from Ichigo Trust, debt restructuring from INCJ

- Announced termination of the investment contract with the Suwa Consortium and negotiations with Ichigo Trust on a capital alliance on 8 January
- Announced a capital alliance with Ichigo Trust after the market close on 31 January
- In the case that shares are delivered through the exercise of acquisition rights of Class A/B/D/E preferred shares, the holding ratio is Ichigo Trust: 72.4%, INCJ: 14.2% (currently INCJ: 25.3%).
- Full dilution ratio including Class A, Class B, Class C preferred, Class D and Class E preferred shares at 577%

Capital injection from Ichigo Trust	Class B preferred shares	Stock acquisition rights (Class C preferred shares)	Class D preferred shares	Stock acquisition rights (Class E preferred shares)
Capital to be raised	¥50.4b	Up to ¥50.4b	¥5.0b	Up to ¥55.4b
Total no. of call options	-	672	-	20
Rights exercise period of share option	-	2020/4/1~2023/3/31	-	Phased from 1 Oct 2020
No. of potential shares (common shares)	1.008b	1.008b	0.1b	2.308b
Dilution rate (when potential shares become common shares)	119%	119%	12%	273%
	238%		285%	
Conversion price	¥50	¥50	¥50	¥20→¥24
Voting right	○	×	○	×
How capital will be used (when class B preferred shares/stock acquisition rights[class C] are issued)	1. Working capital: ¥24.9b 2. Capex: ¥25b(¥5.5b on dealing new OLED products, ¥17b on dealing new LCD products for automotive, ¥2.5b on sensor biz and other capex) 3. Others: ¥470m for issuance-related costs			
How capital will be used (when class D preferred shares/stock acquisition rights[class E] are issued)	1. Working capital: ¥4.96b 2. Repayment of debt: ¥55.07b 3. Others: ¥330m for issuance-related costs			
Common stock consideration purchase request (Ichigo-side put options)	Rights exercise period begins one year after issuance			
Purchase provisions (JDI-side call options)	Allows for discretionary exercise			



Potential investors in Ichigo Trust, LLC

	After class B preferred shares and stock acquisition rights are issued	After class C preferred shares are issued (conversion price=¥50)	After class D preferred shares and stock acquisition rights are issued	After class E preferred shares are issued (conversion price=¥24)	
Main customer(Apple)	\$ 200mn (approx. ¥21.5b)	Main customer(Apple)	\$ 200mn (approx. ¥21.5b)	Main customer(Apple)	\$ 200mn (approx. ¥21.5b)
Influential supplier	\$ 50mn (approx. ¥5.4b)	Influential supplier	\$ 50mn (approx. ¥5.4b)	Influential supplier	\$ 50mn (approx. ¥5.4b)
INCJ	¥102b	INCJ	¥102b	INCJ	¥102b
Ichigo Trust	¥50.4b	INCJ	¥102b	Ichigo Trust	¥55.4b
Stock acquisition rights	(¥0)	Ichigo Trust	¥100.8b	Stock acquisition rights	(¥0)
Total	Approx. ¥180b	Total	Approx. ¥230b	Total	Approx. ¥240b

*Calculated @\$1=¥107.34

Source: Mizuho Securities Equity Research from company data

Apple's display strategy: shifting to OLED and expanding life for LCD together

- **Trend toward OLED:** Focus on AAPL support, funding abilities, capacity (securing necessary equipment), IP, and technological capabilities of panel manufacturers.
 - OLED adoption scenario in 2015: Expect OLED in one model (5.85") in 2017 and in all models (5.28"/5.85"/6.46") in 2018. However, 5.28" has been pushed back, and there is an increasing of use in 6.06" LCD (XR).
 - All Apple products to be OLED in 2020: All three devices (5.42"/6.06"/6.67") could be OLED in 2020/2021. LCD may be for only the SE model.
 - Unstable supplies even for Apple?: If LGD, BOE do not start up, could be difficult to secure volume. SDC price cut could also be difficult.
 - LCD extension: Strong prospect of rolling out a 4.7" new model in 1H 2022 and a 5.7" new model in 1H 2023 with Sharp's acquisition of JDI's Hakusan plant as evidence, BOE's OLED ramp-up progress is a key point
 - Adoption technology: FFM, small molecular material / evaporation method (RGB separate application). Canon Tokki vapor deposition and DNP FMM are the de facto standard, but JDI is competing with AKT by vapor deposition developed with Maxell.
- **OLED makers:** transition from dependent on SDC to diversified with LGD, BOE, and JDI
 - Samsung Display (SDC): Production capacity for AAPL (2H 2019): A3 (G6). Samsung: 105K/month. At max capacity, 150m/year possible. In future production capacity will be 70K/M by increasing number of processes by bringing TP in-house (Y-OCTA) and taking in Haptics. It could result in A5 investments.
 - LGD: Paju E6: Potential 30K/month, 45M/year. Started to supply in 2019. The best scenario would be and 25m in 2020 and 45-50m in 2021. Increasing capacity with E6 phase 3/4 investment.
 - BOE: Mianyang B11: 45K/M. Potential 60m/year. B12 (45K) to also mass produce in 2022. Fastest supply launch in 2020 and full-scale expand in 2021.
 - JDI: Mass production starts at Mobara (G6: 2.5k/m) for Flex OLED, Apple Watch panels (1.78"). No plans for iPhone applications. RGB using AKT vapor deposition machines. The bottleneck in mass production is module (currently 800K/M). Investment is needed for expansion. →Mobara's OLED process to expand to module 2M/M.
 - HonHai + SH?: Extremely unlikely at this stage in terms of production capacity and technology.
 - Oversupply: if Hon Hai is included, production capacity would well exceed iPhone demand. Note the development of foldable/rollable (larger size), potential OLED adoption in iPad, MacBook.
 - Potential impact on value chain: AAPL accumulating technical knowhow through collaboration with LGD/BOE/JDI, Taiwanese and Japanese research labs. There is also the potential for funding. Focus on value chain over several years (materials and equipment, specification of manufacturing methods).

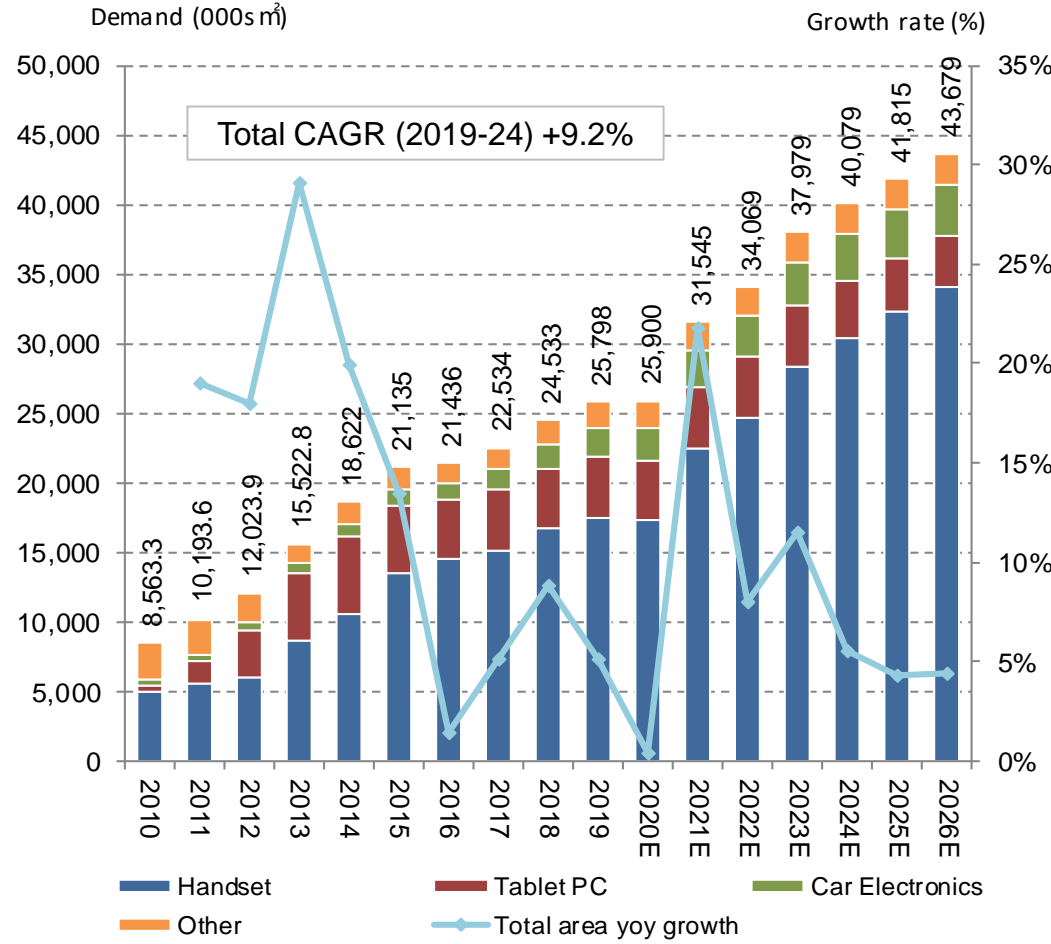
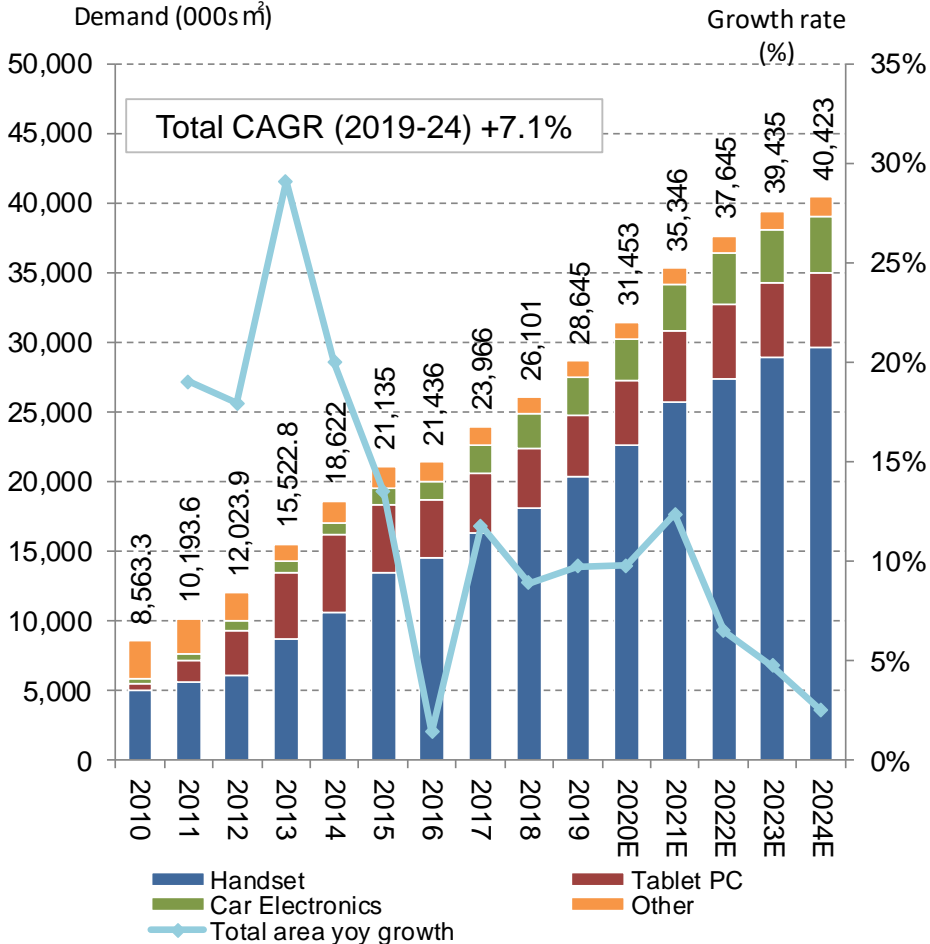
2. Small mid sized panel and its applications

Small/Mid-size Display Demand by Major Application

Demand on a surface area basis

with foldable smartphones not factored into the outlook

with foldable smartphones factored into the outlook

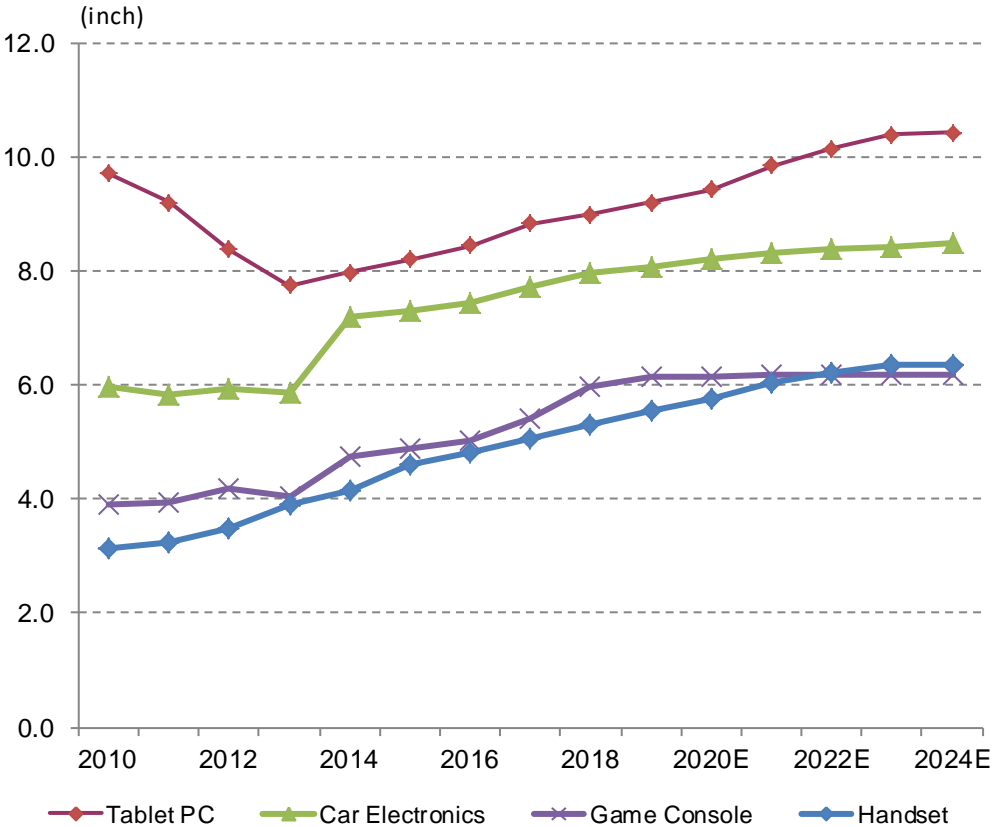


Source: Compiled by Mizuho Securities Equity Research from IHS(DisplaySearch),
 Note: Mizuho Securities forecasts; calculated based on the assumptions that % of all smartphones will be foldable-type products in 2024 and that the average size of foldable smartphones will be 10.5"

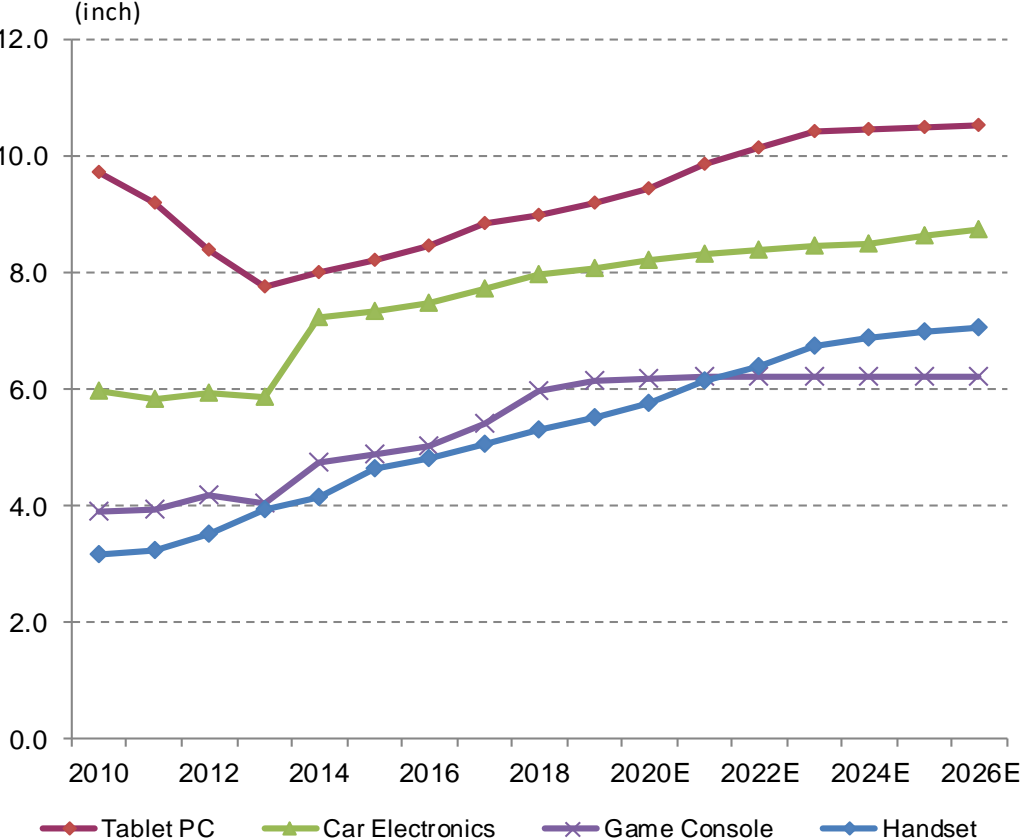
Average Inch Size by Major Application

Average Inch Size

(with foldable smartphones not factored into the outlook)



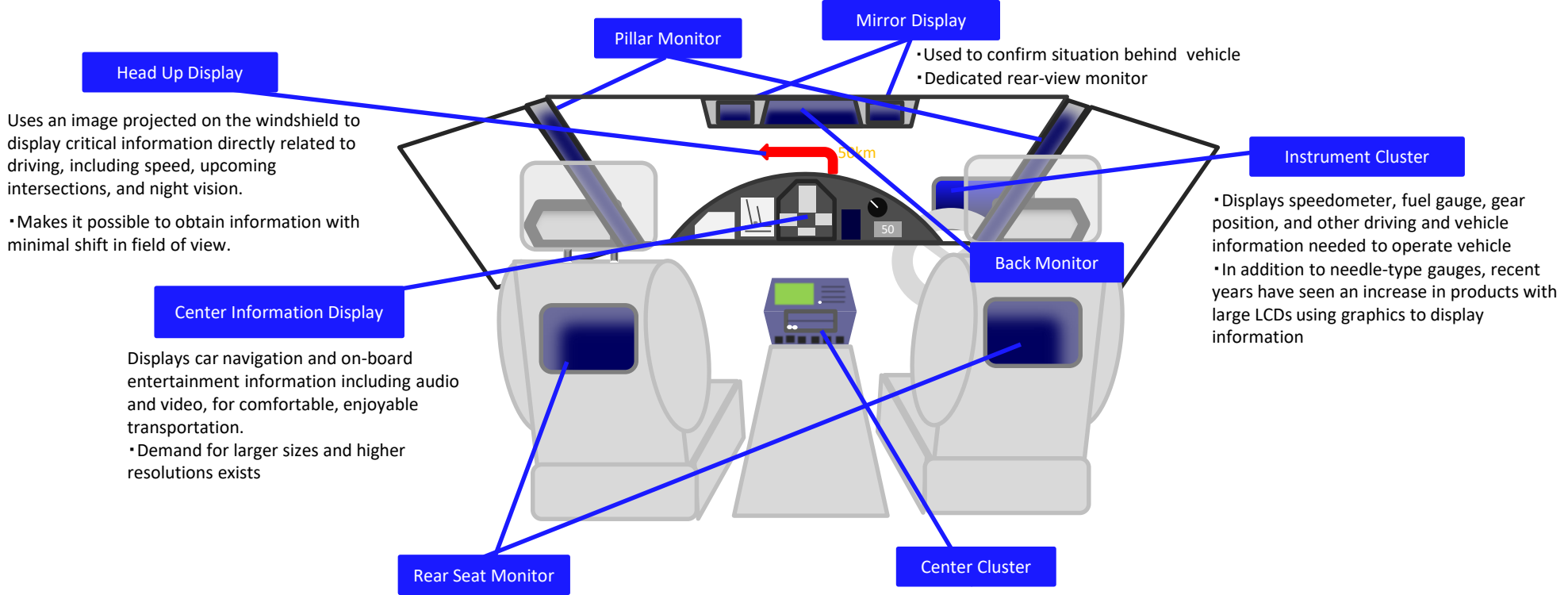
(with foldable smartphones factored into the outlook)



Source: Compiled by Mizuho Securities Equity Research from IHS(DisplaySearch),
 Note: Mizuho Securities forecasts; upside scenario calculated based on the assumptions that 30% of all smartphones will be foldable-type products in 2024 and that the average size of foldable smartphones will be 9.5"

Automotive displays: Increasing types of use and units per vehicle

Display usage shifting from entertainment to rear-view cameras, mirrors and instrument panels.

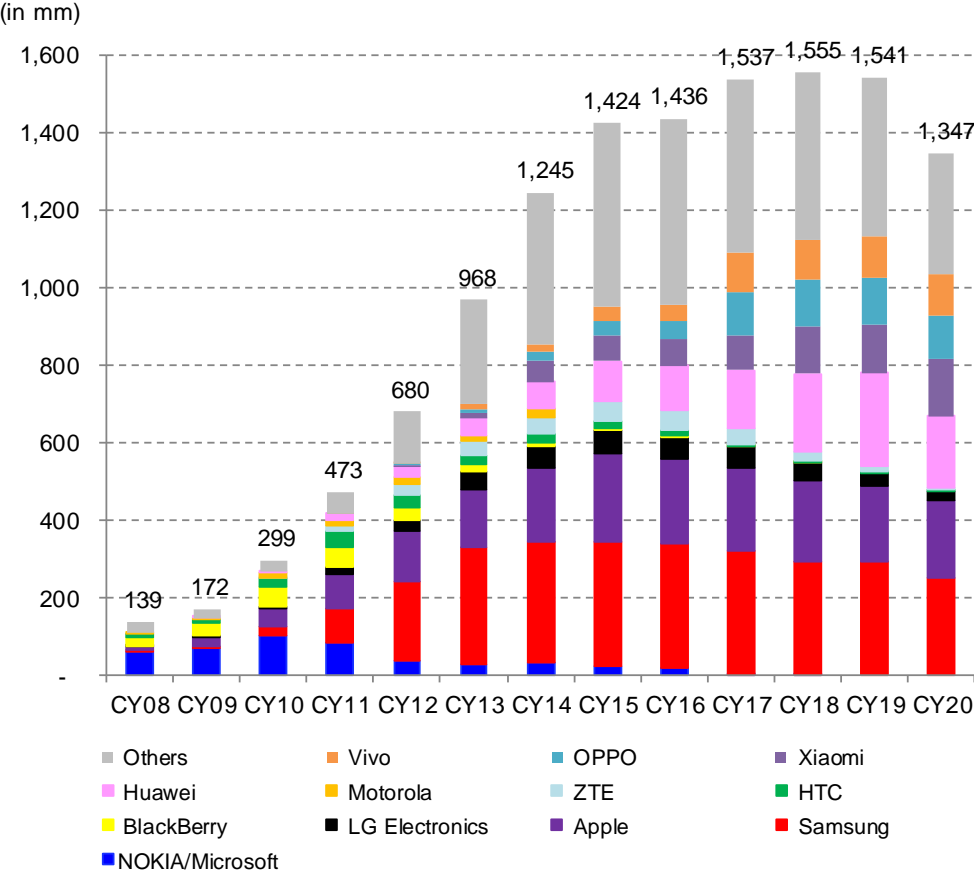


- Larger sizes, power reduction consumption, definition enhancement: use of IPS, Oxide, OLED, mobile (flexible), and mobile in technology aids. High demand for curved, rounded, free form display configurations.
- High quality levels required, including vibration, humidity and heat resistance (for example -40°C to +95°C), as well as wide viewing angle, high luminance (visibility in sunlight/over 1000cd all the time), high contrast, high reliability, high-speed response (for mirrors, requirement to display rear view without delay), antireflection. Significant opportunities for Japanese component manufacturers
- Some obligations on panel manufacturers, such as frequency of low volume and multiproduct production, and need to keep inventory for repairs after vehicle model production ends. High quality requirement means panel prices are significantly higher than for consumer panels.

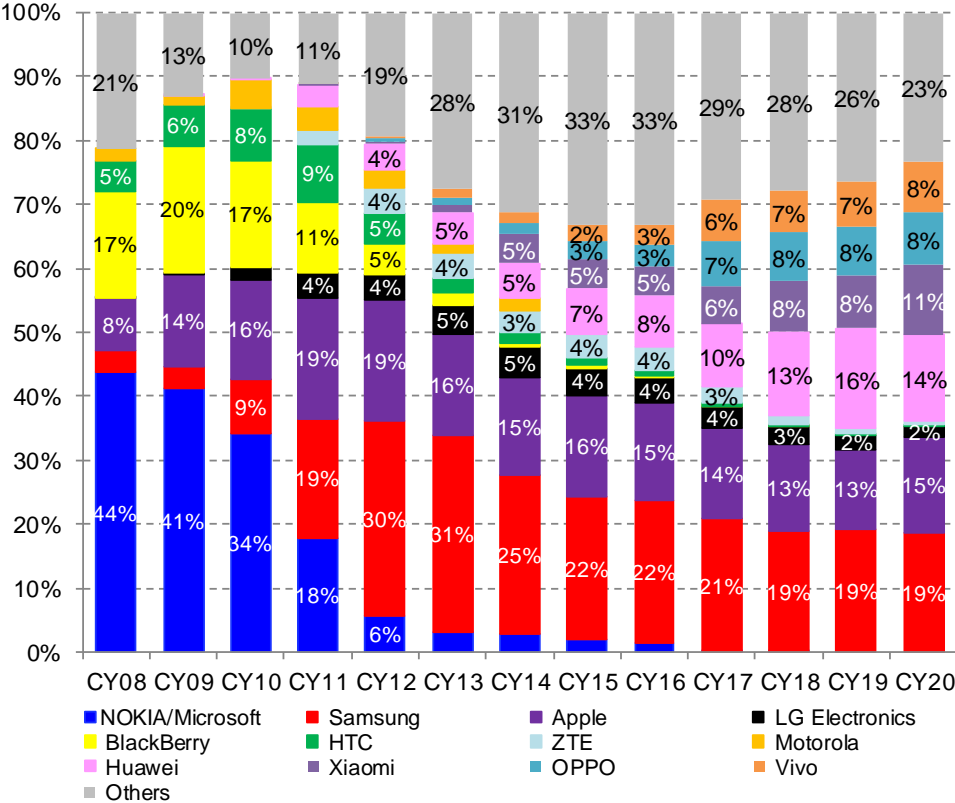
Source: Mizuho Securities Equity Research

Smartphone Shipment by Brand (Annually)

Shipment by Brand



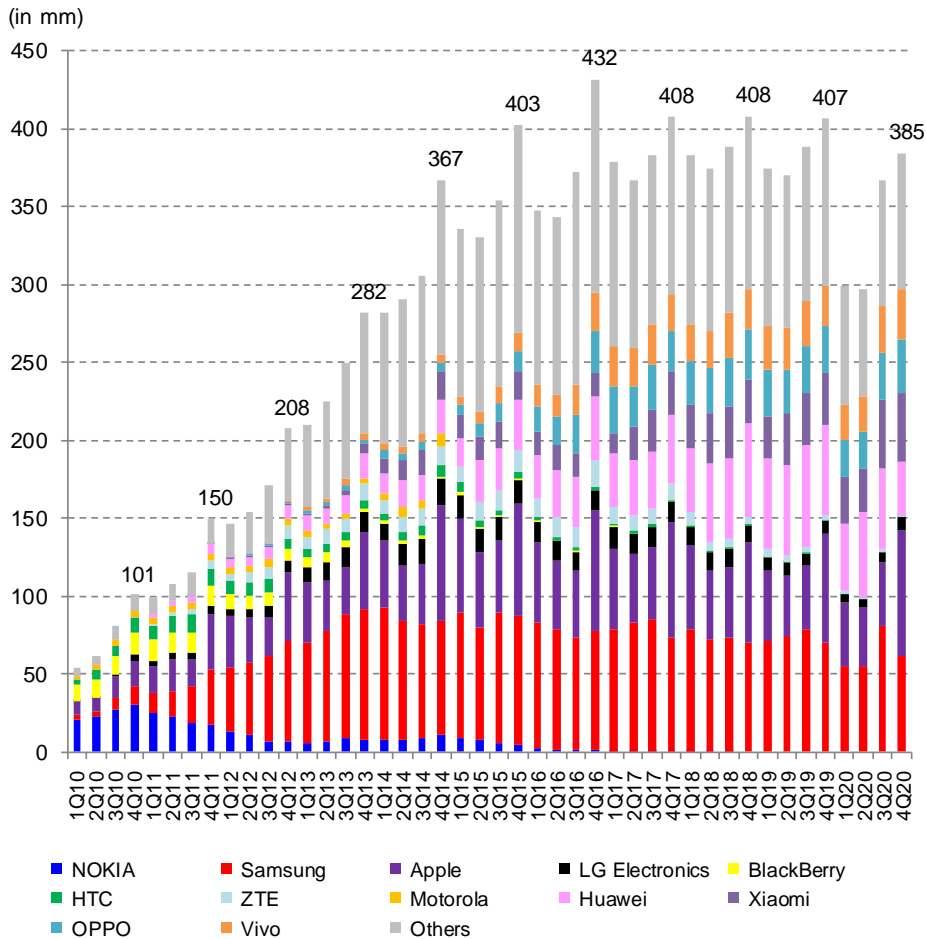
Shipment Share by Brand



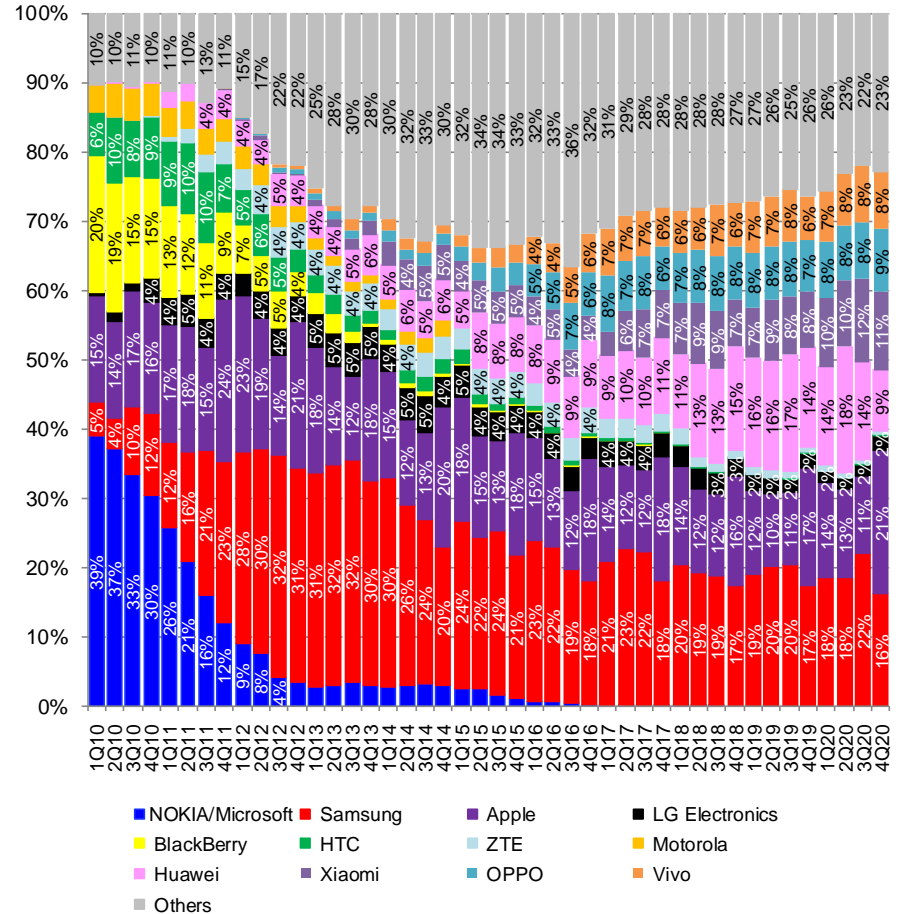
Source: Mizuho Securities Equity Research from Gartner

Smartphone Shipment by Brand (Quarterly)

Shipment by Brand



Shipment Share by Brand



1Q20: 299M (YoY -20.2%, QoQ -26.4%), 2Q20: 297M (YoY -19.8%, QoQ -0.8%), 3Q20: 367M (YoY -5.7%, QoQ +23.5%), 4Q20: 385M (YoY -5.4%, QoQ +4.9%)
 1Q19: 375M (YoY -2.2%, QoQ -8.2%), 2Q19: 370M (YoY -1.1%, QoQ -1.2%), 3Q19: 389M (YoY -0.1%, QoQ +5.0%), 4Q19: 407M (YoY -0.4%, QoQ +4.6%)

Source: Mizuho Securities Equity Research from Gartner

Handset/Smartphone shipment forecast by brand

- 2020: Revised downward twice due to the impact of COVID-19. From +4% to -1% (after factoring in China impact) then to -10% (on lower worldwide demand). Volume strong but high-end business struggling
- 2021 and 2022?: Forecasting a return to cruising speed over two years at 1.40b (up 8%) in 2021 and 1.47b (up 5%) in 2022
- Huawei's movements: High-end business (P/Mate) spun off, middle-end and below sold as Honor. Production volume for new products in 2021: 25m/40m
- Oppo/Vivo/Xiaomi aggressively fill Huawei gaps. Eye on divergence from actual demand and adjustment risk from 2Q FY21
- 2021 total: If forecast figures are correct, volume may overshoot 1400m. But in reality we expect an undershoot in total for Chinese brands and forecast just 1400m.

(M units)

	2011		2012		2013		2014		2015		2016		2017	2018	2019	2020 F Smartphone			Latest forecast	2021F Smartphone Preliminary		
	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Total	Smart-phone	Smart-phone	Smart-phone	Smart-phone	as of Jan2020	After outbreak of COVID-19	before 17-Aug				
Samsung	315	94	400	200	460	300	450	330	400	315	370	310	310	295	295	300	275	255	260	300	Samsung	
Apple	90	90	135	135	155	155	193	193	232	232	215	215	217	208	190	205	205	190	205	230	Apple	
LGE	86	19	58	27	65	44	67	57	70	57	69	52	50	46	36	35	35	28	28	30	LGE	
Sony	33	19	34	34	40	40	38	38	30	30	17	17	13	7	4	4	4	3	3	4	Sony	
Nokia/MS	423	77	340	33	280	27	210	35	150	30	110	10	9	14	11	10	9	7	7	8	Nokia/MS	
HTC	43	44	32	31	20	20	22	22	15	15	10	10	7	3	2	2	2	1	1	1	HTC	
ASUS	0	0	0	0	0	0	8	8	20	20	17	17	12	10	4	4	3	2	2	2	ASUS	
Motorola	40	17	29	16	30	25	34	34	21	21	11	11	27	35	33	30	35	32	32	35	Motorola	
Blackberry	51	51	29	29	20	20	9	9	8	8	5	5	2	2	2	2	2	1	1	1	Blackberry	
Huawei	41	15	55	40	65	45	80	65	102	102	135	135	157	202	240	225	200	180	190	35	Huawei	
Honor																				50	Honor	
Lenovo	16	2	28	16	44	44	65	65	44	44	27	27	17	5	2	1	1	1	1	1	Lenovo	
Xiaomi	n/a	n/a	7	7	18	18	61	61	67	67	60	60	95	120	120	125	117	106	135	195	Xiaomi	
ZTE	57	11	69	25	65	40	65	45	57	47	45	45	45	25	10	12	12	10	10	10	ZTE	
Coolpad	n/a	n/a	n/a	n/a	40	40	44	44	29	29	15	15	9	6	4	0	0	0	0	0	Coolpad	
TCL	34	1	40	10	45	15	50	35	65	45	60	37	30	20	16	20	15	13	13	18	TCL	
Oppo	n/a	n/a	7	7	13	13	28	28	40	40	92	92	115	112	135	135	127	118	143	190	Oppo	
Vivo	n/a	n/a	6	6	12	12	26	26	42	42	73	73	90	92	110	115	103	98	110	160	Vivo	
Transsion	n/a	n/a	4	0	21	0	38	5	46	14	78	17	35	40	43	50	50	50	50	70	Transsion	
Gionee	n/a	n/a	n/a	n/a	18	18	18	15	18	18	27	27	23	12	3	0	0	0	0	0	0	Gionee
LeEco	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4	4	19	19	10	0	0	0	0	0	0	0	0	LeEco
Meizu	n/a	n/a	2	2	3	3	5	5	21	21	18	18	19	12	2	2	2	1	1	1	Meizu	
Others	571	11	575	62	516	161	429	130	440	130	407	218	228	244	178	223	234	199	108	TBD	Others	
Total	1,800	450	1,850	680	1,930	1,040	1,940	1,250	1,920	1,330	1,880	1,430	1,520	1,510	1,440	1,500	1,430	1,295	1,300	1,400	Total	

Target for 2021 ↓
50
100
250
260
180



Source: Mizuho Securities Equity Research

HOVX production: Focus on Honor/Huawei's attitude after short break of O/V/X

*** The Latest Forecasts ***

↑↓: Change from the previous forecasts (m units)

	2016	2017	2018	2019	2020	2018				2019				2020				2021	2021	2021
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1QE	2QE	3QE
Huawei	135	157	202	230	186	37-39	52-54	57-59	50-52	59-61	58-60	63-65	46-48	38-40	56-58	66-68	26-28	16-19	10-14	10-14
Honor																		9-12	12-16	12-16
Oppo	92	115	112	130	151	23-26	30-32	32-34	23-25	26-28	33-35	39-41	33-35	19-21	38-40	42-44	50-52	41-44	45-49	52-56
Vivo	73	90	92	110	120	18-20	23-25	25-27	21-23	25-27	25-27	30-32	26-28	16-18	30-32	32-34	39-41	27-30	35-39	40-44
Xiaomi	60	95	120	120	143	27-29	32-34	34-36	25-27	28-30	30-32	32-34	26-28	19-21	37-39	38-40	45-47	40-43	46-50	55-59
					YoY	13%	30%	23%	-5%	30%	6%	11%	10%	-32%	10%	8%	21%	47%	-4%	-2%
					QoQ	-16%	29%	8%	-19%	15%	6%	12%	-20%	-29%	72%	10%	-10%	-14%	12%	13%

Total change from the previous fcsts 7↑ 6↑ 16.5↑

*** Forecasts as of Oct.2020 ***

	2016	2017	2018	2019	2020				2021
					1Q	2Q	3QE	4QE	1QE
Huawei	135	157	202	230	38-40	53-55	62-64	23-25	10-15
Oppo	92	115	112	130	19-21	30-32	40-42	46-50	42-46
Vivo	73	90	92	110	16-18	26-28	30-32	38-43	33-38
Xiaomi	60	95	120	120	19-21	28-30	32-34	45-49	40-45
				YoY	-32%	-6%	0%	18%	40%
				QoQ	-29%	47%	19%	-5%	-16%

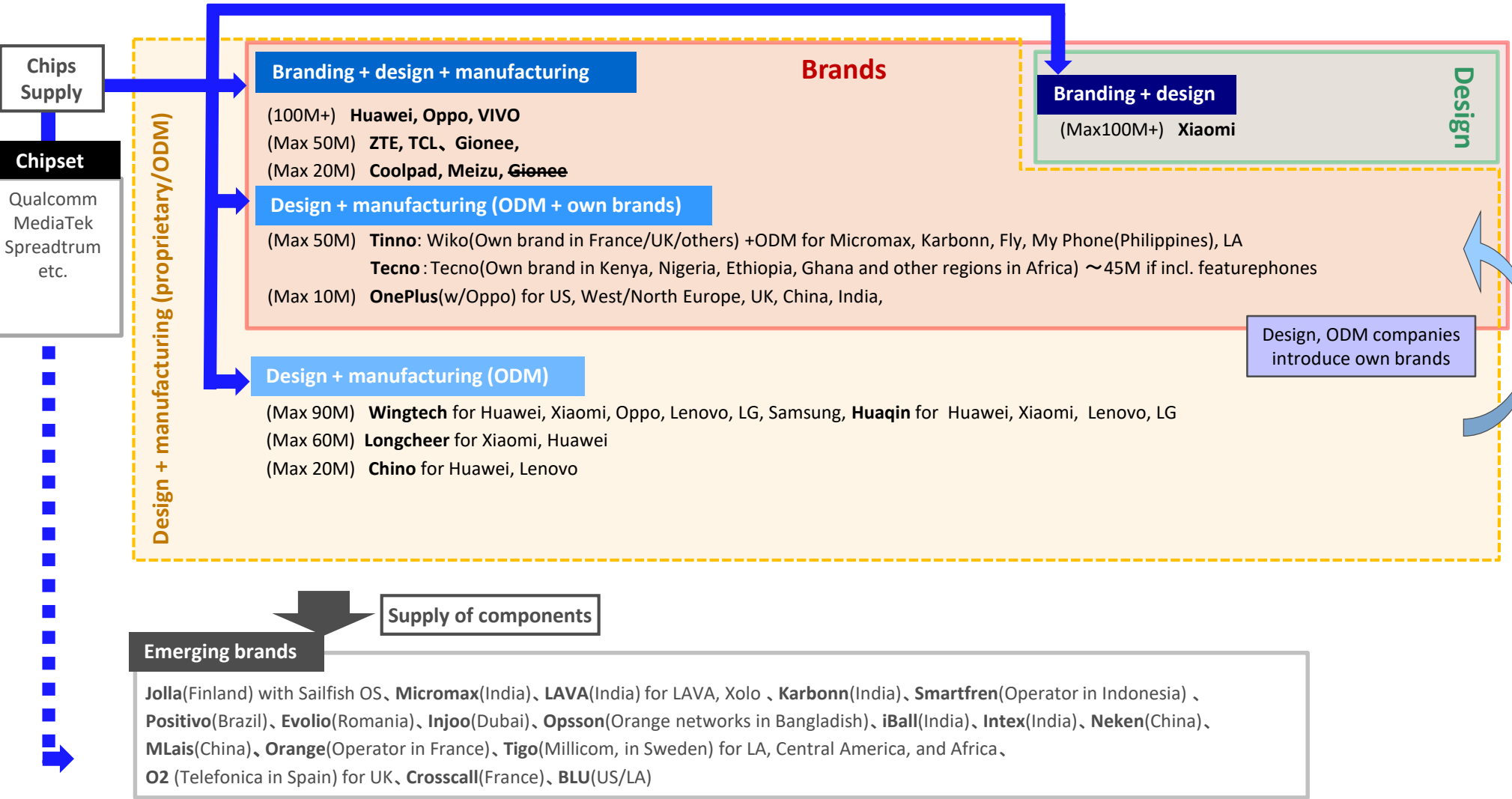
19.5↑ 21.5↑



3Q CY20 : Huawei bringing production forward to 3Q due to sanctions. O/V/X to increase production and fill in gaps. Production to outweigh sales.
 4Q CY20 : Huawei to produce some high-end and ODM models only. O/V/X to further accelerate production.
 1Q CY21 : O/V/X to continue procurement. Huawei focus on 4G due to regulation. Honor to start.
 2Q-3Q CY21 : O/V/X to accelerate production, but short break of parts procurement? How act Huawei and Honor?

Note: Actual figures are estimated by Mizuho Securities.
 Source: Mizuho Securities Equity Research

Conceptual overview of Chinese smartphone sector: brands and ODM to consolidate at majors



Source: Mizuho Securities Equity Research

Focus area for smartphone brands: camera/3D sensing/exterior

■ Improving camera functionality: after compact DSC, SLR? → Huawei is leading

- Multiple lenses for rear cameras: The combination of main camera with high definition/wide and the 2nd/3rd camera with ultra wide angle lens and zoom lens is popular. Three lenses to become the standard.
- Functional improvements: Increase main camera sensor size to 1/1.2", zoom to 10x with periscope. Next step is to further enhance moving image functions.
- Front camera: enhanced self portrait functions, high definition CMOS sensor, multiple camera lenses. Cameras are becoming smaller in shift to full screen.

→ Will benefit CMOS sensors, lenses, actuators, module assembly, and related devices.

■ 3D sensing module (the 4th camera): could produce new commercial opportunities. → Apple is leading

- Face ID: iPhoneX adopted in front camera for face recognition, adopted across all models in 2018.
- Android: Huawei and Samsung actively using from 2019. It is used for Apple only at this point, expectation from 2021 on.
- 2020: iPhone Adopting ToF on rear side. Anticipate new product opportunities in AR, games, e-commerce, maps.
- Market likely to expand swiftly from 2020, after likely being adopted by Apple's rear cameras.

→ Will benefit lasers, illuminators, lenses, infrared sensors, and related devices.

■ Exterior: balance between aesthetics and usability. Full screen, foldables, notches, and punch-hole. → Samsung Electronics is leading

- Notch: iPhone X adopts the notch, increased display size without increasing body. Useful for games, multi-tasking, shopping.
- Punch-hole: increases display ratio compared to notch, popular from 2019. Samsung is actively using.
- How to go full-screen?: ultra narrow frames and corresponding COF, remove button and place fingerprint/face recognition on bottom of display
- Foldables: Samsung Display will start mass production. Outward fold models in future in addition to inward fold models Tablet and smartphone in one device.
- Body: glass and stainless frame for iPhone. What next?
- OLED: thin and light, necessary for foldable models and print/face recognition at bottom of display

→ Will benefit OLED and foldables-related value chain, COF, TDDI, print/finger recognition at bottom of display, body and related materials and devices

5G smartphone forecasts by major brands: Chinese Sub6 models to be driver, 2022 5G weighting to top 50%, delayed inroads of mmW-device

As of Jan.26, 2021

5G smartphone shipments	2019	2020	2021E	2022E	2023E
Apple	0	75	159	190	205
Samsung	7	29	70	140	180
Huawei(Shanghai P/Mate+Part of Xi'An)	6	65	25	47	67
Honor	0	0	35	50	70
Xiaomi	1	20	80	105	135
OPPO	1	24	90	120	150
VIVO	1	25	80	105	135
Others	1	7	27	40	68
Total	17	245	566	797	1,010
% of adoption rate	1%	19%	40%	55%	67%

SoC & modem forecast	2019	2020	2021E	2022E	2023E
Apple	0	85	175	207	223
Apple - QCOM modem	0	85	175	207	223
Qualcomm - excl. Apple	9	61	199	276	354
HiSilicon	7	57	25	29	41
MediaTek	2	45	160	245	340
Samsung	2	24	60	106	140
Spreadtrum	0	0	5	15	25
Total	20	272	624	878	1,124

Breakdown

5G smartphone - Sub-6Ghz only	2019	2020	2021E	2022E	2023E
Apple	0	51	107	124	125
Samsung	5	21	50	94	108
Huawei(Shanghai P/Mate+Part of Xi'An)	6	65	25	47	65
Honor	0	0	35	50	68
Xiaomi	1	20	80	105	128
OPPO	1	24	90	120	143
VIVO	1	25	80	105	128
Others	1	7	27	38	64
Total	15	213	494	682	829
Sub-6Ghz % of 5G	90%	87%	87%	86%	82%

(M units)

5G smartphone - mmWave	2019	2020	2021E	2022E	2023E
Apple	0	24	52	67	80
Samsung	2	8	20	46	72
Huawei(Shanghai P/Mate+Part of Xi'An)	0	0	0	0	2
Honor	0	0	0	0	2
Xiaomi	0	0	0	0	7
OPPO	0	0	0	0	8
VIVO	0	0	0	0	7
Others	0	0	0	2	4
Total	2	32	72	115	181
mmWave % of 5G	10%	13%	13%	14%	18%

[Current view] Including former Huawei (base operations in Shanghai/Xi'an and new entity Honor). We assume Shanghai base (P/Mate) will be independent and launch new products in 2H.

- (1) Market continues to expand rapidly led by Chinese Sub6 models, 5G-device will be nearly 70% of all sales volume in 2023, but we expect full mmW-device uptake to be from 2023.
- (2) Sub6 risks: Difficult to fill the Huawei vacuum in base stations and network equipment if Huawei doesn't return; depleting inventories in 2021? How about after that?
- (3) Milliwave models: AAPL at 100% for the US market though the outlook from 2021 is unclear; what happens if US carriers (Verizon, etc.) deploy Sub6?
- (4) Milliwave risks: Possibility of delayed inroads in the US, Soth Korea, and Japan; urgent need to establish the B2B business model
- (5) Smartphone brands: AAPL and Chinese firms are proactive, Samsung is cautious

Note: Actual figure are estimated by Mizuho Securities.

Source: Mizuho Securities Equity Research

5G smartphone in China (3 carriers' price packages and service area)

Carrier		Package plan							Outside package			
Same 5G network	China Mobile (中国移动)	Monthly fee	89 RMB	108 RMB	198 RMB		298 RMB	398 RMB	598 RMB	Additional 3 RMB per GB 0.15 RMB per min.		
		5G data capacity	30 GB	40 GB	60 GB		100 GB	150 GB	300 GB			
		Call duration	200 min.	600 min.	1000 min.		1500 min.	2000 min.	3000 min.			
	China Unicom (中国联通)	Monthly fee	90 RMB	111 RMB	139 RMB	239 RMB	299 RMB	399 RMB	599 RMB	Additional 3 RMB per GB 0.15 RMB per min.		
		5G data capacity	30 GB	40 GB	60 GB	80 GB	100 GB	150 GB	300 GB			
		Call duration	500 min.	700 min.	1000 min.	1000 min.	1500 min.	2000 min.	3000 min.			
	China Telecom (中国电信)	Monthly fee	103 RMB	129 RMB	199 RMB	239 RMB	299 RMB	399 RMB	599 RMB	Additional 3 RMB per GB 0.15 RMB per min.		
		5G data capacity	30 GB	40 GB	60 GB	80 GB	100 GB	150 GB	300 GB			
		Call duration	500 min.	800 min.	1000 min.	1000 min.	1500 min.	2000 min.	3000 min.			
	China Mobile (中国移动)	China Unicom (中国联通)	China Telecom (中国电信)		China Mobile (中国移动)	China Unicom (中国联通)	China Telecom (中国电信)		China Mobile (中国移动)	China Unicom (中国联通)	China Telecom (中国电信)	
1 Beijing (北京)	○	○	○	21 Nanjing (南京)	○	○	○	41 Yinchuan (银川)	○	○	○	
2 Shanghai (上海)	○	○	○	22 Nanchang (南昌)	○	○	○	42 Changsha (长沙)	○	○	○	
3 Tianjin (天津)	○	○	○	23 Nanning (南宁)	○	○	○	43 Changchun (长春)	○	○	○	
4 Chongqing (重庆)	○	○	○	24 Wuhan (武汉)	○	○	○	44 Yingtian (鹰潭)	○	○	○	
5 Shenzhen (深圳)	○	○	○	25 Fuzhou (福州)	○	○	○	45 Qionghai (琼海)	○	○	○	
6 Wenzhou (温州)	○	○	○	26 Liuzhou (柳州)	○	○	○	46 Wuhu (芜湖)	○	○	○	
7 Jiaxing (嘉兴)	○	○	○	27 Xiong'an (雄安)	○	○	○	47 Zhuzhou (株洲)	○	○	○	
8 Hohhot (呼和浩特)	○	○	○	28 Fushan (佛山)	○	○	○	48 Jincheng (晋城)	○	○	○	
9 Hangzhou (杭州)	○	○	○	29 Xiamen (厦门)	○	○	○	49 Nanyang (南阳)	○	○	○	
10 Hefei (合肥)	○	○	○	30 Harbin (哈尔滨)	○	○	○	50 Haikou (海口)	○	○	○	
11 Kunming (昆明)	○	○	○	31 Guangzhou (广州)	○	○	○	51 Zhuhai (珠海)	○	○	○	
12 Chengdu (成都)	○	○	○	32 Wuxi (无锡)	○	○	○	52 Changzhou (常州)	○	○	○	
13 Xi'an (西安)	○	○	○	33 Dongguan (东莞)	○	○	○	53 Zhongshan (中山)	○	○	○	
14 Xining (西宁)	○	○	○	34 Urumqi (乌鲁木齐)	○	○	○	54 Nantong (南通)	○	○	○	
15 Qingdao (青岛)	○	○	○	35 Lanzhou (兰州)	○	○	○	55 Shaoxing (绍兴)	○	○	○	
16 Shijiazhuang (石家庄)	○	○	○	36 Ningbo (宁波)	○	○	○	56 Jinhua (金华)	○	○	○	
17 Quanzhou (泉州)	○	○	○	37 Jinan (济南)	○	○	○	57 Mianyang (绵阳)	○	○	○	
18 Taiyuan (太原)	○	○	○	38 Suzhou (苏州)	○	○	○					
19 Dalian (大连)	○	○	○	39 Guiyang (贵阳)	○	○	○					
20 Shenyang (沈阳)	○	○	○	40 Zhengzhou (郑州)	○	○	○					

Note: Joint maintenance and operation by China Telecom and China Unicom. ○: maintained by Nov.2019, ○: maintain by 2020

Source: Mizuho Securities Equity Research

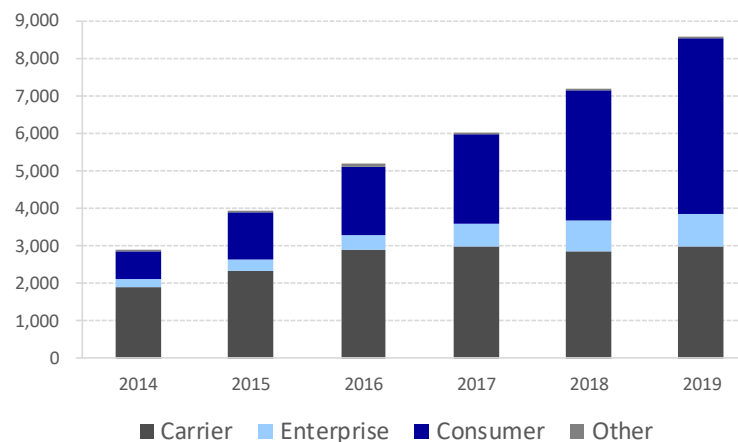
Huawei Technologies: Company Outline

Finance Outlook

	2014 (RMBm)	2015 (RMBm)	2016 (RMBm)	2017 (RMBm)	2018 (RMBm)	2019 (RMBm) (USDm)	
Sales	288,197	395,009	521,574	603,621	721,202	858,833	122,972
OP	34,205	45,786	47,515	56,384	73,287	77,835	11,145
OPM	11.9%	11.6%	9.1%	9.3%	10.2%	9.1%	9.1%
NP	27,866	36,910	37,052	47,455	59,345	62,656	8,971
CF from operation activities	41,755	52,100	49,218	96,336	74,659	91,384	13,085
Cash & cash equiv. /short-term investments	106,036	125,208	145,653	199,943	265,857	371,040	53,127
Working capital	78,566	89,019	116,231	118,503	170,864	257,638	36,890
Total assets	309,773	372,155	443,634	505,225	665,792	858,661	122,947
Total debt balance	28,108	28,986	44,799	39,925	69,941	112,162	16,060
Own capital	99,985	119,069	140,133	175,616	233,065	295,537	42,316
Debt ratio	67.7%	68.0%	68.4%	65.2%	65.0%	65.6%	65.6%

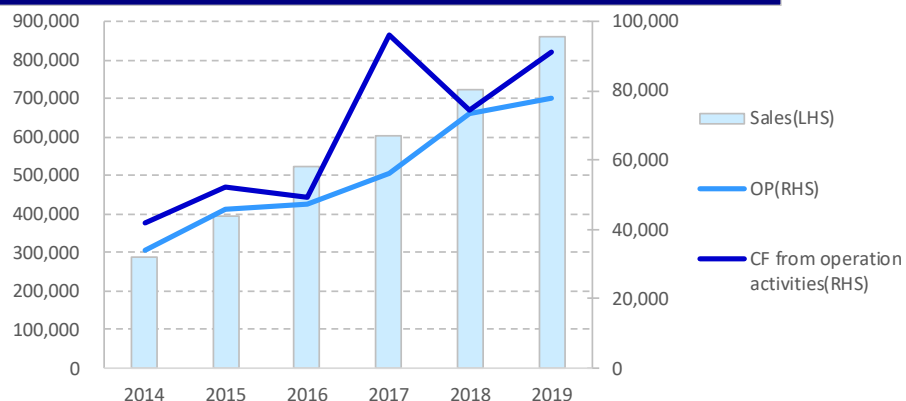
Solid finance, Abundant CF

Sales by business (CNYb)



BtoC: just over 50%
BtoB: Just under 50%

Sales, OP and Operating cash flow

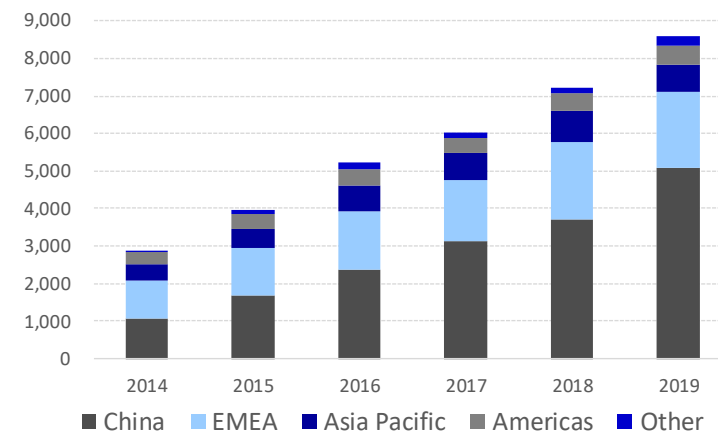


2019: Sales RMB858.8b(+19%)、NP RMB62.7b(NPM7.3%)

Consumer business incl. smartphones: Sales RMB467.3b, Smartphone shipments over 240M(YOY+16%)

Source: Mizuho Securities Equity Research from company data

Sales by region (CNYb)



China: 60%,
Other region: 20%,
Less sales in Europe

Overview of Huawei smartphones

Technological strength in hardware/software; leading Chinese brands supported by in-house AP development

High-end

Low-end

	Ascend Mate	Ascend D2	Ascend Mate 2	Ascend Mate 7	Huawei Mate S	Huawei Mate 8	Huawei Mate 9	Huawei Mate 10	Huawei Mate 20/20 Pro	Huawei Mate X (Foldable)	Huawei Mate 30/30 Pro	Huawei Mate Xs (Foldable)	Huawei Mate X2 (Foldable)
Display	TFT 6.1 inch 1280x720 (241ppi)	TFT 5.0 inch 1920x1080 (441ppi)	TFT 6.1 inch 1280x720 (241ppi)	TFT 6.0 inch 1920x1080 (367ppi)	AM-OLED 5.5 inch 1920x1080 (401ppi)	TFT 6.0 inch 1920x1080 (368ppi)	TFT 5.9 inch 1920x1080 (373ppi)	TFT 5.9 inch 2560x1440 (499ppi)	OLED 6.53/6.39 inch 3120x1440(538ppi) 2244x1080(381ppi)	OLED 8.0 inch(Open) 2480x2220 (414ppi)	OLED 6.53/6.62 inch 2400x1176(409ppi) 2340x1080(402ppi)	OLED 8.0 inch(Open) 2480x2220 (414ppi)	OLED 6.45(Front)/ 8.0(Open) inch 2700x1160/ 2480x2220 (456/413ppi)
CPU	Quad-core / 1.5GHz Hi3620	Quad-core 1.5GHz Hi3620	Quad-core 1.6GHz MSM8928	Octa-core 1.8&1.3GHz Kirin 925	Octa-core 2.2&1.5GHz Kirin 935	Octa-core / 2.3&1.8GHz Kirin 950	Octa-core / 2.4&1.8GHz Kirin 960	Octa-core / 2.4&1.8GHz Kirin 970	Octa-core 2.6&1.92&1.8GHz Kirin 980	Octa-core 2.6&1.92&1.8GHz Kirin 980	Octa-core 2.86&2.36&1.95GHz Kirin 990	Octa-core 2.86&2.36&1.95GHz Kirin 990 5G	Octa-core 3.13&2.54&2.05GHz Kirin 9000
					Ascend P8 max; phablet								
	Ascend P2	Ascend P6/P6 S	Ascend P7	P8 / P8 max	P9/P9 Plus	P10/P10 Plus	P20/P20 Pro	P30/P30 Pro	P40/P40 Pro P40 Pro+				
Display	TFT 4.7 inch 1280x720 (312ppi)	TFT 4.7 inch 1280x720 (312ppi)	TFT 5.0 inch 1920x1080 (441ppi)	TFT 5.2 / 6.8 inch 1920x1080 (424 / 324 ppi)	TFT 5.2/5.5 inch 1920x1080 (423/401ppi)	TFT 5.1/5.5 inch 1920x1080(432ppi) 2560x1440(540ppi)	TFT/OLED 5.8/6.1 inch 2240x1080(429ppi) 2240x1080(408ppi)	OLED 6.1/6.47 inch 2340x1080(398ppi) 2340x1080(422ppi)	OLED 6.1/6.58 inch 2340x1080(422ppi) 2640x1200(441ppi)				
CPU	Quad-core 1.5GHz Hi K3V2	Quad-core 1.5(1.6)GHz Hi3620/Kirin 910	Quad-core 1.8GHz Kirin 910T	Octa-core 2.0(2.2)&1.5GHz Kirin 930 / 935	Octa-core 2.5&1.8GHz Kirin 955	Octa-core/ 2.4&1.8GHz Kirin 960	Octa-core/ 2.4&1.8GHz Kirin 970	Octa-core 2.6&1.92&1.8GHz Kirin 980	Octa-core 2.86&2.36&1.95GHz Kirin 990 5G				
	Honor 2	Honor 3	Honor 6 / 6 Plus	Honor 7 / 7X	Honor 8	Honor 8 Pro	Honor 9	Honor 10					
Display	TFT 4.5 inch 1280x720(326ppi)	TFT 4.7 inch 1280x720(312ppi)	TFT 5.0 / 5.5 Inch 1920x1080 (441/401ppi)	TFT 5.2 / 5.93 Inch 1920x1080(423ppi) 2160x1080(407ppi)	TFT 5.2 Inch 1920x1080 (423ppi)	TFT 5.7 Inch 2560x1440 (515ppi)	TFT 5.15 Inch 1920x1080 (428ppi)	TFT 5.84 Inch 2280x1080 (432ppi)					
CPU	Quad-core / 1.4GHz Hi K3V2	Quad-core / 1.5GHz Hi K3V2	Octa-core / 1.8&1.3GHz Kirin 920 / 925	Octa-core / 2.2&1.5/2.36&1.7GHz Kirin 935 / 659	Octa-core / 2.3&1.8GHz Kirin 950	Octa-core / 2.4&1.8GHz Kirin 960	Octa-core / 2.4&1.8GHz Kirin 960	Octa-core / 2.4&1.8GHz Kirin 970					
	Ascend G500	Ascend G615	Ascend G700	Ascend G6	Ascend G7	Huawei G8	Huawei G9 Plus						
Display	TFT 4.3 inch 960x540 (256ppi)	TFT 4.5 inch 1280x720 (326ppi)	TFT 5.0inch 1280x720 (294ppi)	TFT 4.5inch 960x540(245ppi)	TFT 5.5inch 1280x720(267ppi)	TFT 5.5inch 1920x1080(401ppi)	TFT 5.5inch 1920x1080(401ppi)						
CPU	Single-core / 1.0GHz MT6575	Quad-core / 1.4GHz Hi3620?	Quad-core / 1.2GHz MT6589	Quad-core / 1.2GHz MSM8926	Quad-core / 1.2GHz MSM8926	Octa-core / 1.5&1.2GHz MSM8939	Octa-core / 2.0GHz MSM8953						
	Ascend W1	Ascend W2											
Display	TFT 4.0inch 800x480(233ppi)	TFT 4.3inch 800x480(217ppi)											
CPU	Dual-core / 1.2GHz MSM8230	Dual-core / 1.4GHz MSM8230											
	Ascend Y	Ascend Y210D	Ascend Y300	Ascend Y511	Ascend Y600	Huawei Y6	Huawei Y7						
Display	TFT 3.5inch 480x320(165ppi)	TFT 3.5inch 480x320(165ppi)	TFT 4.0inch 800x480(233ppi)	TFT 4.5inch 854x480(218ppi)	TFT 5.0inch 854x480(196ppi)	TFT 5.0inch 1280x720(294ppi)	TFT 5.5inch 1280x720(267ppi)						
CPU	Single-core / 0.8GHz MSM7625A	Single-core / 1.0GHz MSM7225A	Dual-core / 1.0GHz MSM8225	Dual-core / 1.3GHz MT6572	Dual-core / 1.3GHz MT6572	Quad-core / 1.1GHz MSM8909	Octa-core / 1.4GHz MSM8940						

From flagship model to low-end

- ◆ Mate series: High end, flagship model
- ◆ P series: High end, emphasis on design, slimness
- ◆ Honor series: Mid end to low end
 - ✓ For China and emerging markets; online sales only
- ◆ G series: Mid end
 - ✓ Mostly mid-end, high-end models also on market
- ◆ Y series: Low end
 - (*W indicates smartphone with Windows 8)

Flagship model: Huawei P40 Pro+

- ◆ Front camera: dual lenses of 32MP and Depth Camera
- ◆ Rear camera: quintuple lenses of 40MP (wide), 50MP(Ultra wide), 8MP (telephoto) , 8MP (telephoto) , 8MP (telephoto) , ToF (optical proximity sensor)
- ✓ Leica camera
- ✓ Up to 20x hybrid zoom
- ✓ Up to 100x digital zoom
- ◆ Utilizing AI
 - ✓ Uses AI to select best photo from multiple photos
 - ✓ People or objects can be removed from background
 - ✓ Reflections in glass or other reflective background objects can be removed
- ◆ Other features
 - ✓ In-screen fingerprint verification
 - ✓ Battery capacity of 4200mAh
 - ✓ 5G compatible, IP68 water resistance
 - ✓ Allows swiping, screenshots using gestures

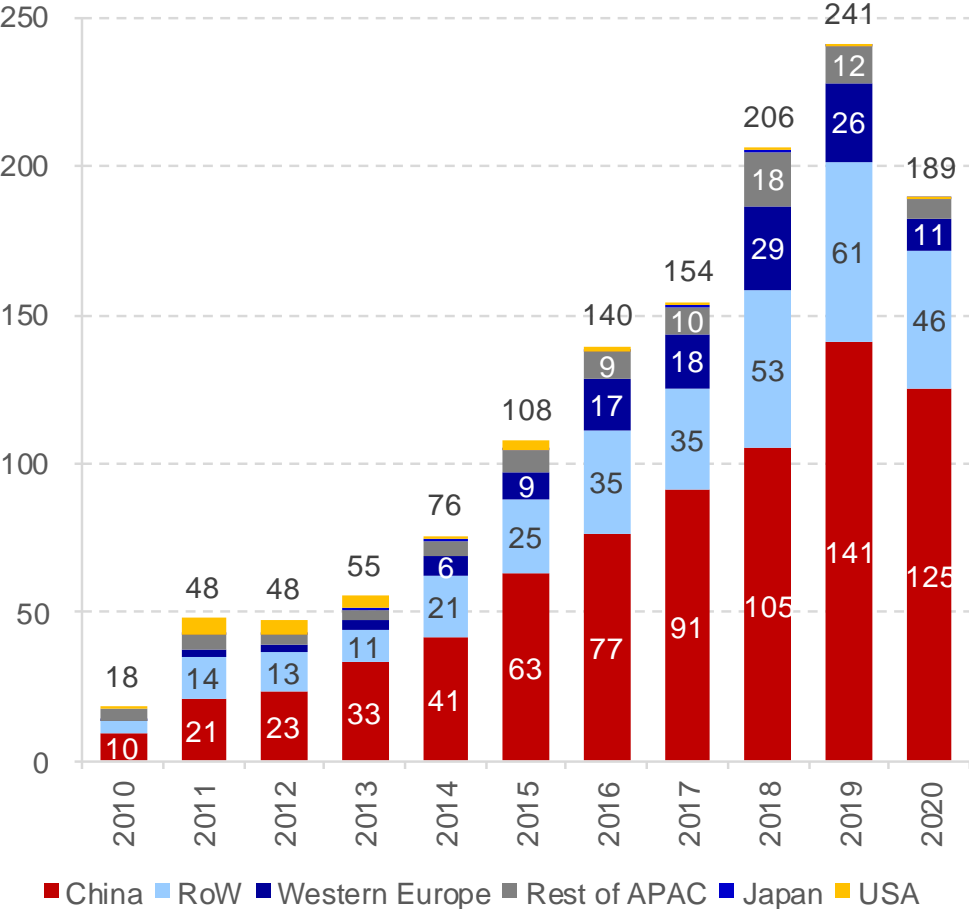
Unique UI: Emotion UI - EMUI

- ◆ Eliminates the "home screen" and "apps list" unique to Android, and instead features a "Uni Home" that displays all downloaded apps on the screen
- ◆ Includes a profile function that facilitates complete customization of settings, etc.
- ◆ Targeted at: High-end models

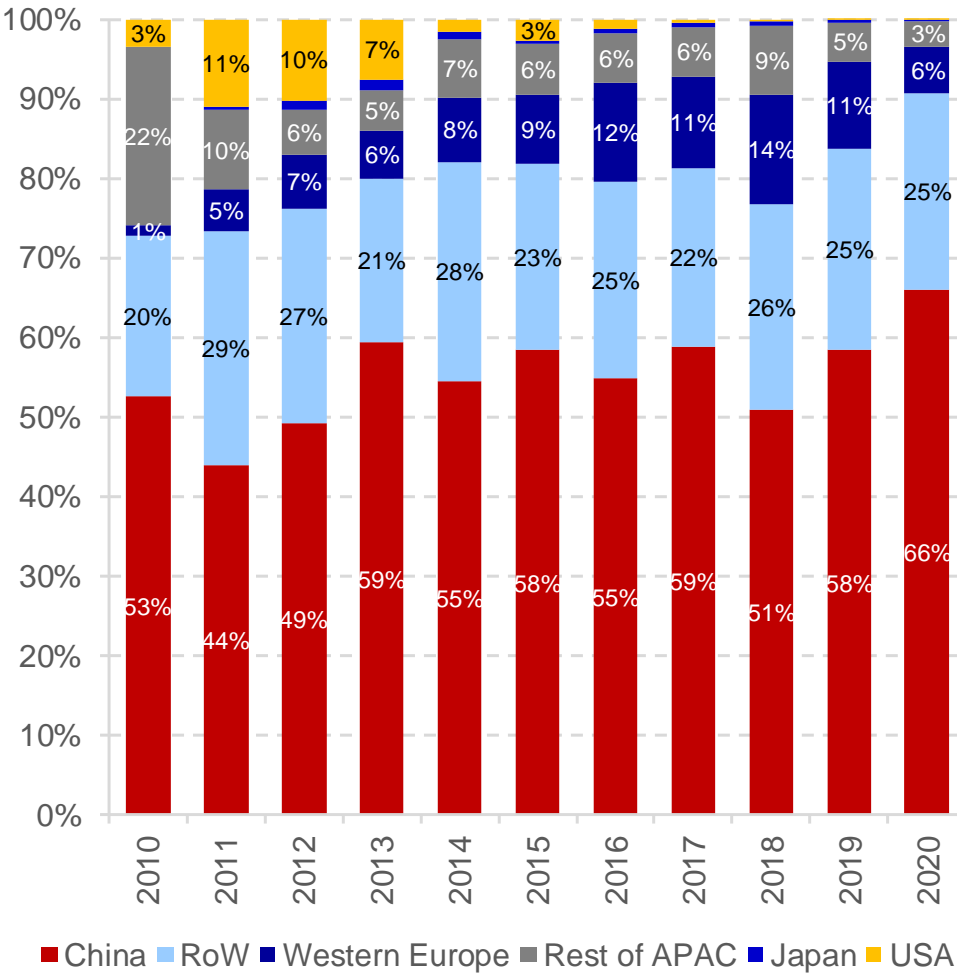
Source: Mizuho Securities Equity Research from company data

Huawei Technologies: Company Outline: smartphone shipment

Huawei (+Honor) shipment volume by region (m units)



Huawei (+Honor) shipment volume by region (%)



Source: Mizuho Securities Equity Research from IDC

Huawei landing on US Entity List: Impact on smartphone business(before 15 May)

■ **Results:** FY12/19 at \$123.0b in sales, \$11.1b in OP, \$9.0b in NP, and 34% capital ratio

- Businesses: Consumer (handsets), telecom carrier networks (base stations, etc.), and corporate solutions
- Consumer handsets): About ¥7.2t in sales(+34% YoY) from smartphones, tablets, watches, NB computers, TCVs, etc.

■ **Entity List:** Maximum US-derived added value: Export not allowed if ratio exceeds 25%; exports of critical parts/software also banned.

- Major US suppliers: Smartphones – Qualcomm, Skyworks, Qorvo, ADI, On Semi, and Cypress. Networks – Xilinx, Intel, Marvell, etc. Semiconductor design – Cadence, Synopsys, ARM (UK), etc. OS – Google. Suspended provision after entering Entity List, but slowly reopening shipments since except Google, RF and FPGA. The buffer period had been extended, but it ended on Aug.13th. Unable to update Android OS for the existing products.

■ **Impact and countermeasures:** Accelerating production of semiconductors and App. HiSilicon is thriving outstandingly.

- 2020 plan: Smartphone output volume declined from 210-250m units to around 180m due to COVID-19. Depending on revival of GMS and the recovery from COVID-19; resumed NB activities after suspending development and production.
- Basic strategy: Protect high-end (P/Mate) business and sacrifice mid-range and low-end business; raise market share in China and focus on emerging countries in overseas business
- Important areas: OS/Apps (switch from Google to proprietary Huawei Mobile Services/Apps) - Likely to be fine in China, but faces hurdles in overseas markets. ARM – Developing the V8 revised version with a permanent license. Semiconductor design – Likely to avoid near-term impacts because contracts with Cadence and others are two years or longer. RF – moving toward in-house production and the sourcing of materials from Japan.
- TSMC (HiSilicon foundry): Currently pledging support and no impact on production

■ **US gov't hardline stance:** targeting foundries? → Became a reality on 15 May

- Upper limit of ??US VAT: Currently 25%, but what if lowered to 10? Prove challenging for TSMC to handle → Postponed
- What if semiconductor manufacturers that supply products to the company are required to acquire a license to use US equipment? → Reality

Huawei: US announces new trade sanctions on 15 May

■ **New sanctions (15 May):** targets semiconductors designed by Huawei, produced by Foundry

- **Details:** Applicable to semiconductors designed by Huawei (HiSilicon). Producer Foundry must acquire US software (incl. EDA) and production equipment usage licenses from US Dept of Commerce.
- Grace period: 120 days (until 14 September). Items in “Production Step” as of 15 May are safe.

■ **HiSilicon:** Huawei Group’s fabless/asset-light semiconductor design firm. Global top 10.

- HiSilicon: Designs semiconductors for smartphones, servers, base stations, outsources production to TSMC (~5nm) and some to SMIC (~14nm).
- Strategy: Full collaboration with Huawei. Ideas embedded in-house in core semiconductors (AP etc.), and finished products are differentiated by AI, algorithms, etc.
- Top 10 in 1Q 2020 (IC Insights): Enters global top 10 at \$2.7b (YOY+54%). 7000+ employees. Top-tier design ability.
- Main products: Kirin (SP-AP/5-7nm), Balong (SP-5G Modem/7nm), Kunpeng (SV-CPU/7nm) Ascend (AI/7-12nm)
- TSMC: 17% of 2020 sales. Large client accounting for 22% of 7nm, 6% of 5nm. Kirin middle-end for SMIC 14nm.

■ **Impact:** Challenges from 2021. Pathway to utilization of existing components. Differentiation for high-end field and personnel retention is key.

- Inventory sufficient for rest of year: Huawei’s end-2019 inventory: CNY167.4b (+73% YoY), CoGS 3.7 months (+1.1 month) of CoGS (up 1.1 month)
- Resolved by 14 Sep?: Governmental issue: eye on China’s counter moves and negotiation talks with the US
- Transfer to SMIC?: Plans up to 7nm but not easy; technology or SMIC itself could enter US Entity List.
- **External procurements?: May use Mediatek’s AP etc. How to implement into Huawei ideas and differentiate?**
- High-end challenges: Difficult to introduce functions ahead of other firms, risk of development stagnation. Eye on movement of development personnel.
- **Collaborations with ex-UK Europe: Possible in software, APP fields.**

Huawei: US Dept of Commerce announces additional sanctions on 17 Aug

- **New sanctions (17 August): Huawei suppliers will also need to acquire licenses**
 - **Even if Huawei is the purchaser, suppliers using US-based technology or manufacturing equipment must acquire licenses from the Department of Commerce**
- **Impact: From 15 September most semiconductors will be unpurchaseable without a license. Ripple effect will go beyond semiconductors.**
 - **Procurement challenges: Almost all areas, including Taiwanese IC design products, memory, logic, CMOS sensors, analog.**
 - **Outside of semiconductors: Components and parts that use US-based technology, including camera lenses.**
 - **Huawei's reaction: Requests additional provisions and licenses from major suppliers before the deadline**
 - **Smartphone business in 2020:190m output, 50m max in 2021, beyond that depends on procurements and ODM.**
 - **Suspend development?: Release Mate40 with limited volume (below 7m), limited volume for one P50 model? Recover with Mate50?**
 - **Stagnation risk for high-end smartphones: Others will struggle to fill gap left by Huawei; wait for Huawei recovery**
 - **Infrastructure: If base station/network equipment production is suspended (from 2022 onwards taking stock into consideration), China 5G will be affected.**
- **Will licenses be issued?: US/China talks could make breakthrough, but hard to see a compromise**
 - **Challenges: Depts of Commerce, Dept of Defense are enactors while party/military are behind the measures**
 - **What about PCs?: Intel/AMD approved but only past products? US intentions are unclear.**
 - **Approval for smartphone-related?: Approval began to appear around October 22nd → 5G wiped out → only 4G seems to be OK?**
 - **US semiconductor sector: Organizations express their surprise and concern**
 - **Any movement will come after US new government post is confirmed: Possible stalling until around February. Is compromise possible?**

Huawei in 2021: Fight for survival of smartphone business (before 17 Aug)

■ External sourcing of AP (Application Processor): secure volume with in-house AP stock + outside procurement

- Candidates: **Mediatek (MTK) is leading candidate**; Qualcomm, Samsung and Spreadtrum are also possibilities.
- Target models: MTK already supplies the Xi'an models (low end); its chips may also be used in the Shanghai (high end) and Beijing (middle end) models as well.
- How much collaboration is possible?: Utilization of IP likely difficult; it is also a race against time.
- What about KIRIN (proprietary AP)?: Remaining inventory as of 12 Sep will be used in some flagship models.

■ What will happen?: Decline in volume, weaker presence in high-end segment, temporary lull in roadmap

- **Volume decline (170m-180m at most; 140m-150m at worst): Domestic focus (TAM: 340m-400m, M/S: 45%-50%);** overseas, some emerging markets and online sales; in 2021, saved by high probability of positive YoY growth (around 10%) in the Chinese market.
- Hard to differentiate in the high-end segment: Must collaborate with suppliers of AP, other key components.
- **How to differentiate?:** Still likely to be on **appearance, camera, APP, and AI functionality.**
- Development team challenged: Must be compatible with Huawei's + other firms' (multiple) AP; camera and other spec upgrades may be stalled for up to a year.
- **1H 2021 is critical: Substantial impact from volume decline, mix deterioration, and roadmap stagnation.**
- **Resurgence from 2H 2021:** Over 6 months to a year, will likely reassess strategies from planning and development through sales, and aim to restore high-end presence with Mate 50 from 2H. If not ready, might aim for 1H 2022 with the P60.
- High-spec components in low/middle-end models: Shanghai models' cameras, displays, etc. may be used in Beijing models also. However, NAND capacity would probably be restricted. **High probability of selective investment in unique/innovative features.**
- **HR retention is key:** Will mid-level developers/engineers remain at Huawei → at this juncture we think the probability is high.

Huawei in 2021: Fight for survival of smartphone business (After 18 August)

- **US allowed companies to supply Huawei with components:** only for non-5G businesses; 5G approval essential for business to survive.
- **Will smartphone business survive?:** If the US targets semiconductors (HiSilicon) and 5G infrastructure (base stations, NW facilities)...
 - Possible relaunch as a separate company (introducing non-Chinese capital, listing in the US, etc.) → Flagship model (Shanghai: P/Mate)
 - Selling a business to another Chinese company: Honor (Beijing: middle-end) to a second-tier brand or channel for a relaunch?
 - → Both scenarios are feasible, but risks remain for the buyer since everything depends on the US's interpretation

Also...

- **On 17 Nov, Huawei announced it would sell Honor to Shenzhen Zhixin New Information Technology, which was formed by Huawei's distributors**
 - Huawei will sell all assets related to Honor and have no stake or involvement in Honor afterward
 - Honor's brand value: specs, cost effectiveness, status as a Huawei company. The former seems worth fighting for.
 - 3,000 developers may move (all of Beijing and almost half of Xi'an).
 - Realistically, Honor likely to work on current development projects for now and on new development projects when the new company is formed. Production volume may be around 60m max in 2021. New company likely to mainly focus on Chinese market and gradually strengthen international business
 - Utilize ODM? +30m–40m possible if low-end models introduced using Xi'an team + ODM
 - US response is unknown but Qualcomm should be safe and is key for Huawei's future in Shanghai (P/Mate).
 - Value chain: Procurement yet to fully start. Demand for parts may exceed actual demand → possible corrections.

Huawei landing on US Entity List : HiSilicon sales trend and major products

Global top semi companies – revenue

1Q20 rank	Company	Sales (USDm)										YoY (%)		
		1Q18	2Q18	1Q19	2Q19	1Q20	1H18	2H18	1H19	2H19	2018	2019	1Q20/1Q19	2019/2018
1	Intel			15,799	16,239	19,508	32,585		32,038	35,716	66,290	67,754	23%	2%
2	Samsung			12,867	13,804	14,797	39,765		26,671	25,520	73,708	52,191	15%	-29%
3	TSMC			7,096	7,749	10,319	16,312		14,845	19,440	34,631	34,285	45%	-1%
4	SK Hynix			6,023	5,535	6,039	17,754		11,558	10,739	36,240	22,297	0%	-38%
5	Micron			5,465	4,710	4,795	15,478		10,175	10,079	29,742	20,254	-12%	-32%
6	Broadcom			4,183	4,163	4,110	9,020		8,346	6,976	16,261	15,322	-2%	-6%
7	Qualcomm			3,753	3,536	4,050	7,984		7,289	6,324	15,375	13,613	8%	-11%
8	TI			3,199	3,685	3,164	7,346		6,884	6,480	14,592	13,364	-1%	-8%
9	Nvidia			2,215	2,459	3,035	6,259		4,674	2,657	8,073	7,331	37%	-9%
10	HiSilicon	1,245	1,555	1,735	1,765	2,670	2,790	3,235	3,500	4,238	6,035	7,738	54%	28%
na	ST						4,464		4,231		9,579	9,451		-1%
na	NXP						4,559		4,311		9,022	8,758		-3%
na	Sony						3,389		3,845		6,465	8,536		32%
na	Infineon						4,581		4,517		8,748	8,471		-3%
na	MediaTek						3,728		3,691		7,890	7,959		1%
na	Kioxia						7,717		5,643		8,533	7,827		-8%
	Total (ex TSMC)						167,419		137,373					

HiSilicon – major in-house ICs for Huawei

Smartphone SoC Kirin (ARMv8-A) TSMC 7/5nm	Server processor Kunpeng (ARMv8-A) TSMC 7nm	AI processor Ascend (ARMv8-A) TSMC 7nm/12nm
5G Modem Balong (smartphone) TSMC 7nm	5G BTS ASIC Tiangang (BTS) TSMC 7nm	WiFi processor Linghsiao (ARMv8-A)
Others DVR SoC TV decoding		NB-IoT processor Boudica (ARM-M)

Source: Mizuho Securities Equity Research from IC Insight, Gartne

Huawei landing on US Entity List : estimated TSMC sales to HiSilicon/Huawei

TSMC: Sales to HiSilicon on major products, 2019-2020

	2019		2020		YoY (%)
	Sales (USDm)	% of TSMC sales	Sales (USDm)	% of TSMC sales	
Smartphone - SoC (Kirin)					
- 12/16nm	864	3%	67	0%	-92%
- 7nm	1,285	4%	1,960	5%	53%
- 5nm	0	0%	306	1%	
Smartphone - modem/RF transceiver					
- 12/16nm	690	2%	828	2%	20%
- 7nm	50	0%	268	1%	436%
Server/AI processor					
- 12/16nm	50	0%	250	1%	400%
- 7/5nm	135	0%	525	1%	289%
Networking processor / BTS ASIC					
- 12nm and above	1,000	3%	1,550	4%	55%
Consumer (WiFi, NB-IoT, STB)					
- 12nm and above	700	2%	980	2%	40%
Total	4,775	14%	6,734	17%	41%
Breakdown by applications					
- smartphone		8%		9%	
- HPC		3%		6%	
- consumer		2%		2%	
Breakdown by node					
- 12nm and above		10%		9%	
- 7nm and below		4%		8%	
					2020
Total wafer shipment (k)					
- 7nm					273
(as % of TSMC's N7 effective capacity)					22%
- 5nm					25
(as % of TSMC's N5 effective capacity)					6%

Source: Mizuho Securities Equity Research

Huawei: Shipment volume forecast by device (Divided into Honor and Huawei in 2021)

Shipment in 2019 and breakdown by device: 240M (Sales:145m in China, 95m overseas)

- Shanghai (P/Mate: flagship devices) : 60m
- Beijing (middle-end phones such as Honor/Nova): 85m
- Xi'an (middle/low-end phones, ODM devices): 95m

Shipment in 2020: 240m down to 190m due to COVID-19/US sanction

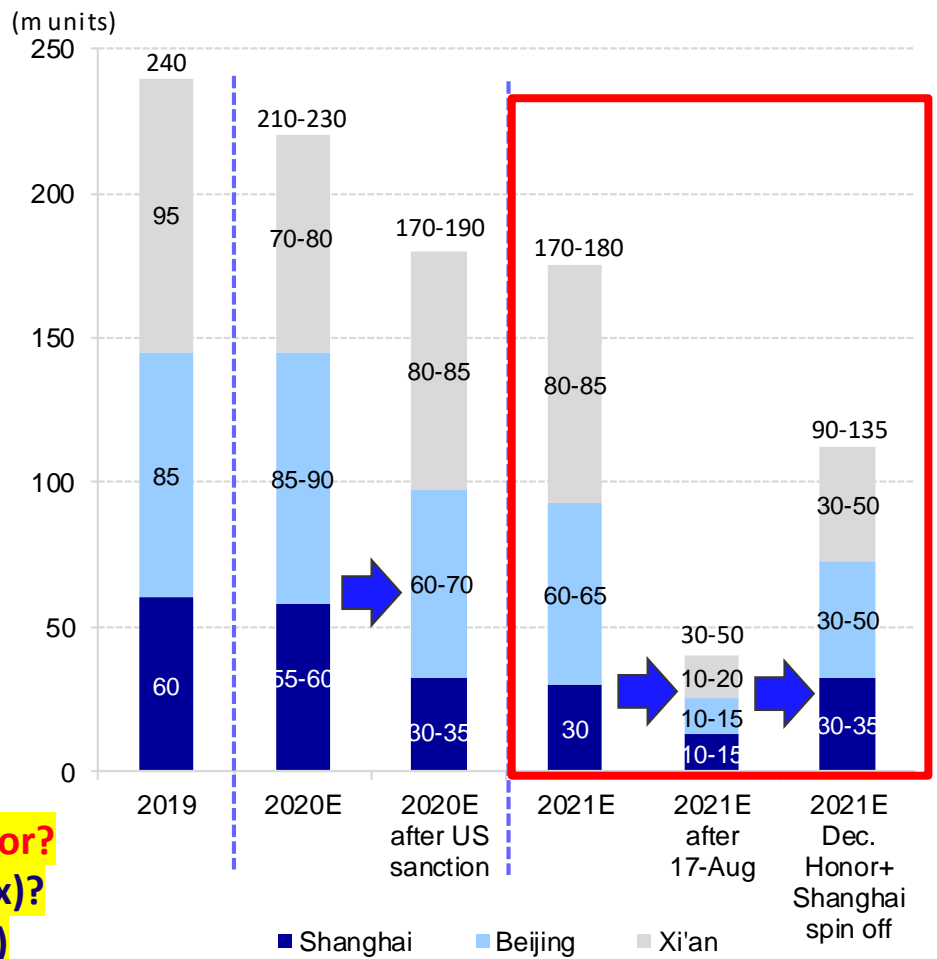
1. Domestic sales focus (145m-155m. M/S: 45%-50%)
2. Overseas sales: Focusing on emerging markets other than western Europe (25m-45m)

Rough estimate by device (2020)

- Shanghai: 55m-60m → after COVID-19 45m-55m → After US sanction 30m-35m
- Beijing: 85m-90m → 75m-85m → 60m-70m
- Xi'an: 70m-80m → 50m-70m → 80m-85m

Rough estimate by device (2021):

- Shanghai: 30m → 10m-15m → Revive by spin-off (20m max)?
- Beijing: 60m-65m → 10m-15m → to Honor (60m-70m max)
- Xi'an: 80m-85m → 10m-20m → Divided into Honor(30m max) and former HW(30m max)?



Source: Mizuho Securities Equity Research from Company data

HUAWEI P40 Pro+ ··· Leica camera equipped with a “fifth lens”

Main-Feature

Leica camera equipped with a “fifth lens”

- wide lens, ultra-wide lens, telephotox2 lens and ToF(optical ranging sensor)lens
- “5G” compatible
- 5G compatible for all 3 models; P40, P40 Pro and P40 Pro+

Spec

Display

- 1200 × 2,640(441ppi)
- 6.58 inch OLED
- Ultra Narrow Bezels:
 - iPhone11 ProMax: Top:4.50mm, Bottom:4.50mm, Side:4.50mm
 - P40 Pro+ : Top:2.65mm, Bottom:3.35mm, Side:1.71mm
- Quad-Curve Overflow Display : Sides are depressed to allow easy operation at both edges
- In-Screen Fingerprint : 30% faster authentication
- Notchless with front camera at the upper left

Processors

- Original latest chip set “Kirin 990 5G” (Octa-core 2.86GHz, 2.36GHz, 1.95GHz)

Battery

- 4200mAh, Quick charge by “HUAWEI SuperCharge”

Camera

Out-Camera

- Quintuple camera: 40MP (wide,f/1.8), 50MP(ultra-wide, f/1.9), 8MP (10x telephoto, f/4.4), 8MP (3x telephoto, f/2.4 lens),ToF lens
- Hybrid zoom up to 20x
- Digital zoom up to 100x
- Top level sensitivity control in the industry(up to ISO204,800)
- ⇒ Capable of very clear pictures even in low light settings

In-Camera

- Dual camera: 32MP(Selfie, f/2.2 lens),Depth Camera

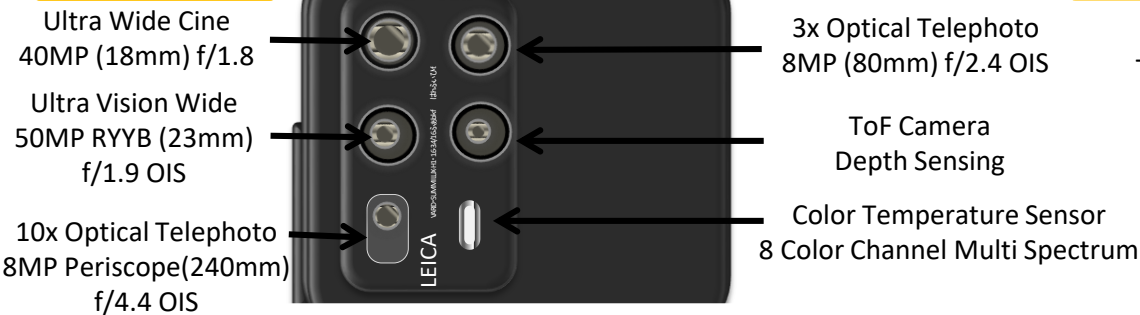
Utilizing AI

- AI Best Moment: Uses AI to select best photo from multiple photos
- AI Remove Passersby: People or objects in the background can be removed after the photo is captured
- AI Remove Reflection: Background objects reflected in glass or other reflective subjects can be removed from photos

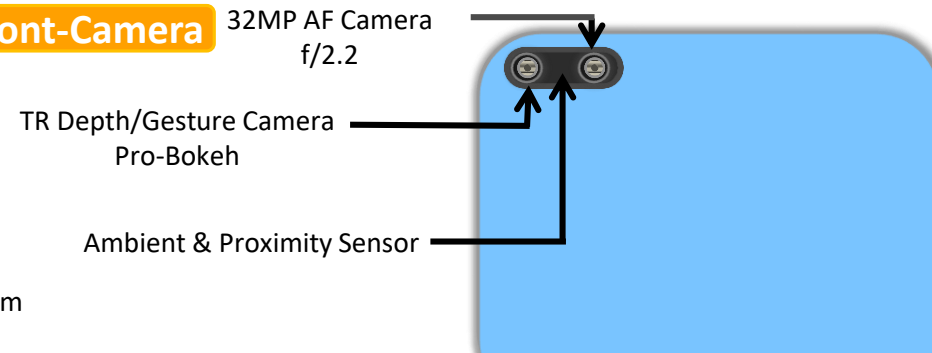
Gesture sensor feature

- Scroll, swipe, and capture screenshots using simple hand gestures

Rear-Camera



Front-Camera



Source: Mizuho Securities Equity Research

P40 series smartphones – 5x/10x periscope, Sony's 1/1.28" RYYB, dual ToFs, 5G, ultra-narrow bezels, HMS, quad-curved flex OLED

Model	P40	P40 Pro	P40 Pro Plus
Rear cam			
Number of cameras	triple	triple	quad
Resolution	16MP (ultrawide); 50MP (ultravision wide); 8MP (telephoto)	40MP (ultrawide cine); 50MP (ultravision wide); 12MP (periscope)	40MP (ultrawide cine); 50MP (ultravision wide); 8MP (periscope); 8MP (telephoto)
Main CMOS sensor(s)	1/1.28" RYYB	1/1.28" RYYB; 1/1.54" RGGB	1/1.28" RYYB; 1/1.54" RGGB
Aperture	f/2.2 (ultrawide); f/1.9 (ultravision wide); f/2.4 (telephoto)	f/1.8 (ultrawide cine); f/1.9 (ultravision wide); f/3.4 (persicope)	f/1.8 (ultrawide cine); f/1.6 (supersensing wide); f/4.4 (persicope); f/2.4 (telephoto)
Ultra low-light sensitivity	n/a	ISO 512000	ISO 512000
Ultra slow-motion	n/a	4K HDR+, 7680fps	4K HDR+, 7680fps
Lens* (main/sub/sub)	7P/6P/5P	7P/7P/5P1G	7P/7P/2P1G/5P
OIS #	1	2	3
Optical zoom	3x	5x	10x
Hybrid zoom	5x	10x	20x
Digital zoom	30x	50x	100x
Front cam			
Resolution	32MP	32MP	32MP
Aperture	f/2.0	f/2.2	f/2.2
Lens*	4P	4P	4P
3D sensing			
Rear – ToF	X	✓	✓
Front – ToF	X	✓	✓

(*) industry rumor; (**) major upgrade

Model	P40	P40 Pro	P40 Pro Plus
Display panel	Flex OLED	Flex OLED	Flex OLED
Display size	6.1"	6.58"	6.53"
Aspect ratio	19.5:9	19.8:9	19.8:9
Curved	n/a	Quad-curved	Quad-curved
Other specs (**)			
SoC	Kirin 990 5G	Kirin 990 5G	Kirin 990 5G
Battery	3800mAh	4200mAh	4200mAh
Ultra-thin FoD	✓	✓	✓

Model	5G	Storage	ASP	ASP (CN)
P40	✓	6GB + 128GB	n/a	CNY 4,188
P40	✓	8GB + 128GB	EUR 799	CNY 4,488
P40	✓	8GB + 256GB	n/a	CNY 4,988
P40 Pro	✓	8GB + 128GB	n/a	CNY 5,988
P40 Pro	✓	8GB + 256GB	EUR 999	CNY 6,488
P40 Pro	✓	8GB + 512GB	n/a	CNY 7,388
P40 Pro Plus	✓	8GB + 256GB	n/a	CNY 7,988
P40 Pro Plus	✓	8GB + 512GB	EUR 1,399	CNY 8,988

Source: Mizuho Securities Equity Research from company data

P40 series smartphones – pioneer in photography with minor upgrade in other specs, infant HMS ecosystem

- Price – **First water testing in super high-end market** with the launch of P40 Pro Plus models starting at about CNY8k! In addition, P40 ASP is in line with expectation while P40 Pro ASP is higher than expected considering **CCM cost surpasses USD100** for each model.
- Display – Huawei **adopts flex OLED panel to all models within a series for the first time**. Especially, P40 Pro/Pro+ has a quad-curved overflow display with ultra narrow bezels in the top and bottom side, only 2.65mm and 3.35mm width respectively compared with 4.5mm for iPhone 11 Pro Max. Suppliers: P40 – BOE; P40 Pro – SDC, LGD & BOE; P40 Pro Plus – SDC.
- Camera – the entrée of whole event. Besides the supersensing cine camera (1/1.54" RGGB) that was firstly introduced in Mate 30 series, Huawei adds one more bigger CMOS sensor (1/1.28 inch RYYB) for P40 Pro/Pro+ models. The dubbed ultra vision sensor has 200% more light intake than iPhone 11 Pro Max. Thanks to this dual main camera system, Huawei dramatically improves performance for night photography, achieving 4,096,000 ISO along with the world's first full pixel octa PD autofocus. Meanwhile, to keep leading in long-range telephoto, Huawei customizes two kinds of periscope cameras, a RYYB periscope and a multi-reflection super periscope, each with up to 50x and 100x digital zoom respectively with impressive clarity.
- AI applications – Besides air gestures and AI auto-rotate those we have seen in Mate 30 series, Huawei creates a special AI application called Golden Snap which is tailored for photography and compromises of “AI best moment” and “AI remove”. The former relies on certain algorithm to take a 4K moving picture when you shot and then recommends 1-3 pictures of the best moving moment. The latter could help you automatically remove the passersby and glass reflection to have a better picture background.
- FoD – ultra-thin optical solutions on all models, supplied by Goodix. Modules are supplied by O-Film and Q-tech.
- SoC – All 5G models powered with Kirin 990 5G chipset (7nm+ EUV) supporting both NSA and SA.
- Huawei mobile service (HMS) – an expedient due to lack of Google's GMS. Huawei unveils Celia to replace Android's AI voice assistant, Huawei Map (overseas map data licensed by Dutch-based TomTom) to replace Google Map and App Gallery to replace Google Play. HMS now has covered 170+ countries/regions with 400m+ monthly active users and 1.3m+ developers/partners. Since Feb 2020, Huawei has intensively and quietly upgraded and tested HMS Core on its smartphones based on EMUI 10.0 interface given users feedback.

Source: Mizuho Securities Equity Research from company data

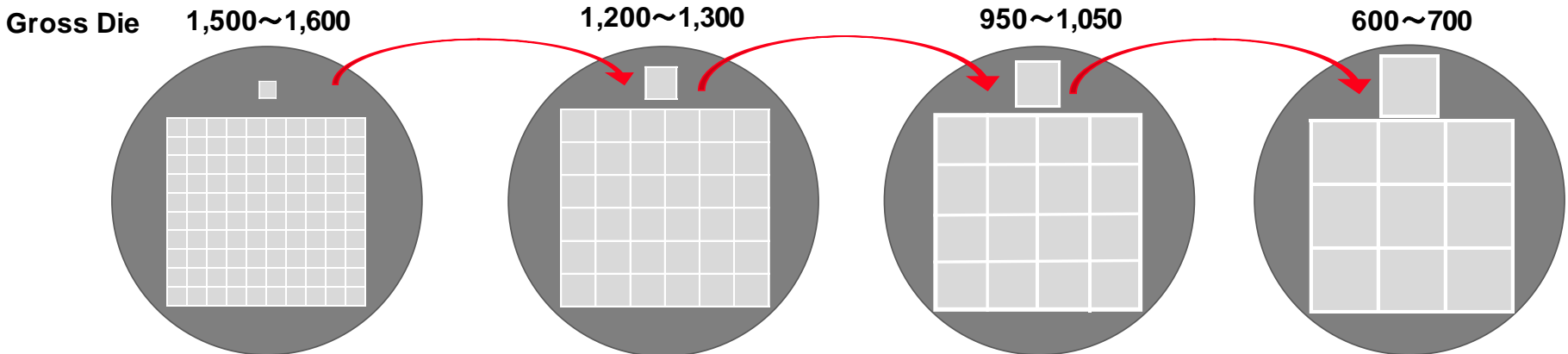
Making larger CMOS sensors: iPhone

Flagship model has three rear cameras (wide, ultra-wide, zoom) and a ToF sensor (distance-measure) and one or two front-facing cameras and a ToF or structured light sensor (facial recognition)

Offsetting relationship between resolution and sensitivity:

- If chip size unchanged, resolution up and pixel size down (lower sensitivity)
- If resolution unchanged, sensitivity up and chip size up (Apple)
- If resolution and sensitivity up, pixel size unchanged or up and chip size up (Huawei)

Prices to climb from increased wafer housing size brought on by larger sensors



*The figure provides relative comparisons and does not show actual changes

	iPhone XS Max / iPhone 11 Pro (2018 / 2019)	iPhone12 Pro Max (2020)	iPhone13 Pro Max / Pro (2021)	iPhone14 Pro Max / Pro (2022)
Resolution	12MP	12MP	12MP	12MP or 48MP
Pixel	1.4µm	1.7µm	1.9µm	1.0µm - 1.2µm
Size	1/2.4"	1/2.0"	1/1.5"	1/1.2" - 1.3"

- Apple will continue with 12MP (until at least 2021)
- Sensitivity will improve with greater pixel sizes
- Larger chips means higher prices

Source: Mizuho Securities Equity Research

ZTE AXON20 5G ··· World's first phone with under-display front camera

Main-Feature

Equipped with under-display front camera

- Placing front camera under the screen display allows for a full front screen.
- Sold in China from 10 September, priced at 2,198–2,798 yuan (approx. 34,100–43,400 yen).

Spec

Display

- 2,400 x 1,080, 6.92 inch OLED
- 90Hz (refresh rate), 240Hz (touch report rate)
- 10bit color depth (1.7 billion colors)
- Camera under screen allows for a full front screen (no notches or punch holes).
- Under-display Fingerprint

5G

- 360 Degree Surround Antenna

Processors

- Qualcomm Snapdragon 765G
- Adreno 620 GPU

Battery

- 4,220mAh
- 30W quick charge. Charge around 60% of battery in 30 minutes.

Camera

Front Camera

- 32MP (internal camera)
- Placement of front camera under screen realized through five technologies.
 - Camera
 - ✓ Secures the amount of light required for photography with micron-level ultra-transparent materials (including organic and inorganic films)
 - ✓ Improved image sharpness/contrast thanks to specially developed algorithm for under-display front camera
 - ✓ Precisely integrated minimalist circuit design employed to avoid interfering with front camera
 - Display
 - ✓ Built-in independent dual-control chip enables color synchronization between camera and display
 - ✓ Special pixel matrix makes camera portion less conspicuous

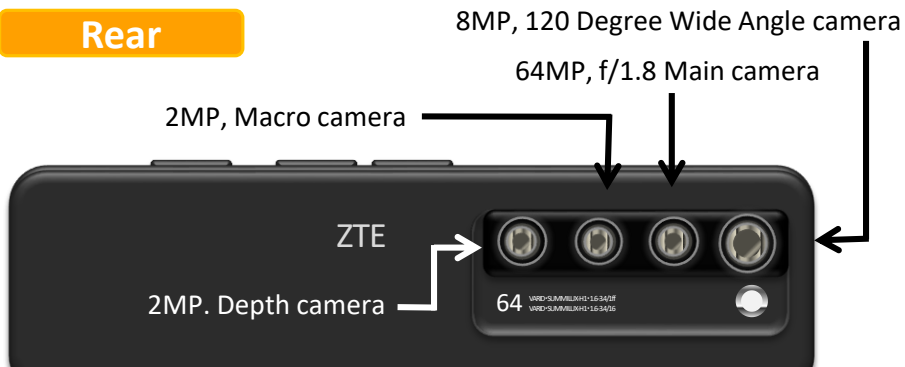
Multiple Under-display Technologies

- Camera, Light Sensor, Sound, Fingerprint

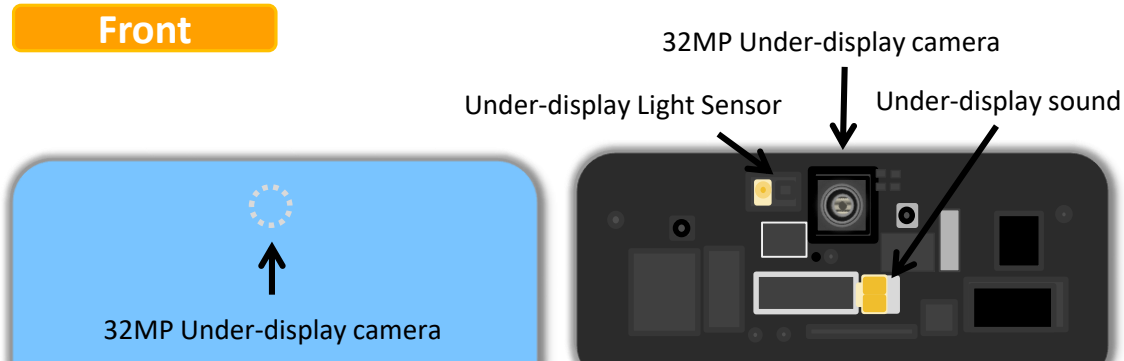
Rear Camera

- Quad camera: 64MP (main,; f/1.8), 8MP (super wide angle, 120 degree), 2MP (macro), and 2MP (depth)
- 4K 60fps video recording, simultaneous recording with front and rear camera, automated video subtitles

Rear



Front



Source: Mizuho Securities Equity Research from mobile01hp, company data

Xiaomi CC9 Pro ··· Leica camera equipped with a “fifth lens”

Main-Feature

Leica camera equipped with a “fifth lens” of over 100m pixel
Large-capacity battery of 5,260mAh, 30W Quick charge

Spec

Display

- 1080 × 2340(398ppi)
- 6.47” curved punch-hole AMOLED

Processors

- Qualcomm Snapdragon 730G

Battery

- 5,260mAh, 30W Quick charge

ID

- in-display fingerprint /facial recognition

Camera

Out-Camera

- 108MP(wide, f/1.69,OIS),20MP(ultra-wide, f/2.2),12MP(telephoto, f/2.0),8MP(telephoto, f/2.0,OIS),2MP(micro, f/2.4)
- Clear photograph in the dark by big camera sensor
- 10x hybrid zoom (5x optic zoom)
- 50x digital zoom
- Clear details even magnification by super pixel
- ultra-wide night mode, HDR, AI function(identifiable 27 scenes), Portrait mode, blurring background

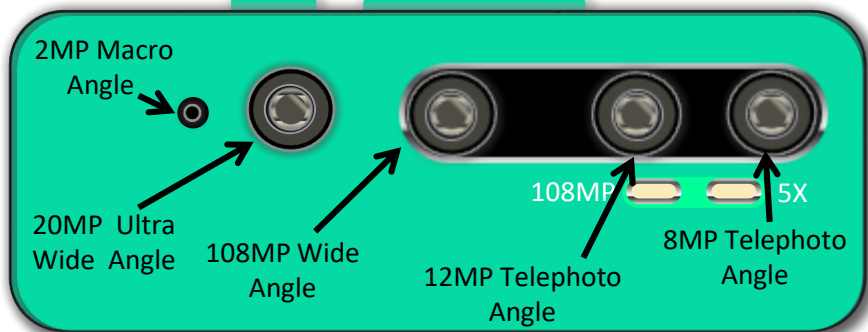
In-Camera

- 32MP(f/2.0)
- AI beauty face, Mimoji(user’s face shown with avatar)

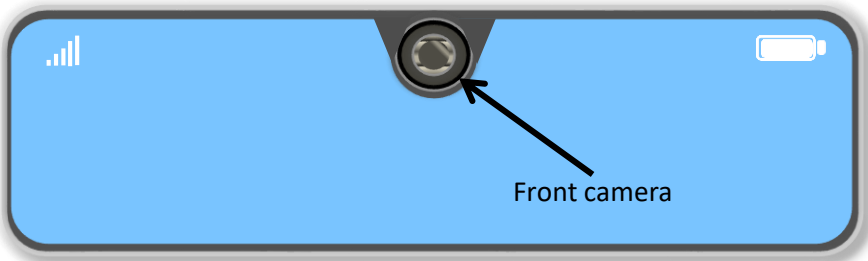
Price

6GB+128GB:RMB2,799、8GB+128GB:RMB3,099、8GB+256GB:RMB3,499

Rear-Camera



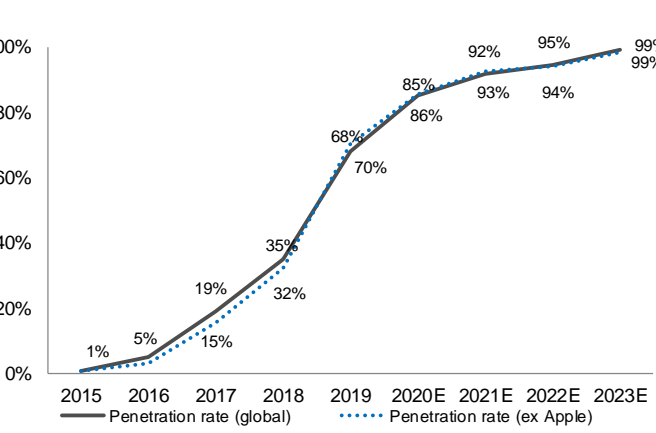
Front-facing Camera



Source: Mizuho Securities Equity Research

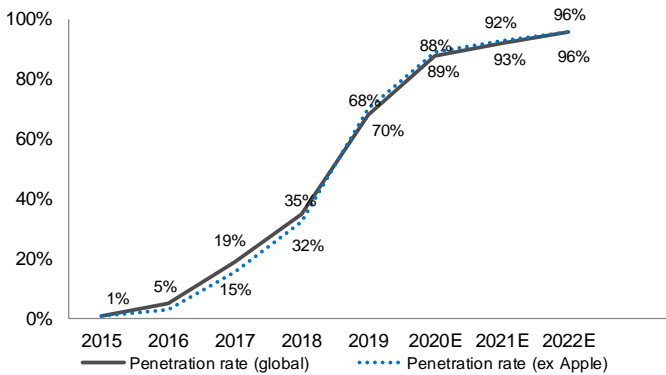
Dual Camera(incl. triple and more camera): Production volume estimates for smartphones equipped with dual camera

Forecast as of Dec.8th, 2020									
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Apple	0	33	90	113	108	173	202	230	245
Samsung	0	0	15	44	236	247	300	300	300
Huawei	9	20	50	107	200	180	45	50	65
Honor							55	110	120
XIAOMI	0	0	10	41	78	122	195	204	215
OPPO	0	0	30	53	100	136	196	198	210
VIVO	0	0	25	45	78	105	162	160	170
Other OEMs	2	17	70	126	184	145	135	115	120
total	11	70	290	529	984	1,107	1,289	1,367	1,445
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Penetration rate (global)	1%	5%	19%	35%	68%	85%	92%	95%	99%
Penetration rate (ex Apple)	1%	3%	15%	32%	70%	86%	93%	94%	99%



Smartphone estimated total volume
CY2020: 1,300m, CY2021: 1,400m

Forecast as of Oct. 1st, 2020								
	2015	2016	2017	2018	2019	2020E	2021E	2022E
Apple	0	33	90	113	108	173	197	225
Samsung	0	0	15	44	236	247	300	300
Huawei	9	20	50	107	200	180	40	20
XIAOMI	0	0	10	41	78	122	195	200
OPPO	0	0	30	53	100	136	196	198
VIVO	0	0	25	45	78	105	132	136
Other OEMs	2	17	70	126	184	183	230	305
total	11	70	290	529	984	1,145	1,290	1,383
	2015	2016	2017	2018	2019	2020E	2021E	2022E
Penetration rate (global)	1%	5%	19%	35%	68%	88%	92%	96%
Penetration rate (ex Apple)	1%	3%	15%	32%	70%	89%	93%	96%

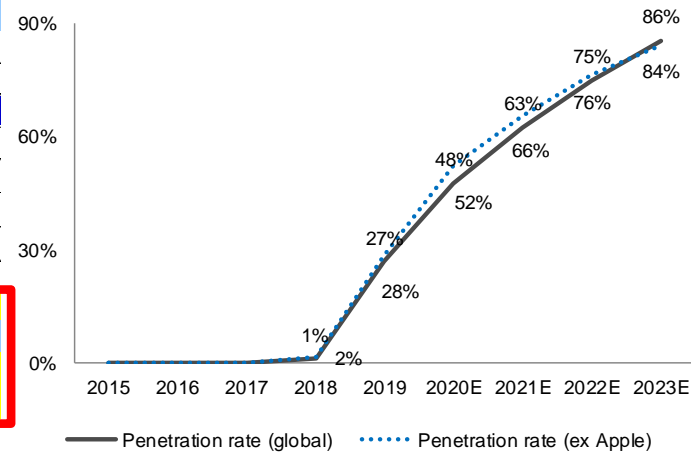


- ◆ The volume likely to rise due to increased brands
- ◆ Major brand products: no single lenses in 2022 (except AAPL)

Source: Mizuho Securities Equity Research

Triple Camera(incl. quadruple & more cameras): Production volume estimates for smartphones (volume likely to increase)

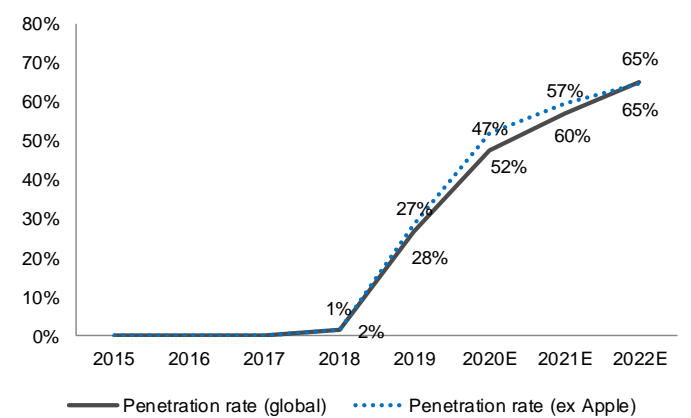
Forecast as of Dec. 8th, 2020									
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Apple	0	0	0	0	33	51	105	160	220
Samsung	0	0	0	2	130	170	230	240	240
Huawei	0	0	0	15	110	155	40	50	65
Honor							45	100	120
XIAOMI	0	0	0	1	25	58	120	160	180
OPPO	0	0	0	2	35	80	150	160	185
VIVO	0	0	0	0	30	66	130	145	155
Other OEMs	0	0	0	1	24	40	55	65	80
total	0	0	0	21	387	620	875	1,080	1,245
	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E
Penetration rate (global)	0%	0%	0%	1%	27%	48%	63%	75%	86%
Penetration rate (ex Apple)	0%	0%	0%	2%	28%	52%	66%	76%	84%



Smartphone estimated total volume
CY2020: 1,300m, CY2021: 1,400m

- ◆ Before: Mix deterioration was assumed though expecting volume to rise by exclusion of Huawei
- ◆ Middle/low-end models and above: at least three lenses
- ◆ Now: Expect volume to rise from 2021 as Huawei and Honor are added

Forecast as of Oct. 1st, 2020									
	2015	2016	2017	2018	2019	2020E	2021E	2022E	
Apple	0	0	0	0	33	51	100	160	
Samsung	0	0	0	2	130	170	240	255	
Huawei	0	0	0	15	110	150	40	10	
XIAOMI	0	0	0	1	25	58	100	120	
OPPO	0	0	0	2	35	75	130	145	
VIVO	0	0	0	0	30	58	110	125	
Other OEMs	0	0	0	1	24	55	80	125	
total	0	0	0	21	387	617	800	940	
	2015	2016	2017	2018	2019	2020E	2021E	2022E	
Penetration rate (global)	0%	0%	0%	1%	27%	47%	57%	65%	
Penetration rate (ex Apple)	0%	0%	0%	2%	28%	52%	60%	65%	



Source: Mizuho Securities Equity Research

3D sensing camera : Production volume estimates for smartphones equipped with 3D sensing camera (the 4th camera)

3D sensing - SL								
	(M units)							
	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Apple	0	40	116	125	189	205	225	240
Samsung	0	0	0	0	0	0	0	0
Huawei	0	0	2	5	2	1	0	0
Honor						0	0	0
Xiaomi	0	0	1	2	2	3	3	5
OPPO	0	0	2	3	3	5	5	8
VIVO	0	0	0	0	0	0	0	5
Others	0	0	1	2	1	2	3	5
total	0	40	121	137	197	216	236	263
	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Penetration rate (global)	0%	3%	8%	10%	15%	15%	16%	18%
Penetration rate (ex Apple)	0%	0%	0%	1%	1%	1%	1%	2%

3D sensing - ToF								
	(M units)							
	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Apple	0	0	0	0	35	60	75	140
Samsung	0	0	0	20	15	15	45	75
Huawei	0	0	0	15	12	5	15	25
Honor						10	35	50
Xiaomi	0	0	1	2	6	17	50	75
OPPO	0	0	1	3	5	20	60	85
VIVO	0	0	1	3	5	15	45	75
Others	0	0	0	1	1	8	15	30
total	0	0	3	44	79	150	340	555
	2016	2017	2018	2019E	2020E	2021E	2022E	2023E
Penetration rate (global)	0%	0%	0%	3%	6%	11%	24%	38%
Penetration rate (ex Apple)	0%	0%	0%	4%	4%	8%	22%	34%

Smartphone estimated total volume
CY2020: 1,300m, CY2021: 1,400m

- ◆ Temporary slowdown at Huawei and Samsung
- ◆ Apple (iPad/iPhone) success/failure (sales trends, APP introduction) is major variable for 2021 onward.

Source: Mizuho Securities Equity Research

iPhone price trends in China as of Jan 2021

as of Jan 2021 (RMB)

	iPhone SE			iPhone 11			iPhone 12 mini			iPhone 12			iPhone 12 Pro			iPhone 12 Pro Max		
	64GB	128GB	256GB	64GB	128GB	256GB	64GB	128GB	256GB	64GB	128GB	256GB	128GB	256GB	512GB	128GB	256GB	512GB
Price tag	3,299	3,799	4,599	4,779	5,299	6,099	5,499	5,999	6,799	6,299	6,799	7,599	8,499	9,299	11,099	9,299	10,099	11,899
ASP in China	3,299	3,666	4,599	4,432	4,832	5,599	5,432	5,932	6,732	6,232	6,732	7,599	8,499	9,299	11,099	9,299	10,099	11,899
%difference	0%	-4%	0%	-8%	-10%	-9%	-1%	-1%	-1%	-1%	-1%	0%	0%	0%	0%	0%	0%	0%
Sunning*	3,299	3,599	4,599	4,399	4,799	N/A	5,499	5,999	6,799	6,299	6,799	7,599	8,499	9,299	11,099	9,299	10,099	11,899
%discount	0%	-6%	0%	-9%	-10%	N/A	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tmall*	N/A	3,599	N/A	4,499	4,899	N/A	5,299	5,799	6,599	6,099	6,599	N/A	8,499	9,299	N/A	9,299	10,099	N/A
%discount	N/A	-6%	N/A	-6%	-8%	N/A	-4%	-3%	-3%	-3%	-3%	N/A	0%	0%	N/A	0%	0%	N/A
JD.com*	3,299	3,799	4,599	4,399	4,799	5,599	5,499	5,999	6,799	6,299	6,799	7,599	8,499	9,299	11,099	9,299	10,099	11,899
%discount	0%	0%	0%	-9%	-10%	-9%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

as of Jun 2020 (RMB)

	iPhone SE			iPhone XR		iPhone 11			iPhone 11 Pro			iPhone 11 Pro Max		
	64GB	128GB	256GB	64GB	128GB	64GB	128GB	256GB	64GB	128GB	256GB	64GB	128GB	256GB
Price tag**	3,099	3,599	4,399	4,199	4,619	4,779	5,239	5,919	7,579	8,679	10,239	8,359	9,459	11,019
ASP in China	2,929	3,396	4,199	3,849	4,182	4,599	5,099	5,899	6,999	8,299	10,099	7,499	8,799	10,599
%difference	-6%	-6%	-5%	-9%	-10%	-4%	-3%	0%	-8%	-5%	-1%	-11%	-8%	-4%
Sunning*	2,899	3,399	4,199	3,699	4,199	4,599	5,099	N/A	6,999	8,299	N/A	7,499	8,799	N/A
%discount	-7%	-6%	-5%	-14%	-10%	-4%	-3%	N/A	-8%	-5%	N/A	-11%	-8%	N/A
Tmall*	2,889	3,389	N/A	N/A	4,149	4,599	5,099	N/A	6,999	8,299	N/A	7,499	N/A	N/A
%discount	-7%	-6%	N/A	N/A	-11%	-4%	-3%	N/A	-8%	-5%	N/A	-11%	N/A	N/A
JD.com*	2,999	3,399	4,199	3,999	4,199	4,599	5,099	5,899	6,999	8,299	10,099	7,499	8,799	10,599
%discount	-3%	-6%	-5%	-5%	-10%	-4%	-3%	0%	-8%	-5%	-1%	-11%	-8%	-4%

*=Top-3 online authorized reseller by Apple in China, **= First-ever official discount in China

Source: Mizuho Securities Equity Research

iPhone price trends in Japan & US as of Oct. 2020

- 2020 models: 12Pro/12ProMax = remain unchanged from 2019 models
- " : 12 = +\$100 from 2019 model
- 2019 model : 11 = ▲\$100 from 2019



(US)

iPhone 12 mini		iPhone SE (2nd gen)	
64GB	\$699	64GB	\$399
128GB	\$749	128GB	\$449
258GB	\$849	256GB	\$549

iPhone 12		iPhone 12 Pro		iPhone 12 Pro Max	
128GB	\$799	128GB	\$999	128GB	\$1,099
256GB	\$849	256GB	\$1,099	256GB	\$1,199
512GB	\$949	512GB	\$1,299	512GB	\$1,399

iPhone 11		iPhone 11 Pro		iPhone 11 Pro Max	
64GB	\$699 → \$599	64GB	\$999 → end of sales	64GB	\$1,099 → end of sales
128GB	\$749 → \$649	256GB	\$1,149 → end of sales	256GB	\$1,249 → end of sales
256GB	\$849 → \$749	512GB	\$1,349 → end of sales	512GB	\$1,449 → end of sales

iPhone XR		iPhone XS		iPhone XS Max	
64GB	\$749 → \$599 → \$499	64GB	\$999 → end of sales	64GB	\$1,099 → end of sales
128GB	\$799 → \$649 → \$549	256GB	\$1,149 → end of sales	256GB	\$1,249 → end of sales
256GB	\$899 → end of sales	512GB	\$1,349 → end of sales	512GB	\$1,449 → end of sales

(Japan)

iPhone 12 mini		iPhone SE (2nd gen)	
64GB	¥74,800	64GB	¥44,800
128GB	¥79,800	128GB	¥49,800
258GB	¥90,800	256GB	¥60,800

iPhone 12		iPhone 12 Pro		iPhone 12 Pro Max	
128GB	¥85,800	128GB	¥106,800	128GB	¥117,800
256GB	¥90,800	256GB	¥117,800	256GB	¥128,800
512GB	¥101,800	512GB	¥139,800	512GB	¥150,800

iPhone 11		iPhone 11 Pro		iPhone 11 Pro Max	
64GB	¥74,800 → ¥64,800	64GB	¥106,800 → end of sales	64GB	¥119,800 → end of sales
128GB	¥79,800 → ¥69,800	256GB	¥122,800 → end of sales	256GB	¥135,800 → end of sales
256GB	¥80,800 → ¥90,800	512GB	¥144,800 → end of sales	512GB	¥157,800 → end of sales

iPhone XR		iPhone XS		iPhone XS Max	
64GB	¥84,800 → ¥64,800 → ¥54,800	64GB	¥96,800 → end of sales	64GB	¥106,800 → end of sales
128GB	¥90,800 → ¥69,800 → ¥59,800	256GB	¥112,800 → end of sales	256GB	¥122,800 → end of sales
256GB	¥101,800 → end of sales	512GB	¥134,800 → end of sales	512GB	¥144,800 → end of sales

Note: ※"End of sales" refers to the end of sales at the Apple on-line store.
 Source: Mizuho Securities Equity Research

iPhone production forecast: Expecting 236m in 2021, production to match demand

Revised on January 29. Raising 2020 production forecast from 218m units to 221m (+13%YoY). Expect shipment of 205m. Outperform the market.

1. 2020: Production (+13%)>shipment(+5%)>sell-through(+slightly), inventory seemed to have slightly increased. We expect production to match actual demand in 2021.
2. 4Q 2020: 91M→94M(+31%). New models 2H: 75M→77M). Lost ground made up mostly, production close to level of typical years.
3. 2020: 218M→221M(+13%). 11: 64M, SE2: 35M; Older models healthy; New models: 77M same as usual.
4. 1Q 2021: 62M→60M(+58%). Apple's assumption of 70M+ seemed to have decreased to the realistic level. Strong sales for older models and Pro/ProMax.
5. 2Q 2021: 44M(+1%). Weak sales for Mini, we suppose there would be a break in good sales of Pro/ProMax.
6. 2021: 235M→236M(+7%). There would be a chance to be 240M-245M. Assumption of 225M shipment. Apple's assumption of 270M is too bull
7. SCM (2Track Strategy) : Increasing adoption by Chinese firms + requesting non-China base for Japan/South Korea/Taiwan firms?

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities

Source: Mizuho Securities Equity Research

iPhone production forecast

iPhone	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19	1Q20	2Q20	3Q20	4Q20	1Q21	2Q21
													E	E
6+6S+7(4.7")	14	10	6	4	9	7	5	3	1	1	1	-	-	-
6plus+6Splus+7plus (5.5")	3	4	2	1	1	0	0	1	0	-	-	-	-	-
iPhone8(4.7" LCD)	9	10	8	7	6	6	6	9	3	3	0	-	-	-
iPhone8plus(5.5"LCD)	10	8	6	5	4	2	2	1	0	0	-	-	-	-
iPhoneX(5.85"OLED)	12	9	7	2	1	0	-	-	-	-	-	-	-	-
iPhoneXR(6.06"LCD)	-	-	1	29	11	10	13	6	4	5	3	3	3	2
iPhoneXS(5.85"OLED)	-	-	9	11	2	3	3	-	-	-	-	-	-	-
iPhoneXS Max(6.46"OLED)	-	-	10	18	3	3	3	-	-	-	-	-	-	-
iPhone11(6.06"LCD)	-	-	-	-	-	-	12	30	19	17	20	8	9	10
iPhone11 Pro(5.85"OLED)	-	-	-	-	-	-	5	10	4	3	2	0	-	-
iPhone11 Pro Max(6.46"OLED)	-	-	-	-	-	-	6	12	5	3	2	0	-	-
iPhone12Mini(5.42"OLED)	-	-	-	-	-	-	-	-	-	-	-	17	3	2
iPhone12(6.06"OLED)	-	-	-	-	-	-	-	-	-	-	-	24	12	13
iPhone12 Pro(6.06"OLED)	-	-	-	-	-	-	-	-	-	-	-	14	12	5
iPhone12 Pro Max(6.67" OLED)	-	-	-	-	-	-	-	-	-	-	-	17	14	7
5S+5C+5+SE (4.0") + SE2 (4.7"LCD)	4	2	2	1	0	0	-	-	1	13	12	10	8	6
Total iPhone	51	43	51	78	37	32	55	72	38	44	46	94	60	44
YOY	9%	18%	2%	-13%	-27%	-26%	8%	-9%	2%	39%	-17%	31%	58%	1%
QOQ	-43%	-17%	19%	54%	-52%	-16%	73%	31%	-47%	16%	3%	106%	-36%	-26%

(M units)

iPhone	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20	CY21E	CY21E	CY21E	FY16	FY17	FY18	FY19	FY20
								median	bull	bear						E
6+6S+7(4.7")	-	59	150	108	71	34	24	3	-	-	-	107	63	29	17	2
6plus+6Splus+7plus (5.5")	-	27	63	58	46	10	2	0	-	-	-	67	31	8	1	-
iPhone8(4.7" LCD)	-	-	-	-	25	34	27	6	-	-	-	-	33	32	24	3
iPhone8plus(5.5"LCD)	-	-	-	-	23	29	9	1	-	-	-	-	33	23	5	0
iPhoneX(5.85"OLED)	-	-	-	-	40	30	1	-	-	-	-	-	51	19	0	-
iPhoneXR(6.06"LCD)	-	-	-	-	-	30	40	15	7	8	5	-	-	41	33	14
iPhoneXS(5.85"OLED)	-	-	-	-	-	19	9	-	-	-	-	-	-	22	7	-
iPhoneXS Max(6.46"OLED)	-	-	-	-	-	28	8	-	-	-	-	-	-	31	6	-
iPhone11(6.06"LCD)	-	-	-	-	-	-	42	64	37	38	35	-	-	-	61	54
iPhone11 Pro(5.85"OLED)	-	-	-	-	-	-	15	9	-	-	-	-	-	-	19	5
iPhone11 Pro Max(6.46"OLED)	-	-	-	-	-	-	18	10	-	-	-	-	-	-	22	5
iPhone12Mini(5.42"OLED)	-	-	-	-	-	-	-	18	7	8	6	-	-	-	-	21
iPhone12(6.06"OLED)	-	-	-	-	-	-	-	26	27	28	25	-	-	-	-	38
iPhone12 Pro(6.06"OLED)	-	-	-	-	-	-	-	15	21	22	20	-	-	-	-	28
iPhone12 Pro Max(6.67" OLED)	-	-	-	-	-	-	-	18	24	25	22	-	-	-	-	31
iPhone13Mini(5.42"OLED)	-	-	-	-	-	-	-	-	18	20	16	-	-	-	-	-
iPhone13(6.06"OLED)	-	-	-	-	-	-	-	-	25	28	22	-	-	-	-	-
iPhone13 Pro(6.06"OLED)	-	-	-	-	-	-	-	-	22	25	19	-	-	-	-	-
iPhone13 Pro Max(6.67" OLED)	-	-	-	-	-	-	-	-	20	22	17	-	-	-	-	-
5S+5C+5+SE (4.0") + SE2 (4.7"LCD)	-	-	36	37	18	9	0	35	31	32	29	38	16	5	1	42
iPhone4S	31	24	3	-	-	-	-	-	-	-	-	0	-	-	-	-
Total iPhone	155	193	252	203	223	223	195	221	236	256	216	211	227	209	196	243
YOY	15%	25%	31%	-19%	10%	0%	-13%	13%	7%	16%	-2%	-9%	7%	-8%	-6%	24%

Total Volume of New Models

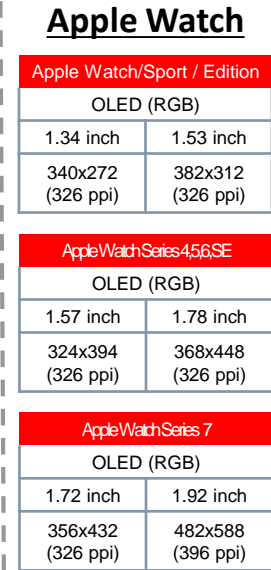
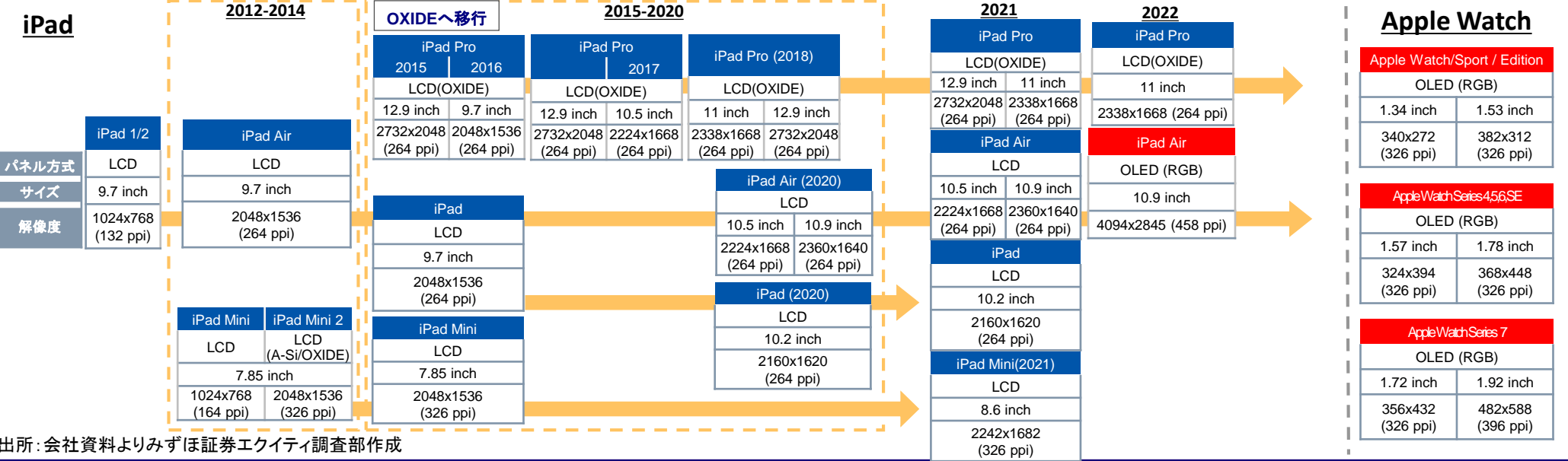
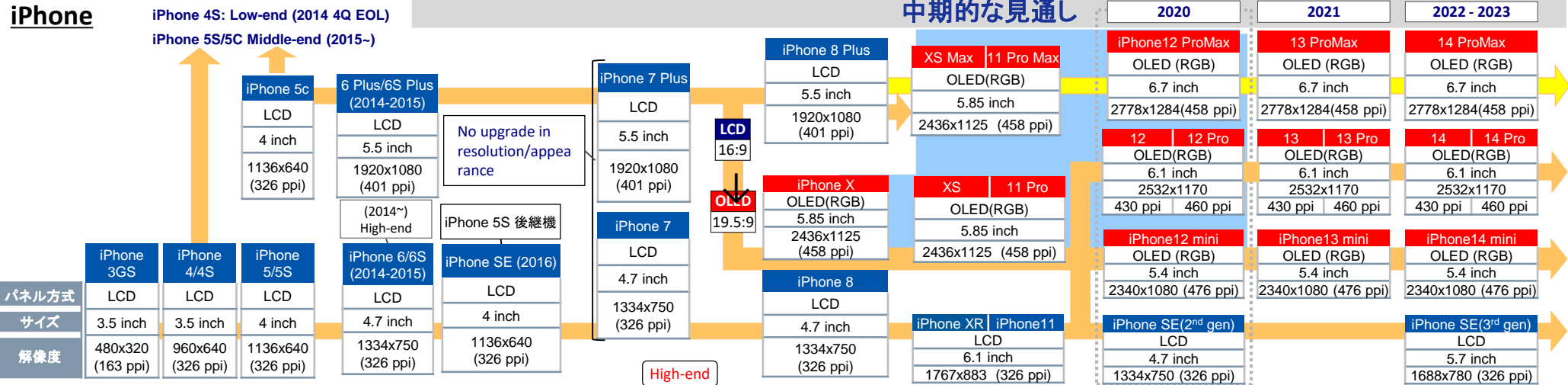
CY	m units
CY17	87
CY18	77
CY19	75
CY20	77
CY21	85

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities, Source: Mizuho Securities Equity Research

iPhone、iPadの今後の展開 (2023年までの見通し)

iPhoneはOLED化へ、iPad(MacBookも)はOxideとA-Si併用。時計はFlexOLEDとMicro LEDの両睨みに。

各ディスプレイの今後の展開



出所: 会社資料よりみずほ証券エクイティ調査部作成

iPhone12 : Spec

		iPhone 12 Pro	iPhone 12 Pro Max	iPhone 12 mini	iPhone 12	iPhone SE(2nd gen)
Display		6.1"	6.7"	5.4"	6.1"	4.7"
		Super Retina XDR display	Super Retina XDR display	Super Retina XDR display	Super Retina XDR display	Retina HD display
Capacity(GB)		128/256/512	128/256/513	64/128/256	64/128/256	64/128/256
Resolution(ppi)		2,532 × 1,170	2,778 × 1,284	2,340 × 1,080	2,532 × 1,170	1,334 × 750
Pixel Density(ppi)		460ppi	458ppi	476ppi	460ppi	326ppi
Size & Weight	Height	146.7mm	160.8mm	131.5mm	146.7mm	138.4mm
	Width	71.5mm	78.1mm	64.2mm	71.5mm	67.3mm
	Depth	7.4mm	7.4mm	7.4mm	7.4mm	7.4mm
	Weight	187g	226g	133g	162g	148g
Water Resistance		IP68	IP68	IP68	IP68	IP67
Chip		A14 Bionic	A14 Bionic	A14 Bionic	A14 Bionic	A13 Bionic
Camera	Rear Camera	Pro 12MP camera system Ultra Wide, Wide, and Telephoto cameras	Pro 12MP camera system Ultra Wide, Wide, and Telephoto cameras	Dual 12MP camera system Ultra Wide and Wide	Dual 12MP camera system Ultra Wide and Wide	Single 12MP camera Wide
	Front Camera	12MP TrueDepth front camera	12MP TrueDepth front camera	12MP TrueDepth front camera	12MP TrueDepth front camera	7MP FaceTime HD camera
Biometric Authentication		Face ID	Face ID	Face ID	Face ID	Touch ID
Power & Battery(Video playback)		Up to 17 hours	Up to 20 hours	Up to 15 hours	Up to 17 hours	Up to 13 hours
Color		Pacific Blue, Gold, Graphite, Silver	Pacific Blue, Gold, Graphite, Silver	Pacific Blue, Gold, Graphite, Silver	Black, White, Green, Blue, (PRODUCT)RED	Black, White, (PRODUCT)RED
5G		○	○	○	○	X
Prices(excl.tax)		128GB: ¥106,800	128GB: ¥117,800	64GB: ¥74,800	64GB: ¥85,800	64GB: ¥44,800
		256GB: ¥117,800	256GB: ¥128,800	128GB: ¥79,800	128GB: ¥90,800	128GB: ¥49,800
		512GB: ¥139,800	512GB: ¥150,800	256GB: ¥90,800	256GB: ¥101,800	256GB: ¥60,800
Reservation start date		2020/10/16	2020/11/6	2020/11/6	2020/10/16	
Sale start date		2020/10/23	2020/11/13	2020/11/13	2020/10/23	

Source: Mizuho Securities Equity Research from company data

2020 iPhone: Content roughly in line with expectations

2020 New iPhones

	EMS	Casing	Size	Display	TP	5G	Rear Cam	ToF Camera	DRAM	NAND	Price
iPhone 12 Pro Max	Hon Hai	Stainless (HH)	6.67"	OLED (SDC)	Y-Octa	mmW+Sub6 (US), Sub6	Triple (1.7 μ m, 7p, SensorShift, LGI)	Yes (LGI)	6GB	128GB 256GB 512GB	\$1,099~
iPhone12 Pro	Hon Hai	Stainless (HH/Jabil)	6.06"	OLED (SDC)	ITO Film	mmW+Sub6 (US), Sub6	Triple (1.4 μ m, same as 11Pro, LGI)	Yes (LGI)	6GB	128GB 256GB 512GB	\$999~
iPhone12	Pegaton/ Hon Hai	Aluminium (Catcher /HH)	6.06"	OLED (SDC+LGD +BOE)	ITO Film	mmW+Sub6 (US), Sub6 only	Dual (1.4 μ m, same as 11, SH)	No	4GB	64GB 128GB 256GB	\$799~
iPhone12 mini	Pegatron / Hon Hai / Wistron	Aluminium (HH/Jabil)	5.42"	OLED (SDC)	Y-Octa	mmW+Sub6 (US), Sub6 only	Dual (1.4 μ m, same as 11, SH)	No	4GB	64GB 128GB 256GB	\$699~

- **Four models: 2020 production volume outlook (from top): 18m/15m/26m/18 for a total of 77m. Lost ground made up mostly.**
- **All 5G: mmW+Sub6 for all models in the US (inexpensive despite these capabilities), Sub6 for others, lack of mmW models in Japan and Korea seems unusual.**
- **Display: OLED. SDC supplies Y-Octa panels for the first time. BOE couldn't start shipments by end-2020. Hoping for 1Q 2021.**
- **Camera: Great changes to Pro Max only. Sensor enlargement, 7p lens, SensorShift, etc. Two ToF models**
- **Memory: NAND capacity slightly suppressed.**
- **Price is the key: In line with above-mentioned anticipated pricing, neutral.**

Source: Mizuho Securities Equity Research

2021~2022 iPhone: Display and camera changes

2021 New iPhones

	Size	Display	TP	5G	Rear Cam	ToF Camera	Face ID
iPhone 13 Pro Max	6.67"	OLED (SDC)	Y-Octa	TBD	Triple (1.9µm, SensorShift)	Yes	Yes
iPhone13 Pro	6.06"	OLED (SDC)	Y-Octa	TBD	Triple (1.9µm, SensorShift)	Yes	Yes
iPhone13	6.06"	OLED (LGD+BOE+SDC)	Y-Octa	TBD	Dual (1.7µm, Sensorshift)	No	Yes
iPhone13 mini	5.42"	OLED (SDC+LGD)	Y-Octa	TBD	Dual (1.7µm, Sensorshift)	No	Yes
iPhone SE2 5G (22 Spring)	4.7"	LCD (Sharp>JDI)	In-Cell	Sub6 only	Single	No	No (Fingerprint Sensor)
iPhone SE3 (23 Spring)	5.7"	LCD (Sharp>JDI)	In-Cell	Sub6 only	Dual (1.4µm, same as 11)	No	No (Fingerprint Sensor)

- Four models except SE: All OLED, basically all the same size. Pro Series with LTPO substrate. All TP to shift to Y-Octa. Eye on BOE share.
- SDC production capacity: Y-Octa eats up TFT capacity with four extra masks. **Capacity could tighten if SDC share is high (A5 investment?).**
- **5G: Content is unclear, focus on whether it releases Sub6 only models in the US and whether it offers mmW models in Japan, Korea, etc.**
- Rear camera (1): New modules for Pro Max and Pro. Larger sensor, 7p lens, sensor shift.
- Rear camera (2): 13 (two models) upgraded using 2020 Pro Max (sensorshift). Triple camera and ToF will be probably adopted for 2 models.
- Rear camera (3): **Ultra wide for Pro Max/Pro with Auto Focus(VCM).**
- **Possible adoption of AF (VCM) on front camera and periscope structure for the second lens (Tele) on rear camera from 2022 onward.**
- SE3: New LCD models. May use iPhone 11 camera. No Face ID for LCD. Side finger-print sensor?

Source: Mizuho Securities Equity Research

iPhone camera : Expected roadmap

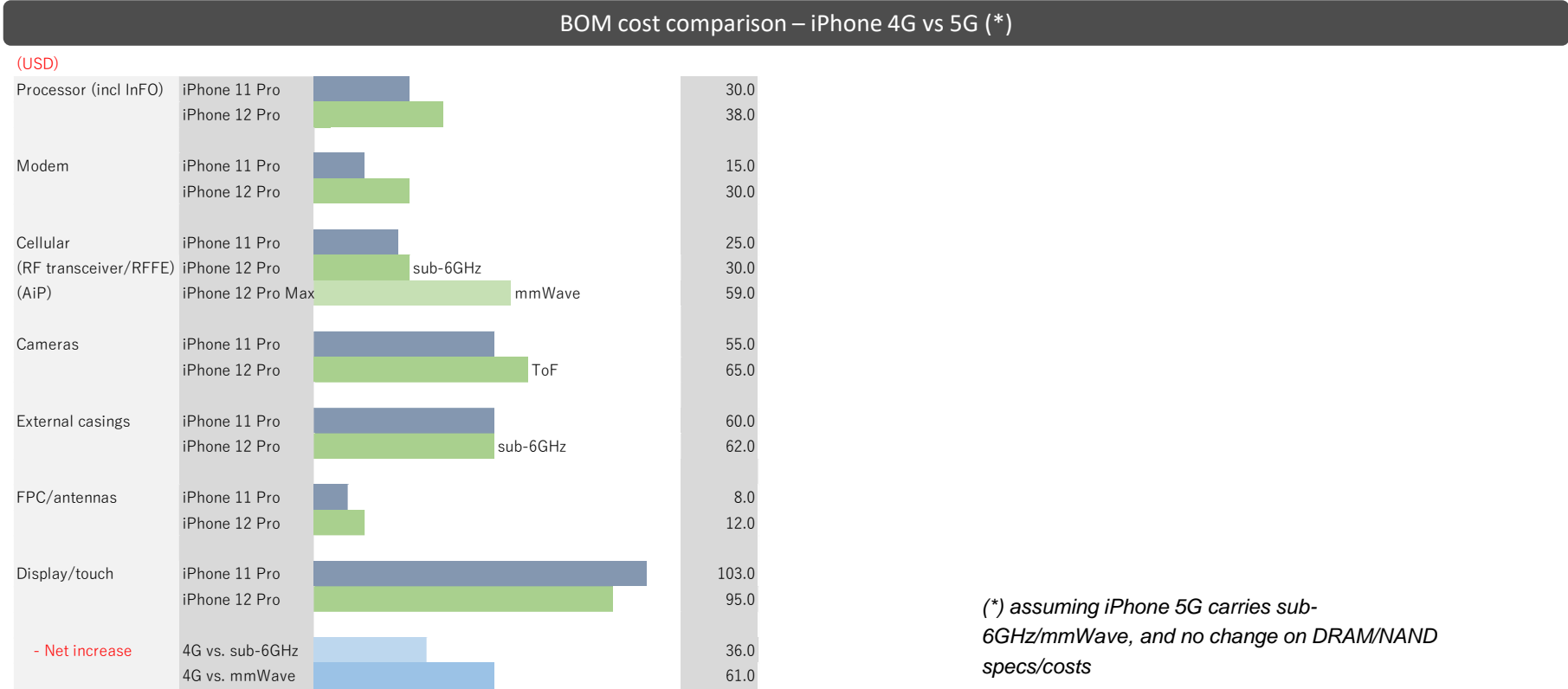
		2019			2020E				2021E			
Model	iPhone 11	iPhone 11 Pro	iPhone Pro Max	iPhone 12	iPhone 12	iPhone 12 Pro	iPhone 12 Pro Max	iPhone 13	iPhone 13	iPhone 13 Pro	iPhone 13 Pro Max	
Display size	6.06"	5.85"	6.46"	5.42	6.06"	6.06	6.67"	5.42	6.06	6.06"	6.67"	
Display panel	LTPS LCD	OLED	OLED	OLED	OLED	OLED	OLED	OLED	OLED	OLED	OLED	
Rear cam												
Number of cameras	dual	triple	triple	dual	dual	triple	triple	triple	triple	triple	triple	
Resolution	12MP (WA) 12MP (Tele)	12MP (WA) 12MP (Tele) 12MP (SW)	12MP (WA) 12MP (Tele) 12MP (SW)	12MP (WA) 12MP (Tele)	12MP (WA) 12MP (Tele) ↗	12MP (WA) 12MP (Tele) 12MP (SW)	12MP (WA) 12MP (Tele) 12MP (SW)	12MP (WA) 12MP (Tele) 12MP (SW)	12MP (WA) 12MP (Tele) ↗ 12MP (SW) ↗	12MP (WA) 12MP (Tele) ↗ 12MP (SW)	12MP (WA) 12MP (Tele) ↗ 12MP (SW)	
CMOS size	1/2.4" (WA) 1/2.8" (Tele) ↗	1/2.4" (WA) 1/2.8" (SW+Tele)	1/2.4" (WA) 1/2.8" (SW+Tele)	1/2.4" (WA) 1/2.8" (Tele)	1/2.4" (WA) ↗ 1/2.8" (Tele)	1/2.4" (WA) 1/2.8" (SW+Tele)	1/2.0" (WA) 1/2.8" (SW+Tele)	1/2.0" (WA) n/a	1/2.0" (WA) n/a	1/1.7" (WA) n/a	1/1.7" (WA) n/a	
Aperture	f/1.8 (WA) f/2.0 (Tele)	f/1.8 (WA) f/2.0 (Tele) f/2.4(SW)	f/1.8 (WA) f/2.0 (Tele) f/2.4(SW)	f/1.8 (WA) n/a	f/1.8 (WA) n/a	f/1.4 (WA) n/a	f/1.4 (WA) n/a	n/a n/a	n/a n/a	n/a n/a	n/a n/a	
Lens (main/sub/sub)	6P/6P	6P/6P/5P	6P/6P/5P	6P/6P	6P/6P	7P/6P/5P	7P/6P/5P	7P/6P/5P	7P/6P/5P	7P/6P/5P	7P/6P/5P	
OIS #	2	2	2	2	2	2	2	2	2	2	2	
Digital zoom	5x	5x	5x	5x	5x	5x	5x	5x	5x	5x	5x	
Optical zoom	2x	2x	4x	2x	2x	4x	4x	4x	4x	4x	4x	
ASP (USD)	1.4 (WA) 1.6 (Tele)	1.4 (WA) 1.6 (Tele) 1.8 (SW)	1.4 (WA) 1.6 (Tele) 1.8 (SW)	1.4 (WA) 1.5 (Tele)	1.4 (WA) 1.5 (Tele)	2.3 (WA) 1.5 (Tele) 1.7 (SW)	2.3 (WA) 1.5 (Tele) 1.7 (SW)	n/a n/a n/a	n/a n/a n/a	n/a n/a n/a	n/a n/a n/a	
Front cam												
Resolution	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	
CMOS size	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5" ↗	1/3.5"	1/3.5" ↗	1/3.5"	1/3.5"	1/3.5"	1/3.5"	
Lens (main/sub/sub)	5P	5P	5P	5P	5P	5P	5P	5P	5P	5P	5P	
ASP (USD)	1.0	1.0	1.0	0.9	0.9	0.9	0.9	n/a	n/a	n/a	n/a	
Front - structured light												
Tx -												
Lens	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	
Suppliers	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	AMS/ Heptagon	
ASP (USD)	3.2	3.2	3.2	3.0	3.0	3.0	3.0	2.7	2.7	2.7	2.7	
Rx -												
Lens	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	
Suppliers	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	
ASP (USD)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	
Rear - ToF												
Tx -												
CMOS						Sony	Sony	Sony	Sony	Sony	Sony	
Lens						5P	5P	5P	5P	5P	5P	
Suppliers						Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	Largan /GESO	
ASP (USD)						2.0	2.0	1.6	1.6	1.6	1.6	
Dollar content (USD) on opticals	7.6	9.3	9.3	7.2	7.2	9.4	12.3					

GESO=Genius Electronic Optical, KT=Kantatsu, WA=wide angle, Tele=telephoto, SW=superwide

Source: Mizuho Securities Equity Research from company data

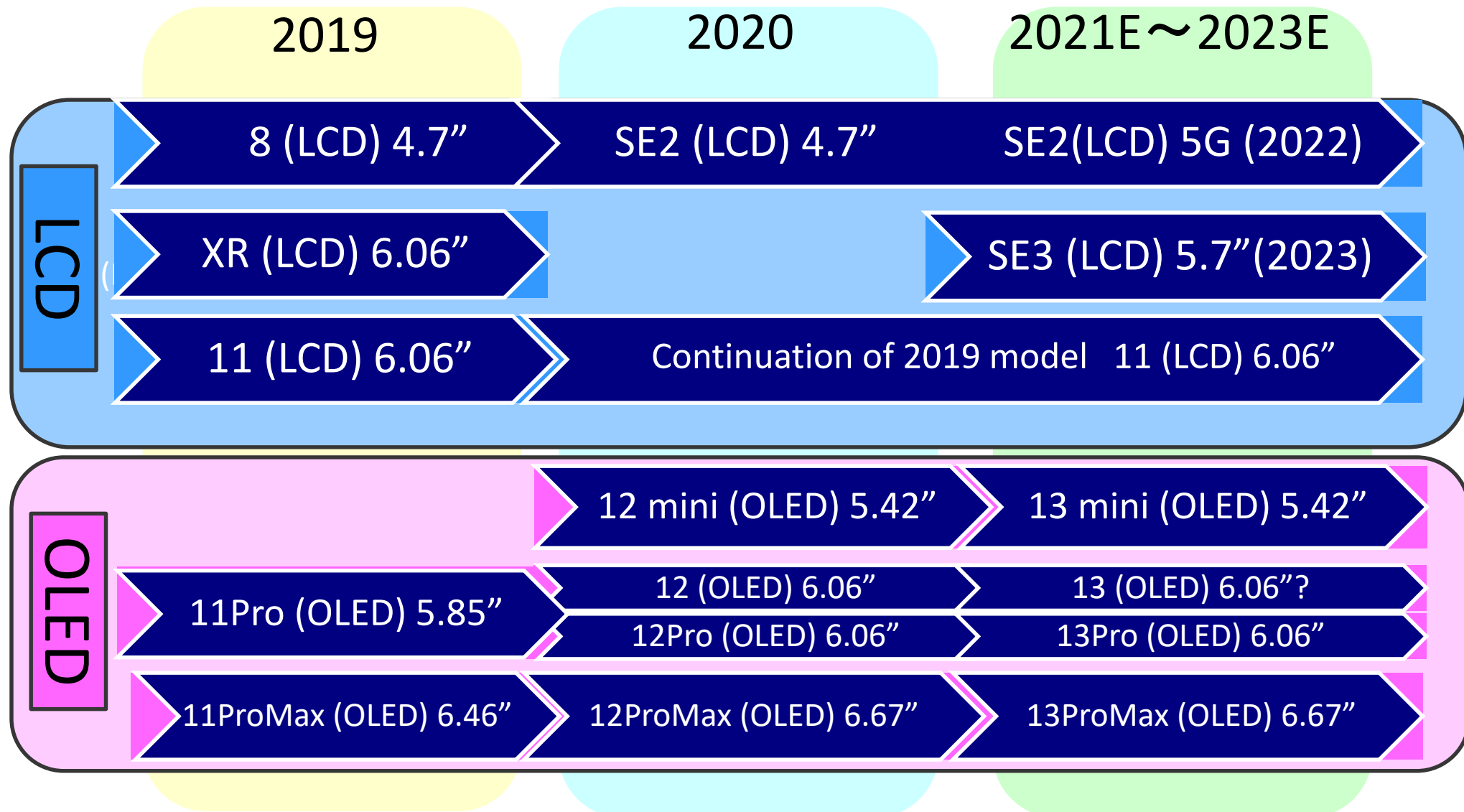
iPhone in 2020: BOM may be much higher than 2019 models

- Key Upgrades:** all 4 models with Sub6Hz, incl. one with MMW together. 2 models with Triple cam, ToF sensor.
- First EUV processor (A14):** 5nm with EUV consumes less electricity, has strong AI, and supports AR.
- BOM difference:** Comparing to 2019 4G models, Sub6Hz 5G models will be higher by 61usd, MMW model by 86usd.
- Retail prices?:** 6.67”(MMW model) with 200usd+, 6.06”(Higher end) with 150usd+, then 6.06”(Lower end) with 100usd+??anyhow, prices will be higher unless AAPL get lower component costs than street.



Source: Mizuho Securities Equity Research from Fomalhaut Techno Solutions

iPhone Display Roadmap: differentiate high-end model from mid-end clearly?



Source: Mizuho Securities Equity Research

Market Cap Top10 in Chinese Market (Technology-related stocks)

- 6 companies are Apple suppliers → Locking Apple out of China market likely difficult?

中国市場(上海+深セン) 社名		時価総額 (USD bn)			法人登録年	CAGR	
		10年前	5年前	直近		10Y	5Y
杭州海康威視数字技術	HANGZHOU HIKVI-A	-	14.3	64.1	2001		+16%
立訊精密工業	LUXSHARE PRECI-A	-	3.7	56.4	2004		+31%
Foxconn Industrial Internet	FOXCONN INDUST-A	-	-	41.7	2015		
WILL SEMICONDUCTOR LTD	WILL SEMICONDU-A	-	-	28.7	2007		
京東方科技集團	BOE TECHNOLOGY-A	5.8	12.1	27.7	1993	+17%	+9%
用友網絡科技	YONYOU NETWORK-A	2.5	4.4	23.0	1988	+25%	+18%
藍思科技[レンズ・テクノロジー]	LENS TECHNOLOG-A	-	-	22.4	2006		
深セン市中興通訊 [ZTE]	ZTE CORP-A	11.3	9.5	21.9	1997	+7%	+9%
聞泰科技	WINGTECH TECH-A	0.4	1.1	21.2	1993	+47%	+35%
Avary Holding Shenzhen Co Lt	AVARY HOLDING -A	-	-	19.7	1999		
三安光電	SANAN OPTOELEC-A	2.1	5.5	19.6	1993	+25%	+14%
歌爾	GOERTEK INC -A	1.0	6.0	18.9	2001	+35%	+12%

- (2nd) Luxshare: The largest supplier of AirPods. Acquired Wistron's iPhone assembly plant.
- (3rd) Foxconn Industrial Internet: iPhone/iPad assembly (Hon Hai Group)
- (5th) BOE: supply of LCD panels for IT industry. Supply of OLED panels for iPhone (from 2021)
- (7th) Lens: Supply of cover glass for iPhones and TP for iPad. Acquired Catcher's housing factory.
- (10th) Avary: Hon Hai(ZDT)'s subsidiary and PCB manufacturer. Key supplier to Apple.
- (12th) Goertek: Major in VR. Produces AirPods.

Source: Mizuho Securities Equity Research from Bloomberg

Sharp's JDI D3 (Hakusan: G6 LTPS) plant acquisition background

- **Hakusan plant sale announced on 28 Aug:** JDI to sell Hakusan plant. Equipment is to go to Apple, land/buildings to go to Sharp, which will operate factory
 - JDI to sell land, properties for \$390m to Sharp (use proceeds to repay Apple). Book value: ¥50b. Equipment to be sold to Apple for \$200m (see below)+\$85m
 - Handover: Sep-Oct. JDI set to book extraordinary gain of ¥21.1b and extraordinary loss (up to ¥ 3.3b from startup costs)
 - Factory to be managed by Sharp: Manufacture iPhone 11, SE3 panels for 2022. Repay advance payment using proceeds from panel sales. Devices owned by Apple; order priority likely given to Sharp>JDI.
- **Background:** Sale driven by Apple, continuation of LCD devices
 - iPhone strategy change: All OLED→prolonging LCD life (spring '22 models) due to panel costs, tech gap in SDC vs. competitors.
 - LG Display's OLED focus: Suppliers: JDI (J1:20k), SH (K1:22k), LGD (AP3:20k). LGD production to be terminated in 2020. May cause capacity shortage.
 - Must collect ¥87.9b (Feb) payment to JDI. Production/sales growth with D3 is fastest but JDI struggling with finance/personnel.
 - Supporting JDI: Buys \$200m D3 plant. Profit booking + prepayment offset (down ¥66.4b) for JDI.
 - Importance of JDI: IPS/LTPS/LTPO/cell technology, superior developers. Supplies OLEDs for Apple Watch. **Prepayment collection cancels out JDI survival.**
- **JDI's perspective:** Sale allows JDI to repay Apple, reduce D3 burden. However, JDI needs to maintain business with Apple until it can develop its next major business
 - Apple: biggest client, drives tech. Low MP ratio, swaying demand, big prepayment returns. Watch OLED module expansion costly.
 - Autos: Firm customer base. Strong tech. Environment challenging due to intense competition. Focusing on new fields such as timepieces, VR, and B2B. Needs investment, time.
 - After Hakusan sale: JDI keen on maintaining 40% share of work for iPhone. Key is OLED work for Apple Watch. Maybe it still has too many factories?
- **Sharp's perspective:** Benefit/risks from acquiring D3
 - D3's appeal: JDI's plant with tech (25K/month, another 25K for future is possible). Get a plant of ¥170b without cash expenditure (devices on loan). Sharp takes on operating risk and repayment risk
 - K1 limitations: Apple limitations to be lifted at same time. Close G4/G4.5 plants & shift autos to K1, KI to D3 for Apple products.
 - Strengthen relationship with Apple: Expand work in IT sector with focus on K2. Increasing order of iPad, MacBook and iMac is key.
 - Nex Gen Display: Possible to invest µLED, µOLED and OLED in collaboration with Apple.

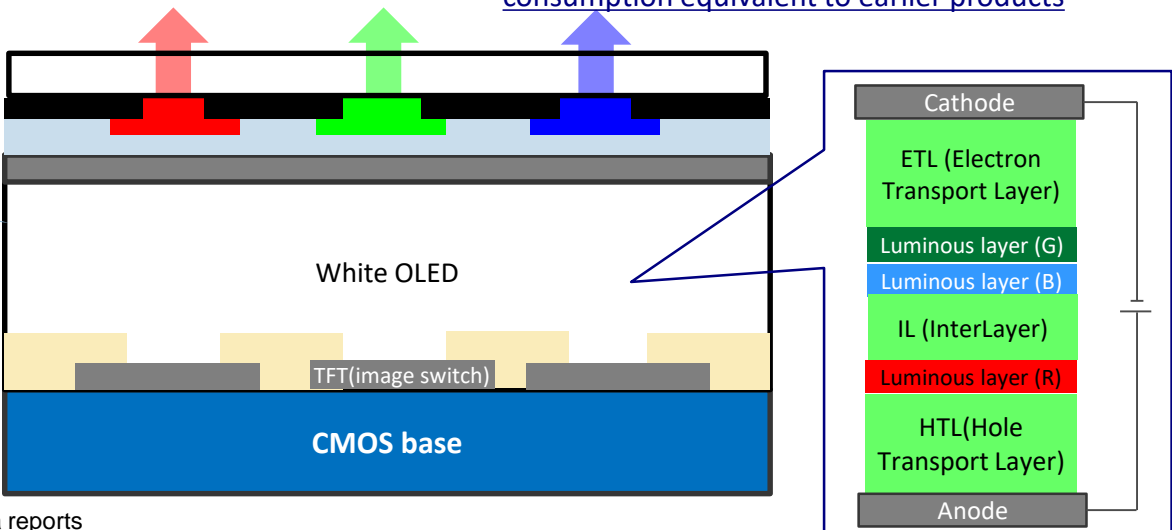
Micro OLED Outlook: Potential adoption of AR glasses

What is micro OLED(M-OLED)?

- Achieves higher definition than regular OLED, resolution of at least 1,000ppi, high contrast (LCD is 3,000:1, OLED is 10,000:1, M-OLED is 1,000,000:1), wide viewing angle
- In regular OLED displays, polysilicon TFT or oxide semiconductor TFT bases are used as backplanes. While TFT bases can be enlarged, it is difficult to form the micro wiring and transistors that are demanded in high-definition micro displays
- In the case of M-OLED, single crystal silicon wafers are used in bases, so micro wiring and micro transistors can be formed
- When the human eye is close to a display and resolution is low, the pixels can form a lattice-shaped pattern called a moiré. This means that high-resolution displays are necessary
 - Put to practical use in applications like digital camera EVFs

■ The color displays of OLED elements employ a system whereby the RGB color elements are arranged separately and a white element uses vapor deposition to emit white light. For OLED color separation, white OLED+CF using color filters, is employed. However, in the case of M-OLED, white OLED+CF, which is suited to high definition, is employed

■ In the case of an AMOLED display, peripheral drive circuits such as H Driver and V Driver are necessary. However, M-OLED uses a CMOS base, so it is possible to construct the drive circuits and panel as one and integrate them into to the backplane



Future issues

- Issues of efficiency and lifespan
 - In a white OLED+CF structure, luminous efficiency is 1/3 due to the dimming of white-light luminescence by the CF. For this reason, in order to achieve the equivalent luminescence with no CF, around 3x the level of electric current needs to be applied, which hastens degradation.
- Issue of color stability
 - Luminescent balance is changed because electric current has to be applied to each LED element individually.
- Efficiency and color stability can be improved using thick ETL and thin HTL
- ECX339A (developed by Sony) achieves low power consumption equivalent to earlier products

Source: Mizuho Securities Equity Research from company data and media reports

AP for iPhone from TSMC standpoint

➤ After the sharp decline of Apple's business in 2019, due to weaker iPhone demand and pricing pressure, we expect TSMC to recover this business significantly in 2020 driven by:

- Higher new iPhone built-in units (90-100m in 2H20 versus 75-80m in 2H19)
- Advanced node on 5nm, engaging deeper EUV layers for higher wafer price
- Share wins of iPhone 5G baseband modem, as the foundry for Qualcomm under 7nm

➤ Based on our bottom-up model, we forecast TSMC's Apple sales to increase by 24% YoY in 2020, the most important growth drivers to TSMC.

iPhone : AP transistor costs on various technologies

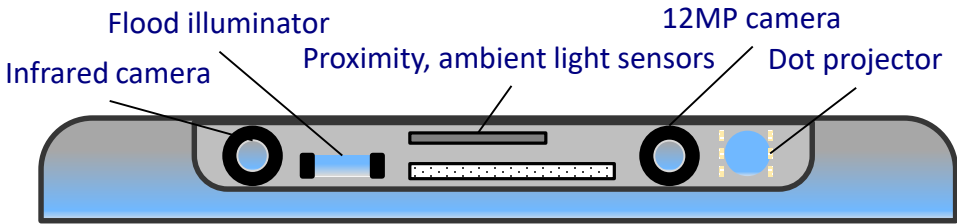
	16nm	10nm	7nm	5nm*	3nm*
Chip area (mm ²)	125.00	87.66	83.27	85.00	85.00
Number of transistors (BU)	3.3	4.3	6.9	10.5	14.1
Gross die per wafer	478	686	721	707	707
Net die per wafer	359.74	512.44	545.65	530.25	509.04
Wafer price (\$)	5,912	8,389	9,965	12,500	15,500
Die cost (\$)	16.43	16.37	18.26	23.57	30.45
Transistor cost per 1B transistors (\$)	4.98	3.81	2.65	2.25	2.16

	2018	2019	2020E	2021E
iPhone: (m)	205	193	185	238
A11 units (m) - 10nm	85	25	5	
Good dies per wafer	476	625	625	
Wafers required (k)	179	40	8	
A12 units (m) - 7nm	75	70	50	20
Good dies per wafer	495	615	676	706
Wafers required (k)	151	114	74	28
A13 units (m) - 7nm Pro		78	50	70
Good dies per wafer		519	565	598
Wafers required (k)		150	88	117
A14 units (m) - 5nm			80	60
Good dies per wafer			551	603
Wafers required (k)			145	100
A15 units (m) - 5nm Pro (N5P)				88
Good dies per wafer				609
Wafers required (k)				144
Total iPhone wafers required (k)				
10nm wafers (A11)	179	40	8	
7nm wafers (A12)	151	114	74	28
7nm Pro wafer (A13)		150	88	117
5nm wafer (A14)			145	100
5nm Pro wafer (A15)				144
sub-total	427	344	316	389
Total AP wafer required - iPhone + iPad (k)	560	459	426	492
Revenue estimate (USDm) - iPhone + iPad				
10nm wafers (A11)	2,317	810	206	-
7nm wafers (A12)	1,747	1,381	1,051	607
7nm Pro wafers (A13+A12X)		1,650	988	1,209
5nm wafers (A14+A13X)			1,813	1,095
5nm Pro wafers (A15)				1,877
Revenue estimate (USDm)	4,064	3,842	4,059	4,788
Add (1): InFO packaging (USDm)	1,491	1,380	1,219	1,584
Add (2): iPhone baseband 4G/5G				
Intel share (in-house)			51%	31%
Qualcomm share (X55; TSMC's 7nm)			49%	69%
Total wafer required - baseband (k)			94	176
Revenue estimate (USDm)			753	1,144
Wearables (m)	50	73	110	140
Add (3): Apple Watch/AirPod AP				
Total wafer required - Apple Watch + AirPod(k)	29	43	67	85
Revenue estimate (USDm)	191	262	367	425
Total Apple's revenue to TSMC (USDm)	6,472	5,778	6,398	7,941
% of TSMC revenue	18.7%	16.9%	16.3%	17.9%
% YoY	-3.1%	-10.7%	10.7%	24.1%

Note: * = estimates, Source: Mizuho Securities Equity Research from IBS

iPhone X 3D Sensor Technology

The camera captures dots projected on the user's face from the vertical-cavity surface-emitting laser (VCSEL) and then the sensor compares the shape and depth of the user's face to its reference patterns.



Camera

- ✓ **Portrait mode:** creates background blurring and adjusts lighting according to facial features when taking selfies
- ✓ **Animoji:** tracks 50 facial muscles to sync user's expressions with emoji characters. Voice can also be added and shared using messaging app. Twelve Animoji options.

Security – FaceID –

- ✓ In place of Touch ID, uses facial/iris recognition for unlocking, authentication, payments, etc.
- ✓ Utilizes 3D sensor technology to prevent security breaches using photos, etc.
- ✓ Uses machine learning to adapt to changes in appearance (major changes require password entry and data updating)
- ✓ Multiple faces can be registered
- ✓ Works with glasses, hats, and even in the dark

Augmented Reality

Improved ARkit (AR app development kit) performance

Entertainment

- ✓ **World Brush:** App that allows users to paint in 3D on the real world. Can be viewed from other devices also
- ✓ **Stack AR:** AR game in which users stack up blocks
- ✓ **Thomas and Friends:** Design a railroad track for Thomas, and then project it onto the real world

Convenience

- ✓ **Edmonds:** Project life-size car in the real world. Allows users to verify a car's actual size before buying it.
- ✓ **Housecraft:** Projects furniture in actual size. Various catalogs built in; user can verify size before purchasing
- ✓ **AR Measurement:** Using ARkit, user can measure the dimensions of objects around him/her
- ✓ Other: Display nutritional values of foods; directions using AR

Can it do this, too ?

- ✓ Made-to-order shoes (measure size/shape of feet); input gestures (while cooking, etc.)

Source: Compiled by Mizuho Securities Equity Research from company data

What is Time of Flight (ToF)?

Basic concept

- ◆ Time of Flight (ToF) is a system that resolves distance by measuring the time-of-flight of a light signal between the camera and the subject.
- ◆ Allows the calculation of 3D information that was not previously possible under 2D recognition.

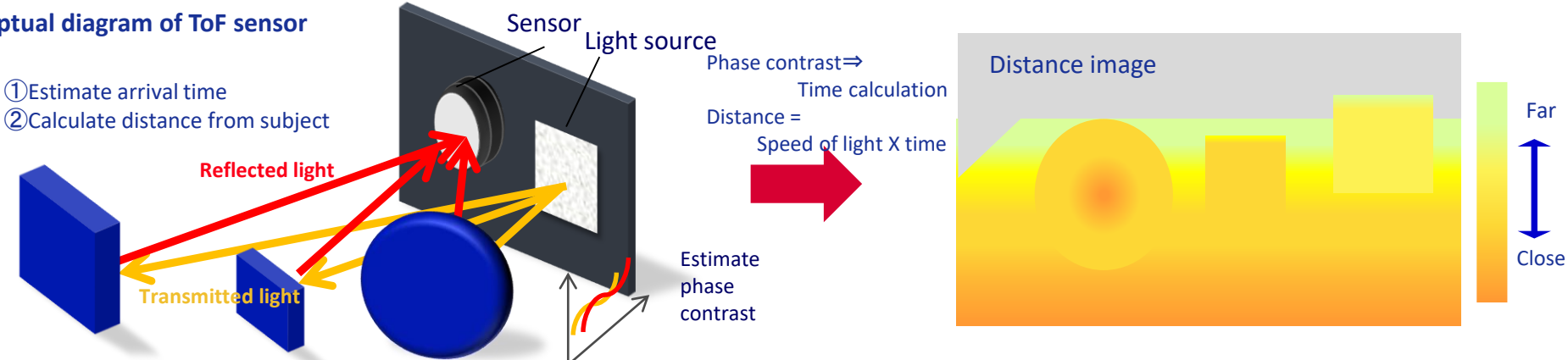
ToF application examples

- ◆ Monitoring
 - ✓ Entry/exit management/Counting store customers/ATM anti-peeking
 - Reduces image processing burden compared to 2D recognition
 - ✓ Platform screen doors: Shape assessment of falling objects
- ◆ Automation
 - ✓ Autonomous driving (LiDAR is essentially the same concept)
 - ✓ Elevators, automated doors: Opening and shutting based on position information of individuals
 - ✓ Automation of distribution/delivery services: automatic delivery robots
- ◆ Interface
 - ✓ Gesture recognition: Medical and foods sectors, etc.

Could smartphones do these things too?

- ◆ Augmented reality apps and games
 - ✓ Games based on real world spaces where you find hidden items behind obstacles etc.?
- ◆ Measuring functionality
 - ✓ Instant measurement of object size when camera is pointed toward it.
 - ✓ cameras that estimate clothing size and fit without needing to try on?
- ◆ Gesture recognition
 - ✓ Starts up consumer electronics (TVs, air conditioners, etc.) just by pointing camera at them
- ◆ Navigation
 - ✓ Navigation in small buildings where GPS functionality doesn't work
 - ✓ Automated explanations of exhibitions at museums, etc. by pointing camera.
- ◆ Exercise/health apps
 - ✓ Record and analyze golf/baseball form
 - ✓ Apps that save your body information and plan a diet for you

Conceptual diagram of ToF sensor



Source: Mizuho Securities Equity Research from company data

LiDAR (3D time-of-flight (ToF) sensor)

Main features

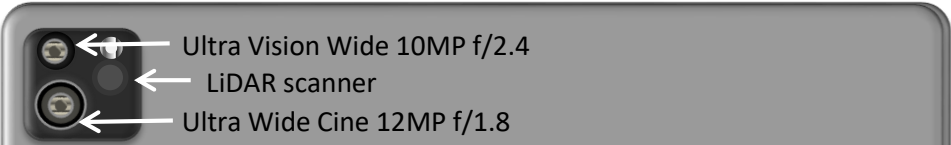
- First product equipped with a LiDAR scanner (light source + ToF sensor) launched in March 2020
→Also used in iPhone12Pro/ Pro Max released in October 2020
- LiDAR(Light Detection and Ranging) Scanner: D-ToF method that measures distance with light reflection and recognizes 3D shapes within a range of about 5m using scan; sensor supplied by Sony
 - ✓ Object occlusion: Recognizes real, complex shapes and depth, and accurately draws what is in front of and behind virtual objects→Applied to the AR app
 - ✓ Improvement in existing camera functions: Six-fold increase in auto focus speed in dark places; also supports night-mode portrait that blurs the background in dark places

Application to the AR app

- 3d Scanner App (measurement): Prepares a mesh and generates 3D data
- RoomScan LiDAR (measurement): Accurately scans a room and creates a floor plan
- Height measurement app (measurement): Measures height while sitting
- Effectron (measurement): Draws 3D effects in Realtime using a scanned terrain
- IKEA Place (furniture): Match up real furniture with virtual furniture and simulate potential changes to your room’s layout
- Hot Lava (game): Your room becomes the map of an AR game, and your furniture takes damage in the game
- Complete Anatomy (anatomical drawings of the human body): Detects human skeletal structure, responds to movement, and observes how bones and muscles move

iPad Pro2020

- Display : : LCD、11.0”：2,388 × 1,668、12.9”：2,732 × 2,048
- Processor : A12Z Bionic chip
- Out-Camera : 12MP (wide angle, f/1.8), 10MP (super wide angle, f/2.4)
: 2x optical zoom, up to 5x digital zoom
- In-Camera : 7MP (Selfie, f/2.2), Face ID
- Price : 11.0”：¥84,800 (excl. tax) ~, 12.9”：¥104,800 (excl. tax) ~
- Magic keyboard: Released in May 2020 (sold separately), equipped with a trackpad
- Does not support 5G, supports Wi-Fi 6



iPhone 12 Pro/ Pro Max

- Display : Super Retina XDR
12Pro : 6.1” , 2,532 × 1,170、12Pro Max : 6.7” , 2,778 × 1,284
- Processor : A14 Bionic chip
- Out-Camera
12Pro : 12MP(Ultra Wide, f/2.4),12MP(Wide, f/1.6),12MP(Telephoto, f/2.0)
12Pro Max : 12MP(Ultra Wide, f/2.4),12MP(Wide, f/1.6),12MP(Telephoto, f/2.2)
- In-Camera : 12MP (Selfie, f/2.2)、Face ID
- Price : 12Pro: ¥106,680(excl. tax) ~, 12Pro Max: ¥117,800(excl. tax) ~



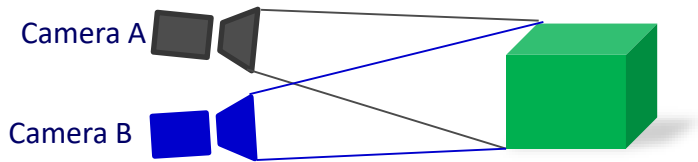
Source: Mizuho Securities Equity Research

3D sensor characteristics by type

	Time of Flight (ToF)	Stereo camera	Structured light
Precision	○High	× Low	◎Very high
Performance in dark environments	○Good	× Weak	○Good
Performance in bright environments	○Fair (relies on light source)	○Good	○Fair (relies on light source)
Response time	◎Fast	○Middle	× Slow
Cost	○Middle	◎Low	× High
Depth accuracy	mm to cm	cm	mm to cm
Distance Range	Short to long range (relies on light source)	Mid range	Very short to mid range (relies on light source)

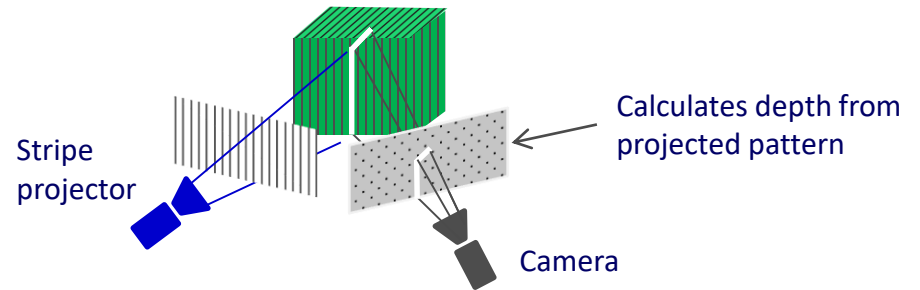
Stereo camera

- ◆ Captures images using two parallel lenses at the same time. Image processing enables camera to obtain depth information of object.
- ◆ Device structure is easy to simplify and allows caps on costs, but depth precision is poor.
- ◆ This technology has been adopted in Subaru’s Eyesight system



Structured light

- ◆ Projects random stripes or lattice shaped patterns, with the pattern’s distortions used to calculate depth.
- ◆ Good depth precision, but complex device means high costs
- ◆ Technology has been adopted in iPhone X’s Face ID



Source: Mizuho Securities Equity Research from company data

Shipment and Panel Supply/Production Capacity of iPhone/iPad

iPhone and iPad Production

iPhone

(in mm) 2011 2012 2013 2014 2015 2016 2017 2018 2019E

Total Production	95	140	155	185	253	194	223	223	178
Panel Demand	100	170	175	191	284	235	270	246	220

Display Supply Capacity (Maximum)

JDI	46	65	95	100	110	155	160	110	70
LG Display	39	50	70	90	110	130	100	80	70
Sharp	15	50	75	80	70	55	55	50	60
Innolux	0	10	7	0	0	0	0	0	0
Samsung Display	0	0	0	0	0	0	100	170	150

iPad Air + Pro

(in mm) 2011 2012 2013 2014 2015 2016 2017 2018 2019E

Total Production	43	60	35	35	25	21	47	47	37
Panel Demand	48	65	38	42	29	29	53	60	50

Display Supply Capacity (Maximum)

LG Display	30	30	23	25	15	20	30	25	15
Samsung Display	25	25	9	17	15	20	5	0	0
Sharp	0	5	3	0	5	10	30	30	30
Innolux	3	3	0	0	0	0	0	0	0
BOE	0	0	0	0	0	0	5	10	20

iPad Mini

(in mm) 2011 2012 2013 2014 2015 2016 2017 2018 2019E

Total Production	0	9	43	24	20	13	7	4	7
Panel Demand	0	11	45	29	25	16	9	5	10

Display Supply Capacity (Maximum)

LG Display	0	10	32	17	20	15	15	5	10
AUO	0	1	11	1	0	0	0	0	0
Samsung Display	0	0	2	2	10	10	0	0	0
Sharp	0	0	1	7	10	5	10	5	5

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities
Source: Mizuho Securities Equity Research

iPhone Panel Supply Forecast (LCD/OLED)

◆ Supplier : For OLED, SDC > LGD > BOE. For LCD, Sharp > JDI.

	Panel Size (inch)	Panel Size 2020 new models~	Panel Size 2021 new models~	Fab	Gen.	2014	2015	2016	2017	2018	2019	2020	2021E Maximum
										20LED 1LCD	20LED 1LCD	30LED 1LCD	30LED 0LCD
(LCD)													
LG Display	4.0"			AP2	G4.5	20	11	8	1	-	-	-	-
Japan Display	4.0"			D1	G4.5	29	11	25	7	4	-	-	-
Sharp	4.0"			Kameyama1	G6	39	18	22	15	7	2	-	-
4.0" subtotal						88	40	55	23	11	2		
LG Display	4.7"	4.7"		AP3	G6	25	61	44	43	10	-	-	-
Japan Display	4.7"	4.7"		J1	G6	20	56	43	44	14	12	24	11
Sharp	4.7"	4.7"		K1/Hakusan	G6	24	57	34	29	50	43	17	20
4.7" (incl.SE2) subtotal						69	174	121	116	74	55	41	31
LG Display	5.5"			AP3	G6	17	33	31	38	19	8	2	-
Japan Display	5.5"			D2→D3	G5.5→G6	17	37	28	41	21	9	-	-
5.5" subtotal						34	70	59	79	40	17	2	
LG Display	6.06"			AP3	G6					14	34	26	6
Japan Display	6.06"			J1	G6					25	41	26	9
Sharp	6.06"			K1/Hakusan	G6					-	11	28	34
6.06" (XR/11) subtotal										39	86	80	49
LCD total						191	284	235	217	164	160	123	80
(OLED)													
Samsung Display	5.85"			A3	G6				53	49	29	10	-
5.85" (X+XS+11Pro) subtotal									53	49	29	10	
Samsung Display	6.46"			A3	G6					33	26	9	-
LG Display	6.46"			E6	G6						4	5	-
6.46" (XS Max+11Pro Max) subtotal										33	30	15	
Samsung Display	5.42"			A3	G6							24	26
LG Display	5.42"			E6	G6							-	9
5.42" (12Mini/13Mini) subtotal												24	35
Samsung Display	6.06"			A3	G6							27	56
LG Display	6.06"			E6	G6							22	39
BOE	6.06"			B7/11	G6							-	9
6.06" (12/12Pro/13/13Pro) subtotal												48	104
Samsung Display	6.67"			A3	G6							26	46
LG Display	6.67"			E6	G6								
6.67" (12Pro Max/13Pro Max) subtotal												26	46
OLED Total									53	82	59	123	185
Total (LCD+OLED)						191	284	235	270	246	219	246	265

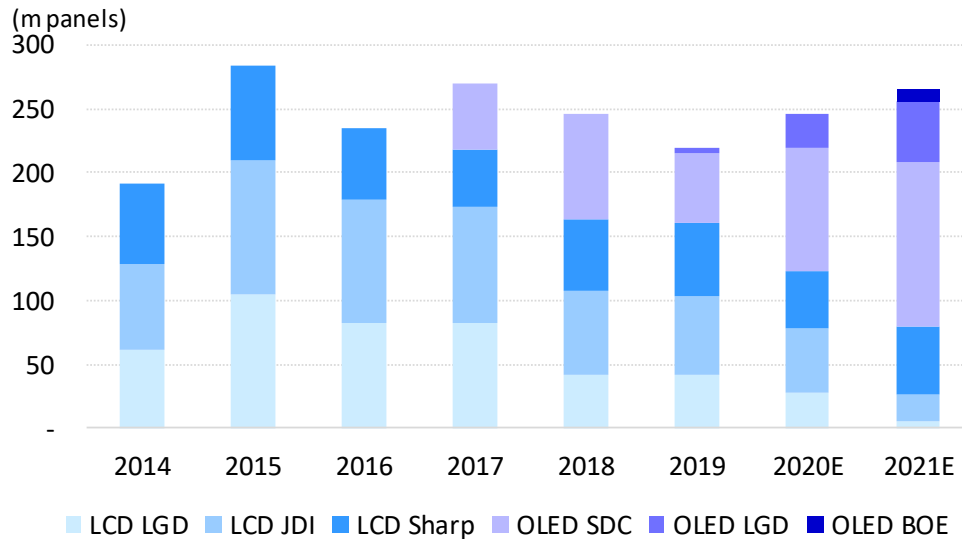
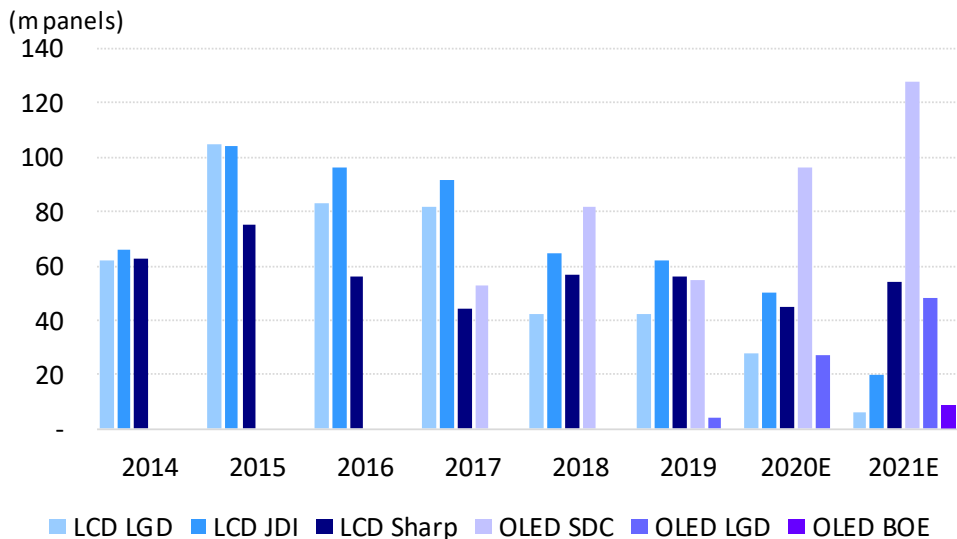
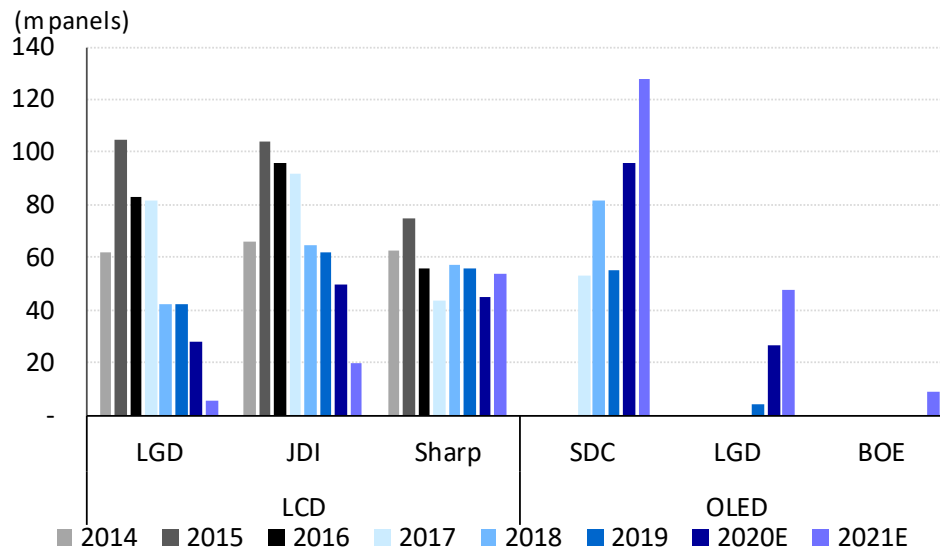
Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities

Source: Mizuho Securities Equity Research

iPhone Panel Supply Forecast (LCD/OLED by supplier)

iPhone Panel Supply Forecast (LCD/OLED)

		(m panels)								
Panel	Maker	2014	2015	2016	2017	2018	2019	2020E	2021E	
LCD	LGD	62	105	83	82	43	42	28	6	
	JDI	66	104	96	92	65	62	50	20	
	Sharp	63	75	56	44	57	56	45	54	
OLED	SDC	-	-	-	53	82	55	96	128	
	LGD	-	-	-	-	-	4	27	48	
	BOE	-	-	-	-	-	-	-	9	
LCD + OLED	LGD	62	105	83	82	43	46	55	54	
	JDI	66	104	96	92	65	62	50	20	
	Sharp	63	75	56	44	57	56	45	54	
	SDC	-	-	-	53	82	55	96	128	
	BOE	-	-	-	-	-	-	-	9	
Total		191	284	235	270	246	219	246	265	



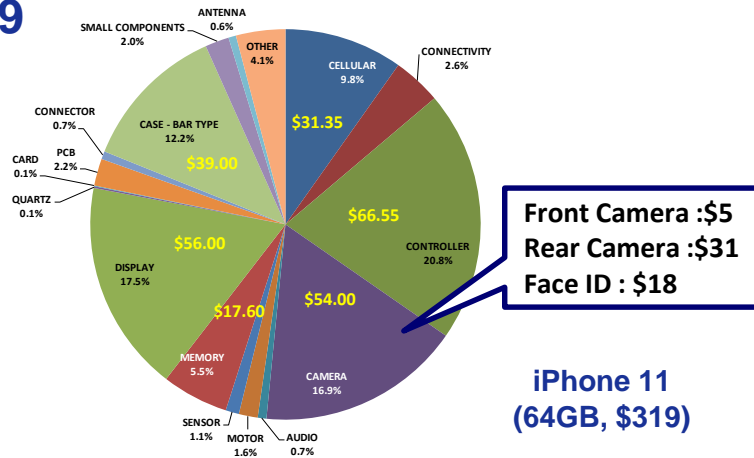
Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities

Source: Mizuho Securities Equity Research

iPhone12/iPhone12 Pro: Estimated cost for each component (USD)

iPhone 11 (64GB) / iPhone 12 (64GB)

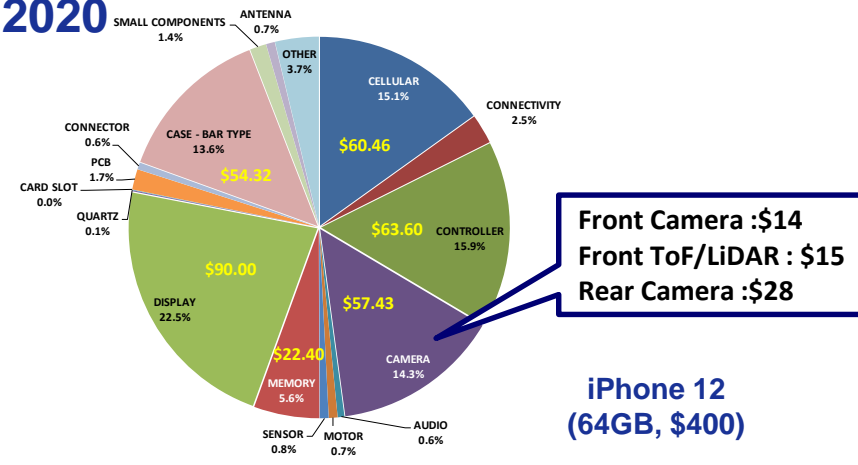
CY2019



iPhone 11 (64GB, \$319)

Front Camera :\$5
Rear Camera :\$31
Face ID : \$18

CY2020

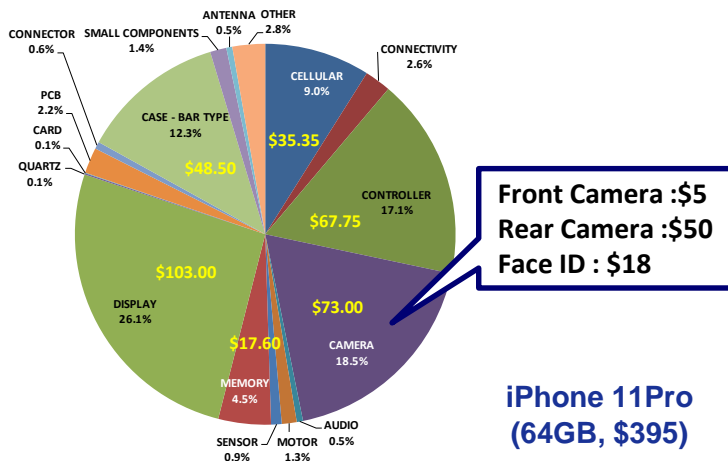


iPhone 12 (64GB, \$400)

Front Camera :\$14
Front ToF/LiDAR : \$15
Rear Camera :\$28

iPhone 11 Pro(64GB) / iPhone 12Pro (128GB)

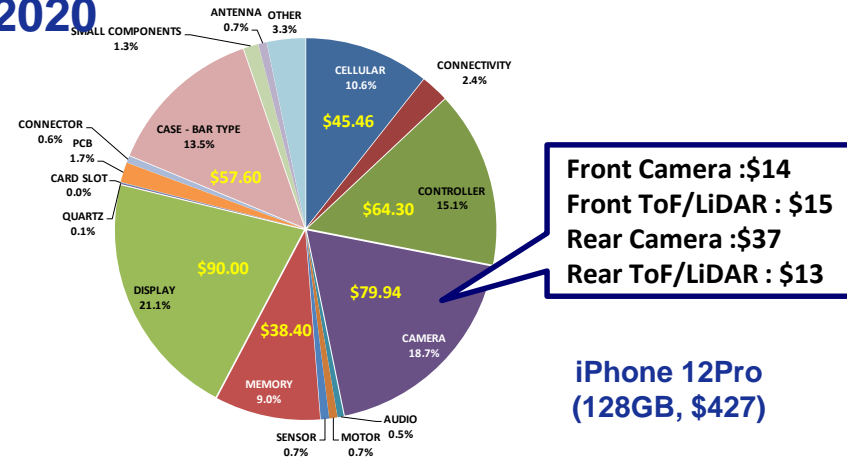
CY2019



iPhone 11Pro (64GB, \$395)

Front Camera :\$5
Rear Camera :\$50
Face ID : \$18

CY2020



iPhone 12Pro (128GB, \$427)

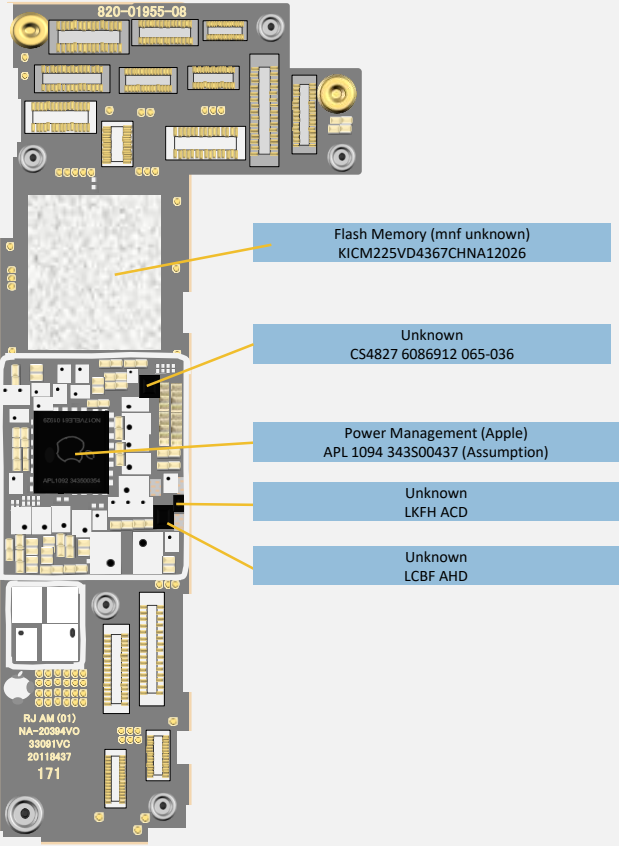
Front Camera :\$14
Front ToF/LiDAR : \$15
Rear Camera :\$37
Rear ToF/LiDAR : \$13

Note: Some data is estimated by Mizuho Securities Equity Research
Source :Fomalhaut Techno Solutions, Mizuho Securities Equity Research

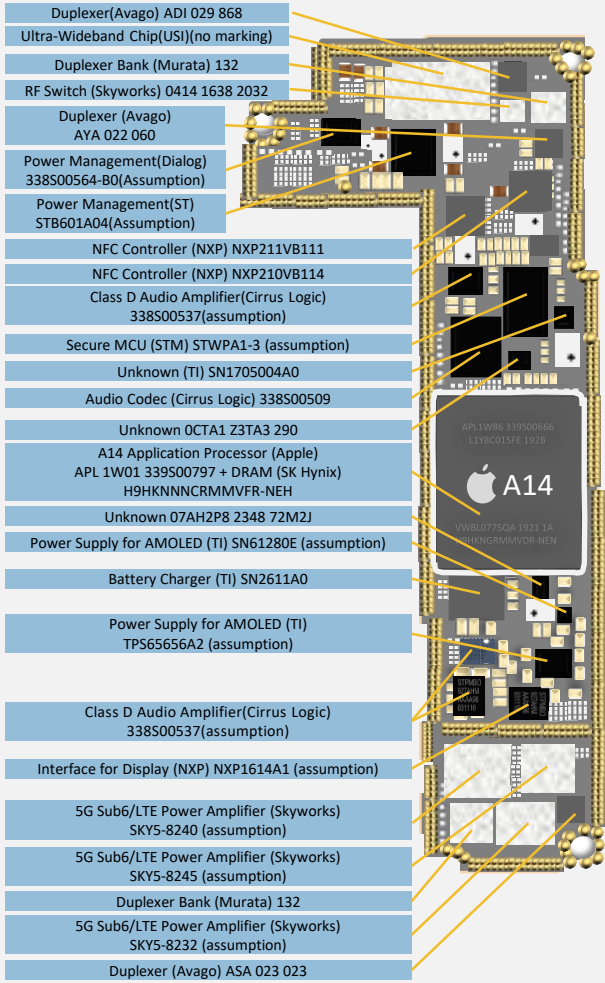
Teardown of iPhone 12 (6.1")

Main circuit board of iPhone 12

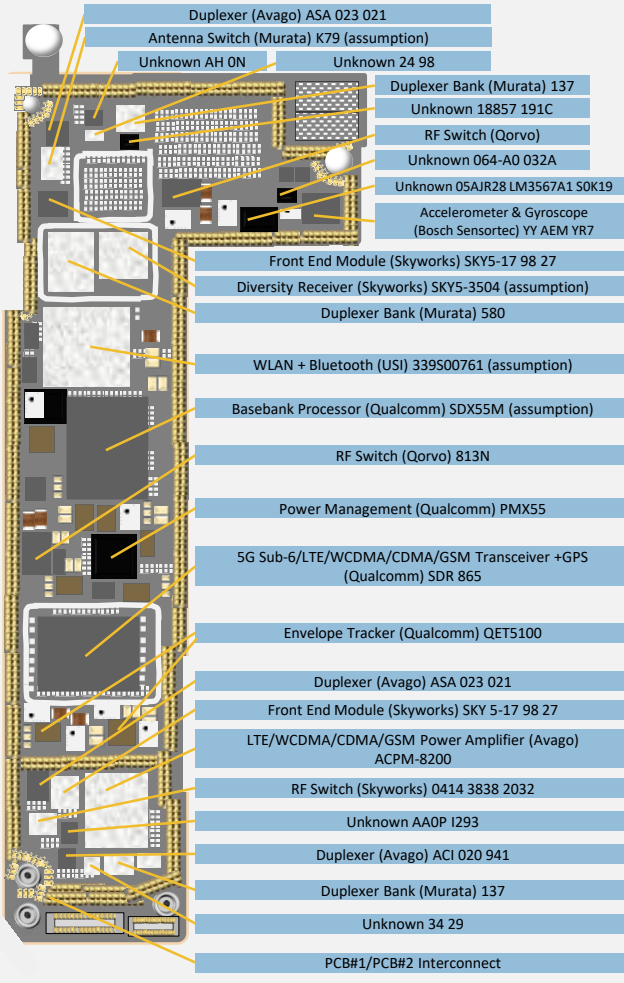
DISPLAY SIDE(PCB#1)



BATTERY SIDE(PCB#1)



DISPLAY SIDE(PCB#2)

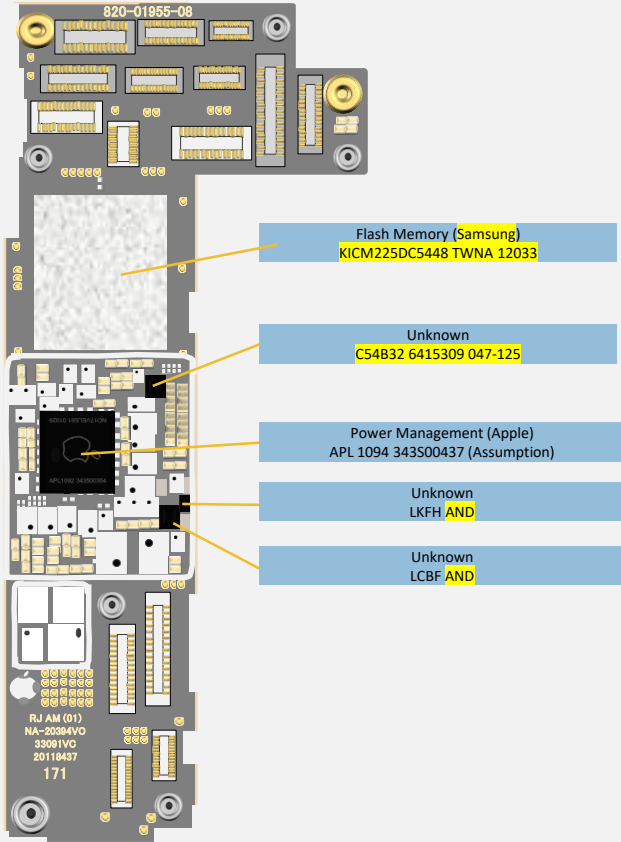


Source :Fomalhaut Techno Solutions

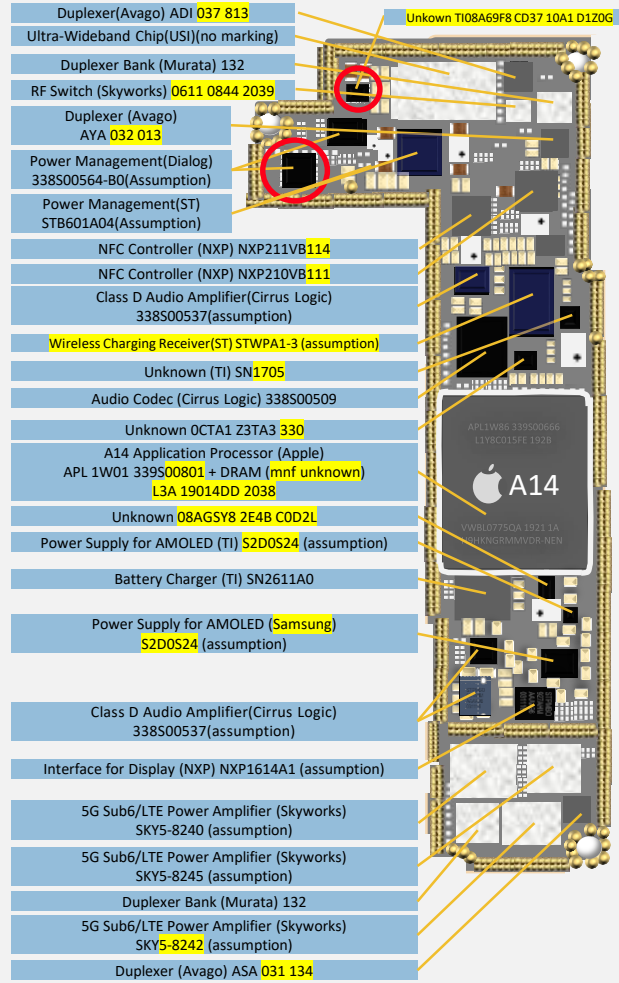
Teardown of iPhone 12 Pro (6.1")

Main circuit board of iPhone 12 Pro

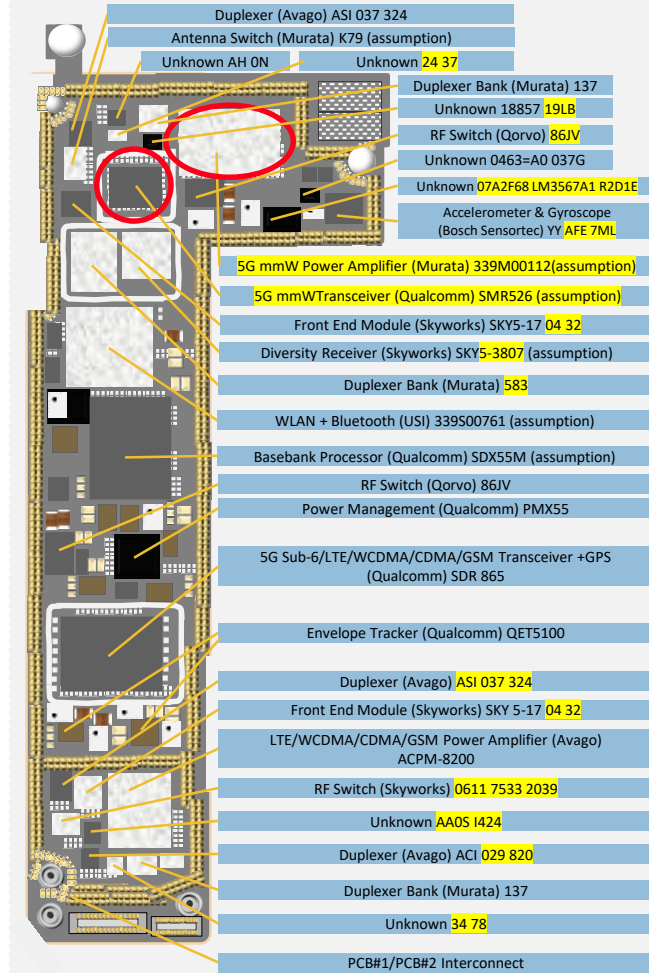
DISPLAY SIDE(PCB#1)



BATTERY SIDE(PCB#1)



DISPLAY SIDE(PCB#2)



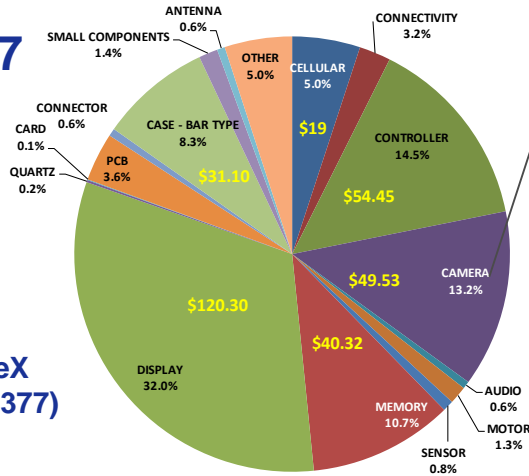
Note : / : differences from iPhone 12
Source : Fomalhaut Techno Solutions

iPhone XS / iPhone XS Max : Estimated cost for each component (USD)

iPhone X/ iPhone XS

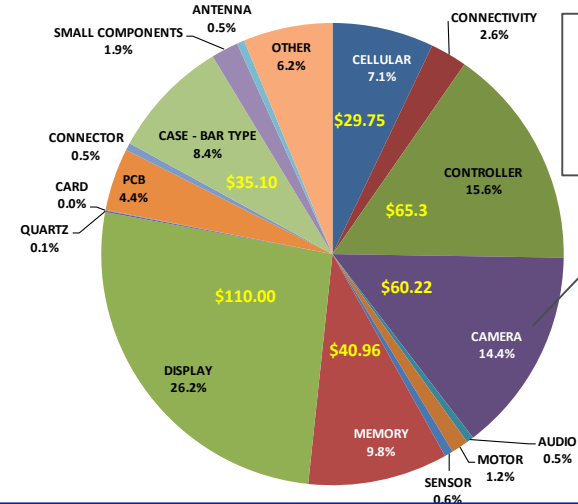
CY2017

iPhoneX
(64GB, \$377)



FACE ID
\$21.60(43.6%)
Others
\$27.93(56.4%)

CY2018

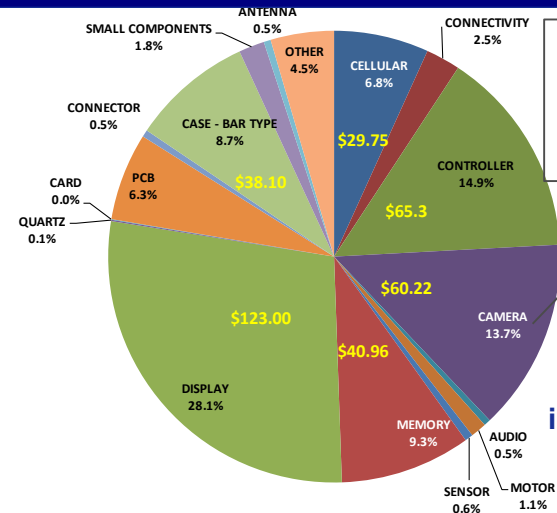


FACE ID
\$24.60(40.9%)
Others
\$35.62(59.1%)

iPhoneXS
(64GB, \$419)

iPhone XS Max

CY2018



FACE ID
\$24.60(40.9%)
Others
\$35.62(59.1%)

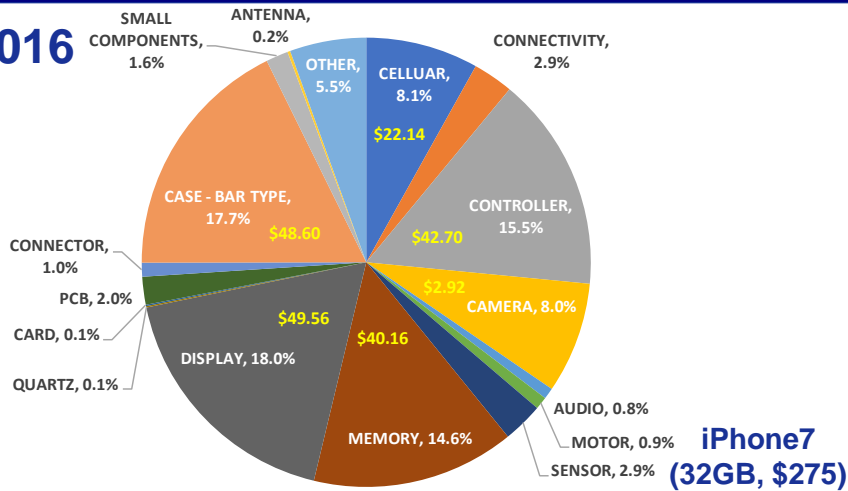
iPhoneXS MaX
(64GB, \$438)

Note: Some data is estimated by Mizuho Securities Equity Research
Source :Fomalhaut Techno Solutions, Mizuho Securities Equity Research

iPhone(4.7") BOM cost(7→8→SE) : SE cost down almost \$50

iPhone7(32GB), iPhone8(64GB), iPhone SE(64GB)

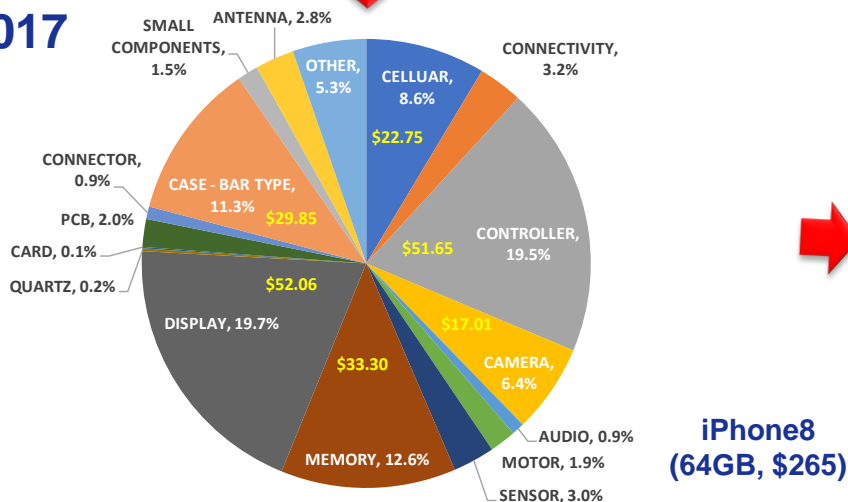
CY2016



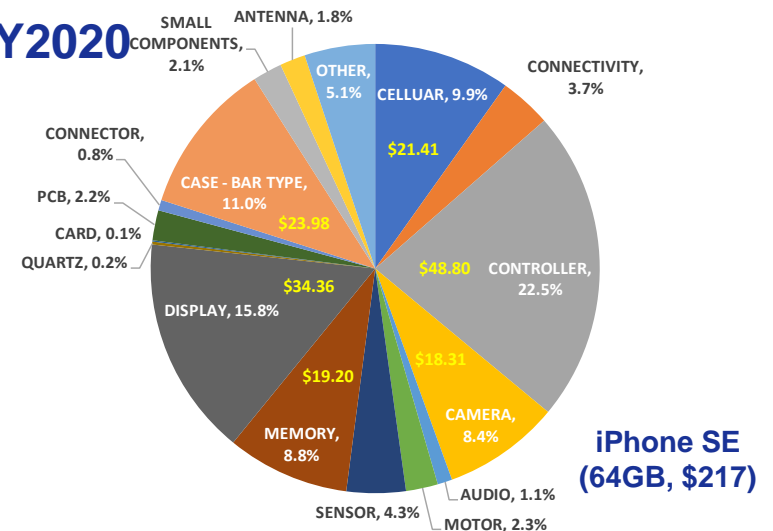
BOM : SE down \$48 versus iPhone 8

- ✓ Memory: DRAM capacity up (2→3GB), NAND unchanged, but CoGS down \$14 due to drop in bit cost.
- ✓ Display: CoGS down \$18 due to termination of ForceTouch, decline in LCD prices.
- ✓ CPU: Upgraded to latest version (A11→A13), but CoGS down slightly.

CY2017



CY2020

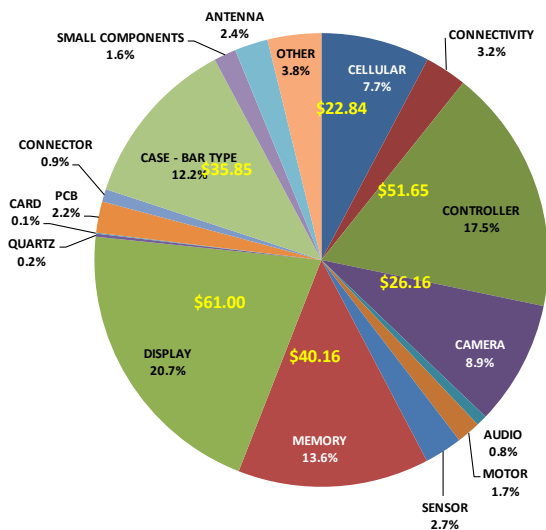
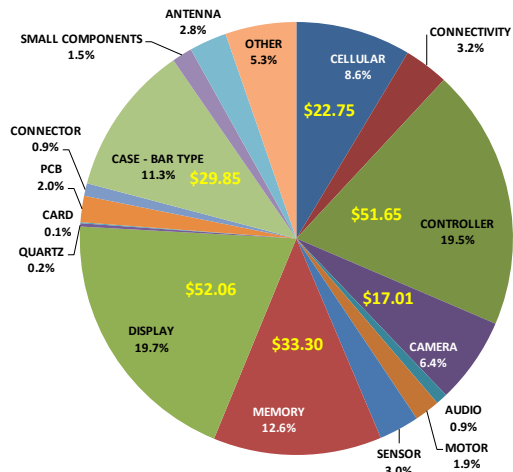


Note: Some data is estimated by Mizuho Securities Equity Research
Source :Fomalhaut Techno Solutions, Mizuho Securities Equity Research

iPhone XR(6.1") : Estimated cost for each component (USD)

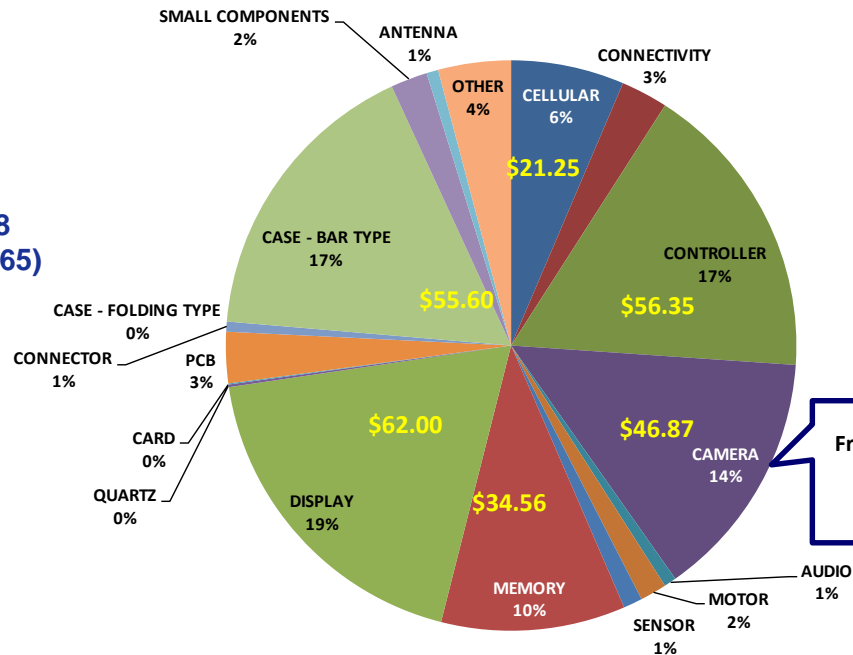
iPhone 8 (64GB)/iPhone XR(64GB)

CY2017



CY2018

iPhone8 (64GB, \$265)



Front+Rear Camera : \$22.27
Face ID : \$24.6

iPhone8 Plus (64GB, \$295)

iPhone XR (64GB, 331\$)

Note: Some data is estimated by Mizuho Securities Equity Research
Source :Fomalhaut Techno Solutions, Mizuho Securities Equity Research

Apple: Watch / Pad / TV

- **Apple Watch:** released in April 2015, finally started to take off from 2017, and continues to grow at roughly 20% annual pace
 - Sizes are 1.8" and 1.6" (1.9"/1.76" for Series7 in 2021). Uses an LGD/JDI OLED panel. Assembly by Taiwan's USI (boards) and Quanta (final assembly). Sapphire glass/TP. GG/OLED flexible.
 - Functions: iPhone-linked (health, exercise management). FDA approval from Watch 4; functions include EKG, blood oxygen saturation and pulse rate monitoring, emergency notifications, etc.
 - Price: \$399/\$429~(Series6). \$298/\$198~for older models. Growth trend continues, with roughly 28m in 2019 and 33m in 2020 (production basis)
 - Display: Focus on possible adoption of MicroLED. Based on development status, most likely possibility is adoption from 2023. No adoption is also possible
- **iPad:** Both high-end and entry-level models; combined use of Oxide and A-Si; linkage with MacBook, migration to 4K, etc.
 - Pro (12.9"/11.0" the latest AP+dual camera+ToF): Mini LED+LCD for 12.9". Focus on prices, weight, image quality and power consumption. 5G model for 11"?
 - Air (10.9"): No new models in 2021. OLED new model in 2H 2022 or Mini LED cheap edition? There are many questions.
 - iPad (10.2"): the volume of cheap edition is around 25m per year and it is around 50% of total volume. Successor to be introduced in 2021.
 - Mini: Successor to 8.3" model to be introduced. Small size, but with A14 on board, may command higher positioning than iPad (10.2").
 - Display: Pro features Oxide LCD (SH/LGD), others have A-Si (+BOE). For Pro/Air, battle is between Oxide LCD+Mini LED and OLED. Likely OLED in the medium/long term
 - Price: \$799(64GB)/\$949(256GB) for 12.9" 2018 models. \$649(64GB) for 11.0" model (677g), \$799(256GB) for 11.0" model (469g).
 - Volume: Around 50m of shipment per year → Upside for iPad/Mini. In terms of price, Pro/Air. Applications: personal entertainment, WFH, education.
 - Future: Pro/Air to become thinner, lighter (from roughly 500g to under 400g), and higher-performance. Cost reductions for iPad/Mini.
- **iTV:** Low potential as pure TV; iMac Monitor likely to be the solution.
 - Two approaches: Pure Smart TV (55" and up, 4K), and iMac type development (20-32", 4K, touch monitor + Apple TV Box). Choose the latter.
 - Existing 5K 27" iMac (5,120 x 2,880) could be solution. Retail price ¥200,000 for iMac and ¥500,000 for Pro! May eventually offer 32"/34.5". Possible battle between LCD+Mini LED and OLED in this space as well.

Apple Watch: A wearable device for the wrist

Timepiece functions

Standard functions

• In addition to displaying time, Apple Watch can also work as an alarm clock, timer, stopwatch, and world clock.

Customizable user interface

• Possible to set the dial face to display in analog or digital mode
 • Time can be set to display in minutes, seconds, and milliseconds.

Accurate time display

• Accuracy within 0.05 seconds of the global time standard (*the same level of accuracy found in GPS satellites)

Other functions

Functions in common with iPhone

• Calendar, Map, Passbook, Siri, Music, Photos, Weather, and Stocks

Connectivity with other Apple products

• Controlling iPhone's camera
 • Remote control for Apple TV
 • Operating iTunes application on Mac and Windows

Fitness monitor functions

Accurate exercise data tracking

• Monitors heart rate via heart rate sensor
 ⇒ Sends alerts when it detects heart rate irregularities or atrial fibrillation
 • Equipped with FDA-approved electrical heart rate sensor
 ⇒ Place finger on the edge of the display for about 30 sec to take an ECG

Activity app

• Tracks the amount of time spent sitting down
 • Monitors heart rate and measure calories burned
 • Measures all physical activities above brisk walking

Workout app

• Selecting an activity type triggers appropriate sensors, which then track the workout

Feedback functions

• Coaching reminder function that assists based on past workout history
 • Displays historic exercise data in charts

Newly added features and specs for Series 4 Cellular model

Improved health tracking functions

• Equipped with FDA-approved electrical heart rate sensor.
 ⇒ Place finger on the edge of the display for about 30 sec to take an ECG.
 • Improved function of optical heart rate sensor on the bottom of the watch.
 ⇒ Detects when your heart rate is irregular and alerts you.

Improved accuracy of gyroscope and optical sensor

• Can detect when you slip, trip, or fall
 ⇒ Emergency call button automatically displayed when it detects a fall

Newly added features and specs for Series 5 Cellular model

Always-on Retina Display

• Display can stay always on with up to 18 hours of battery life by slightly dark display and hiding some parts incl. second hand.

Built-in compass

• Able to determine elevation, latitude, longitude, incline and direction. The maps app shows the direction you're facing.

Newly added features and specs for Series 6 Cellular model

Measurement of blood oxygen levels (excl. SE model)

• Measures oxygen levels in blood in approx. 15 secs. Can measure in background throughout the day. For fitness rather than medical purposes.
 • 4 LED clusters on the back irradiate vessels on wrist with red/green LED and infrared light, feed back to 4 photodiodes on underside.

Apple Watch Series 6/SE/3

Apple Watch Series 6	Apple Watch SE	Apple Watch 3
GPS ¥42,800*	GPS ¥29,800*	GPS ¥19,800*
GPS+Cellular ¥53,800*	GPS+Cellular ¥34,800*	



GPS + Cellular model (has new Walkie-Talkie function)

• Can make calls/text with regular Apple Watch.
 • Can stream music by linking with Apple Music.

Communication functions

LINE

Quick confirmation of videos, emoji, stamps, new message voice alert, can reply using emoji and stamps

Apple Pay

Accepts Suica and credit card details

Unique tools

• Heartbeat function - Pressing the screen with two fingers activates the built-in heart rate sensor, which records and sends heart rate to a contact.
 • Tap function – Taps that contacts feel on their wrists
 • Sketch function – Send hand-drawn sketches to contacts

Apple Watch compatible applications

Release of software development kit

• Enhancement of applications likely in the future with the release of WatchKit for developers

Currently usable apps

• SNS : (Twitter, Instagram)
 • Navigation: (Citymapper, TripAdvisor)
 • Scheduler: (Expedia, Invoice2go)
 • News: (NY Times, ESPN)
 • Online auction: (eBay)

Specifications

Display Type (Series 4/5/6/SE)

• Type LTPO OLED retina display with touch sensitivity
 • Size 1.57" / 1.78"
 • Resolution 324x394 (326ppi)/448x368 (326ppi)
 • Protective glass
 ✓ Ion-X glass (aluminum model, SE)
 ✓ Sapphire Glass (titanium, stainless, ceramic model)
 • Brightness (1000nits)

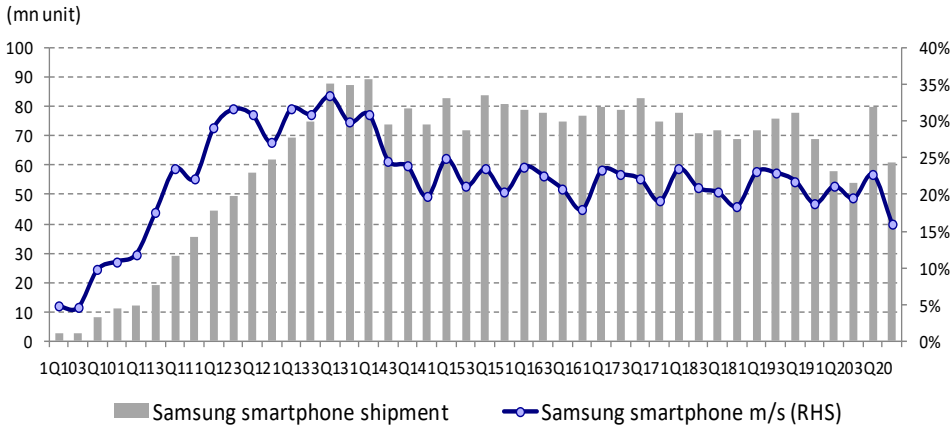
Main features

• Storage 16GB (Series 4) → 32GB (Series 5, 6, SE)
 • Chip S4 (Series 4) → S5 (Series 5) → S6 SiP (Series 6) / S5 SiP (SE)
 • Battery life: (*Up to 18 hours on normal charge) (Series 4/5/6/SE)

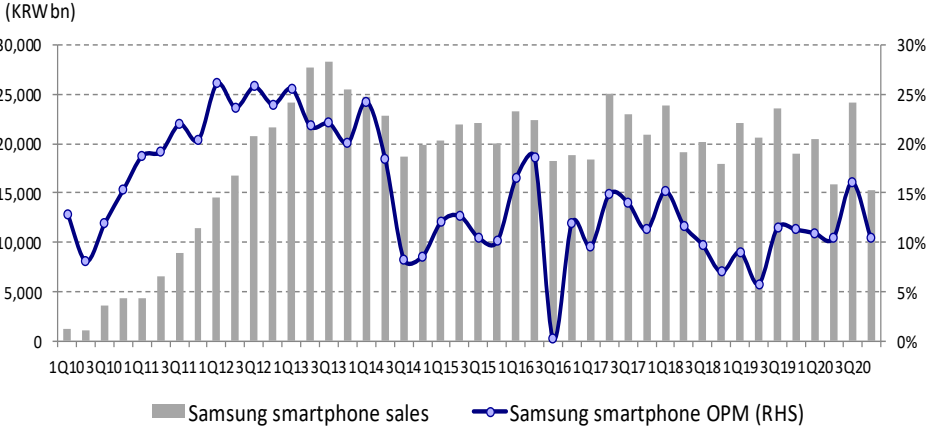
Source: Mizuho Securities Equity Research from company data

Samsung Mobile: Status quo

Smartphone shipment and m/s trend



Smartphone sales and OPM trend



Source: Mizuho Securities Equity Research from company data

Major takeaways post 4Q20 earnings

- SEC's smartphone shipment declined by 24% QoQ to 61mn in 4Q21, mainly due to inventory adjustment ahead of new model launch in 1Q21. Despite dips in revenue, SEC' IM was able to achieve OP margin of 11% in 4Q20 in light of ongoing improvements in cost efficiency with limited marketing cost spending.
- SEC targets to increase smartphone shipment by 20% QoQ to 70-75mn in 1Q20 along with earlier launch of GS21 in January 2021.

Bixby: In a chicken and egg situation

- **Samsung's Bixby is designed to learn and develop its AI assistant service with accumulated data from users. However, Samsung dose not have a clear strategy to shift consumers preference in AI assistant experience from well-established competitors' services including Google Assistant, Siri and Alexa.**
- Due to inferior competitiveness, SEC currently reviews future roadmap of Bixby. One of options will include shifting Bixby's role to assist other AI services.

Samsung Mobile: Outlook and Strategy

SEC targets to achieve solid smartphone growth in 2021

- For 2020, SEC's smartphone sharply decreased 14% YoY to 253mn, one of the largest drops among major smartphone makers. This will be primarily attributable to weaker high-end smartphone sales together with its marginal position in the China market.
- SEC target to increase its smartphone shipment to around 295-300mn in 2021, along with recovering end-demand.

SEC should consider a dramatic shift in strategy

- We believe that it will be incrementally challenging for Samsung Mobile to differentiate itself from its major competitors in the Android camp with camera specifications display resolutions/sizes given commodity nature of camera module/display.
- In our view, Samsung Mobile should take more aggressive stance on foldable smartphones where it can leverage its strong bargaining power thanks to superior smartphone volume as well as unique relationship with Samsung Display.

Challenges and opportunity for 2021

- Given its marginal presence in the China market, Samsung Mobile has relatively cautious stance on 5G smartphone shipment in 2021, which will become challenges for the company to gain share in 5G market.
- SEC's IM lowered operating costs by 11% YoY in 2020, mostly centered on marketing and S&A costs. As we expect SEC's marketing cost to rebound in 2021 due to intensifying competition, SEC should enhance cost structure further to maintain profitability in 2021.

Further collaboration with Harman

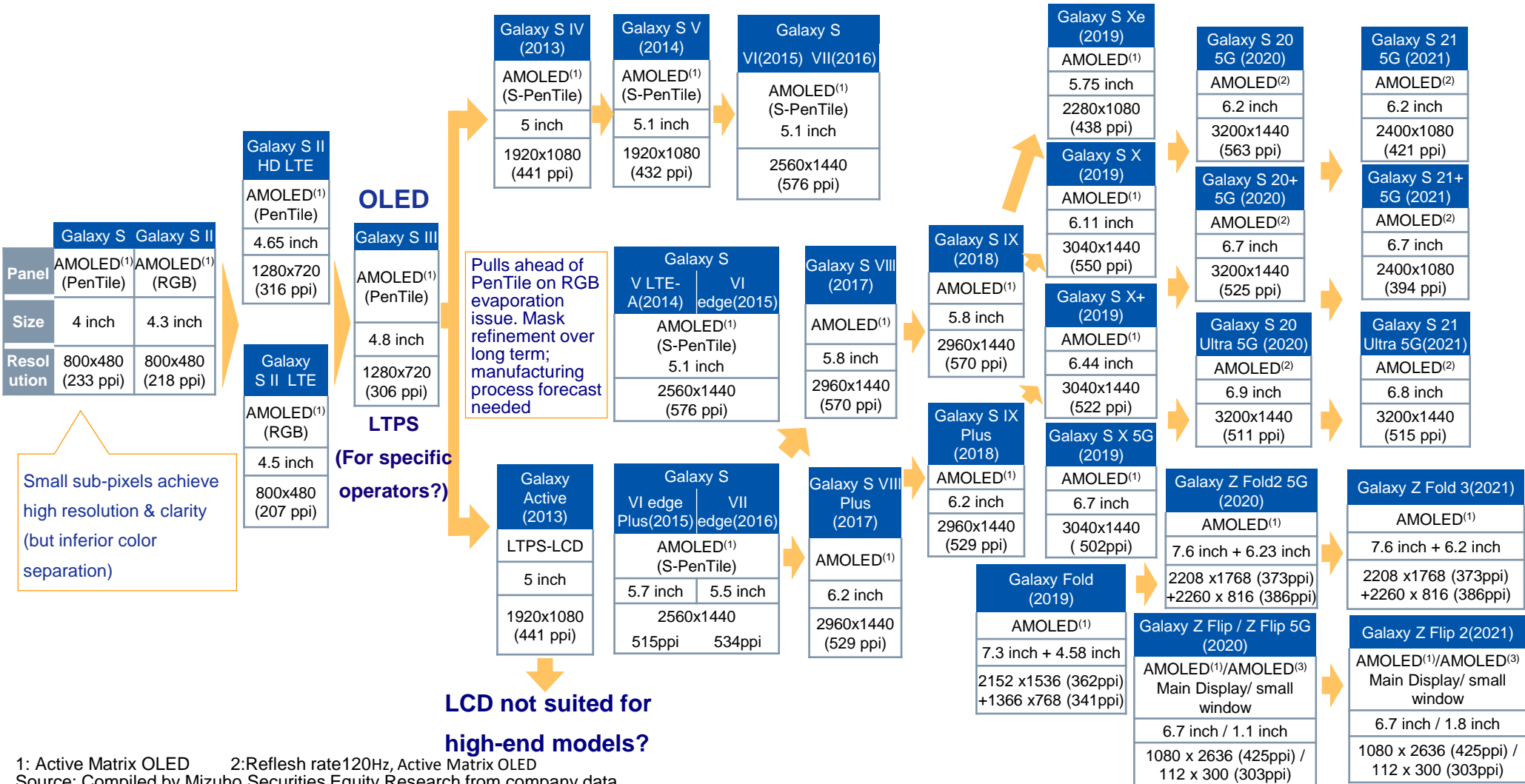
- Samsung management shares a clear vision that the car of tomorrow will be much different than today, which will offer substantial opportunities for Samsung as a whole. Samsung management expects Harman acquisition to bring: (1) well-established customer relationship, (2) strong connected car technology, and (3) Harman's solid management leadership.
- **Samsung Mobile will incrementally focus on collaboration with Harman to leverage opportunity.**

Source: Mizuho Securities Equity Research from company data

Outlook for Samsung smartphone and tablets ①

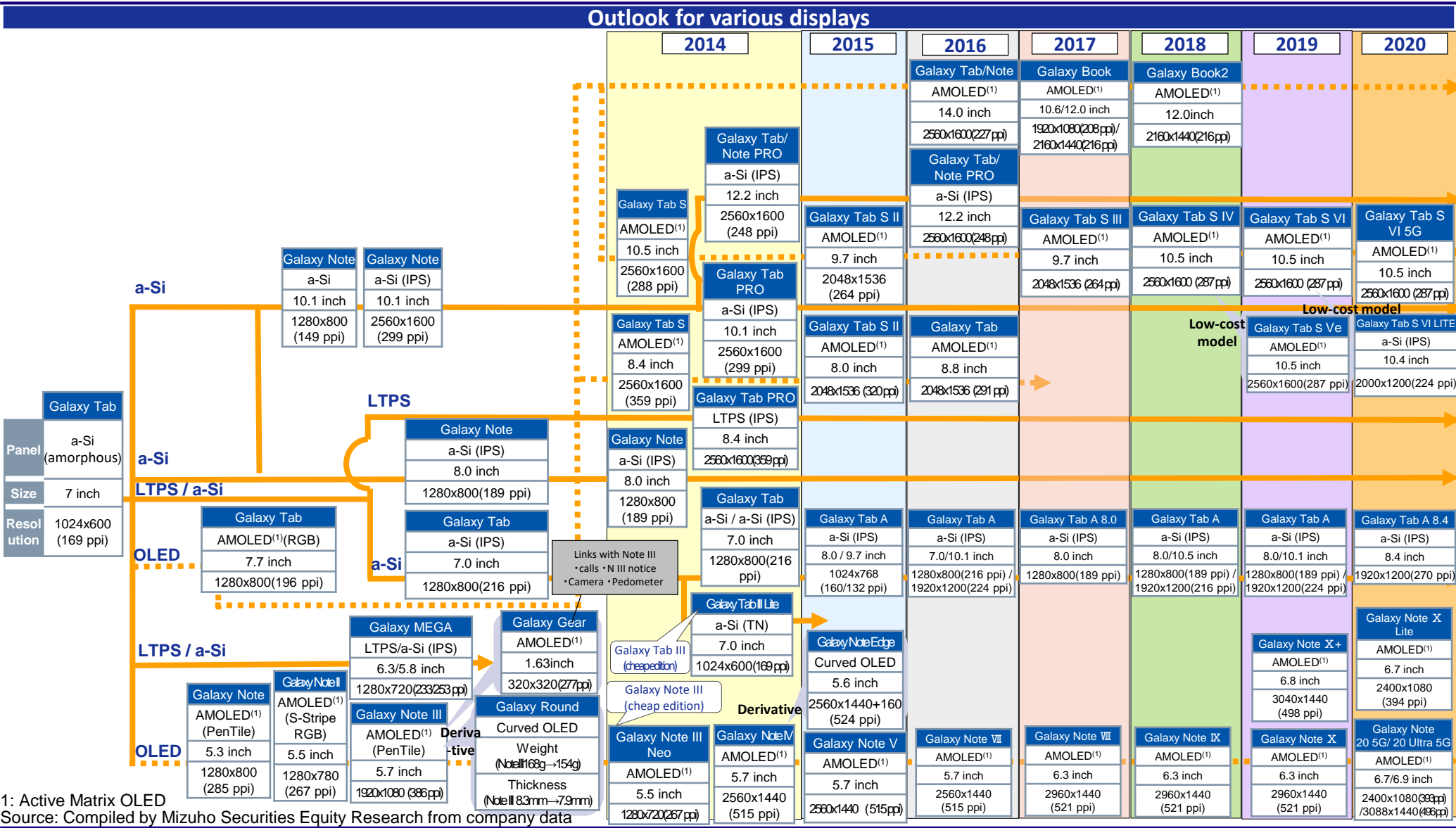
Flex OLED, resolution topping out, how big will they go? Big expectations for foldable devices

Upcoming display developments



Outlook for Samsung smartphone and tablets ②

Narrow down the models. OLED for high-end models and LCD for low-end ones.



Samsung OLED smartphone production forecast

(Unit: M)

	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20E Max	211Q	212Q	213Q	214Q	CY21E Max
Galaxy S21 series									11	5	6	2	25
Galaxy S20 series								24	4	3	0	0	6
Galaxy S10 series							36	7	1				1
Galaxy S9						18	5	0					
Galaxy S9+						15	1	0					
Galaxy S8(5.77")					22	11	2						
Galaxy S8+(6.22")					18	3	0						
Galaxy S7				24	9	2							
Galaxy S7 Edge				24	6	1							
Galaxy S6			26	7	3								
Galaxy S6 Edge			17	4	2								
Galaxy S6 Edge+			6	1									
Galaxy S5		38	16	1									
Galaxy S5 Mini		5	3	1									
Galaxy S4	52	20	5	0									
Galaxy S4 Mini	15	13	3	0									
Galaxy S3	45	19	6	0									
Galaxy S3 Mini	26	10	2	0									
Galaxy Note II + III + IV + V	42	34	20	6	3								
Galaxy Note VII + VIII				4	14	5	0						
Galaxy Note IX						10	3						
Galaxy Note X							10	3					
Galaxy Note 20								8	2	1	1	0	4
Galaxy Fold							0.3	0.2					
Galaxy Fold 2								0.7	0.1	0.1	0.1	0.0	0.2
Galaxy Fold 3											0.4	0.6	1.0
Galaxy Z Flip								1.3	0.2	0.2	0.1	0.0	0.5
Galaxy Z Flip 2											2.9	1.6	4.5
Galaxy A Series + Grand Prime		6	47	31	52	55	179	206	48	60	72	59	240
Galaxy J, C and M Series+others	29	35	43	162	175	165	61	15	4	5	5	4	18
Total	209	180	195	265	303	284	297	265	70.0	74.0	88.0	68.0	300
Estimated Original Plan	210	240	240	260	300	280	290	290					300

➤ **Flagship(S + Note): sluggish growth**

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities

Source: Mizuho Securities Equity Research

Samsung Mobile: 2021 smartphone model line-ups

Samsung Mobile's smartphone line-up for 1H21: Galaxy S

Model name	Galaxy S		
	GS21 5G	GS21+ 5G	GS21 Ultra 5G
Launch timing	1Q21 (Jan 21)	1Q21 (Jan 21)	1Q21 (Jan 21)
Display size (Aspect ratio)	6.2" (20:9)	6.7" (20:9)	6.9" (20:9)
Display resolution	1440*3200	1440*3200	1440*3200
Display technology	OLED	OLED	OLED
AP	Exynos 2100/SDM888	Exynos 2100/SDM888	Exynos 2100/SDM888
Camera (Rear)	Triple (12+12+64)	Triple (12+12+64)	Quad (10+10+12+108)
Camera (Front)	Single (10)	Single (10)	Single (44)
DRAM	10GB LPDDR5	12GB LPDDR5	12GB/16GB LPDDR5
NAND	128GB/256GB	128GB/256GB	128GB/256GB/512GB
Battery	4000mAh	4800mAh	5000mAh

Samsung Mobile's smartphone line-up for 2H21: Galaxy Z

Model name	Galaxy Z	
	Galaxy Z Flip 2	Galaxy Z Fold 3
Launch timing	3Q21	3Q21
Display size (Aspect ratio)	6.7"/1.8"	7.6"/6.2"
Display resolution	QHD+	QHD+
Display technology	OLED	OLED
AP	SDM865+	SDM888+
Camera (Rear)	Dual (12+12)	Triple (12+12+64)
Camera (Front)	Single (10)	Single (10)
DRAM	12GB LPDDR5	16GB LPDDR5
NAND	256GB	512GB
Battery	4000mAh	4800mAh

Source: Mizuho Securities Equity Research from company data

Samsung Mobile: 2021 smartphone model line-ups

Samsung Mobile's smartphone line-up for 2021: Mid/Low-end

	Galaxy A							
Model name	A02	A02s	A12	A22 5G	A32 5G	A42 5G	A52	A72
Launch timing	1Q21	1Q21	2Q21	3Q21	1Q21	4Q21	2Q21	2Q21
Display size	6.5"	6.5"	6.5"	6.6"	6.5"	6.6"	6.5"	6.6"
Display resolution	720*1600	720*1600	720*1600	720*1600	720*1600	720*1600	1080*2400	1080*2400
Display technology	LCD	OLED	LCD	LCD	LCD	OLED	OLED	OLED
AP	MTK6739W	SDM450	MTK6765	SDM750	MTK6853	SDM750	SDM750	SDM750
Camera (R)	Dual (13+2)	Tripple (13+2+2)	Quad (48+5+5+2)	Quad (13+5+2+2)	Quad (48+8+5+2)	Quad (48+8+5+5)	Quad (64+12+5+5)	Quad (64+12+8+5)
Camera (F)	Single (5)	Single (5)	Single (8)	Single (8)	Single (13)	Single (20)	Single (32)	Single (32)
DRAM	3GB	3GB/4GB	3GB/4GB/6GB	4GB	4GB/6GB/8GB	4GB/6GB/8GB	6GB/8GB	8GB
NAND	32GB	32GB/64GB	32GB/64GB/128GB	64GB	64GB/128GB	128GB	128GB/256GB	128GB/256GB

	Galaxy M/F		
Model name	M02	M02s	M12
Launch timing	1Q21	1Q21	1Q21
Display size	6.5"	6.5"	6.5"
Display resolution	720*1600	720*1600	720*1600
Display technology	LCD	LCD	LCD
AP	MTK6739W	SDM450	Exynos 850
Camera (R)	Dual (13+2)	Tripple (13+2+2)	Quad (48+5+2+2)
Camera (F)	Single (5)	Single (5)	Single (8)
DRAM	2GB/3GB	3GB/4GB	3GB/4GB/6GB
NAND	32GB	32GB/64GB	32GB/64GB/128GB

Source: Mizuho Securities Equity Research from company data

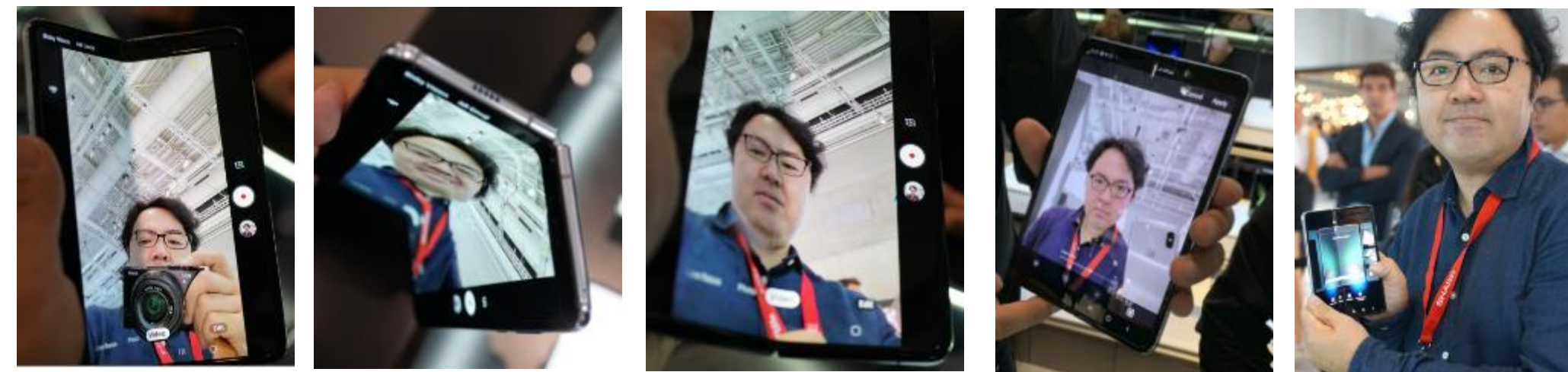
Samsung Electronics: Foldable smartphone outlook

Why do foldable smartphones matter?

- Heightened expectations for replacement demand: however, prices need to fall below US\$2,000, US\$1,500, and US\$1,000 (expected around 2023).
- Who will buy them? Those with affinity for the new, women who keep their phones in their handbags, business men and middle aged/elderly customers who need larger screens.
- Future for the technology: expected to expand to laptops.

Increase in foldable display panel suppliers will be critical for foldable smartphone expansion

- We think smartphone makers and panel suppliers other than Samsung group companies will play important roles in order to accelerate the speed of penetration. We understand Huawei plans to launch a foldable smartphone with BOE panels, and Shenzhen based start-up Royole has already announced the launch of one model with their own panels. But production volume should be quite limited given the difficulty of foldable OLED panel production.
- Although other panel makers including LG Display, AUO, JDI, Sharp, and Tianma are currently in R&D status for foldable display panels, we do not expect to see real product anytime soon. Samsung Display is practically the only supplier. The emergence of a meaningful second panel supplier will be a very important factor to encourage those makers to focus more on foldable products.



Samsung Mobile: Galaxy Note20

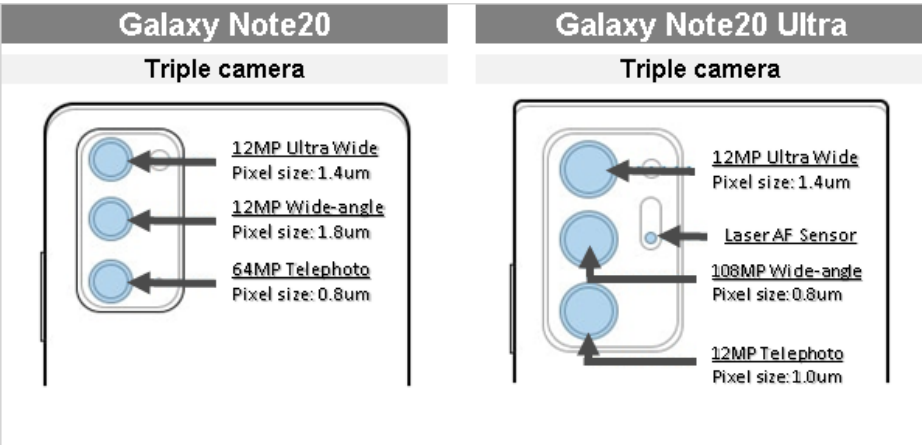
Galaxy Note20 has downgraded camera specifications to lower BOM burden

- Given GS20's much weaker sales volume in 1H20, Samsung Mobile has decided to lower BOM of Galaxy Note20 in order to lower retail prices of its flagship models to more affordable levels. Accordingly, Samsung Mobile lowered camera specification for Galaxy Note20.
 - ✓ Galaxy Note20 models adopt triple camera (vs. quad camera for Galaxy S20+/S20 Ultra), removing ToF sensors. In addition, Note20 Ultra has lowered hybrid zoom specification to 50X (vs. 100X for Galaxy S20 Ultra).

Galaxy Note20 to support Xbox games over Project xCloud

- During tis unpacked event Samsung Mobile announced that Galaxy Note20 will start to support Xbox streaming games equipped with MOGA XP5-X plus controller. Microsoft plans to launch Xbox Game Pass Ultimate membership in the middle of September 2020, which includes all the benefits of Xbox Live Gold, plus over 100 console and PC games at \$14.99/month. Samsung Mobile offers 3 month of free trial for Xbox Game Pass Ultimate to Galaxy Note20 preorders.

Galaxy Note20: Rear camera specifications



Note20 supporting Xbox with MOGA controller



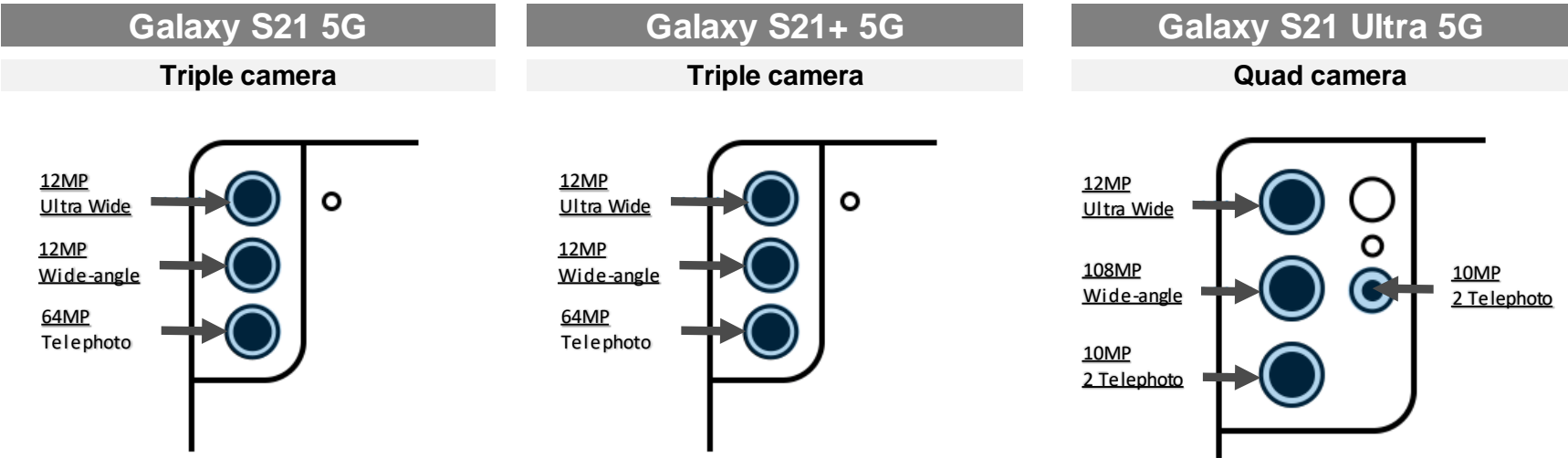
Source: Mizuho Securities Equity Research from company data

Samsung Mobile: GS21 focusing more on price competitiveness

SEC slightly lower camera specifications of GS21 to enhance cost competitiveness

- Samsung Mobile views that GS20's much weaker shipment of approximately 24mn in 2020 (vs. around 36mn of GS10 in 2019) will be mostly attributable to higher pricing points as well as worse launch timing when COVID-19 started to rapidly spread, which resulted in sharp dips in demand as well as economic lockdowns.
 - ✓ Samsung Mobile targets to lower price levels of GS21 so as to recover sales volume of flagship products for 2021. In order to lower cost, Samsung Mobile has lowered specifications for GS21 including backplate substrate and rear camera specifications (from quad to triple in the case of GS21+).
- GS21 Ultra supports the S Pen which was exclusively adopted for the Galaxy Note series, although it does not bundle the S Pen. We continue to view that Samsung Mobile will likely discontinue Galaxy Note series from 2021 given that: 1) its ongoing efforts to lower R&D cost burden; as well as 2) limited differentiation compared to large-size flagship models.

Galaxy S21: Rear camera specifications



Source: Mizuho Securities Equity Research from company data

Samsung Electronics: Foldable smartphone outlook

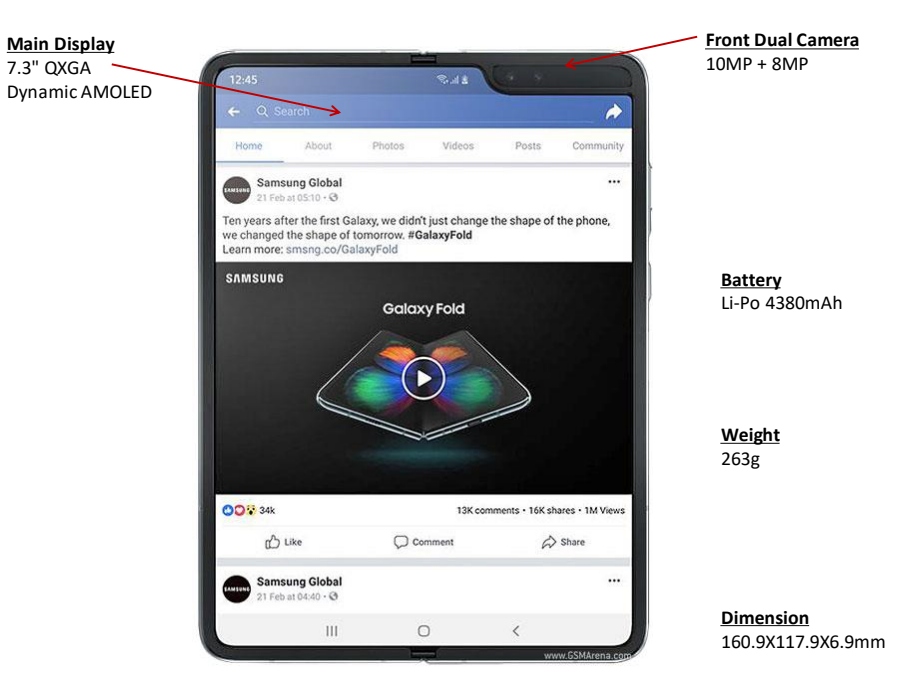
SEC finally relaunched Galaxy Fold after delays due to reported durability issues in Sep 19

- SEC originally planned to launch Galaxy Fold, in mid-April 2019, but the company delayed its public launch of Galaxy Fold after several reviewers raised durability issues with the display of Galaxy Fold.
- SEC has resolved reported problems from reviewers' feedbacks as follows. (1) Protective film layer: SEC has redesigned the protective film to wrap around the entire screen and into the outer bezel, making it much harder for consumers to peel off. (2) Hinge: SEC has also reengineered hinge to move more upward, creating a nearly invisible protrusion that may reduce the chance of a crease developing in the middle of the screen. With revisions for reported problems, SEC finally relaunched Galaxy Fold in September 2019.

Galaxy Fold: External specifications



Galaxy Fold: Internal specifications



Source: Mizuho Securities Equity Research from company data, GSM Arena

Samsung Electronics: Foldable smartphone outlook

SEC has added new foldable smartphone line-up, Galaxy Z Flip

- At Galaxy Unpacked 2020 event in February 2020, SEC announced the launch of new foldable smartphone model, Galaxy Z Flip, with a clamshell formfactor, focusing on: 1) better mobility with smaller dimension, and around 30% lower weights compared, and 2) more affordable pricing (USD1,380), approximately 30% lower price compared to Galaxy Fold (USD1,980).
- Galaxy Z Flip has a three-stop hinge, named as Hideaway hinge, which has special fibers to keep it and other particles or debris out. In addition, SEC has adopted ultra thin glass (UTG) which will be able to endure around 200,000 times of folding/unfolding .

Galaxy Z Flip: External specifications

Rear Dual Camera
12MP + 12MP

Cover Display
1.1" 303ppi (300X112)
Super AMOLED

AP
SDM855+ (7nm)

Memory
DRAM: 8GB
NAND: 256GB
UFS3.0

Hinge
Hideaway hinge

Dimension
Folded: 73.6 x 87.4 x 17.3mm
Unfolded: 73.6 x 167.3 x 7.2mm

Galaxy Z Flip: Internal specifications

Main Display
6.7" 425ppi (1080X2636)
Dynamic AMOLED with
Ultra Thin Glass (UTG)

Front Dual Camera
12MP + 12MP
(Ultra Wide + Wide Angle)

Battery
Li-Po 3300mAh

Charging
Wired/Wireless
charging

Weight
183g

Dimension
160.9X117.9X6.9mm


Source: Mizuho Securities Equity Research from company data, GSM Arena

Samsung Electronics: Foldable smartphone outlook

SEC's two track strategy on foldable smartphone: Z Flip and Z Fold

- Samsung Mobile plans to roll out foldable smartphone products with two flagship model line-ups including Galaxy Z Flip series (mid-range in foldable smartphone) in 1H and Galaxy Z Fold series in 2H (premium-range in foldable smartphone). We anticipate that Samsung Mobile will continue to lower retail price of its foldable smartphone products to more affordable levels with increasing volume growth.
- On 5 August 2020, SEC unveiled the successor of Galaxy Fold, Galaxy Z Fold s with even larger display panel size for cover display, adopting UTG in main display, and enhancing hinge specification along with Hideaway hinge system.

Galaxy Z Fold 2 5G: External specifications



Rear Tripple Camera
12MP + 12MP +12MP
(Wide + Telephot + Ultra wide)

Cover Camera
10MP

Cover Display
6.23" (816X2260)
Super AMOLED

Hinge
Hideaway hinge

AP
SDM865+ (7nm+)

Memory
DRAM: 12GB
NAND: 256GB
UFS3.1

Dimension
Folded: 159.2 x 68.0 x 16.8mm
Unfolded: 159.2x 128.2 x 6.9mm

Galaxy Z Fold 2 5G: Internal specifications



Main Display
7.6" 372ppi (1768X2280)
Dynamic AMOLED
2X capacitive touchscreen
Ultra Thin Glass (UTG)

Camera
10MP

Battery
Li-Po 4500mAh

Charging
Fast charging (25W)
Fast wireless charging (11W)
Reverse wireless charging (9W)

Weight
279g

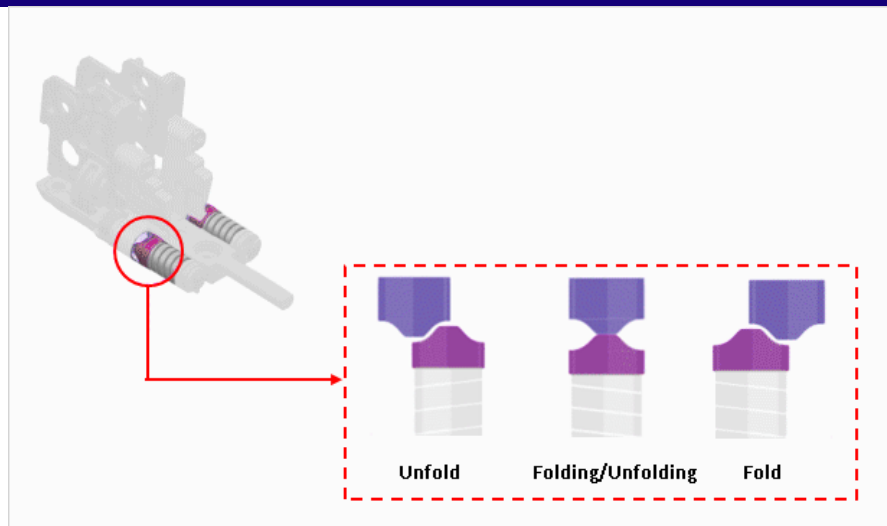
Source: Mizuho Securities Equity Research from company data, GSM Arena

Samsung Electronics: Foldable smartphone outlook

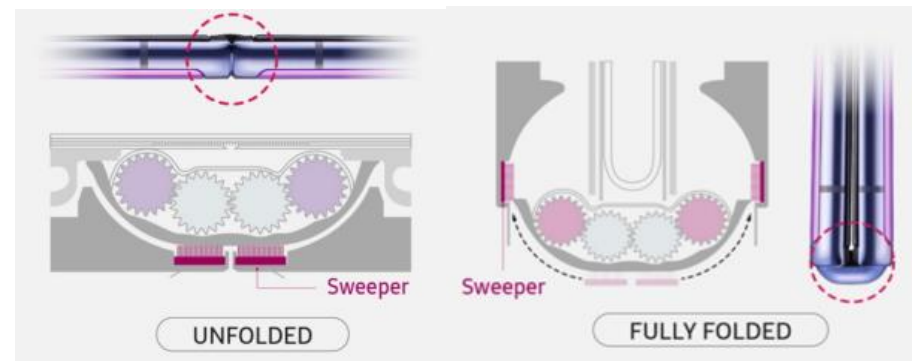
Hideaway hinge with dual cam mechanism and sweeper technology

- In order to enhance consumers' user experience of foldable smartphones, SEC has been trying to improve quality of hinge which should offer strong, stable and smooth experience, without adding any extra bulk which can prevent small particles, like dust and sand, from entering the tiny gap between the hinge and screen.
 - ✓ **Dual cam mechanism:** Hideaway hinge's dual cam mechanism consists of two cam detents on both ends of the entire hinge. Each of them has tow ridge-shaped parts engaged and a spring supporting the motion of the cam detent.
 - ✓ **Sweeper technology:** Hideaway hinge's sweeper mechanism sits inside the gap between the hideaway hinge and the body. As the hinge folds and unfolds, the nylon fibers sweep through the gap to help prevent micro particles from getting under the display.

Hideaway hinge: Dual cam mechanism



Hideaway hinge: Sweeper technology



Source: Mizuho Securities Equity Research from company data

Samsung Electronics: Foldable smartphone outlook

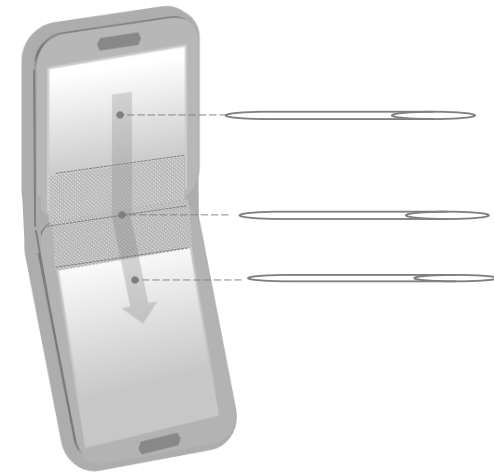
SEC to diversify form-factors of Galaxy Fold with potential S Pen support

- In line with our expectation, SEC announced to launch clamshell style foldable phone, Galaxy Z Flip, with more affordable price range.
 - ✓ At Galaxy Unpacked 2020 event in February 2020, SEC announced the launch Galaxy Z Flip with a clamshell formfactor, focusing on better mobility and more affordable pricing ranges.
 - ✓ SEC has adopted 1.1-inch OLED panels for external display in the model. This will potentially result in: 1) better mobility with smaller smartphone size when folding; and 2) lower retail pricing with less BOM burden for display panel, in our view.
- SEC considers expanding its S Pen support to Galaxy Fold
 - ✓ SEC recently filed for the patent with the United States Patent and Trademark Office regarding a foldable smartphone with the input mechanism by using not only finger but also a stylus.
 - ✓ Albeit limited visibility for launch timing, we also view SEC will include S Pen into Galaxy Fold in order to: 1) maximize large screen size; and 2) promote a smooth shift of Galaxy Note consumers' interests to Galaxy Fold.

Galaxy Z Flip



SEC's patent on foldable smartphone with S Pen



Source: Mizuho Securities Equity Research from company data, World Intellectual Property Office database

Samsung Electronics: Foldable smartphone outlook

Expanding foldable smartphone ecosystem with other smartphone makers

- With its failed efforts to introduce native operating systems (Bada, Tizen), Samsung is undoubtedly fully aware of the need to build a mobile ecosystem together with a diverse array of industry stakeholders. We therefore expect the company to act quickly to expand the foldable smartphone ecosystem in alliance with other brands.
- We forecast that Samsung Display has started to supply foldable display panels to external customers such as Motorola (Razr 2019) and will continue to expand its customer base including Oppo, Vivo, Huawei, and other Chinese smartphones.
- Samsung Display will soon have to invest in a new plant (A5 or A6) in order to continue going panels production capacity expansion for notebooks/monitors and in the foldable panel space (for smartphones and tablets). However, at this juncture, we do not foresee any indications that the company is set to make an investment decision in the near term.
- Vollume: around 500k in 2019, 5m in 2021, more than 12m for the target of 2021. Investment in 2020 is the key for investment in A5.

Global smartphone makers developing foldable smartphones with various panel makers

- Major brands developing foldable smartphones with other panel makers (e.g., AUO, BOE, LGD), with plans for release in 2020 or later. Positive for the whole industry.

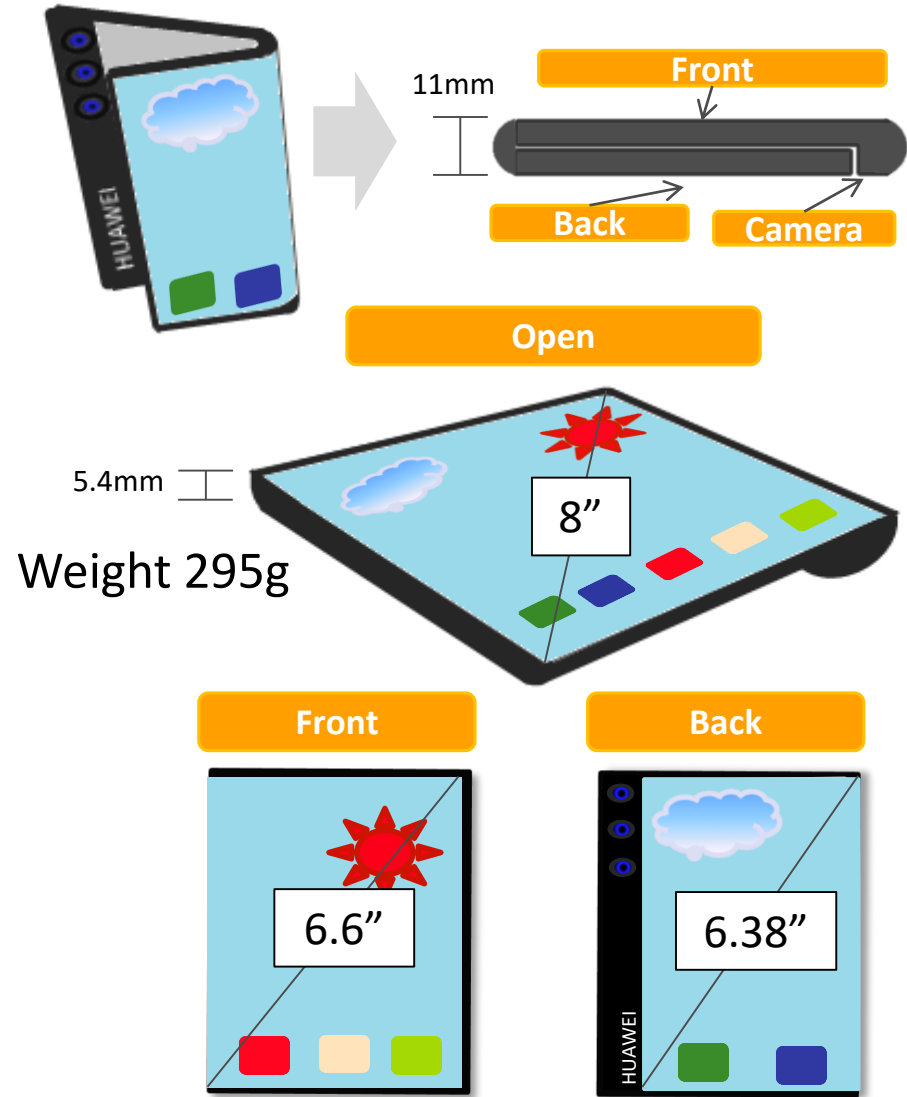
Foldable smartphone product line-ups vs. Panel suppliers

	Apple	Google	Huawei				Lenovo			LGE	Mororola	Oppo	Royole	Samsung				TCL	Vivo	Xiaomi	
	7.5"/4.X"	TBD	8.0"/6.6"	8.0"/6.6"	7.5"/4.X"	6.X"/3.X"	6.2"/3.X"	7.3"/4.X"	13.X"/7.X"	TBD		TBD	7.5"/4.X"	7.8"/4.0"	7.3"/4.6"	6.7"/1.1"	7.6"/6.2"	12.4"/7.X"	7.2"/4.X"	7.5"/4.X"	7.2"/4.5"
AUO							√														
BOE			√	√							√										
CSOT																		√			
LGD						√		√	√	√											
Royole												√									
SDC	√	√			√					√		√		√	√	√	√	√		√	√
Visionox																					√
Launched			Mate X	Mate Xs							Razr 2019		Flexpai	Galaxy Fold	Z Flip	Z Fold 2					

In-folding
Out-folding
TBD

Source: Mizuho Securities Equity Research from company data

Mate X: Huawei's first foldable smartphone (outward-folding type) Released in November 2019



Main Features

Huawei's first foldable smartphone

- ✓ Folded phone can be stored with no inner gaps (outward folding type)
 - 11mm thick when folded
 - 5.4mm thick when unfolded

Display

- ✓ OLED
 - ✓ Display is rectangular with no notches
- Size / Resolution (414ppi)**
- ✓ Open: 8 inch (2480 × 2220)
 - ✓ Front: 6.6 inch (2480 × 1148)
 - ✓ Back: 6.38 inch (2480 × 892)

Price

- ✓ €2,299 (about ¥270,000、@¥117.8/€)

Specs

Camera

- ✓ Leica triple camera
 - 40MP (Wide Angle Lens), 16MP (Ultra Wide Angle Lens), 8MP (Telephoto)
- ✓ Taking pictures with folded phone: camera preview is on both sides

Chipset / CPU

- ✓ 「Balong 5000」
- 5G/4G dual SIM
- ✓ 「Kirin 980」

Battery

- ✓ 4500mAh
- ✓ 55W quick charge
 - Can recharge to 85% in 30 minutes

Source: Mizuho Securities Equity Research

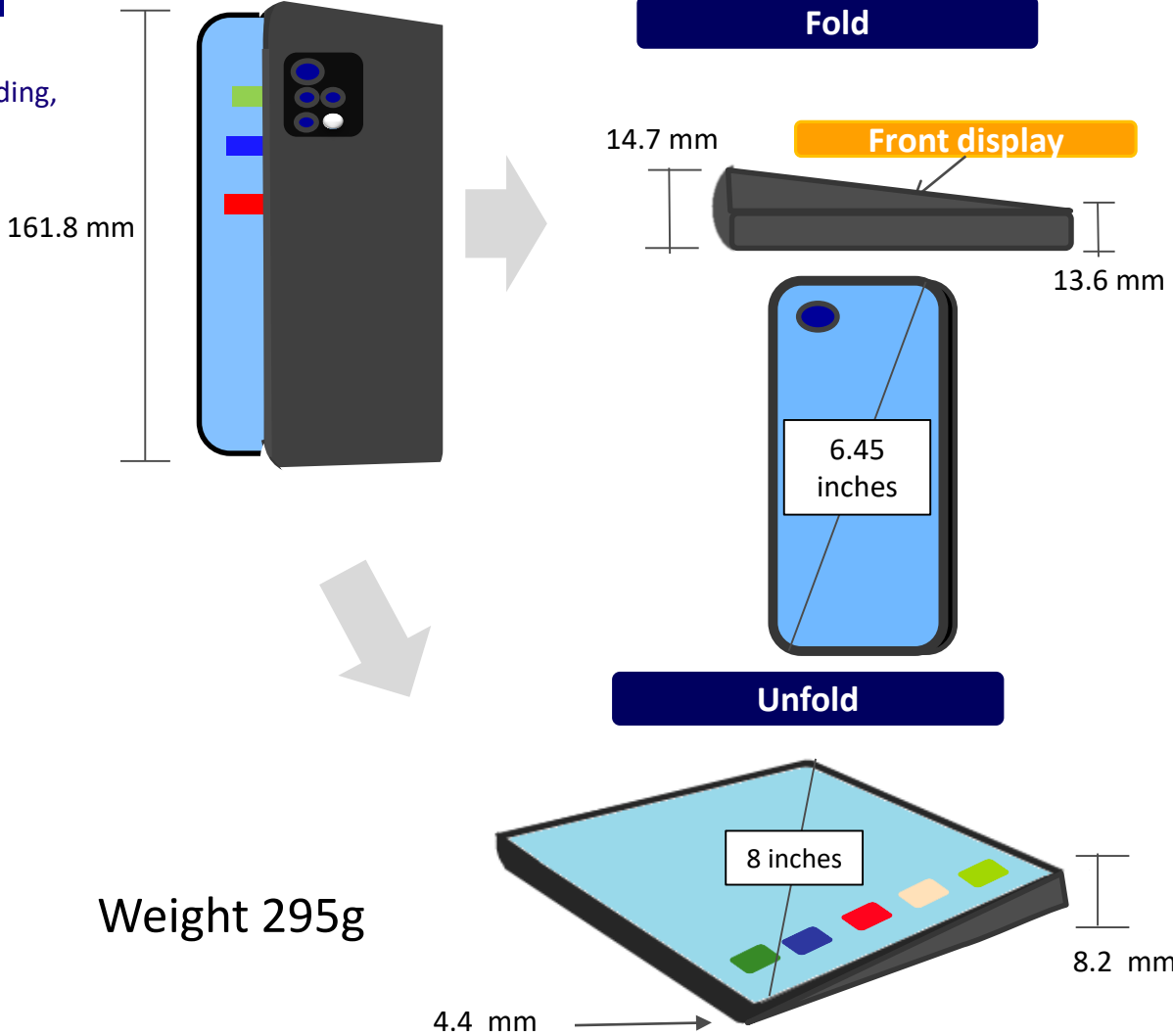
Mate X2 : Huawei's foldable smartphone (inward folding type)

Features

- Huawei's first inward foldable smartphone
- Thickness reduction is achieved by eliminating gaps during folding, which was a issue of internal folding.
- Equipped with quad camera

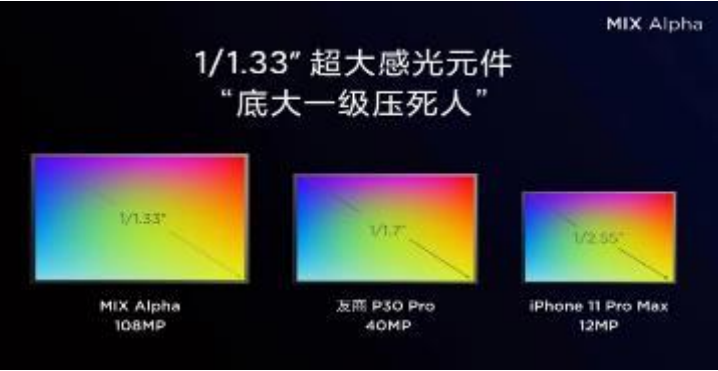
Spec

- Display (BOE, Flexible OLED)
 - ✓ Interior screen : 8 inches (2,480 × 2,200) / 413 ppi
 - ✓ Exterior screen : 6.45 inches (2,700 × 1,160) / 456 ppi
- Rear Camera
 - ✓ 50MP Ultra Vision Camera
 - ✓ 16MP Cine Camera
 - ✓ 12MP TelephotoCamera
 - ✓ 8MP SuperZoom Camera
- Front Camera
 - ✓ 16MP Selfie Camera
- Processor
 - ✓ CPU : HUAWEI Kirin 9000 GPU : 24-core Mali-G78
 - ✓ RAM : 8GB
- Battery
 - ✓ 4,500 mAh
- Price
 - ✓ 256GB : RMB17,999 (approx. JPY290,000)
 - ✓ 512GB : RMB18,999 (approx. JPY310,000)



Source: Mizuho Securities Equity Research from company's website

MIX Alpha(小米) : Samsung's 1/1.33" 108MP CIS, 7P lens, surround display, 5G, virtual buttons



- Price: RMB19,999 (approx. ¥300,000!)
- Display – Surround display(环绕屏) . The screen takes 181% of the usable area. Supplied by Visionox.
- Triple camera (CMOS sensor)
 - 1) wide(108MP, 1/1.33" (0.8μm), f/1.69
 - 2) ultrawide (20Mp, 1/2.8", f/2.2
 - 3) telephoto(12Mp), 1/2.55", f/2.0
- Fingerprint sensor (on Display) – Optical, supplied by Goodix.
- Virtual buttons : on the side, structure that resembles Mate 30. Supplied by AAC Technology
- Chip set : Qualcomm Snapdragon 855+ (based on TSMC 7nm tech plus an add-on X50 5G modem)
- Antenna : 8 LCP antennas are embedded, supporting n79, n78 and n41 5G bands, Supporting big three Chinese telecommunications carriers.
- Battery : 4050mAh and 4500mAh. Wireless charging 40W function.
- AI :real-time scenario tracking for applications.

Source: Mizuho Securities Equity Research, from company materials

Royole FlexPai - World's first foldable smartphone (128GB : RMB8,999)

Specs

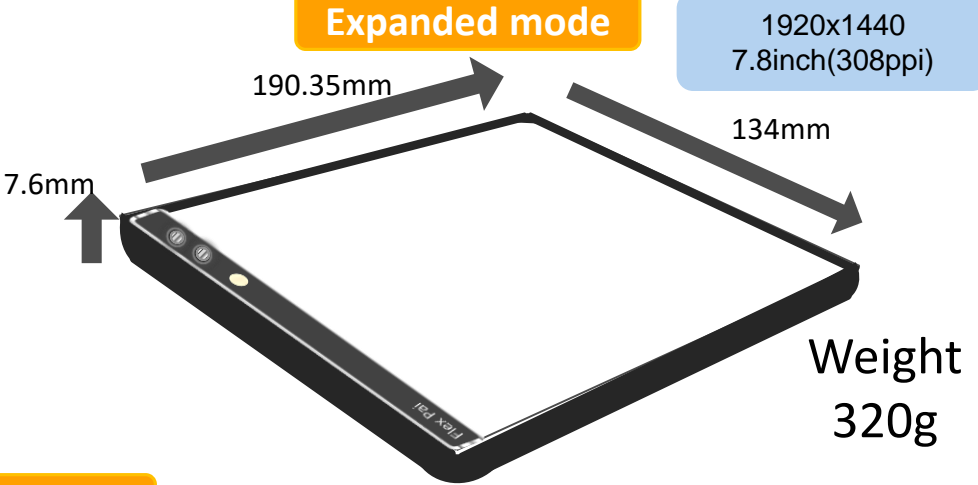
Display

- 1920x1440 (308 ppi) flexible AMOLED when expanded
- 810x1440 for primary display, 710x1440 for secondary display, and 390x1440 edge when folded
- ⇒ Primary, secondary displays use differing interfaces. Edge can show notifications without interrupting videos or apps

Camera

- Dual Camera (16MP (Wide-Angle) + 20MP (Telephoto))
- Can identify objects using either primary/secondary display when folded

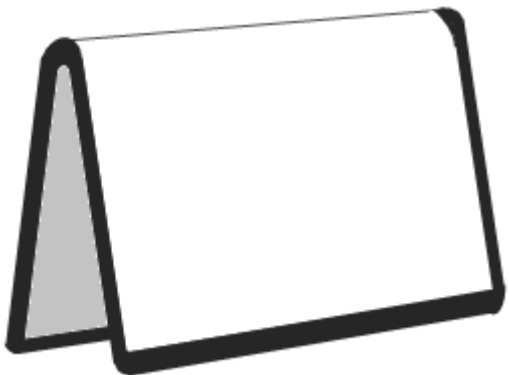
Expanded mode



Split-screen mode

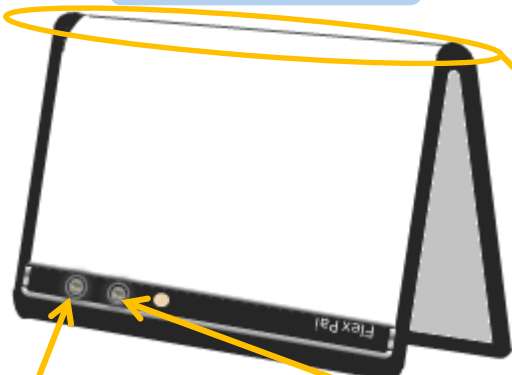
Primary Display

810 × 1440(5.4inch)



Secondary Display

710 × 1440(5.2inch)



20 MP Telephoto Camera

16 MP Wide-Angle Camera

Edge Display

390 × 1440(4.8inch)

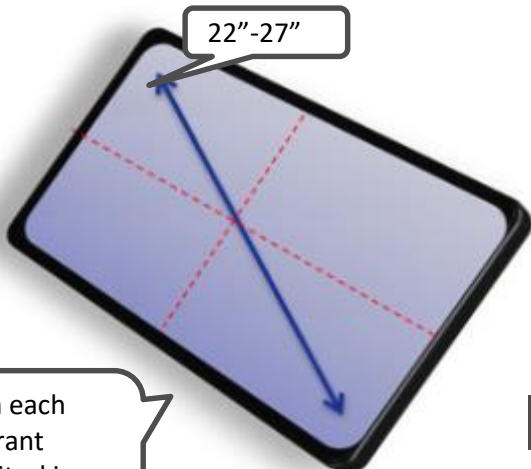


Source: Mizuho Securities Equity Research

Possibility of large 22" tablets: My dream one step closer to reality?

Specs

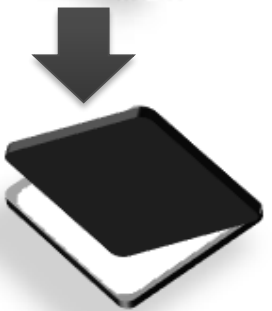
- ◆ Display: OLED / LCD, 4K2K(QFHD)
- ◆ Panel size: 22"-27" with capacitive touch panel
- ◆ Wireless capability: Wifi
- ◆ Thickness: 10-15mm
- ◆ Weight: <1.5kg
- ◆ Water resistant
- ◆ Narrow frame
- ◆ Battery powered
- ◆ Enough battery life
- ◆ For an overnight business trip
- ◆ Better style: foldable



4K2K: FHD in each screen quadrant making multitasking easy

Can be folded if flexible substrate is used

48.7cm high x 27.4cm wide + frame
 →27.4cm high x 24.3cm wide + frame (22" model)



How to use as a TV/PC

- ◆ Place in STB/PC dock, operate with keyboard and smartphone (as a remote control)



How to use as a tablet

Quite large so needs to be supported on table or lap and used with both hands.



Source: Mizuho Securities Equity Research

Lenovo OLED Foldable PC

What is ThinkPad X1 Fold?

- World's first foldable display PC, Display is developed in collaboration with LG.

Specs

- Display
 - Size : 13.3"/OLED
 - Aspect ratio/Resolution: 4:3/QXGA(2,028 x 1,536)
- Case
 - Material: light weight alloy/carbon fiber, Weight: under 1kg
- Connector
 - USB 3.1 Type-C, USB 3.0 Type-C, SIM card slot
- Software
 - Windows10 is preinstalled, to be converted windows10x(for dual-screen PC) in fall 2020
- Accessories
 - Leather folio cover (to support self standing horizontally)
 - Bluetooth Mini Fold Keyboard (rechargeable keyboard by putting it between folding displays, fixed with magnet)
 - ThinkPad X1 Fold Stand (to support "full-screen" self standing vertically, optional extra)
 - Active pen
- Expected Price
 - USD2,499



How to use

- Use as laptop
 - Output software keyboard on the lower half of display.
 - Able to use by putting Mini Fold Keyboard on the lower half of display.



Bluetooth Mini Fold Keyboard

Leather folio cover

Use as full screen



Use as dual screen



Source: Mizuho Securities Equity Research, from Lenovo StoryHub, IT media PC USER and media reports

Smartphone: Panel Supply Matrix(2013)

(M units)

	SHARP	JDI	SDC	LGD	AUO	BOE	Innolux	CPT	Tianma	Others	TTL panel demand
SAMSUNG		10.0	188.0		2.0	75.0	-	18.0	5.0	17.0	315.0
Apple	60.0	70.0		50.0			7.0				187.0
LGE		10.0		31.0	4.0			8.0	3.0	-	56.0
Huawei		3.0			5.0	5.0	14.0		20.0	2.0	49.0
ZTE	2.0	2.0			6.0	2.0	2.0	25.0	7.0	2.0	48.0
Sony	12.0	15.0		5.0	9.0		2.0				43.0
Nokia		1.0	2.0	5.0	2.0		16.0			4.0	30.0
Motorola	2.0	2.0	3.0		4.0		5.0	5.0		6.0	27.0
HTC	5.0	7.0			3.0			6.0			21.0
RIM		9.0	5.0				5.0			1.0	20.0
Others	8.0	43.0	3.0	2.0	30.0	18.0	12.0	50.0	10.0	120.0	296.0
FCST Total	81.0	129.0	198.0	91.0	35.0	82.0	51.0	62.0	35.0	32.0	1,092.0
Panel Makers' Capacity											

Source: Mizuho Securities Equity Research

Smartphone: Panel Supply Matrix (2015)

(M units)

	SHARP	JDI	SDC	LGD	AUO	BOE	Innolux	CPT	Tianma	Others	TTL panel demand
SAMSUNG		2.0	195.0			70.0		20.0	5.0	28.0	320.0
Apple	73.0	102.0		105.0							280.0
Huawei	0.5	34.0	3.0	2.5		32.0	14.0	5.0	29.0	2.0	122.0
Lenovo/Motorola		2.0	3.0	8.0	9.0	12.0	14.0	5.0	8.0	10.0	71.0
Xiaomi	26.0	14.0		5.0	17.0	3.0			2.0		67.0
Oppo		6.0	13.0	4.0	2.5	2.0			11.0	3.0	41.5
ZTE	4.0				5.0	13.0	2.0	12.0	7.0	8.0	51.0
LGE		15.5		33.0		6.0	2.0	6.5		-	63.0
Sony	3.0	8.0		3.0	9.0		6.0			4.0	33.0
Microsoft/Nokia				3.5	4.0		14.0	5.0	2.0	3.0	31.5
HTC	0.5	3.0			2.0			5.0	6.0		16.5
Others	14.0	13.0	35.0	30.0	38.0	40.0	19.0	50.0	62.0	120.0	421.0
FCST Total	121.0	200.5	251.0	194.0	86.5	178.0	76.0	108.5	132.0	179.0	1,526.5
Panel Makers' Estimated Max Capacity(2014)	190.0	210.0	270.0	155.0	115.0	180.0	100.0	150.0	100.0	150.0	1,620.0
Panel Makers' Estimated Max Capacity(2015)	210.0	240.0	300.0	210.0	120.0	220.0	110.0	150.0	140.0	210.0	1,910.0

Source: Mizuho Securities Equity Research

Smartphone: Panel Supply Matrix (2017 - as of Dec.)

(M units)

	SHARP	JDI	SDC	LGD	AUO	BOE	Innolux	CPT	Tianma	Others	TTL panel demand
SAMSUNG		3.0	270.0			50.0					323.0
Apple	46.0	76.0	52.0	66.0							240.0
Huawei	8.0	26.0	6.0	7.5	5.5	44.0	27.0		36.0		160.0
Lenovo/Motorola			3.7	2.5	4.0	15.0	3.0	6.0	14.0		48.2
Xiaomi	4.5	7.5		6.5	8.0	20.0			25.0	3.0	74.5
Oppo		11.0	45.0		13.0	34.0			20.0		123.0
BBK/VIVO		2.0	34.0	6.0		29.0			23.0		94.0
ZTE			1.0		5.0	17.0	2.0	9.0	11.0	4.0	49.0
LGE		3.0		33.0		8.0		8.0		-	52.0
Sony	2.0	5.0		4.0	1.5		3.5			1.0	17.0
Asus		1.0			1.0			4.0	11.0		17.0
Microsoft/Nokia			1.5				7.0				8.5
HTC				1.0	2.0			3.0	4.0		10.0
Others	20.0	21.0	25.0	15.0	70.0	90.0	25.0	60.0	55.0	200.0	615.0
FCST Total	80.5	155.5	438.2	141.5	110.0	307.0	67.5	90.0	199.0	208.0	1,831.2
Panel Makers' Estimated Max Capacity(2016)	170.0	300.0	360.0	240.0	120.0	250.0	110.0	150.0	200.0	240.0	2,150.0
Panel Makers' Estimated Max Capacity(2017)	140.0	250.0	520.0	170.0	180.0	350.0	110.0	115.0	250.0	240.0	2,325.0

Source: Mizuho Securities Equity Research

Smartphone: LCD/OLED Panel Supply Matrix (2018 - as of Dec.)

(M units)

	SHARP	JDI	SDC	LGD	AUO	BOE	Innolux	Tianma	Others	TTL panel demand
SAMSUNG		1.0	230.0			41.0		10.0	25.0	307.0
Apple	54.0	70.0	84.0	45.0						253.0
Huawei	5.5	17.0	15.0	11.0	29.0	61.0	29.0	69.0		236.5
Xiaomi		4.0	12.0	2.0		17.0		34.0	70.0	139.0
Oppo		14.0	41.0		12.0	28.0		26.0	15.0	136.0
VIVO			33.0		7.0	43.0		25.0	10.0	118.0
LGE		2.0		23.0		19.0		6.0	2.0	52.0
Sony		5.0		2.4	1.3		0.3		1.0	10.0
Asus					1.0			8.0		9.0
Others	7.0	15.0	25.0	10.0	75.0	98.0	65.0	40.0	250.0	585.0
FCST Total	66.5	128.0	440.0	93.4	125.3	307.0	94.3	218.0	373.0	1,845.5
Panel Makers' Estimated Max Capacity(2018)	80.0	190.0	520.0	150.0	180.0	400.0	110.0	240.0	450.0	2,320.0

OLED: SDC's market share is more than 95%
 OLED: approx 450m in total

Source: Mizuho Securities Equity Research

Smartphone: OLED Supply Matrix (2019 - as of Feb 2020.)

(M units)

	SHARP	SDC	LGD	BOE	Visionox	Tianma	EDO	CSOT	Others	TTL OLED demand
SAMSUNG		213.0								213.0
Apple		54.0	4.0							58.0
Huawei		48.0	2.0	17.0						67.0
Xiaomi		19.0			2.3	0.3				21.6
Oppo		41.0		0.1						41.1
VIVO		39.0								39.0
ZTE			0.5		0.2					
LGE			1.9							1.9
Sony		2.0	0.7							2.7
Asus						0.5				0.5
Others	0.1	20.0	0.9	1.0	12.0	8.0	12.5	-		55.2
FCST Total	0.1	436.0	10.0	18.1	14.5	8.8	12.5	-	-	500.0
Panel Makers' Estimated Max Capacity(2019)	5.0	540.0	60.0	70.0	35.0	15.0	20.0			745.0
Panel Makers' Estimated Max Capacity(2020)	5.0	540.0	50.0	210.0	35.0	30.0	35.0	30.0		935.0

Source: Mizuho Securities Equity Research

Smartphone: OLED Supply Matrix (2020 - as of Apr.2020)

	(M units)									
	SHARP	SDC	LGD	BOE	Visionox	Tianma	EDO	CSOT	Others	TTL OLED demand
SAMSUNG		188.0								188.0
Apple		87.0	25.0	1.0						113.0
Huawei		57.0	2.0	43.0	7.0			0.1		109.1
Xiaomi		29.0		2.0	3.0	3.0		1.5		38.5
Oppo		46.0		3.5	1.0			0.5		51.0
VIVO		38.0		1.0						39.0
ZTE				2.0	3.0					5.0
Lenovo		3.0				3.0		1.0		7.0
LGE			3.0		1.0					4.0
Sony		2.4	0.2							2.6
Asus						1.1				1.1
Others	0.3	16.0	3.0	5.0	14.0	9.0	18.0	4.5		69.8
FCST Total	0.3	466.4	33.2	57.5	29.0	16.1	18.0	7.6	-	628.1
Panel Makers' Estimated Max Capacity(2020)	5.0	540.0	50.0	210.0	70.0	60.0	60.0	30.0		1,025.0

Consider the impact (revised downward smartphone shipment/production forecasts)by COVID-19 (683M→628M : YOY+26%)/ Still downside risk.

• SDC: Lowering our forecasts as panels for Samsung Electronics/Chinese brands are affected. Can demand be aroused by price cut of rigid?

• China: Still better yields is issue. Rigid to compete with price of LTPS-LCD. Can Flex catch up with SDC in quality?

Source: Mizuho Securities Equity Research

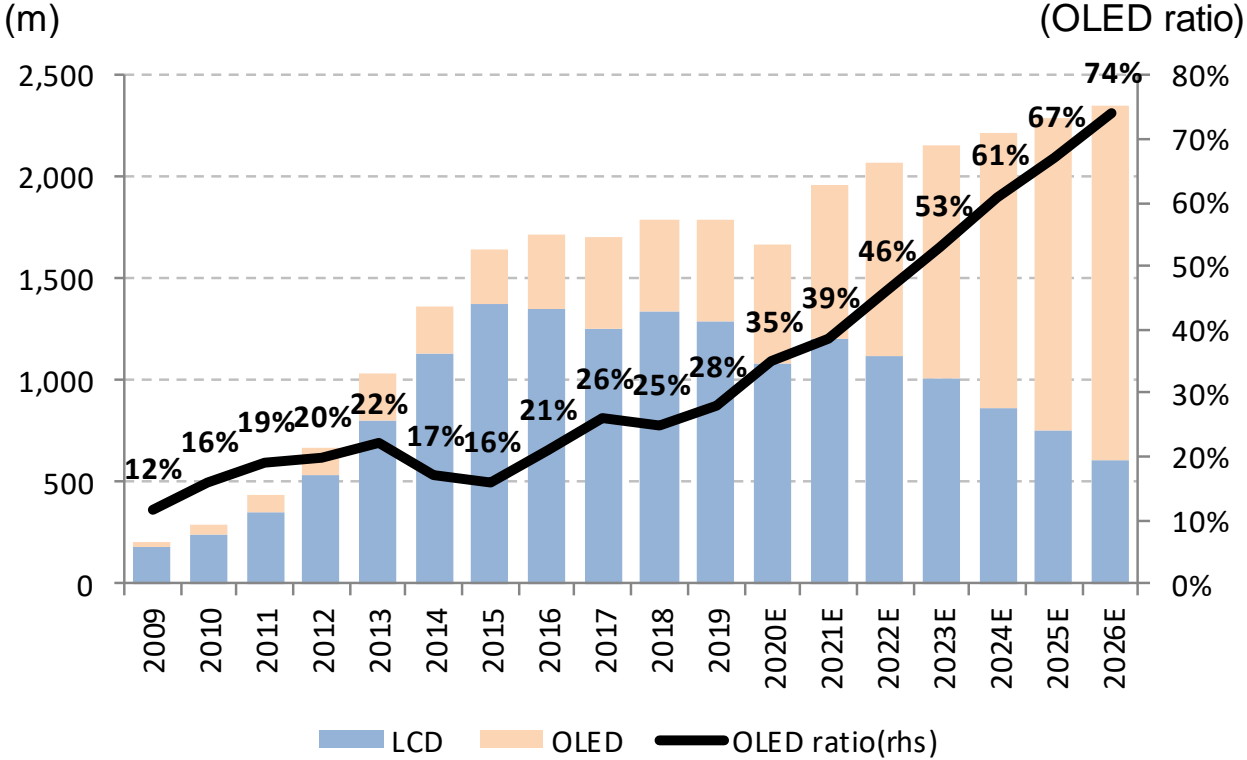
Smartphone: OLED Supply Matrix (2020 - as of Jul.2020)

(M units)

	SHARP	SDC	LGD	BOE	Visionox	Tianma	EDO	CSOT	Others	TTL OLED demand
SAMSUNG		184.0								184.0
Apple		86.0	25.0	1.0						112.0
Huawei		37.0	4.8	39.0	7.0			0.1		87.9
Xiaomi		21.0		2.0	3.0	3.0		1.5		30.5
Oppo		42.0		3.5	1.0			0.5		47.0
VIVO		40.0		1.0						41.0
ZTE				2.0	3.0					5.0
Lenovo		3.0				3.0		1.0		7.0
LGE			2.0		1.0					3.0
Sony		1.1	0.2							1.3
Asus						1.1				1.1
Others	0.2	15.0	2.0	5.0	14.0	9.0	13.0	4.0		62.2
FCST Total	0.2	429.1	34.0	53.5	29.0	16.1	13.0	7.1	-	582.0
Panel Makers' Estimated Max Capacity(2020)	5.0	540.0	50.0	210.0	70.0	60.0	60.0	30.0		1,025.0

Source: Mizuho Securities Equity Research

Smartphone: OLED penetration rate likely to surpass the LCD after 2023



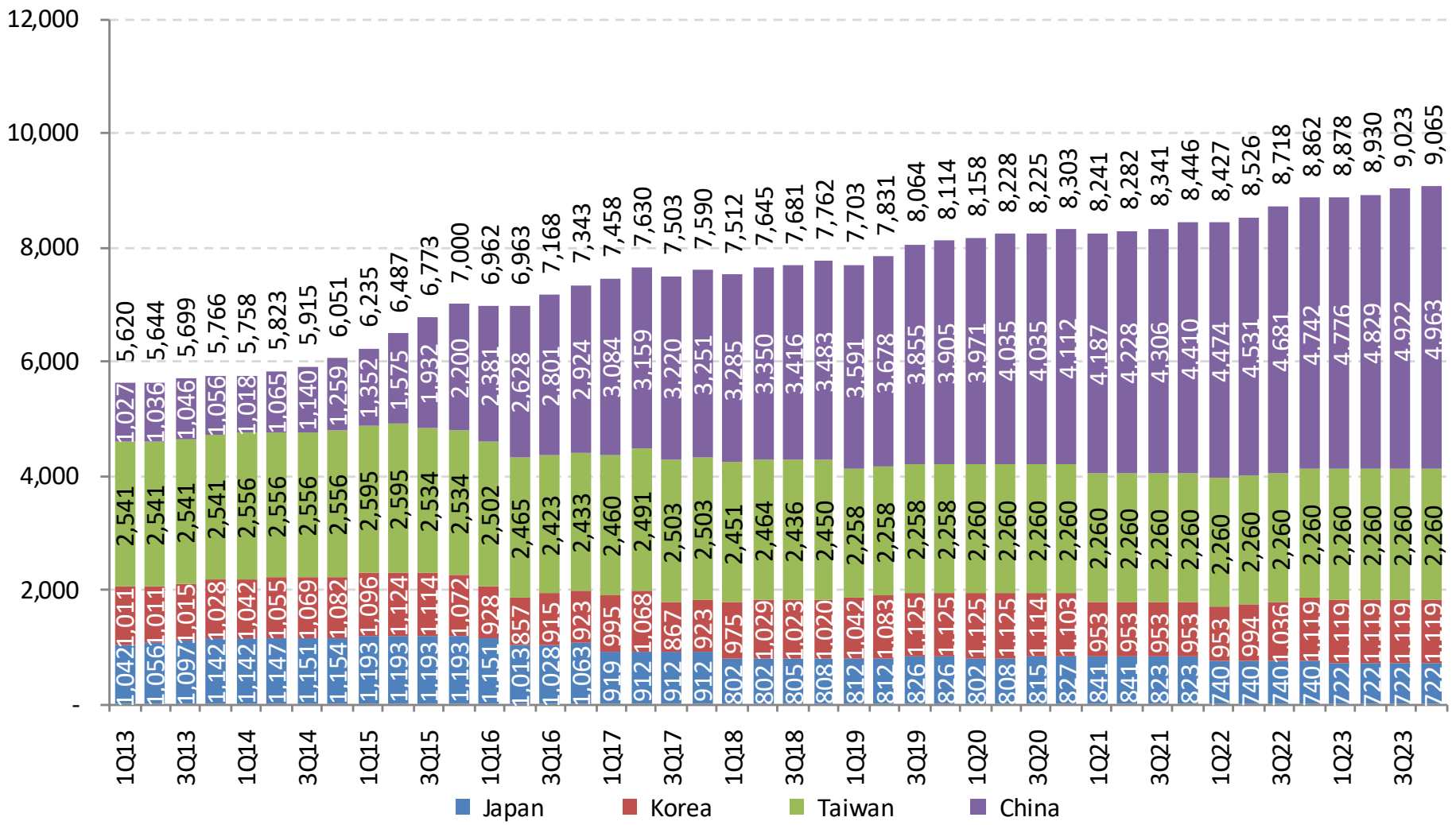
- Panel shipment volume base
- over 50% of OLED ratio : revised forecast of timing from 2022 to 2023. Our forecast is assuming that Apple will sell both OLED and LCD models for the time being.
- OLED ratio is expected to be more than 50% in 2022 for the major 5 brands(Samsung, Huawei, Oppo, Vivo and Xiaomi) except AAPL.

Note: Actual figure are estimated by Mizuho Securities. E=forecasts by Mizuho Securities
 Source: Mizuho Securities Equity Research

Small and Mid sized panel production capacity assumption (By region)

-Total (A-si/Oxide/LTPS/OLED)

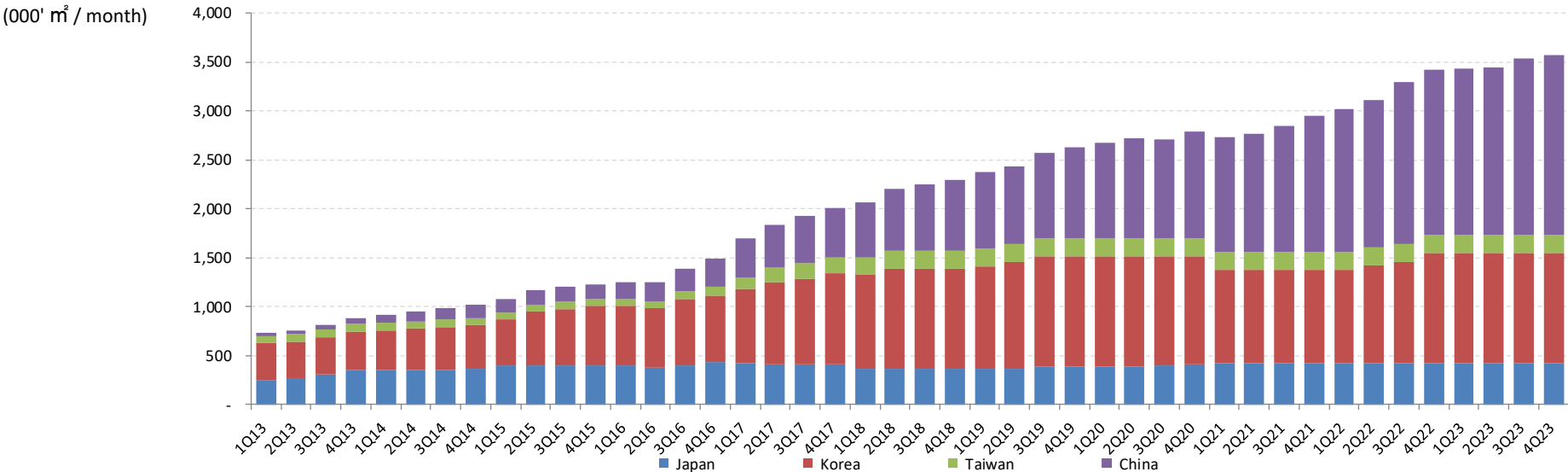
(000' m² / month)



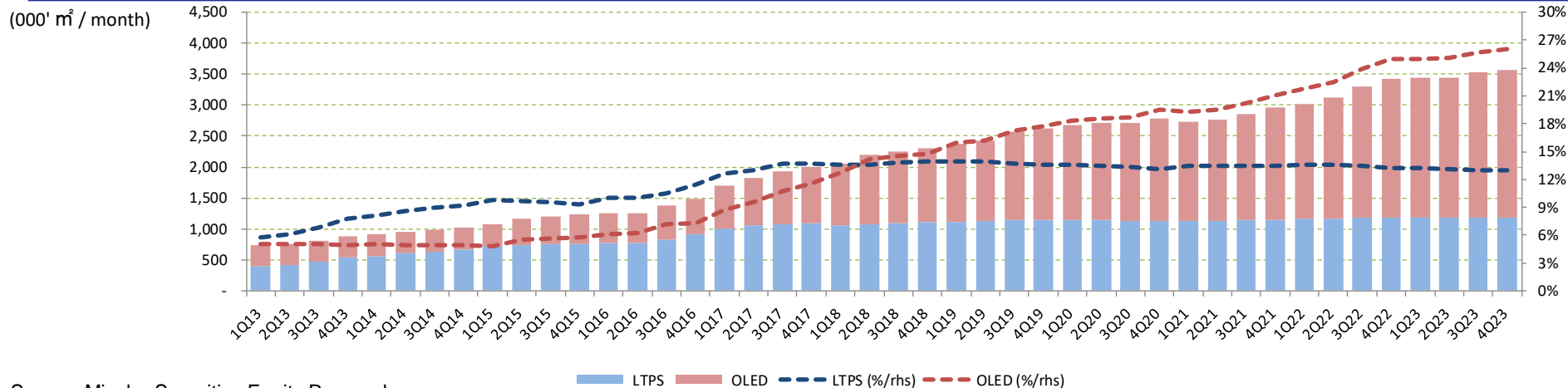
Source: Mizuho Securities Equity Research

Mid and small sized panel capacity expansion (LTPS&OLED)

LTPS&OLED Panel production capacity assumption (monthly, by region)



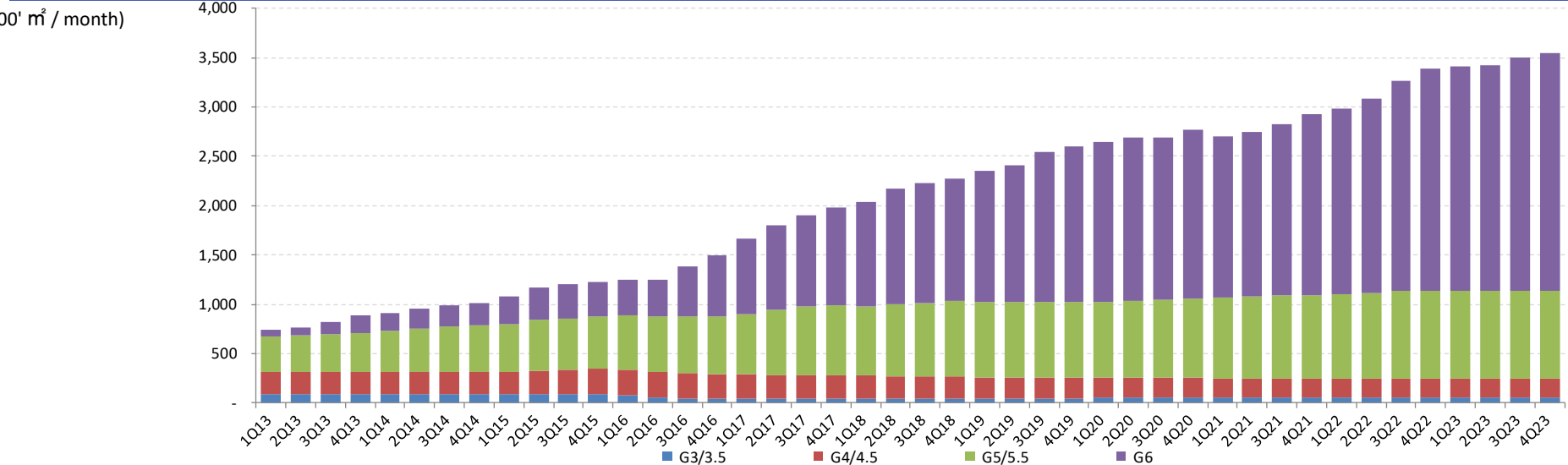
LTPS&OLED Panel production capacity assumption (monthly, by technology)



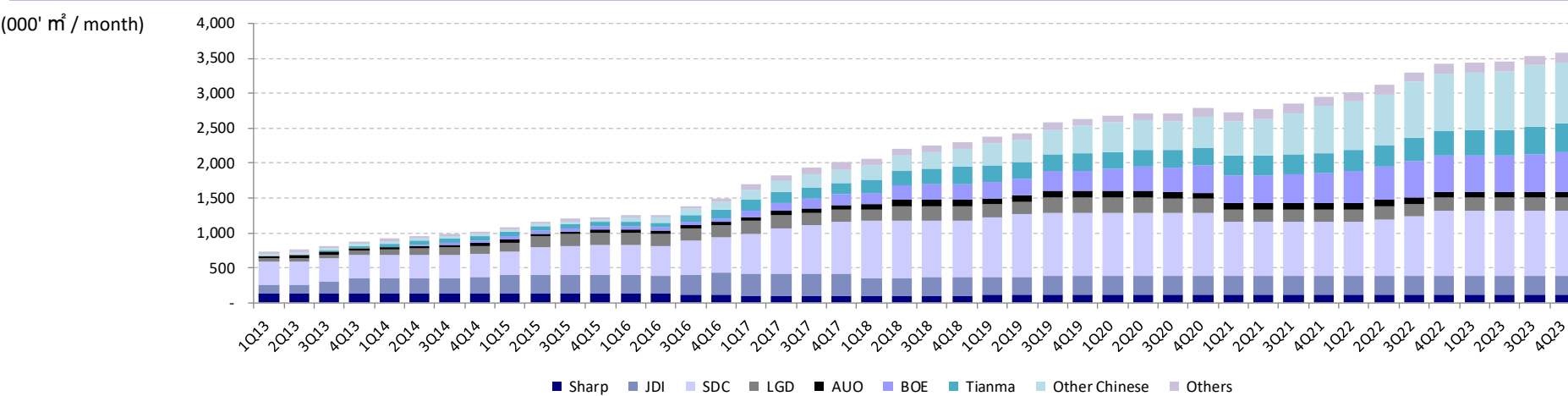
Source: Mizuho Securities Equity Research

Mid and small sized panel capacity expansion (LTPS&OLED)

LTPS&OLED Panel production capacity assumption (monthly, by fab generation)



LTPS&OLED Panel production capacity assumption (monthly, by company)



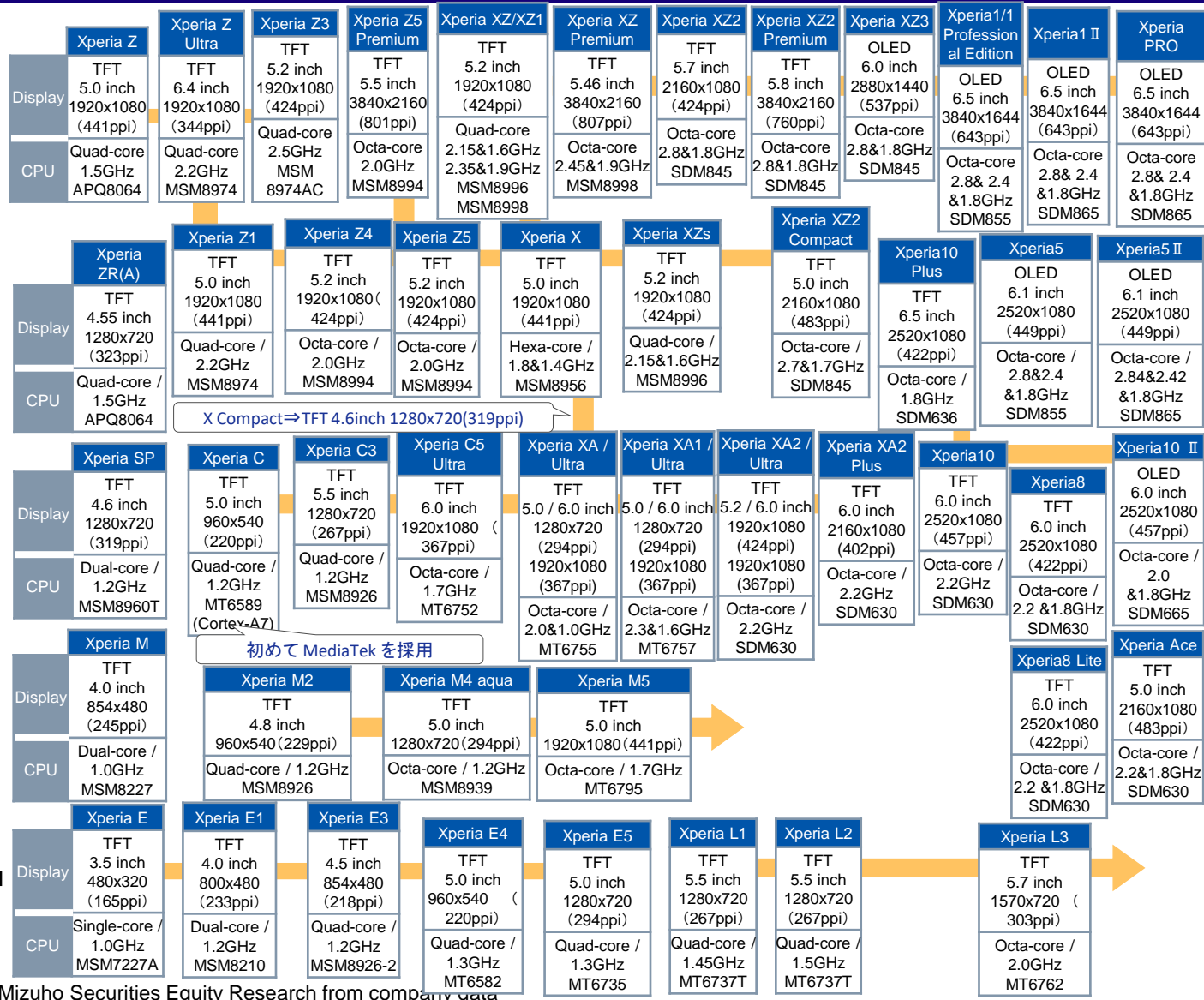
Source: Mizuho Securities Equity Research

Overview of Sony smartphones

Aggregation of Sony's sensor, camera, and content creation technologies

High-end

Low-end



X Compact ⇒ TFT 4.6 inch 1280x720 (319ppi)

初めて MediaTek を採用

Xperia strategy

- ◆ Focus on high end, designed and produced in-house
- ◆ Uses ODM for mid and low end
- ◆ Creation of a distinct product that combines cutting-edge technology from Sony

Flagship model Xperia 1 II

- ◆ The latest model of 5G Xperia 1 series
 - ✓ For Sub6 only
 - ✓ Xperia PRO released on Feb.10, 2021 to be for millimeter wave
 - Equipped with HDMI, for business incl. video production
 - ¥227,091(excl. tax)
- ◆ Aspect ratios 21:9, "CinemaWide" 4K HDR OLED display
 - ✓ Same aspect ratios as cinema screen
 - ✓ BT.2020 capable
 - ✓ Front camera expressing equivalent to 10 bit color is achieved
 - ✓ Possible to show apps simultaneously on 2 screens
- ◆ Equipped with triple camera/3D iToF sensor
 - ✓ Triple camera: 12.2MP(ultrawide, focal distance of 16mm, f/2.2)+12MP(standard, focal distance of 24mm, f/1.7)+12.2MP(telephoto, focal distance of 70mm, f/2.4) ZEISS Lens (T* coating reduces reflection)
 - ✓ 3D iToF sensor : Capable of recognizing objects in 3D
 - ✓ Front camera: 8MP(wide, f/2.0)
 - ✓ Equipped with "Eye AF" which focuses on the subject's eyes automatically, and "real-time pupil AF", which utilizes AI to track the eyes in real time with a half-press of the camera key
 - ✓ 20FPS high-speed AF/AE tracking high-speed continuous photos (technology from "α" camera)
 - ✓ "BIONZ X for mobile" improves image quality of photos shot in dark places
- ◆ "Cinematography Pro" enable to shoot moving images like cinema
 - ✓ Supervised by the team that developed SONY's movie filming cameras

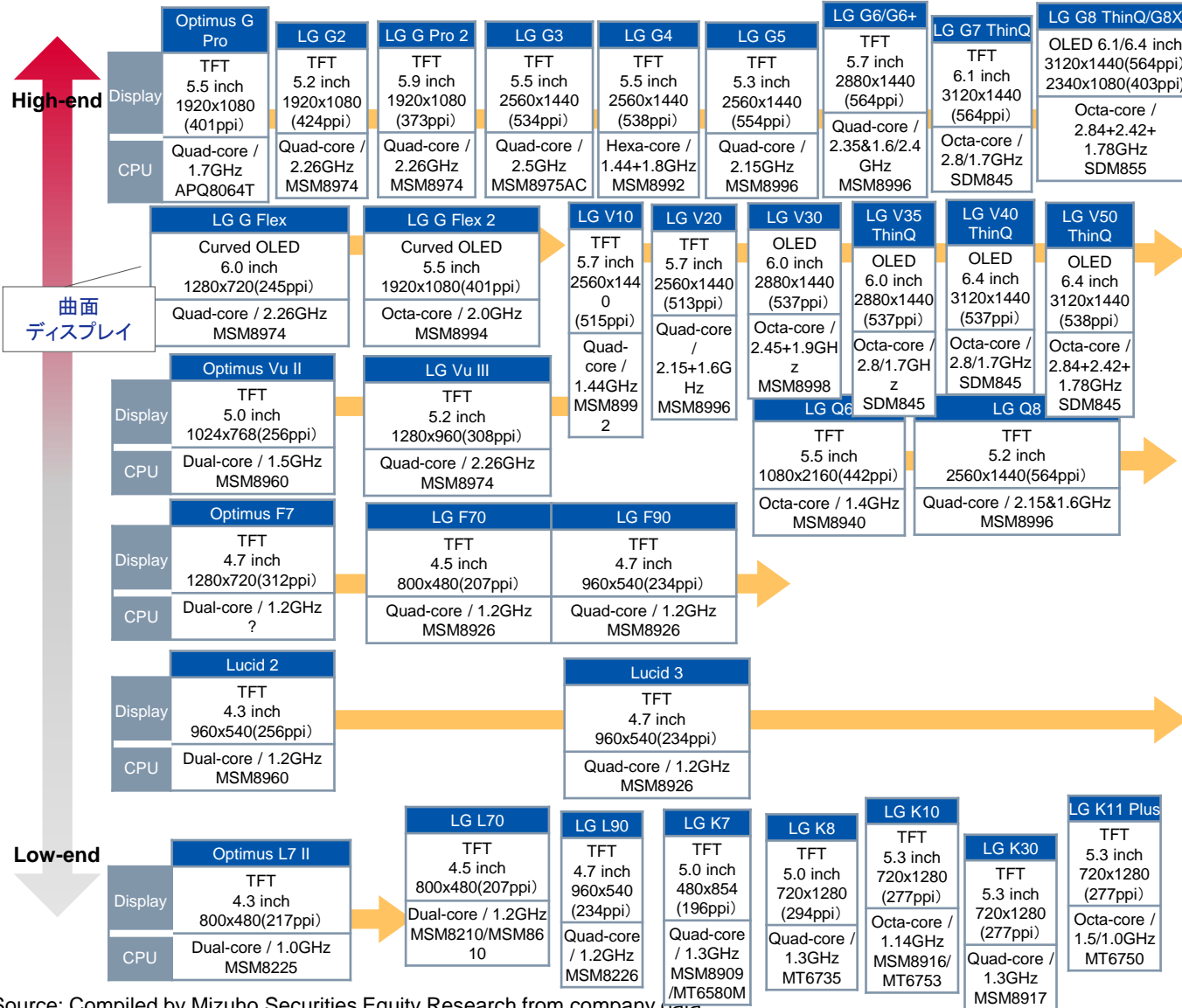
Xperia smart products

- ◆ Xperia Ear : Makes automatic speech possible for Twitter and weather/news. Does not block the ears; allows surrounding sounds to be heard
- ◆ Xperia Touch : Operated by touching an image projected on a wall or table
- ◆ SmartBand 2 : Attached to the wrist, and records heart, sleep, and activity data

Source: Mizuho Securities Equity Research from company data

Overview of LG smartphones

Going global with five types



- ### Five types
- ◆ G series: high end, flagship model
 - ◆ Vu series: fablet model, used like tablet
 - ◆ F series: mid end, seeks to promote 4G LTE service worldwide
 - ◆ Q series: mid end, inherits the design of G series
 - ◆ L series: low end, focus on design, aimed at emerging markets
- (※Lucid is cheap LTE smartphone for Verizon)

- ### Flagship model (LG G7 ThinQ)
- ◆ Aspect ratios 19.5:9, 6.4" Full Vision display
 - ✓ 83.8% image occupancy
 - ◆ Dual screen operation with LG DualScreen
 - ✓ Can be used as dual-screen smartphone by connecting LG DualScreen display case to main body
 - ✓ DualScreen itself weighs 134g
 - ✓ Hinge can bend 360° so users facing each other can each watch their own screen
 - ✓ Can be used like a PC or game console
 - ◆ Equipped with dual camera
 - ✓ Back camera - 12MP(standard)/13MP(wide) dual camera, Front camera – 32MP
 - ✓ When using DualScreen one screen can be used as a photo light
 - ◆ 2.1' monochrome display "Cover Display"
 - ✓ Monochrome display on the back of the DualScreen allows user to check the time, etc., even when DualScreen is in use and the main body display cannot be seen

- ### Releases for Japanese market
- ◆ The Optimus it L-05E, one of the Japanese "Optimus it" series models made specifically for DoCoMo
 - ✓ It was launched in May and has almost the same specs as Optimus G Pro except that the Japanese display is 5".
 - ◆ Isai series for au
 - ✓ G series base with some design changes

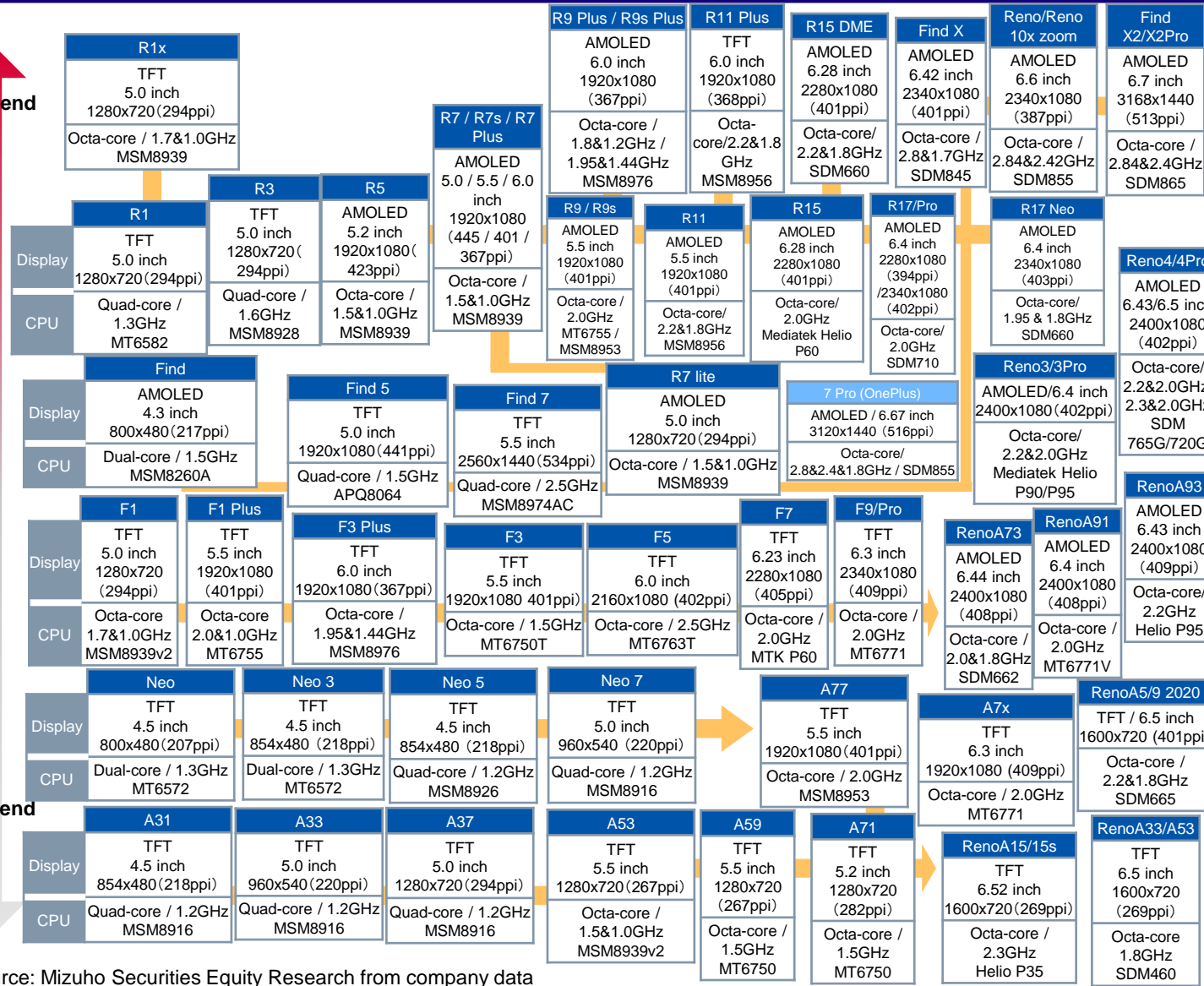
Source: Compiled by Mizuho Securities Equity Research from company data

Overview of OPPO smartphones

Rapid growth in the past few years; become one of the major Chinese brands

High-end

Low-end



OPPO strategy

- ◆ Sold through the offline channel (brick-and-mortar stores), mainly outside the largest cities
- ◆ Expanding market share, mainly in Asia
 - ✓ Entering Japanese market from Feb 2018
 - ✓ Sales in China account for about 50% of the sales volume as of 3Q20

Flagship model: Find X2/X2 Pro

- ◆ Rear camera
 - ✓ Features 10x hybrid zoom, 60x digital zoom
 - ✓ Equipped triple camera (wide 48MP, ultra wide 48MP and telephoto 13MP)
- ◆ Front camera
 - ✓ 32MP
- ◆ Night Mode
- ◆ Other performance features
 - ✓ Battery capacity of 4260mAh
 - ✓ VOOC2.0 quick charge
 - ✓ Faster touch ID verification on screen

vs OnePlus

- ◆ OPPO smartphone brand subsidiary "OnePlus"
 - ✓ 3x optical zoom for "OnePlus7 Pro"
 - ✓ Higher pixel density than the Reno 10x zoom
 - ✓ 7Pro is water resistant, uses face ID lock
 - ✓ 7Pro slightly more expensive than Reno (Reno 10x zoom: ¥4,799, 7Pro: ¥4,999)

Source: Mizuho Securities Equity Research from company data

Overview of VIVO smartphones

Like OPPO, targets younger users with feature-rich, mid-high and middle-end phones; in addition to China, focusing on sales in India and SE Asia as well

High-end

Low-end

	Xplay3S	Xplay5	Xplay5 Elite	Xplay6	NEX S	NEX3	NEX3S	X60 Pro					
Display	TFT 6.0 inch 2560x1440 (490ppi)	AMOLED 5.43 inch 2560x1440 (541ppi)	AMOLED 5.43 inch 2560x1440 (541ppi)	AMOLED 5.46 inch 2560x1440 (538ppi)	AMOLED 6.59 inch 2316x1080 (388ppi)	AMOLED 6.89 inch 2256x1080 (363ppi)	AMOLED 6.89 inch 2256x1080 (363ppi)	AMOLED 6.56inch 2376x1080 (398ppi)					
CPU	Quad-core 2.3GHz S801	Octa-core / 1.8&1.4GHz MSM8976	Quad-core / 2.15&1.6GHz MSM8996	Quad-core / 2.15&1.6GHz MSM8996	Octa-core / 2.7&1.7GHz SDM845	Octa-core / 2.96&2.4GHz SDM855+	Octa-core / 2.96&2.4GHz SDM865	Octa-core / 2.8&2.6&2.0GHz Exynos 1080					
	X3S	X5/X5 Pro	X6S / Plus	X7/Plus	X9/Plus	X20/Plus/UD	X21/UD	X21i	X23	X27	X30/30Pro	X50/50Pro /Pro+	X50e
Display	TFT 5.0 inch 1280x720 (294ppi)	TFT 5.0/5.2 inch 1280x720 (294ppi)	AMOLED 5.2 / 5.7 inch 1920x1080 (424ppi)	AMOLED 5.2/5.7 inch 1920x1080 (424ppi)	AMOLED 5.5/5.88 inch 1920x1080 (401ppi/375ppi)	AMOLED 6.01/6.43 inch 2160x1080 (402ppi)	AMOLED 6.28 inch 2280x1080 (402ppi)	AMOLED 6.28 inch 2280x1080 (402ppi)	AMOLED 6.41inch 2340x1080 (402ppi)	AMOLED 6.39inch 2340x1080 (400ppi)	AMOLED 6.44inch 2400x1080 (409ppi)	AMOLED 6.56inch 2376x1080 (398ppi)	AMOLED 6.44inch 2400x1080 (409ppi)
CPU	Octa-core 1.7GHz MT6592	Octa-core / 1.5&1.0GHz MSM8939	Octa-core / 1.8&1.4GHz MSM8976	Octa-core / 1.8&1.4GHz MSM8976	Octa-core / 1.8&1.4GHz MSM8953	Octa-core / 2.2&1.8GHz SDM660	Octa-core / 2.2&1.8GHz SDM660	Octa-core / 2.0&2.0GHz MT6771	Octa-core / 2.0&1.8GHz SDM670	Octa-core / 2.2&1.7GHz SDM710	Octa-core / 2.2&1.8GHz Exynos 980	Octa-core 2.4&2.2 &1.8GHz Adreno 620	Octa-core 2.4&2.2 &1.8GHz Adreno 620
	V1 Max	V3 Max	X6 / Plus	Z1/Z1 i	Z3/Z3 i	Z5/Z5i	Z6 5G	V15/V15 Pro	V17/V17 Pro	V20/V20 Pro/V20 SE			
Display	TFT5.5 inch 1280x720 (267ppi)	TFT5.5 inch 1920x1080 (401ppi)	AMOLED 5.2 / 5.7 inch 1920x1080 (424/386ppi)	TFT 6.26 inch 2280x1080 (403ppi)	TFT 6.26 inch 2280x1080 (403ppi)	AMOLED /TFT 6.38 /6.53 inch 2340x1080 (404ppi) /2340x1080 (394ppi)	TFT 6.57 inch 2400x1080 (401ppi)	TFT/ AMOLED 6.53/ 6.39inch 2340x1080 (402ppi)	AMOLED 6.44 inch 2400x1080 (409ppi)	AMOLED 6.44 inch 2400x1080 (409ppi)			
CPU	Octa-core / 1.4&1.0GHz MSM8939	Octa-core/1.8&1.4GHz MSM8976	Octa-core 1.7GHzMT6752	Octa-core / 2.2/1.8GHz 1.8GHz SDM636/ SDM660	Octa-core SDM710/MT6771 2.2 GHz / 2.0 GHz	Octa-core / 2.3 GHz SDM712 / 2.0GHz SDM675	Octa-core / 2.4 GHz SDM765	Octa-core 2.1/2.0GHz Mail-G72 MP3 Adreno 612	Octa-core 2.0&1.7GHz Adreno 612	Octa-core 2.3&1.8GHz 2.4&2.2&1.8GHz Adreno618/620/610			
	V1	V3	V5/Plus	V5s	V7/V7+	V9	V11/V11 i	Y7s	Y7s	Y9s			
Display	TFT 5.0 inch 1280x720 (294ppi)	TFT 5.0 inch 1280x720 (294ppi)	TFT 5.5 inch 1280x720/ 1920x1080 (267ppi) / (401ppi)	TFT 5.5 inch 1280x720 (267ppi)	TFT 5.7/5.99 inch 1440x720 (282/269ppi)	TFT 6.3 inch 2280x1080 (400ppi)	TFT 6.41 /6.3 inch 2340x1080 (402ppi)	AMOLED 6.38 inch 2340x1080 (404ppi)	AMOLED 6.38 inch 2340x1080 (404ppi)	AMOLED 6.38 inch 2340x1080 (404ppi)			
CPU	Quad-core 1.2GHz MSM8916	Octa-core / 1.5&1.0GHz MSM8939 v2	Octa-core / 1.8&1.4GHz MSM8976/ 2.0GHz MSM8953	Octa-core / 1.5GHz MT6750	Octa-core / 1.8GHz SDM450	Octa-core / 2.2GHz MSM 8953-Pro	Octa-core 2.2/1.8GHz SDM660 2.0GHz MT6771	Octa-core 2.0/1.7GHz Adreno 612	Octa-core 2.0GHz MT6768	Octa-core 2.0GHz SDM665			
	Y15	Y27	Y37	Y51	Y55	Y67	Y71/Y71 i	Y81/83	Y97	Y5s	Y11s	Y12s	
Display	TFT 4.5inch 854x480 (218ppi)	TFT 4.7 inch 1280x720 (312ppi)	TFT 5.5 inch 1280x720 (267ppi)	TFT 5.0 inch 960x540 (220ppi)	TFT 5.2 inch 1280x720 (282ppi)	TFT 5.5 inch 1280x720 (267ppi)	TFT 6.0 inch 1440x720 (268ppi)	TFT 6.22 inch 1520x720 (270ppi)	TFT 6.3 inch 2280x720 (400ppi)	TFT 6.53 inch 2340x1080 (395ppi)	TFT 6.51 inch 1600x720 (270ppi)	TFT 6.51 inch 1600x720 (270ppi)	
CPU	Quad core 1.3GHz MT6582	Quad core 1.2GHz MSM8916	Octa core 1.4&1.0GHz MSM8939	Quad core 1.2GHz MSM8916	Octa core 1.4GHz MSM8937	Octa core 1.5GHz MT6750	Octa core 1.4GHz MSM8917	Octa core 2.0GHz MT6762	Octa core 2.0GHz MT6771	Octa core 2.0GHz MT6768	Octa-core 2.0GHz SDM665	Octa-core 2.35&1.8GHz PowerVRGE8320	

Basic strategy

- ◆ Targets younger consumers with middle to mid-high-end phones sold in brick-and-mortar stores
- ◆ Emphasizing sales in India and SE Asia in addition to China

Flagship model : NEX 3S

- ◆ NEX series as new one on market
 - ✓ Minor change model of NEX3, 5G
 - ✓ Pop up camera(Vivo's new technology for the industry's first one)
 - ✓ Camera pops up only when taking a picture by front camera, and no need of notch (motion time: around 1 second) ⇒99.6% image occupancy
- ◆ High-spec camera
 - ✓ Rear(1 Triple 64MP: f/1.8 + 13MP: f/2.2 + 13MP:f/2.46)
 - ✓ Front(16MP: f/2.09)
 - ✓ Recognition by AI and quadaxial OIS
- ◆ Screen Sound Casting Technology
 - ✓ New technology using display as speaker
 - ✓ Sound quality the bass register is boosted
- ◆ Other
 - ✓ In-screen fingerprint authentication
 - ✓ Battery capacity of 4500mAh
 - ✓ 19.3:9 aspect ratio
 - ✓ Quick charge:44W Super Flash Charge
 - ✓ Display aspect ratio 18.8:9

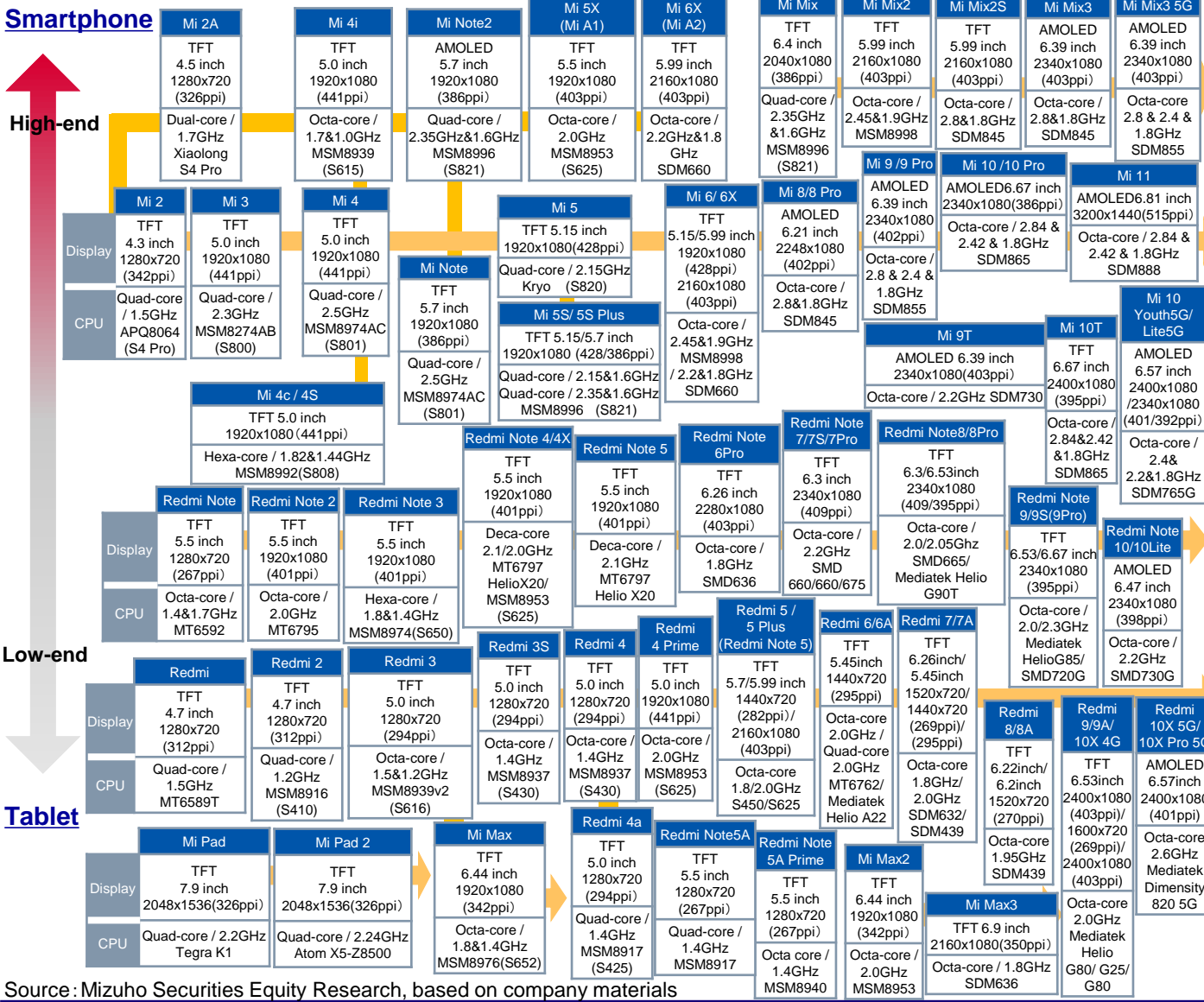
Funtouch OS

- ◆ Custom ROM developed by Vivo
 - ✓ Users can take single long screenshots by scrolling
 - ✓ Users can wake phone from sleep mode by holding palm over the screen
 - ✓ Screen's working area can be shrunk to allow for single-handed operation

Source: Mizuho Securities Equity Research from company data

Overview of Xiaomi smartphones

Sells low-priced, high-spec handsets, more than 60% of sales online, weak market share in China, but expanding commercial reach in India and Southeast Asia



Flagship model "Mi 11"

- ◆ Successor to Mi 10 released in Jan. 2021, 5G
 - ✓ CPU: SDM888
- ◆ AMOLED supports high-speed drive and high resolution
 - ✓ Up to 90Hz refresh rate, 480Hz touch sampling rate
 - ✓ 2K resolution, contrast ratio 5,000,000 : 1
- ◆ Dual stereo speaker supervised by Harman Kardon
 - ✓ 2 bluetooth can be connected
- ◆ Rear camera (Mi10 quad lenses→triple lenses) /front camera
 - ✓ (rear):108MP(main camera, f/1.9), 13MP(super wide angle, f/2.4), 5MP(telephoto, f/2.4), video(8K, 4K, 1080p)
 - ✓ (front): 20MP, video(1080p, 720p)
- ◆ Price: RMB3,999~(around JPY63,000~)
- ◆ Battery capacity: 4,600mAh,55W quick charge, 50W wireless charge

Dual Brand/On Line Focus

FY19 SP sales of CNY122b, up 7.3% YoY, with 124.6m shipments

- ◆ Dual-brand strategy
 - ✓ Transition to mid-/high-end market and Redmi focuses on low-/mid-end market; wider price range lineups
 - ✓ Digging in photography, following Huawei's suit
 - ✓ ASP up 2.2% YoY with margins improving by 1ppt to 7.2%
- ◆ Re-focus on online channels amid COVID-19 global spread
 - ✓ Eyeing more on domestic market which recovers at first
 - ✓ Activist in 5G pricing war pioneered with Redmi K30, the first 5G model with price tag only CNY1,999, in addition to rear quad-cam, front dual-cam & SDM765G (7nm EUV)

Sales and Share

- ◆ Sales of RMB205.8b(USD29.6b) in 2019 (USD1RMB6.96)
- ◆ 6th Global market share in 2019 (shipment value basis from IDC)
 - Apple(34.9%,159.6m), Samsung(22.1%,101.2m), Huawei(16.2%, 74.1m), OPPO(5.8%, 26.4m), vivo(4.9%, 22.6m), Xiaomi(4.7%, 21.5m)

Source: Mizuho Securities Equity Research, based on company materials

Xiaomi(小米): 5G+AIoT ecosystem, foray into premium smartphone market

Established in 2010. Listed on the Hong Kong Exchanges.

4th largest smartphone brand in the world in terms of shipment volume.

Main businesses: 1) **Smartphones**, 2) **IoT/Lifestyle Products**, and 3) **Internet Services**

- Smartphones:** Dual-brand “Mi + Redmi” strategy, Mi for mid-/high-end market and Redmi for mid-low (ASP with RMB980 ≈ ¥15,000 in 2019). CEO Lei Jun promises Hardware net margins will never exceed 5%. Originally specialized only for online sales, but now focusing on store sales. Shipment volume is 66.5M/55.4M/91.4M/118.7M /124.6M in 2015-2019.

- IoT and Lifestyle Products:** It sells wearable devices, smart electrical appliances, smart speakers, etc. Sales contribution rose to 30% in 2019 from 25%. Rising star in TV market with 12.8m global shipments (10m+ units in China) in 2019, +52% YoY.

⇒ 1st (19.3% M/S) and 6th (5.5% M/S) ranked in China/Global TV shipments respectively (as of 4Q 2019).

⇒ 1st (25.1% M/S) and 2nd (12.4% M/S) ranked in China/Global wearable device shipments respectively (as of 4Q 2019).

- Internet Services:** diversified revenue inflows from advertising, online gaming, TV subscription, as well as e-commerce and fintech businesses.

Sales weighting by region in 2019: 56% in China (60% last year), 44% outside of China (40% last year). Overseas sales growth is well outpacing domestic growth yearly.

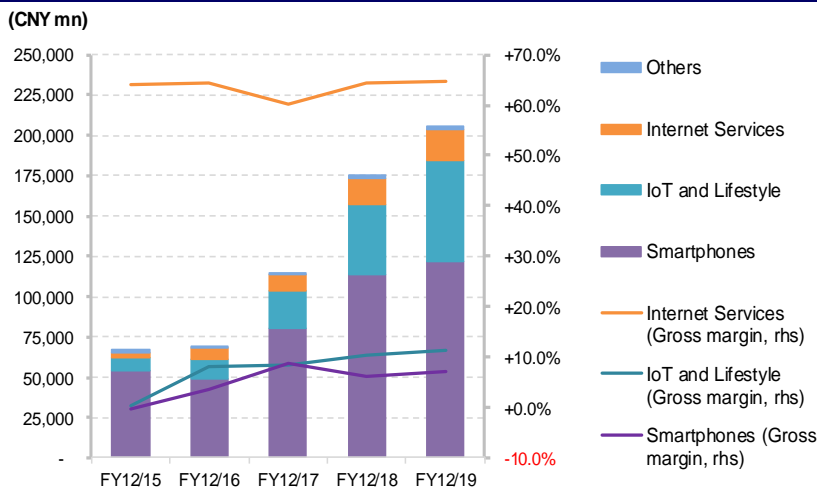
⇒ 1st (28.7% M/S) ranked in Indian smartphone shipments (as of 4Q 2019).

⇒ 115% YoY shipment growth in Western Europe (as of 4Q 2019).

Xiaomi

	(CNY mn)	FY12/15	FY12/16	FY12/17	FY12/18	FY12/19
Sales		66,811	68,434	114,625	174,915	205,839
	(Seq%)		+2%	+67%	+53%	+18%
Gross profit		2,700	7,249	15,154	22,192	28,554
	(Gross margin)	4.0%	10.6%	13.2%	12.7%	13.9%
Operating profit		-1,350	1,424	5,613	-3,276	8,619
	(Operating margin)	-2.0%	2.1%	4.9%	-1.9%	4.2%
Net profit		-7,581	553	-43,826	13,554	10,044
Oper_CF		-2,171	4,704	-633	-701	23,810
Invest_CF		376	-4,045	-3,248	-8,465	-31,570
Fin_CF		635	66	6,422	26,818	3,121
FCF		-4,695	2,877	-1,851	-4,486	20,405
EBITDA		-1,143	1,664	5,974	-2,528	10,000
	(EBITDA margin)	-1.7%	2.4%	5.2%	5.2%	5.2%
Dep&Amot		206	240	361	748	1,381
R&D		1,512	2,104	3,151	5,777	7,493

Sales trends by segment



Source: Compiled by Mizuho Securities Equity Research from company data/Bloomberg/IDC

Relationship Among Telecom Carriers & Handset Makers

Samsung and Apple built very strong position at major carriers in most of the countries.

		Handset Makers & Global Market Share																		
Telecom Career		Samsung	Apple	LG	Sony	Google	Huawei	OPPO	Vivo	Xiaomi	TCL	ALCATEL	Motorola	Lenovo	ZTE	Hisense	Nokia	BlackBerry	Sharp	Kyocera
U.S	AT&T	S	S	S		S						F			S		S			S
	Verizon	S	S	S		S						S	S				S			S
	T-Mobile	S	S	S		S						F	S							
	Sprint	S	S	S		S						F	S					S		S
Canada	Bell	S	S	S	S	S	S					S	S		S			S		
	Rogers	S	S			S	S					F	S							
	TELUS	S	S	S		S	S					F	S					S		
	Fido	S	S	S		S	S					F	S		F					
Japan	NTT Docomo	S	S	S	S	S	S												S	F
	Softbank		S	S	S	S	S												S	F
	KDDI	S	S	S	S	S	S								F				S	S
China	China Mobile	S	S				S	S	S	S	S		S	S	S		S			
	China Telecom	S	S				S	S	S	S					S		S	S		
	China Unicom	S	S				S	S	S	S					S					
Germany	Telefonica (O2)	S	S			S	S			S								S		
	Vodafone	S	S		S	S	S					F					S	S		
	T-Mobile	S	S			S	S					F					S	S		
France	France Télécom (Orange)	S	S		S	S	S	S					S				S	S		
	SFR	S	S		S	S	S		S			S						S		
	Bouygues Telecom	S	S		S	S	S	S	S			S					S	S		
UK	Telefonica (O2)	S	S		S	S	S	S		S		S					S			
	Vodafone	S	S		S	S	S	S		S		S	S				S			
	T-Mobile (EE)	S	S	S	S	S	S	S		S		S	S				S			
	Hutchison (Three)	S	S		S	S	S	S		S		S	S		S		S			
Italy	Telecom Italia	S	S	S			S			S		S	S		S		S	S		
	Wind	S	S	S			S	S		S		F	S		S					
	Vodafone	S	S	S			S			S										
Australia	SingTel (Optus)	S	S			S	S	S												
	Vodafone	S	S			S	S	S										S		
	Telstra	S	S	S		S	S	S					S					S		
Mexico	Telcel	S	S	S			S	S		S		S	S		S	S	S			
	Telefonica (Movistar)	S	S	S			S					S	S		S	S				
	AT&T (Iusacell)	S	S				S					S	S		S	S				
India	Vodafone	S	S	S	S	S	S	S		S	S	S	S	S	S		S	S		
	Reliance	S	S	S			S	S	S				S	S	S		S			
	Airtel (Bharti)	S	S			S											S			
Korea	SK Telecom	S	S	S																
	KT	S	S	S	S										S					
	LG Telecom	S	S	S															S	
Thailand	Advanced Info Service	S	S				S	S	S	S										
	DTAC	S	S				S	S	S											
	Ture Move	S	S		S		S	S	S				S	S			S			
South Africa	Vodafone	S	S	S			S		S	S		F		S			S			
	MTN	S	S	S			S										S			
	Cell C	S	S	S	S		S										S			
Difference (2013/7→2015/3)		-1	+3	-1	+2	-	-5	-	-	+1	+0	-	-7	+1	-1	+0	+2	-7	+1	+3
Difference (2015/3→2017/7)		-	-	-5	-8	+7	+5	+10	+4	+3	-1	+14	-3	+5	-3	+0	-26	-22	-2	+2
Difference (2017/7→2019/2)		-1	-1	-4	-8	+12	+4	+2	+4	+9	+1	+3	+9	-3	+5	+1	+11	+5	+1	-3
Difference (2019/2→2020/2)		-	+1	-3	-7	+4	+1	+7	+1	-	-	+3	-1	-1	+3	-	-	-6	-	+2

S Smartphone
 F Feature Phone
 S Smartphone(not update)

S : Smartphone (Including Feature phone)
 F : Only Feature phone

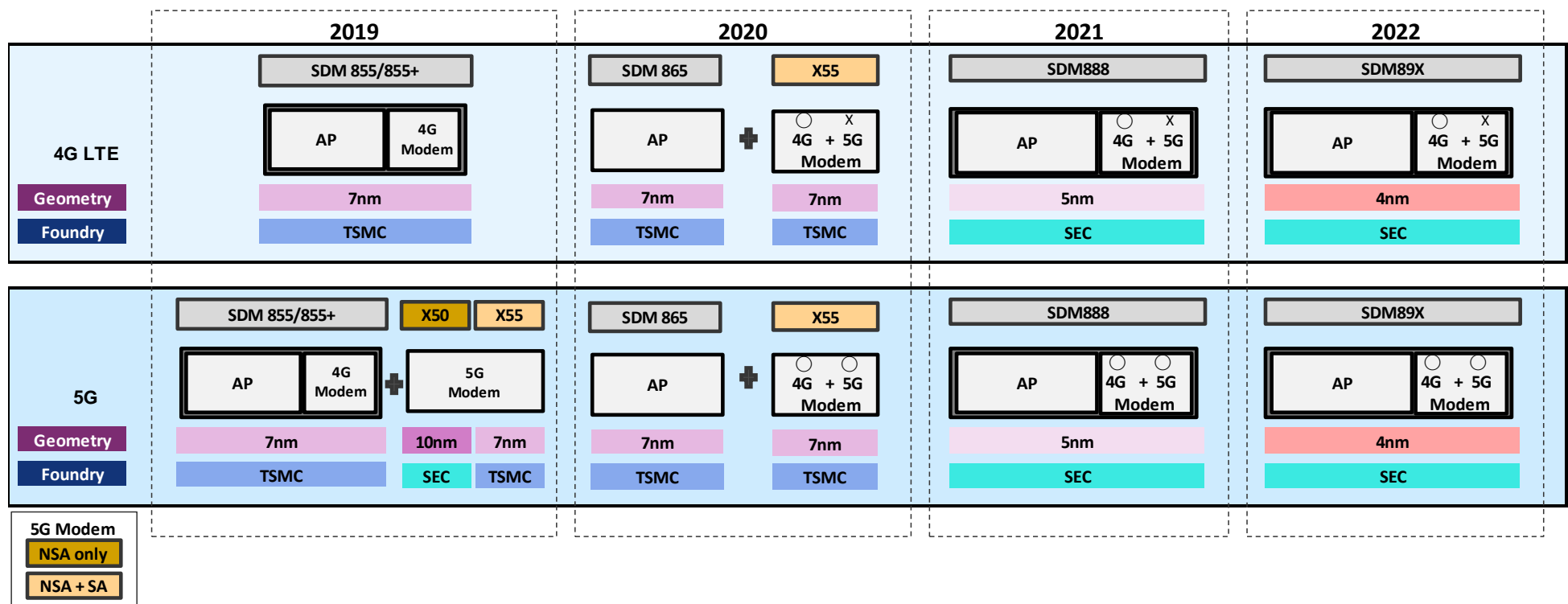
Source: Compiled by Mizuho Securities Equity Research from company data

SoC roadmap: Qualcomm's premium segment

Qualcomm's premium SoC roadmap

- For 2020, Qualcomm provided smartphone makers with identical SoC products (i.e. SDM865 + X55) in the premium segment for both 4G and 5G. The only difference in premium SoC in 2020 will be whether it deactivates 5G cellular functionality or not in the X55 modem.
- Qualcomm has rolled out SDM888 combining AP together with 4G/5G modem, based on Samsung Foundry's 5nm. We expect Qualcomm will launch one-chip SoC in the premium segment based on Samsung Foundry's 4nm in 2022.

Qualcomm's chipset roadmap: Premium line-ups



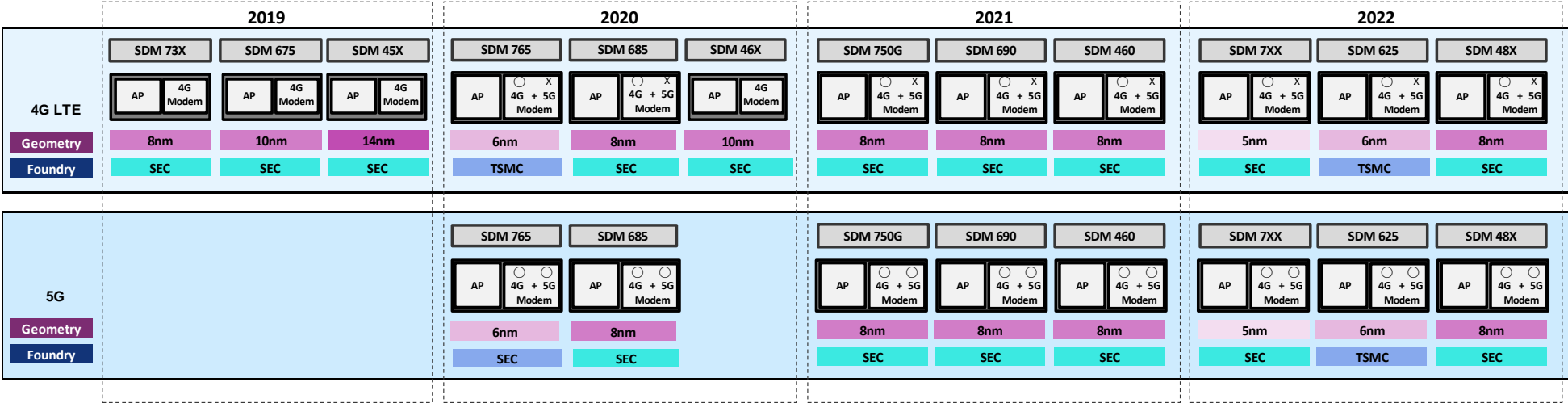
Source: Mizuho Securities Equity Research from Company data

SoC roadmap: Qualcomm's mid-range segment

Qualcomm's mid-range SoC roadmap

- For 2020, Qualcomm provided smartphone makers with two SoC chipsets for both mid-high (SDM765) and mid-mid (SDM685), based on a single-chip solution given smaller chip sizes with smaller transistor counts for mid-range SoC, compared to the premium segment.
- We expect Qualcomm will likely roll out our mid-range SoC chips mostly based on Samsung Foundry's 8nm node for 2021. For 2021, we anticipate that Qualcomm will likely utilize both Samsung Foundry (5nm and 8nm) and TSMC (6nm), mainly for its mid-range SoC product foundry.

Qualcomm's chipset roadmap: Mid-range line-ups



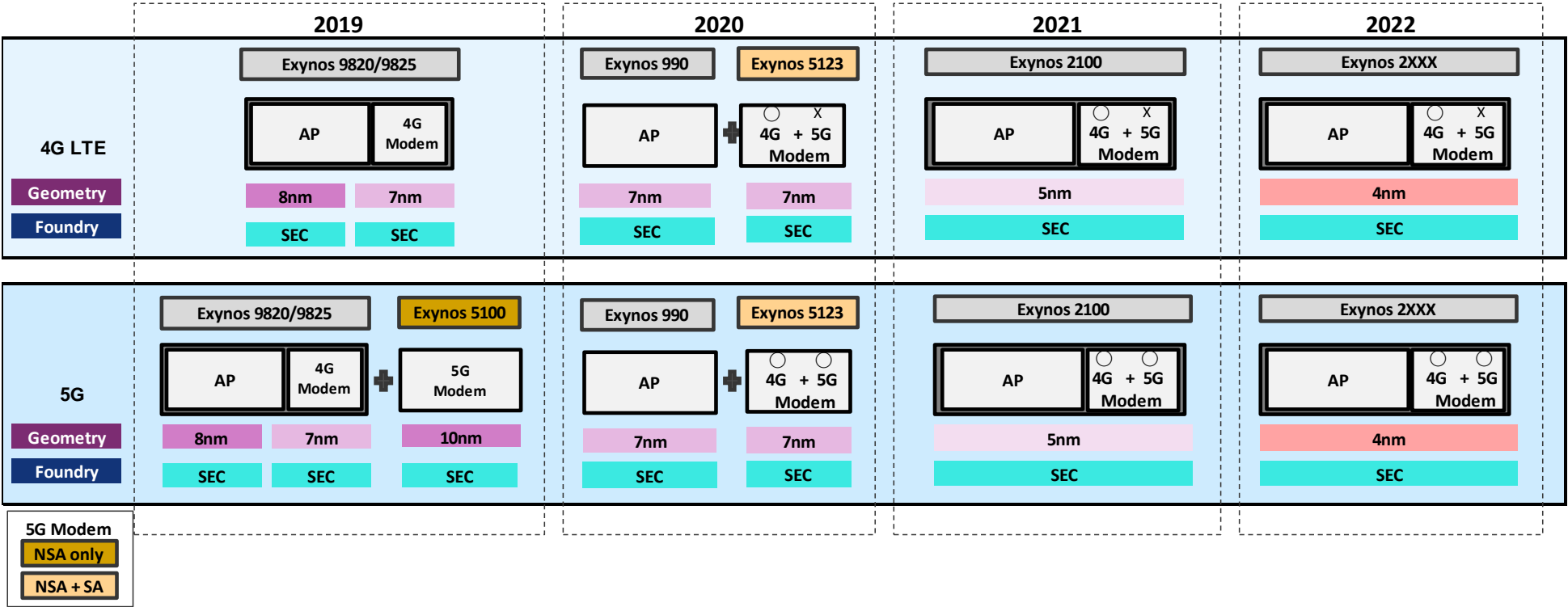
Source: Mizuho Securities Equity Research from Company data

SoC roadmap: Samsung LSI's premium segment

S-LSI's premium SoC roadmap

- For 2020, both 4G and 5G smartphones in the premium segment required the adoption of a discrete AP (i.e., Exynos 990) and cellular modem (i.e. Exynos 5123) for 2020.
- Samsung LSI will roll out one chip SoC solution from 2021 in the premium segment based on Samsung Foundry's 5nm and 4nm for 2021 and 2022, respectively.

S-LSI's chipset roadmap: Premium line-ups



Source: Mizuho Securities Equity Research from Company data

SoC roadmap: Samsung LSI's mid-range segment

S-LSI's mid-range SoC roadmap

- As for the mid-range SoC roadmap, S-LSI introduced a single-chip SoC for the mid-high end 5G smartphones in 2020, Exynos 980 and Exynos 880. We anticipate that S-LSI will likely expand 5G SoC products to the mid-mid and mid-low segments from 2021.
- S-LSI has been trying to focus more on customer diversification in the mid-range SoC to counter Samsung Mobile's ODM/JDM strategy. For instance, S-LSI's Exynos 1080 has been adopted for ViVo's X60 series.

S-LSI's chipset roadmap: Mid-range line-ups

	2019			2020		2021		2022	
4G LTE	Exynos 9611	Exynos 8895	Exynos 7855	Exynos 980	Exynos 880	Exynos 1080	Exynos 780	Exynos 1XXX	Exynos 8XX
	AP, 4G Modem	AP, 4G Modem	AP, 4G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem
	Geometry: 10nm	Geometry: 10nm	Geometry: 14nm	Geometry: 8nm	Geometry: 8nm	Geometry: 5nm	Geometry: 8nm	Geometry: 5nm	Geometry: 6nm
Foundry	SEC	SEC	SEC	SEC	SEC	SEC	SEC	SEC	SEC
5G				Exynos 980	Exynos 880	Exynos 1080	Exynos 780	Exynos 1XXX	Exynos 8XX
				AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem	AP, 4G + 5G Modem
				Geometry: 8nm	Geometry: 8nm	Geometry: 5nm	Geometry: 8nm	Geometry: 5nm	Geometry: 6nm
Foundry				SEC	SEC	SEC	SEC	SEC	SEC

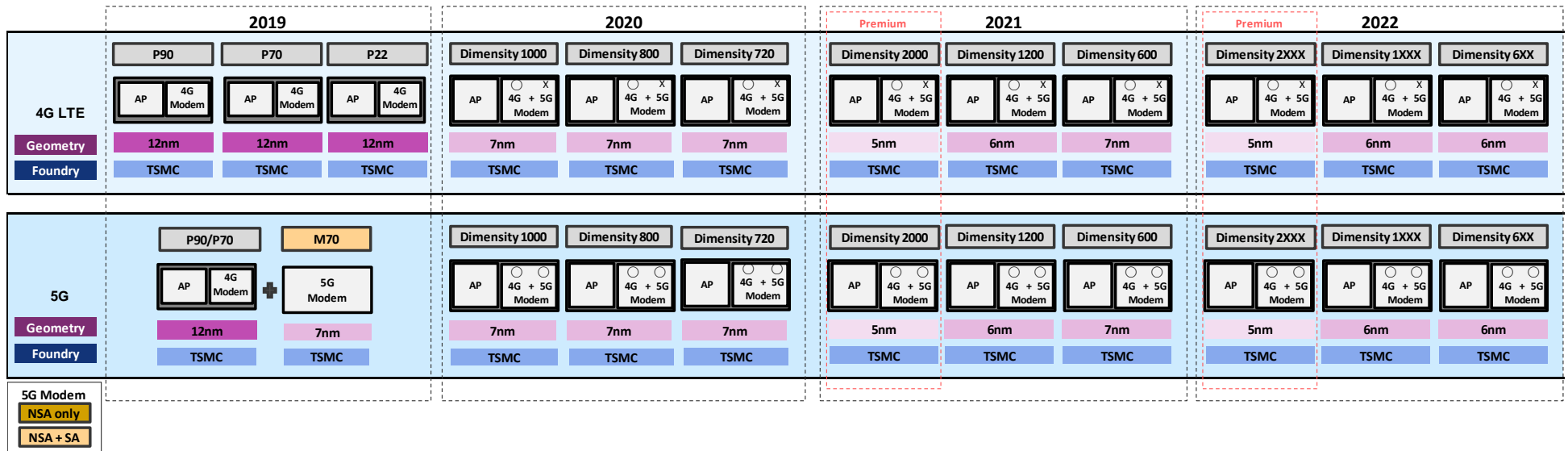
Source: Mizuho Securities Equity Research from Company data

SoC roadmap: MediaTek

MediaTek's SoC roadmap

- MediaTek introduced Dimensity 1000 SoC based on CA77/CA55 in 2019. Given that Dimensity 1000 supports only Sub-6 5G, it will only target for Chinese smartphone makers. In 2020, Mediatek expanded its 5G SoC line-ups to not only the premium segment (i.e. Dimensity 2000) but also the mid/low-end segment Dimensity 800 and Dimensity 720.
- We expect Mediatek's mid/low-end SoC fabrication will continue to utilize TSMC's 6nm/7nm for the next couple of years, so as to secure cost competitiveness.

MediaTek's SoC roadmap



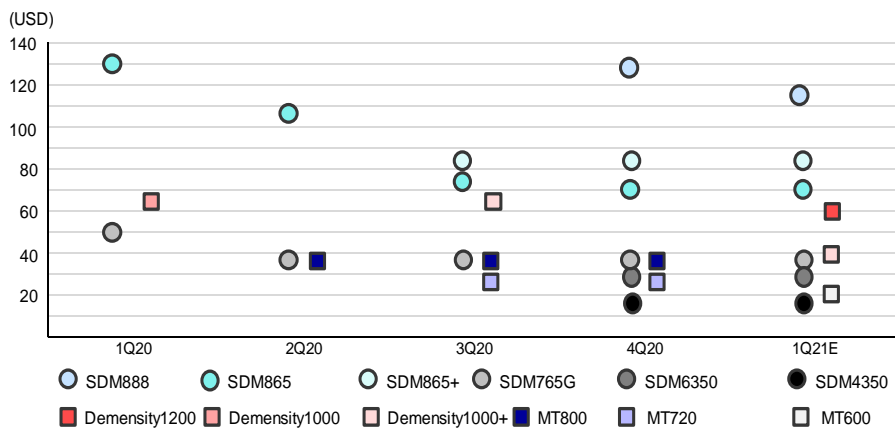
Source: Mizuho Securities Equity Research from Company data

SoC roadmap: SoC and RFFE cost analysis

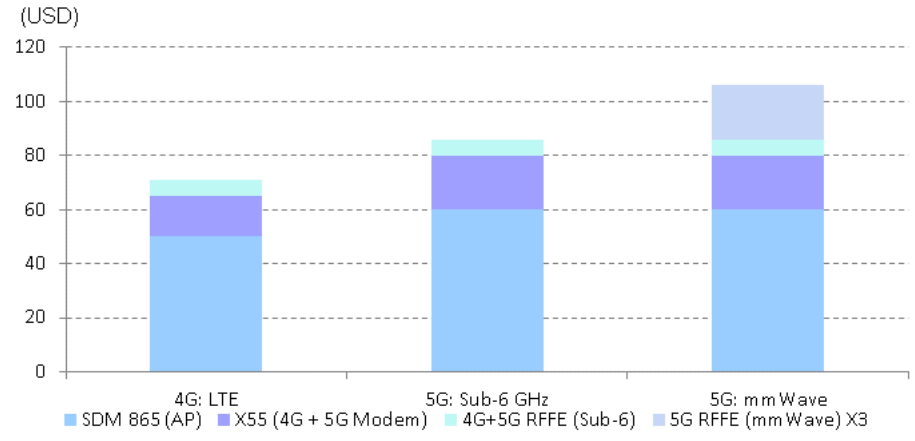
Decreasing 5G SoC and RFFE cost burdens for 2021

- We view that 5G SoC cost burden will keep decreasing along with: 1) decreasing SoC prices in the premium segment; and 2) increasing SoC product launch in the mid-end 5G smartphone .Along with decreasing SoC prices, RFFE costs for 5G decreased during 1H20. Our checks suggest that RFFE cost for Sub-6 declined from US\$45-50 in 4Q19 to US\$25-30 in 3Q20 while mmWave RFFE cost fell to US\$45-50 in 3Q20 from US\$75-80 at the end of 2019.
- We view that decreasing cost burden for 5G SoC and RFFE module will likely accelerate 5G smartphone growth from 2021, not only in the high-end segment but also in the mid-end segment.
- In 4Q20, Qualcomm and Mediatek rolled out new flagship SoC chips for 2021 (i.e. SDM888 and Demensity1200), in 4Q20, of which prices are mostly in line with initial price ranges for previous flagship SoC chips (i.e. SDM865 and Demensity1000). Given that SDM865 have integrated modem in SoC (i.e. one-chip solution), however, smartphone makers' SoC and RFFE cost burden will likely decrease for 2021.

SoC price trends



SoC and RFFE cost comparison in 4Q20 (SDM865)



Source: Mizuho Securities Equity Research from Company data

SoC roadmap: SoC foundry roadmap

Surging demand for leading-edge node foundry

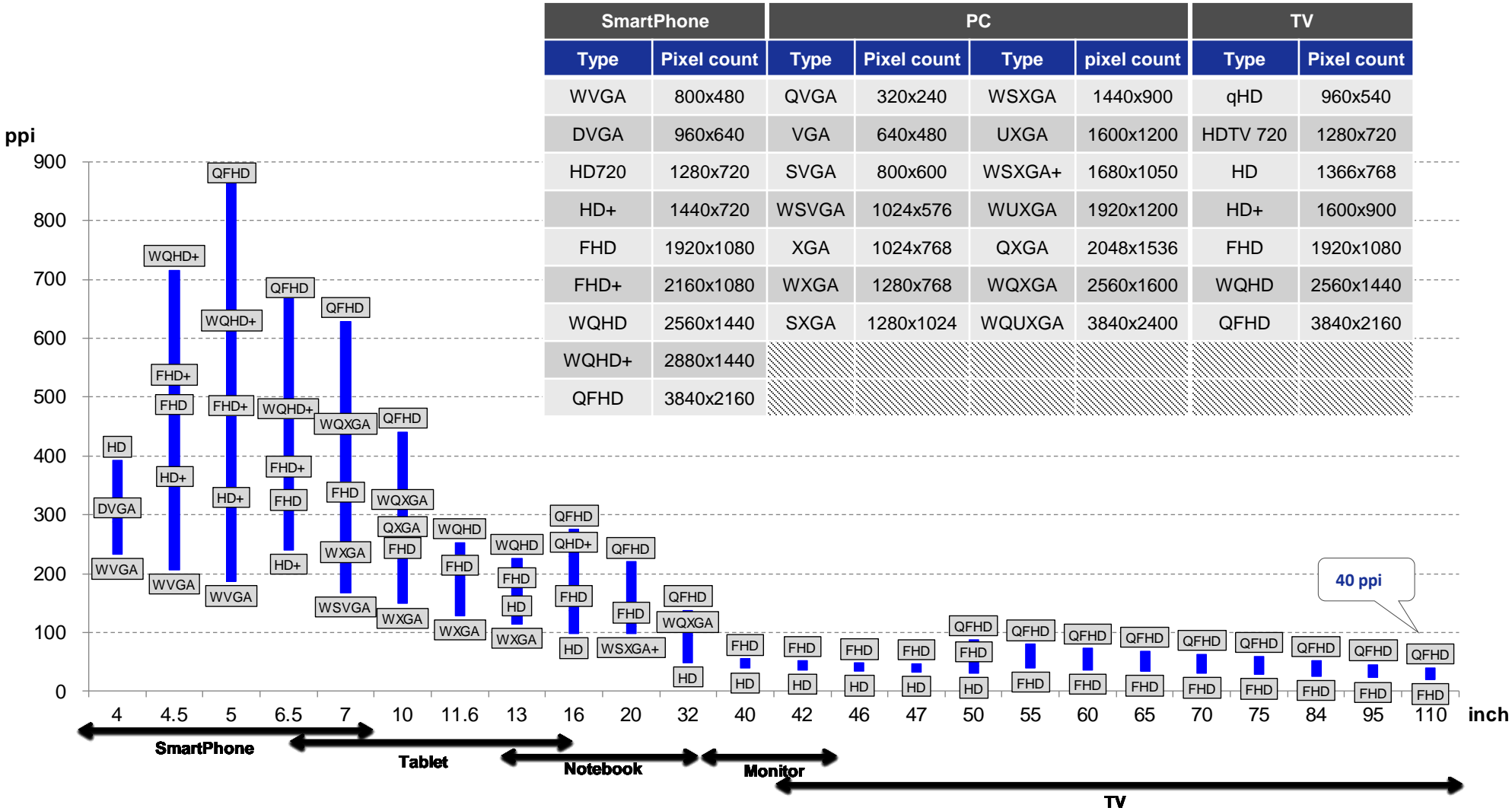
- According to our SoC roadmap analysis, major SoC makers will aggressively adopt leading-edge geometry for wafer fabrication from 2020. We expect the majority of smartphone SoCs to be manufactured at 5nm/5nm+ for the premium segment and 8nm/6nm for the mid-range segment in 2021.
- As for the foundry service partnership, we believe most SoC makers will continue to maintain current foundry partners except Qualcomm's premium SoC, SDM888, for 2021 (shifting from TSMC to Samsung Foundry).
- Due to the upgraded ban from the US government, Huawei may not continue utilizing foundry services for its SoC fabrication from 2021.

SoC foundry roadmap by node

		2019						2020					2021			2022				
		14nm	12nm	10nm	8nm	7nm	7nm+	12nm	10nm	8nm	7nm	6nm	5nm	8nm	6nm	5nm	8nm	6nm	5nm	4nm
Qualcomm	Premium						√				√					√				√
	Mid-range	High				√					√				√				√	
		Mid			√						√			√				√		
		Low	√						√					√			√			
S-LSI	Premium					√	√			√					√				√	
	Mid-range	High			√					√					√				√	
		Mid			√					√				√				√		
		Low	√						√					√			√			
MediaTek	Premium														√				√	
	Mid-range	High		√						√				√				√		
		Mid		√						√				√				√		
		Low		√					√					√				√		
HiSilicon	Premium					√	√					√			X			X	X	
	Mid-range					√				√					X			X	X	
√	TSMC																			
√	Samsung Foundry																			
X	Restricted																			

Source: Mizuho Securities Equity Research from Company data

LCD Resolution by applications



Source: Mizuho Securities Equity Research

Mid and small size panels: resolution and ppi by major size

Comparison between LTPS and A-Si

LTPS Very Advantageous	LTPS Advantageous	Equal	LTPS Disadvantageous
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ppi Comparison

Smartphone														
Type	Pixel count	3.5"	4"	4.5"	5"	5.5"	6"	6.5"	7"	7.5"				
QFHD	3840x2160	1259	1101	979	881	801	734	678	629	587				
WQHD	2560x1440	839	734	653	587	534	490	452	420	392				
FHD	1920x1080	629	551	490	441	401	367	339	315	294				
HD	1280x720	420	367	326	294	267	245	226	210	196				
qHD	960x540	315	275	245	220	200	184	169	157	147				
WVGA	800x480	267	233	207	187	170	155	144	133	124				
Tablet														
Type	Pixel count	7"	7.5"	8"	8.5"	9"	9.5"	10"	10.5"	11"	11.5"	12"	12.5"	13"
QFHD	3840x2160	629	587	551	518	490	464	441	420	401	383	367	352	339
WQHD	2560x1440	420	392	367	346	326	309	294	280	267	255	245	235	226
FHD	1920x1080	315	294	275	259	245	232	220	210	200	192	184	176	169
HD	1280x720	210	196	184	173	163	155	147	140	134	128	122	117	113
qHD	960x540	157	147	138	130	122	116	110	105	100	96	92	88	85
WVGA	800x480	133	124	117	110	104	98	93	89	85	81	78	75	72
NoteBook														
Type	Pixel count	12.2"	13"	14"	15"	15.6"	17.3"							
QFHD	3840x2160	361	339	315	294	282	255							
WQHD	2560x1440	241	226	210	196	188	170							
FHD	1920x1080	181	169	157	147	141	127							
HD	1280x720	120	113	105	98	94	85							

Resolution and ppi (Major smartphone & Tablet)

Maker	Name	Type	Pixel Count	Size	ppi	Technology
Apple	iPhone11	Close to FHD+	1767x883	6.1	326	LTPS
	iPhone11 Pro	Close to FHD+	2436x1125	5.9	458	OLED
	iPhone11 Max	(Close to HD)	2688x1242	6.5	458	OLED
Samsung	Galaxy Fold(Open)	Close to FHD+	2152x1536	7.3	362	OLED
	Galaxy Fold(Fold)	HD+	1960x840	4.6	464	OLED
	Galaxy S10	QHD+(19.9)	3040x1440	6.1	551	OLED
	Galaxy S10+	QHD+(19.9)	3040x1440	6.4	526	OLED
	Galaxy S10e	Close to FHD+	2280x1080	5.8	435	OLED
	Galaxy Feel2	HD+	1480x720	5.6	294	OLED
	Galaxy S9	QHD+(18.5.9)	2960x1440	5.8	570	OLED
	Galaxy S9+	QHD+(18.5.9)	2960x1440	6.2	529	OLED
	Galaxy Note 9	WQHD+(18.5.9)	2960x1440	6.4	516	OLED
	Galaxy Note 10	FHD+(19.9)	2280x1080	6.3	401	OLED
Galaxy Note 10+	WQHD+(19.9)	3040x1440	6.8	498	OLED	

Maker	Name	Type	Pixel Count	Size	ppi	Technology
Huawei	Mate 20	QHD+(19.5.9)	3120x1440	6.53	381	OLED
	Mate 20 Pro	QHD+(19.5.9)	2244x1080	6.39	538	OLED
	Mate 30	FHD+(19.5.9)	2340x1080	6.62	402	OLED
	Mate 30Pro	FHD+(18.5.9)	2400x1176	6.53	409	OLED
	P30	FHD+(19.5.9)	2340x1080	6.1	398	OLED
Google	P30 Pro	FHD+(19.5.9)	2340x1080	6.47	422	OLED
	Pixel 3	FHD+	2160x1080	5.5	443	OLED
	Pixel 3XL	QHD+(18.5.9)	2960x1440	6.3	522	OLED
	Pixel 4	FHD+(19.9)	2280x1080	5.7	444	OLED
Pixel 4XL	WQHD+(19.9)	3040x1440	6.3	537	OLED	

Maker	Name	Type	Pixel Count	Size	ppi	Technology
Apple	iPad Pro 12.9(2018)	QXGA	2732x2048	12.9	265	Oxide
	iPad Pro 11(2018)	4.29:3	2388x1668	11.0	265	Oxide
	iPad(2019)	QXGA	2168x1620	10.2	265	
	iPad Air(2019)	QXGA	2224x1668	10.5	265	
	iPad mini(2019)	QXGA	2048x1536	7.9	324	
Samsung	Galaxy Tab S6	WQXGA	2560x1600	10.5	287	OLED
	Galaxy Tab A6.0	WQXGA	1280x800	8.0	189	
Google	Pixel Slate	WUXGA	3000x2000	12.3	293	LTPS
	Nexus 7	WUXGA	1920x1200	7.0	323	LTPS
	Nexus 10	WQXGA	2560x1600	10.1	300	LTPS

Game	Maker	Name	Type	Pixel Count	Size	ppi	Technology
Sony	PSP		qqHD	480x272	4.3	128	LCD
	PS Vita		qHD	960x544	5.0	221	OLED-LCD
Nintendo	DS	Top	WVGA	256x192	3.0	107	LCD
		Bottom	QVGA	320x240	3.0	133	LCD
	3DS	Top	WVGA	800x480	3.5	267	(3D)LCD
		Bottom	QVGA	320x240	3.0	133	LCD
	3DSLL	Top	WVGA	800x480	4.9	190	(3D)LCD
2DS	Bottom	QVGA	320x240	4.2	95	LCD	
	Top	WVGA	400x240	3.5	133	LCD	
	Bottom	QVGA	320x240	3.0	133	LCD	
Wii-U Controller			FWVGA	854x480	6.2	158	LCD
Switch			HD	1280x720	6.2	237	LCD
	Lite		HD	1280x720	5.5	267	LCD

Source: Mizuho Securities Equity Research

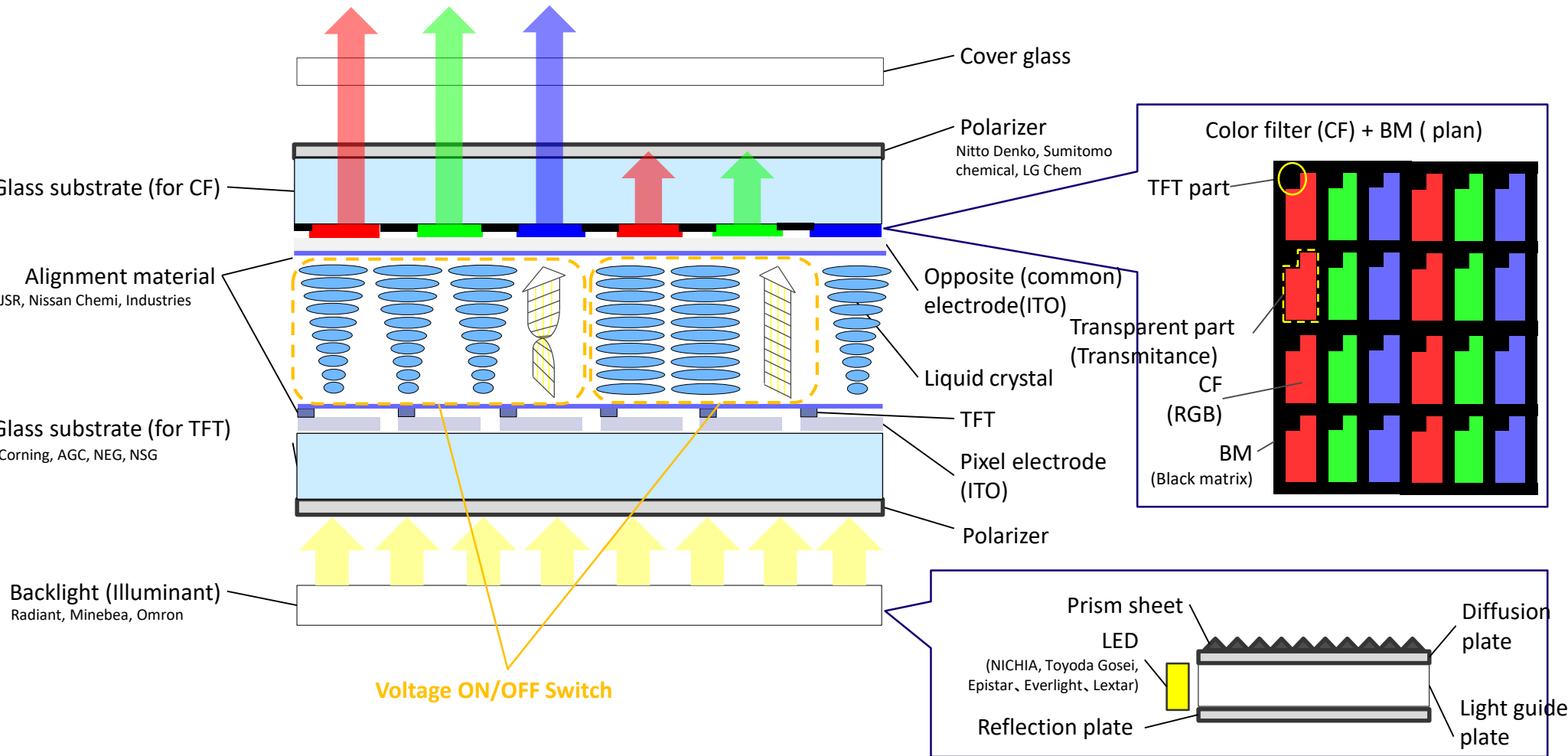
Mid-small sized panel : Number of panels by main generation and main size

Ratio	Gen.	Substrate size	3.5"	4"	4.3"	4.5"	4.7"	5"	5.2"	5.5"	5.8"	6"	6.3"	7"
18:9	G3	550x670	96	77	60	60	55	45	40	40	36	28	28	24
	G3.5	600x720	112	84	77	66	60	60	45	45	40	40	36	28
	G4.5	730x920	187	135	126	104	96	90	84	77	65	60	54	44
	G5.5	1300x1500	540	390	350	336	299	275	240	220	198	189	170	144
	G6	1500x1850	774	570	504	476	416	375	360	308	286	273	240	198
	G8	2200x2500	1530	1173	1008	920	880	756	720	646	576	525	495	390
Ratio	Gen.	Substrate size	7.5"	7.85"	8"	8.4"	8.6"	8.9"	9.7"	10.1"	10.6"	11.6"	12.2"	13"
4:3	G3	550x670	16	16	16	15	12	9	9	9	9	6	6	6
	G3.5	600x720	20	16	16	16	16	15	9	9	9	9	6	6
	G4.5	730x920	30	28	28	28	25	25	18	16	16	15	9	9
	G5.5	1300x1500	99	90	90	77	77	72	56	56	45	42	35	30
	G6	1500x1850	135	135	132	112	110	104	84	77	72	60	49	45
	G8	2200x2500	294	260	260	228	224	198	168	168	150	120	104	96
Ratio	Gen.	Substrate size	13.3"	14"	15.6"	17.3"	19"	20"	21.5"	23"	24"	26"	30"	32"
16:9	G3	550x670	6	6	3	3	2	2	2	2	2	1	1	0
	G3.5	600x720	8	6	6	3	3	2	2	2	2	2	1	1
	G4.5	730x920	12	10	8	6	6	4	3	3	3	2	2	2
	G5.5	1300x1500	35	32	24	18	18	15	12	10	8	8	6	6
	G6	1500x1850	50	40	36	24	24	21	18	15	12	12	8	8
	G8	2200x2500	104	98	77	60	50	40	40	32	32	24	18	18

Source: Mizuho Securities Equity Research

LCD Structure

LCD Structure (section)



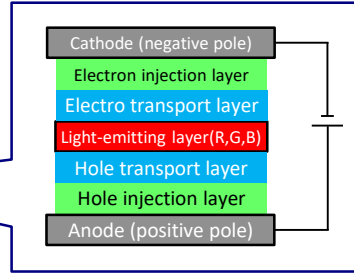
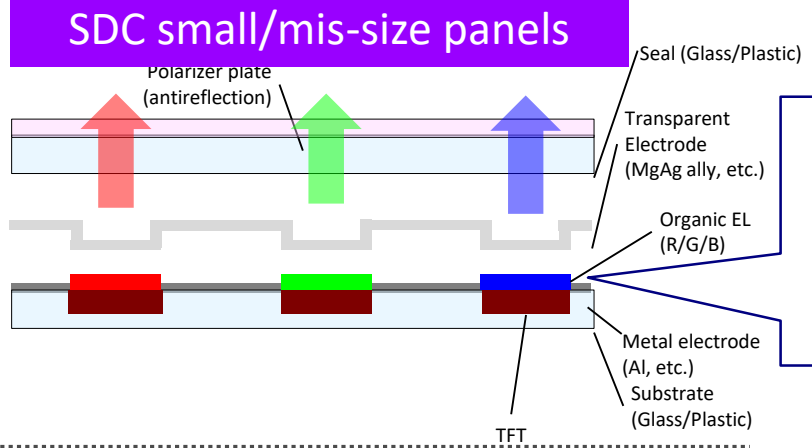
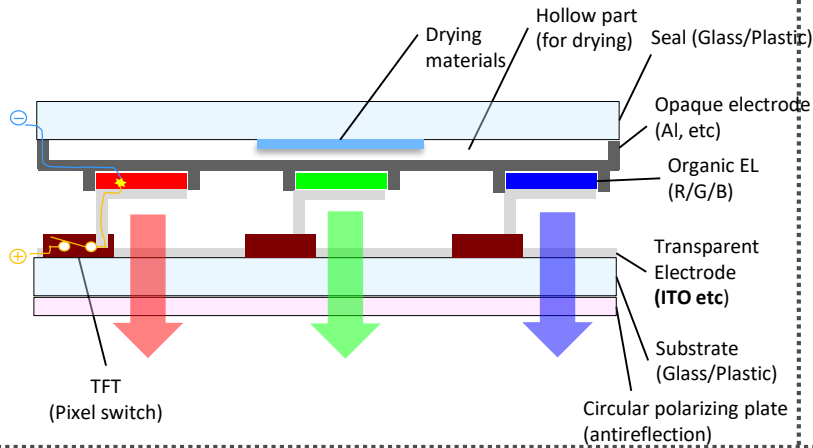
Source: Mizuho Securities Equity Research from company data

OLED Structure

Bottom Emission

Top Emission

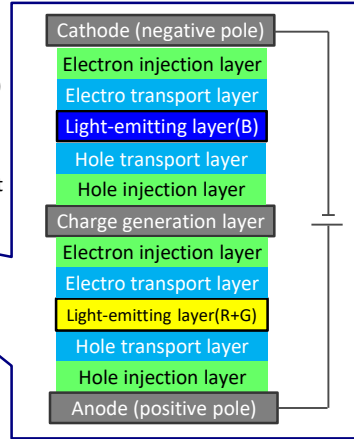
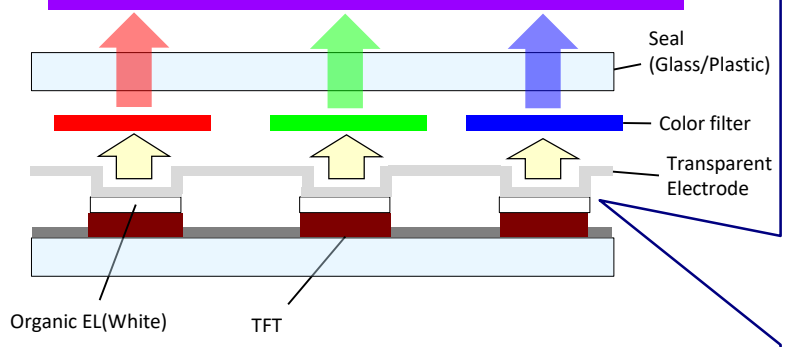
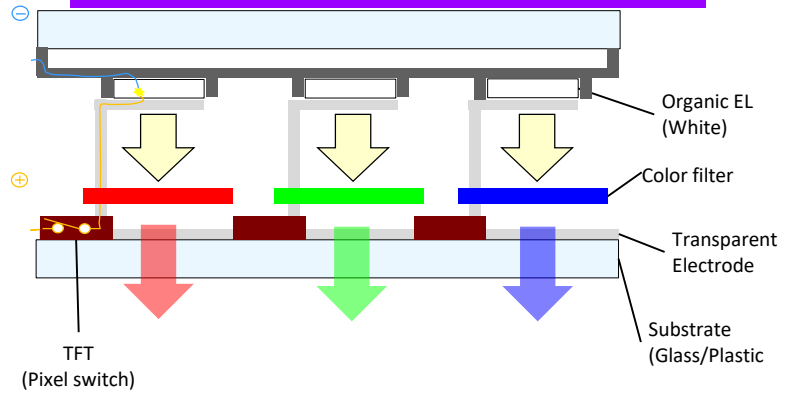
R, G, B



White + Color Filter

LGD large panels

SDC large panels

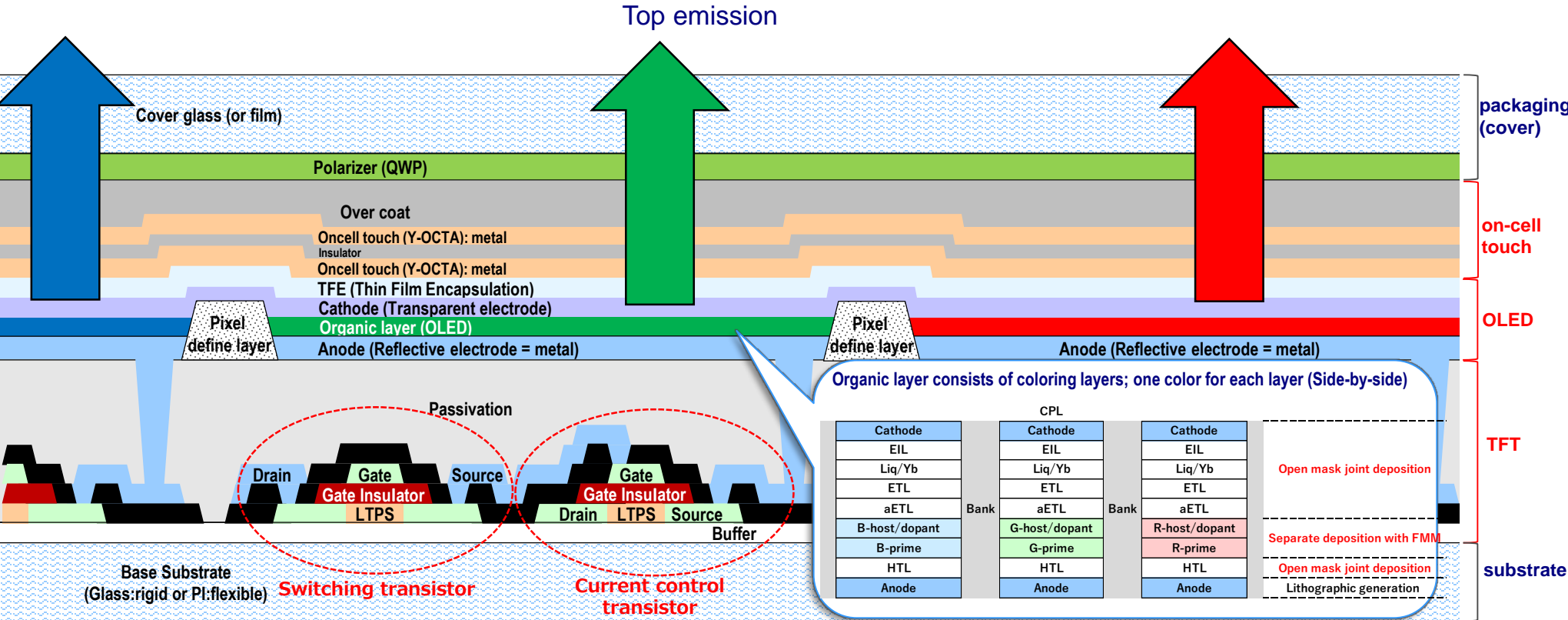


Material supplier:
Sumitomo Chemi, Idemitsu Kosan, Hodogaya Chemi, Chisso, Toray, Mitsubishi Chemi, JSR, Doosan, Dow Chemi, Merck, Universal Display (IPs)

Source: Mizuho Securities Equity Research from company data

Small/mid-size RGB-OLED structure: cross section diagram

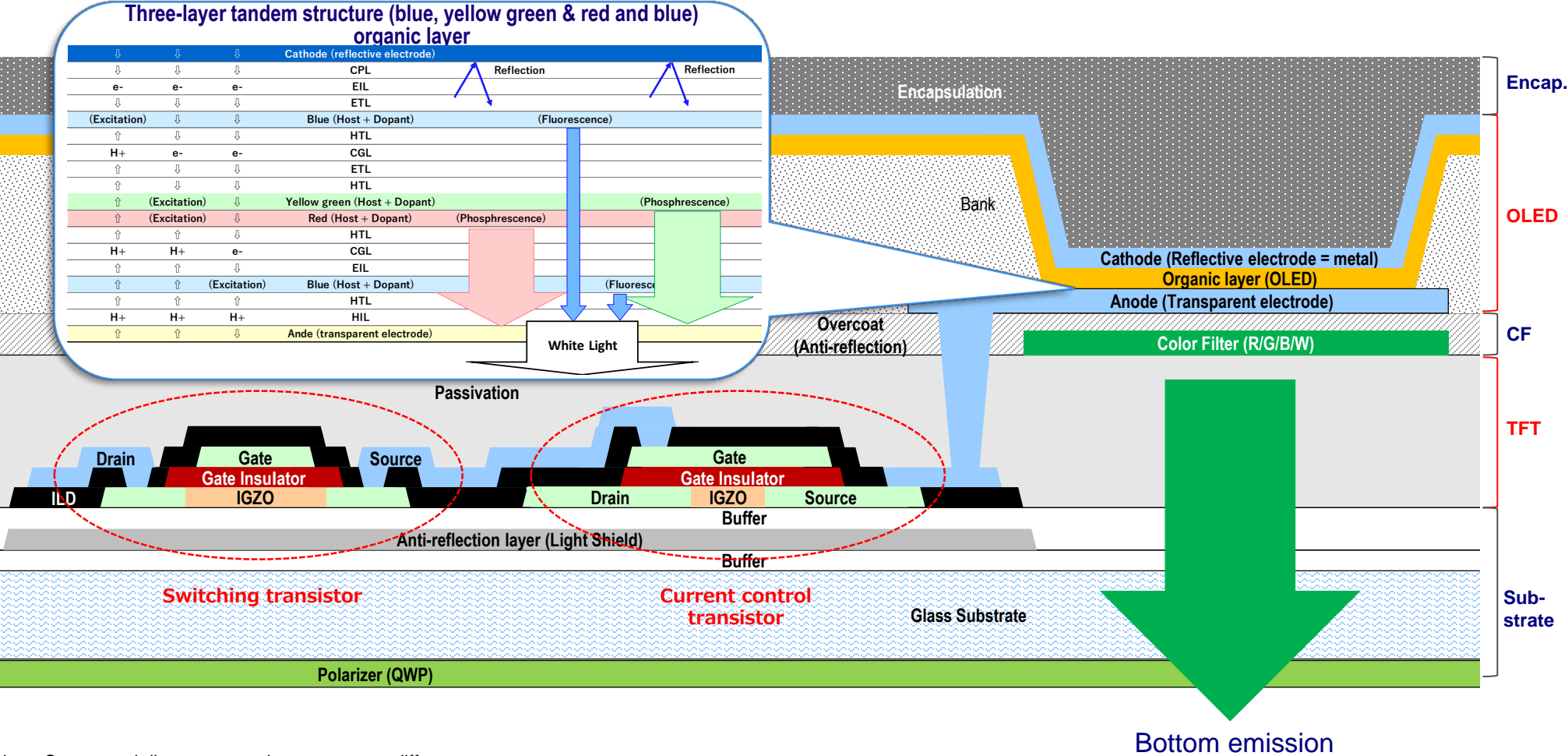
- OLED layer created using separate RGB deposition with fine metal masks; circular polarizing plate prevents reflection and thin film encapsulation (TFE) required for top emission
- Samsung Display's panel has more than five transistors per pixel for revision and other purposes and utilizes more than 10 masks for TFT and on-cell touch



Note: Conceptual diagram; actual structure may differ
 Source: Mizuho Securities Equity Research

White-OLED structure: cross section diagram

- Organic emitting layer generated through coated vacuum deposition with an open mask; thick film encapsulation allowed because of the bottom emission (light exits the bottom side of the TFT substrate) format
- OLED itself is white and the color filter adds coloring and also prevents reflection; uses a single glass substrate

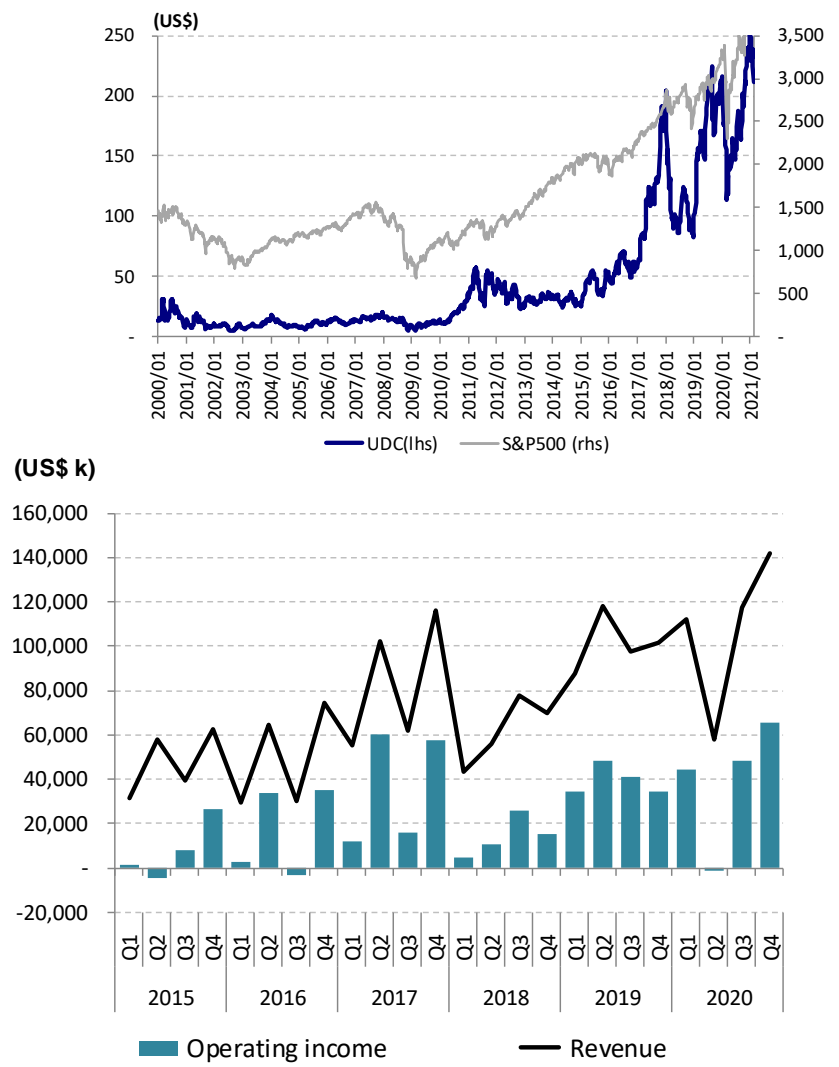


Note: Conceptual diagram; actual structure may differ
 Source: Mizuho Securities Equity Research

Universal Display Corp (UDC): Outline

- Established in 1994, listed on NASDAQ in April 1996, Ticker: OLED. Headquartered in Ewing, New Jersey. The number of the employees is 265 at the end of 2018.
- A fables operation solely engaged in R&D and IP management; outsources all production to PPG Industries.
- Holds over 4,500 patents/pieces of intellectual property. Manages all of the OLED-related IP/patents formerly of Princeton University, the University of Southern California, and the University of Michigan (including the collection of royalties and the granting of licenses). These patents include some fundamental patents on phosphorescent materials. UDC's patent portfolio has continued to grow with its acquisition of \$159m worth of OLED-related patents from Motorola in 2011, \$109.5m worth from Fujifilm in 2012, and \$96m worth from BASF in 2016.
- Sales break down into three segments: 1) material sales, 2) royalty and license fees, and 3) technology development and support.
 - **Material sales:** Offers only phosphorescent materials; does not handle any fluorescent materials. Red and green emitter dopants account for the bulk of sales (green emitter dopants include yellow-green emitter dopant's for LG Display's WOLED (B+YG+B) TVs). UDC is currently developing a blue PHOLED emitter. (To date, the only blue-emitting materials that have been put into commercial use are fluorescent materials from Idemitsu Kosan, SFC, and other companies besides UDC.) UDC previously handled green host materials, but has now almost entirely exited this business in the face of stiff competition. In matching emitters to host materials, the company collaborates with other companies that handle host materials, including Nippon Steel.
 - **Royalty and license fees:** Only receives payments from SDC (where the majority of its payments come from) in 2Q/4Q, but upon changing its accounting standard, it now books recognized revenue in accordance with Material sales. The company also has licensing agreements with LG Display, AU Optronics, Sumitomo Chemical, Sony, and Konica Minolta, among others. The agreement with SDC runs through the end of 2017 (and is renewed as needed); the agreement with LG Display is a long-term agreement that runs through 2022.
- Sales to South Korean firms accounted for 62% of 2019 consolidated sales (44% for SDC, 27% for LG Display).
- Fundamental patents managed on behalf of Princeton University and other universities are expected to expire in 2017/2019 in the US and in 2018/2020 outside the US.

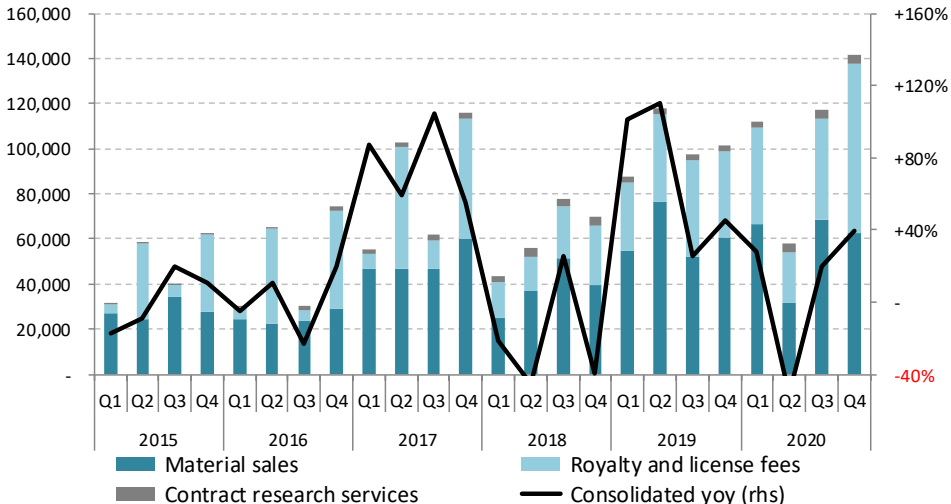
Share price performance / Earnings Trend



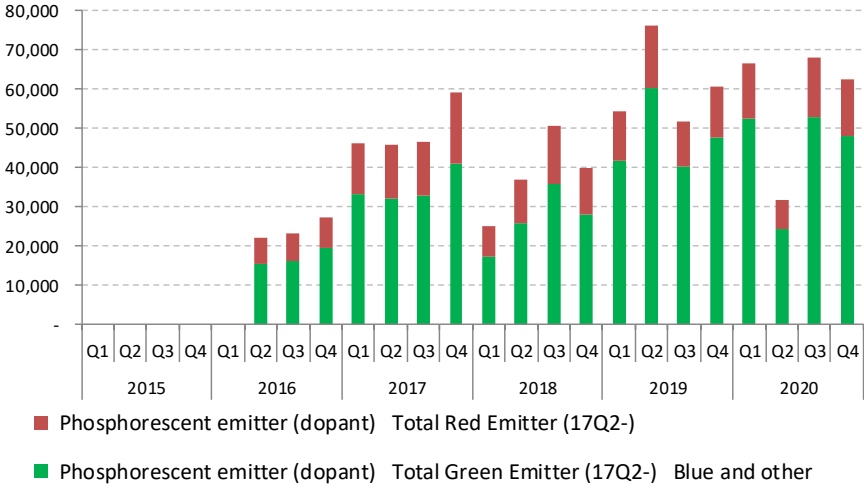
Source: Mizuho Securities Equity Research, from company materials

Universal Display Corp(UDC) : Sales trends

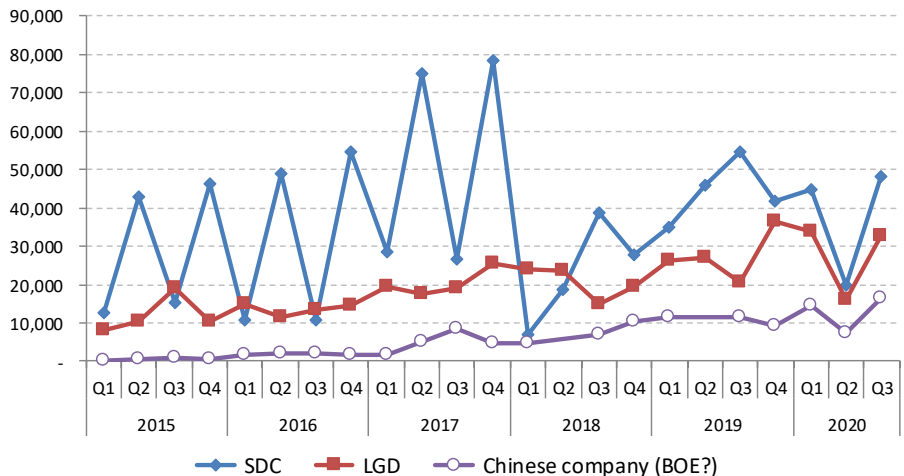
Universal Display - Revenue by segment (US\$ k)



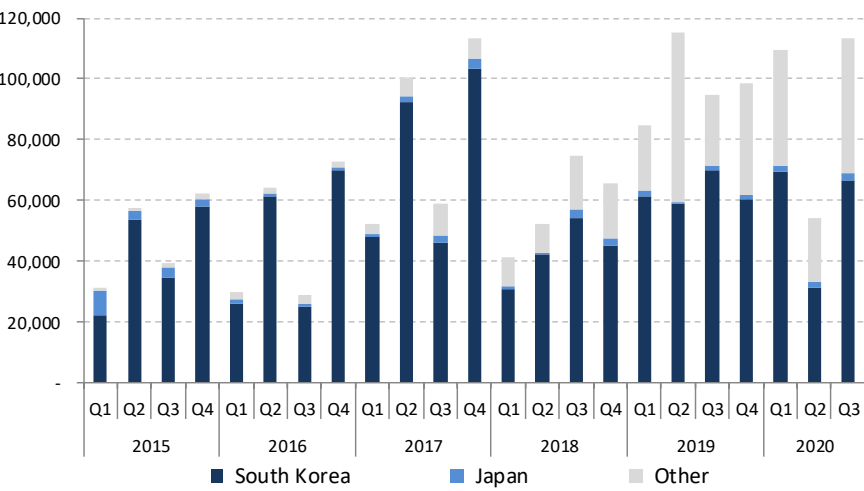
Material sales by color (US\$ k)



Universal Display - Revenue by customer (US\$ k)



Universal Display - Revenue by country (US\$ k)



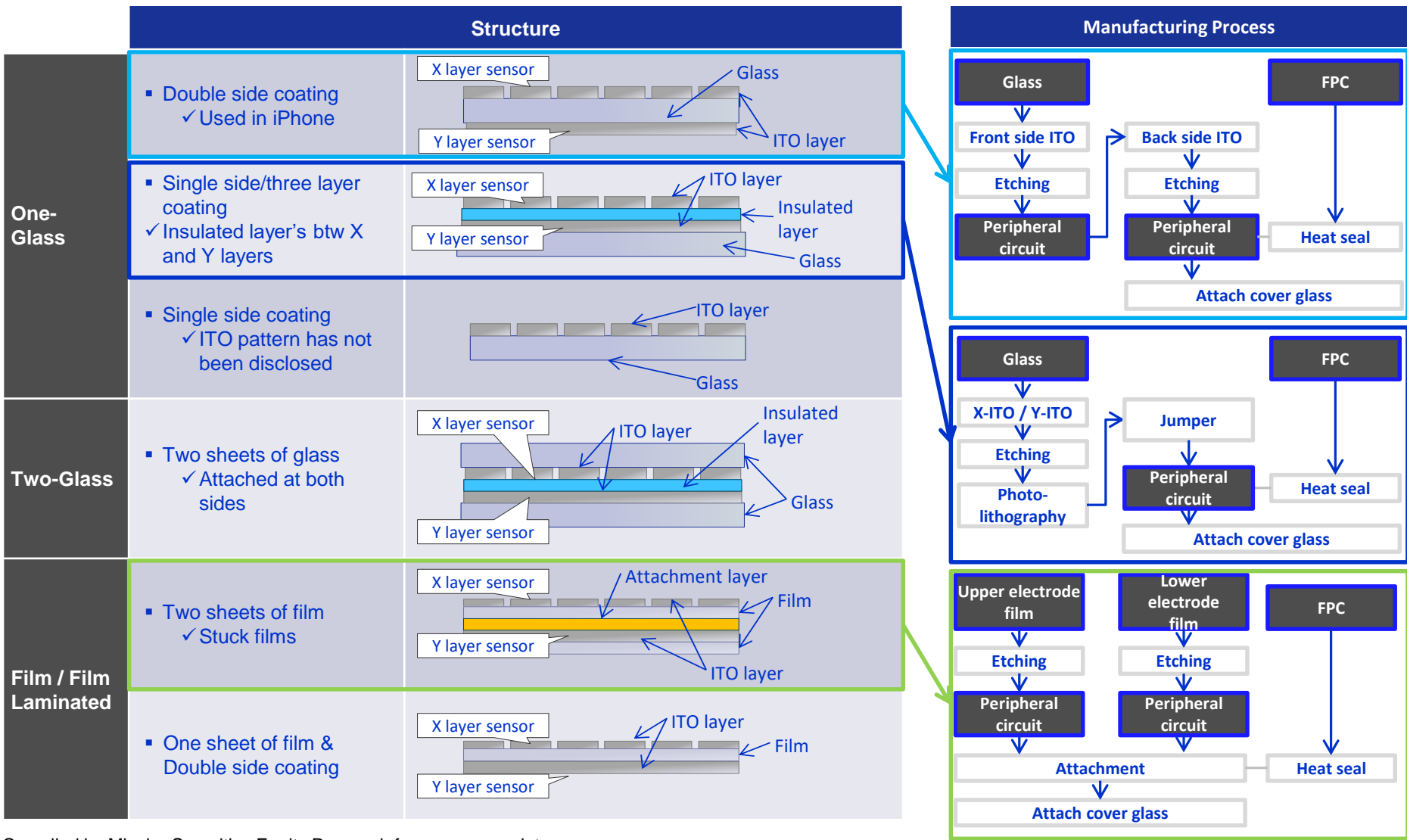
Source: Mizuho Securities Equity Research, from company data

Touch Panel Technology Comparison

	Resistive	Capacitive (Glass)	Capacitive (Film)	One Glass	On-cell	In-cell
Structure						
Principle	<ul style="list-style-type: none"> ◆ Detects touch signal by sensing a change in electronic current (lower ITO on film contacts upper ITO on glass with a touch) 	<ul style="list-style-type: none"> ◆ ITO is coated on a substrate (glass or film) ◆ Detects and measures a touch signal by sensing and processing the change in electronic capacitance 		<ul style="list-style-type: none"> ◆ Coats transparent electrodes directly on the cover glass 	<ul style="list-style-type: none"> ◆ Touch sensor on the surface of the LCD ◆ Has two types; resistive and capacitive 	<ul style="list-style-type: none"> ◆ Touch sensor inside of the LCD ◆ Has several types including optical and capacitive, etc.
Cost	◎	△	△	○	× (○ with higher yield in the future)	
Thick-ness	×	△	△	○	◎	
Weight	×	△	△	○	◎	
Multi touch	Single	Multi	Multi	Multi	Multi	
Other Considerations	<ul style="list-style-type: none"> ◆ Any inputs could be detected (by a stylus or gloved hand) ◆ Less durability 	<ul style="list-style-type: none"> ◆ Previous major method (Used in until iPhone 3GS) ◆ Sensor quality is impacted by ITO patterning (thickness /uniformity) or controller IC 	<ul style="list-style-type: none"> ◆ Current major method ◆ Sensor quality is impacted by ITO patterning (thickness /uniformity) or controller IC ◆ Large panel production is challenging 	<ul style="list-style-type: none"> ◆ The strength of the cover glass and chemically strengthened cover glass cut are challenges 	<ul style="list-style-type: none"> ◆ Touch sensor production is integrated into the panel production flow (LCD makers produces touch panels) ◆ Affected from EMI (electro magnetic interfere) by TFT, and other environmental noises ◆ Currently cost inefficient with low yield 	
Major Suppliers	<ul style="list-style-type: none"> ◆ Young Fast ◆ EELY-ECW ◆ Nissha ◆ Truly ◆ Swenc ◆ Jtouch 	<ul style="list-style-type: none"> ◆ TPK ◆ Wintek ◆ CMI 	<ul style="list-style-type: none"> ◆ Nissha ◆ Young Fast ◆ JTouch 	<ul style="list-style-type: none"> ◆ TPK ◆ Wintek 	<ul style="list-style-type: none"> ◆ Samsung ◆ Innolux ◆ AUO ◆ BOE ◆ Hannstar ◆ Tianma 	<ul style="list-style-type: none"> ◆ JDI ◆ LGD ◆ AUO ◆ BOE ◆ Tianma(Plan)

Source: Compiled by Mizuho Securities Equity Research from company data

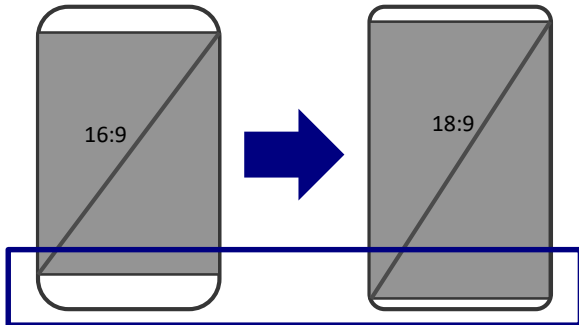
Projected Capacitance Touch Panel Structure



Source: Compiled by Mizuho Securities Equity Research from company data

Smartphone aspect ratios and methods for mounting driver ICs

Difference between 16:9 and 18:9

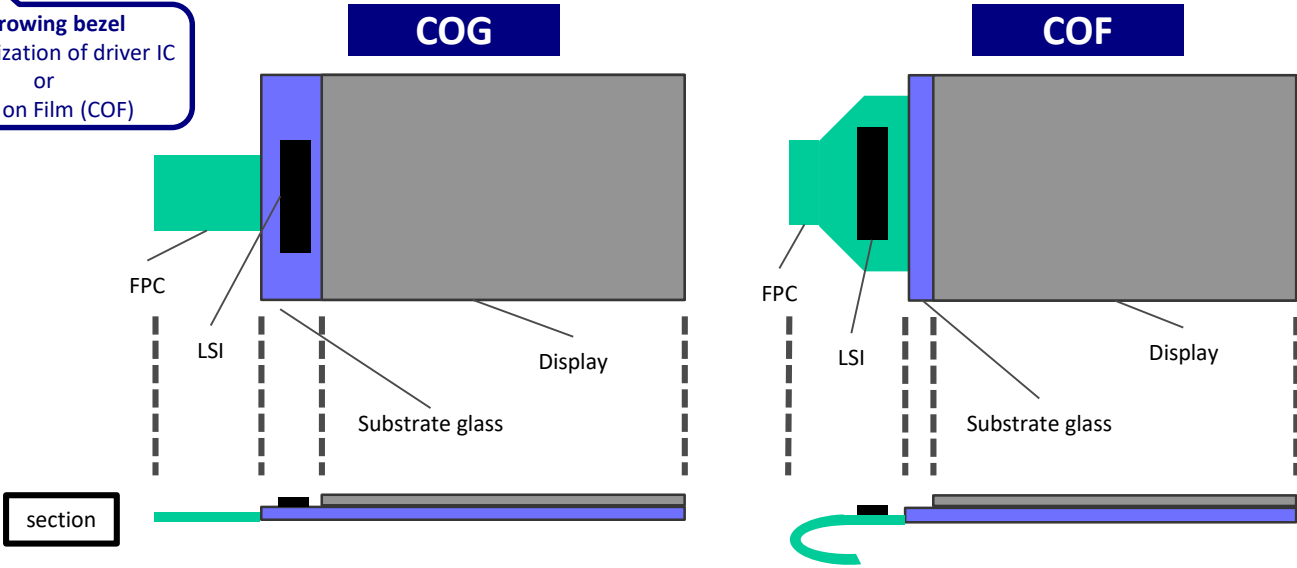


16:9	18:9
Resolution	
HD 1,280x720	HD+ 1,440x720
FHD 1,920x1,080	FHD+ 2,160x1,080
WQHD 2,560x1,440	WQHD+ 2,880x1,440
Screen Size	
5.0"	5.48"
5.2"	5.70"
5.5"	6.03"

Narrowing bezel
Miniaturization of driver IC
or
Chip on Film (COF)

COG / COF

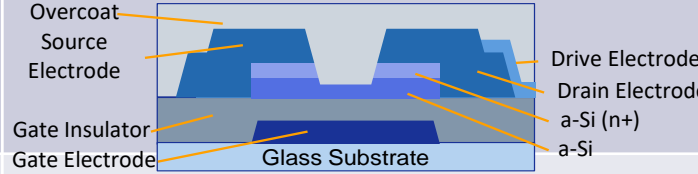
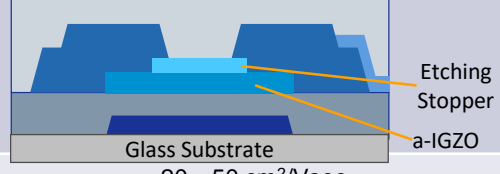
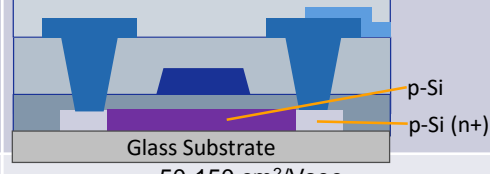
- Chip on Glass (COG)
 - ✓ Technology used to mount semiconductor chips (driver ICs) directly onto liquid crystal display (LCD) substrates
- Chip on Film (COF)
 - ✓ Technology used to mount semiconductor chips (driver ICs) onto film-like integrated circuit substrates
 - ✓ The bezel can be narrowed since the driver IC is mounted on flexible film



Source: Mizuho Securities Equity Research

Comparison of IGZO TFT and Other TFTs

IGZO TFT allows to manufacture high-resolution small and mid-size panels efficiently by utilizing existing facilities

	a-Si TFT	IGZO TFT	LTPS TFT
Structure	Bottom Gate Inverted Staggered 	Bottom Gate Inverted Staggered 	Top Gate Staggered 
Electron Mobility	0.5 cm ² /Vsec	20~50 cm ² /Vsec (more than 20x of a-Si)	50-150 cm ² /Vsec (more than 100x of a-Si)

Merits of IGZO TFT

- ◆ Smaller size panel due to higher electron mobility
→ Lower power consumption, higher resolution
- ◆ Suitable for the OLED backplane (cost competitiveness)
- ◆ Can be deposited by sputtering
→ low running cost/equipment price, stable process
- ◆ Lower initial investment by utilizing existing fabs/Efficient production by TFT mother glass for large panels

Considerations of IGZO TFT

- ◆ Rare metals (In: Indium, Ga: Gallium) are used
→ Risks of future procurement and cost increase
- ◆ Higher resolution than a-Si TFT, however, LTPS TFT has an advantage for higher resolution (over 408ppi)
- ◆ Technical challenges for MP of large panels (stable and uniform deposition)

Recent Development for IGZO TFT Panels

- ◆ Sharp: Volume production of mid-sized/compact panels at Kameyama No. 2 plant
- ◆ Japan Display: R&D/pilot stage.
- ◆ Samsung: Test production of 70" IGZO TFT on G7 line and 19" organic.
- ◆ LGD: Its 2012 55" OLED panel consists of IGZO substrate + white OLED + CF. Will begin prototyping at G10.5 plant in 2019.
- ◆ Test production of 2.4" organic EL and 32", 40", 56" and 65" IGZO TFT.

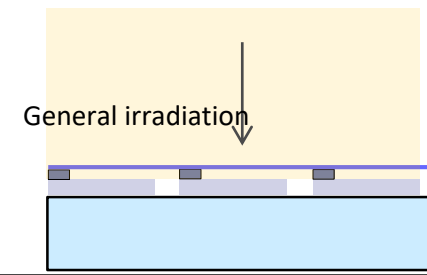
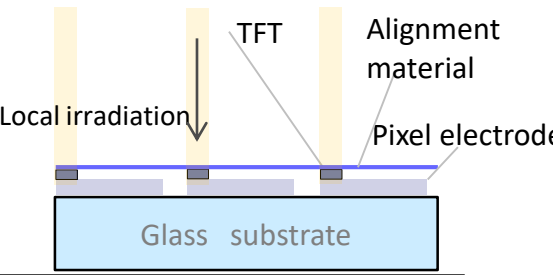
Source: Mizuho Securities Equity Research from company data

PLAS (partial annealing): The TFT backplane technology to follow LTPS and Oxide

Overview

- ❑ Low-temperature polycrystalline-silicon (LTPS) and indium gallium zinc oxide (IGZO) offer better electron mobility than amorphous silicon (a-Si), thereby allowing for the manufacture of higher-resolution panels (by miniaturizing the wiring so as to allow for larger apertures). The cost and the limits on equipment compatibility have been obstacles, however, so LTPS panels have mostly been adopted only in high-end small and mid-sized panels.
 - ✓ The existing laser annealing approach for LTPS is not useable with large glass substrates due to the very long exposure times required.
- ❑ Sakai Display Products' G10 plant has succeeded in creating prototypes of large LTPS-TFT panels using a localized annealing process. The equipment is manufactured by V-Technology.
 - ✓ In the partial laser anneal silicon (PLAS) method, the laser is focused on an isolated part of the substrate using a micro lens array (MLA), crystallizing the silicon only at the targeted site.
 - ✓ The time required for the process can be cut substantially because the laser needn't be directed at the entire surface of the substrate.
 - ✓ The process can be performed on existing a-Si production lines, so the additional investment is less than that required with IGZO.
 - ✓ The carrier mobility that can be achieved is comparable to that with IGZO. In principle, PLAS should be usable for the manufacture of large OLED backplanes

Laser annealing methods

Technology	LTPS (current technology)	PLAS
Structure		
Laser type	XeCL excimer laser	XeCL excimer laser
Number of shots	Approx. 20 shots	Approx. 20 shots
Running costs in comparison	1	1/5 or less

Developments at Sakai Display Products

- ❑ Has already applied for the relevant patents in Japan and overseas.
- ❑ Began prototyping at the Sakai G10 plant in April 2016.
- ❑ Publicly revealed its prototype in May 2016.
- ❑ As of March 2017, no word yet on when volume production will begin or if there will be collaboration among Hon Hai, Sharp, and Sakai Display Products.
- ❑ Might PLAS technology be used at the G10.5 plants being planned by the Hon Hai group for Guangzhou or the US?

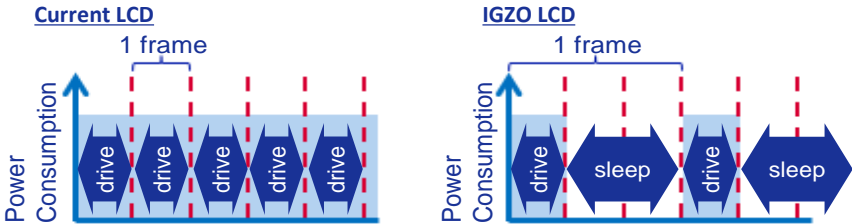
Source: Mizuho Securities Equity Research, from company materials

Sharp CAAC (C-Axis Aligned Crystal) IGZO LCD

Sharp achieved higher resolution and IGZO application to OLED with new technology, CAAC IGZO

Current IGZO Technology

- **High resolution**
 - ✓ 20~50x electron mobility than a-Si. Achieved smaller TFT and thinner wiring
 - ✓ Double resolution at the same transmissivity with a-Si
- **Low power consumption**
 - ✓ High OFF function. 100x than a-Si, 1,000x than LTPS



- **Affinity for touch panel**
 - ✓ Lowered noises from LCD panel by controlling its drive. Achieved sensitive and smooth touch.
- **Simple production process**
 - ✓ As simple as a-Si process. Unlike LTPS, preprocess is not necessary.
 - ✓ Unlike LTPS, no restriction to mother glass size (Over G8 glass size usable)

CAAC IGZO Technology

- **Higher resolution than current IGZO**
 - ✓ Over 500ppi resolution
- **Applications**
 - ✓ OLED and non-displays (SRAMs, imagers, CPU)
- Crystallized current IGZO and stabilized its physicality. Co-development of Sharp and Semiconductor Energy Lab.
- Within FY12, targeting the production shift from current IGZO to new IGZO. No large additional investment.

LCD (prototype displays)

Inch size	4.9	6.1
Resolution	720 x 1280 (302 ppi)	2560 x 1600 (498 ppi)
Application	Smartphone	Mobile Equipment

OLED (prototype displays)

Inch size	13.5	3.4
Resolution	3840 x 2160 (326 ppi)	540 x 960 (326 ppi)
Application	White OLED + RGB CF	Flexible display

Source: Compiled by Mizuho Securities Equity Research from company data

Sharp: MEMS-IGZO Display

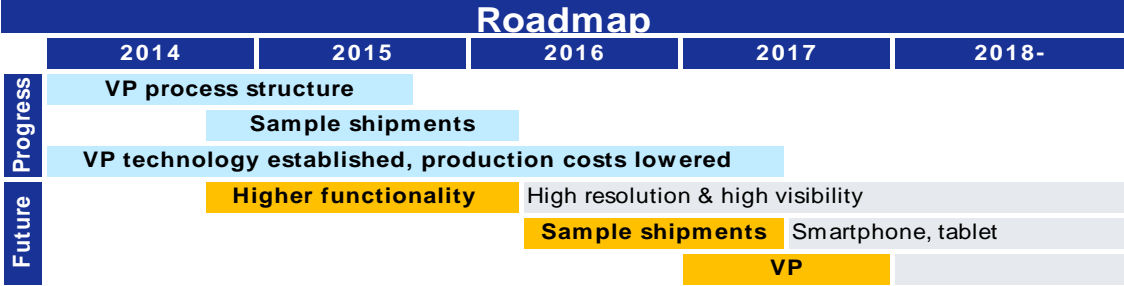
Volume production from 2017, higher-definition and other challenges → However, sales started in 2015 (B2B only)

Characteristics

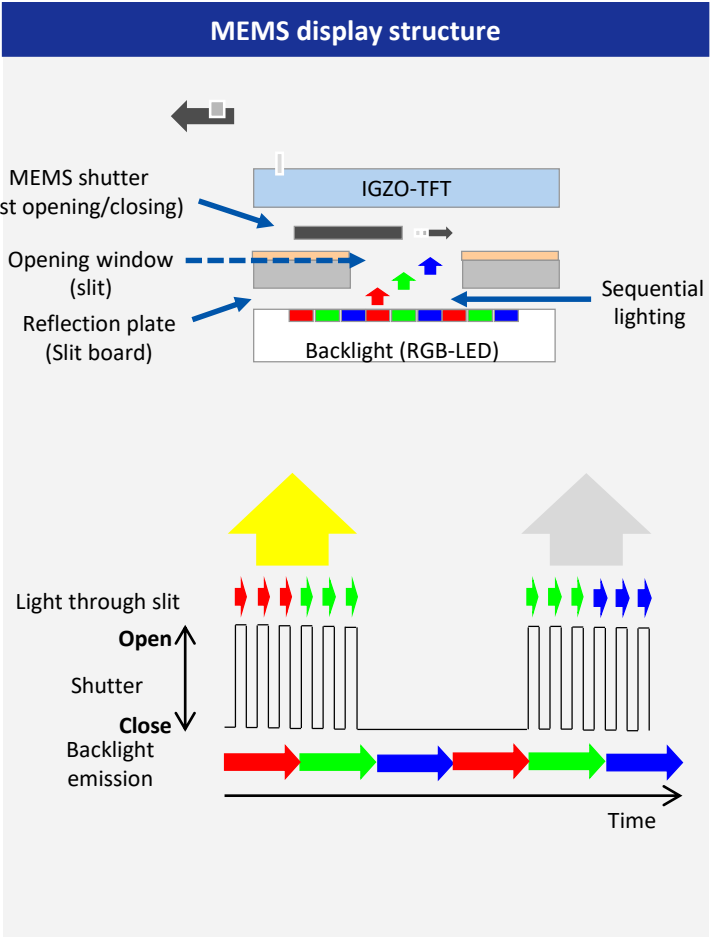
- Three-color RGB backlights field-sequential lighting method, MEMS shutter light-density & color control, shutter open/close speed 100μs
- Low power consumption = high color-purity, high backlight transmittance because polarizer, color filter not needed
- Simple mechanical mechanism rendering good environmental resistance (under extremely low or high temperatures)

Sharp conditions and challenges

- Development using Pixtronix's (Qcom wholly owned subsidiary) MEMS technology and Sharp's IGZO & panel production technology
- Testing lines at Sharp Yonago plant (Tottori), firm announced 2014/09/12 volume-production (VP) goal
- Production divertible to existing LCD production lines (modify at low cost)
- 7" 800*1280 samples exhibited at CEATEC 2013 (roughly 220ppi)
- Higher-def challenges, many masks needed
- Small & medium-sized (S/M) targets for smartphones and tablets, in-car displays, etc (larger sizes possible in principle)
- Changes occurring in competitive axis?
(High-def, narrow-frame, low power consumption) → (Design efficiency, environmental resistance, UI innovation)



Source: Compiled by Mizuho Securities Equity Research from company data



3. Mid/Large sized panel and its applications

Topics

- **LCD: Supply and demand both waning. Beginning of the end or end of the beginning? China to dominate large LCDs**
 - Samsung Display: Switch to QD-OLED except G7/G8. Production is -22% YoY in 2019, -4% in 2020, and -27% in 2021.
 - T8 (G8) : 380K → currently 250K → 80K by the end of 2020 → from 2021 on
 - QD-OLED (G8): Starting with 30K(Phase 1) in 2Q 2021. The fastest scenario is 60K in 2022 and 90K in 2023, but undecided at this moment. Possible to jump to QNED.**
 - T7 (G7): 180K. Continue to manufacture 75"/82".
 - Suzhou (G8): 130K. Mostly 65"/32", but no production from 2021. However, **it will be sold to CSOT, not closed.**
 - LGD: LCD for TV is put into Guangzhou. LCD for IT only in Korea.
 - P6 (G6): 50K → close by the end of 2020
 - P7 (G7.5): 240K → currently 130K → close by the end of 2020 ? How about 75"? → **continue to produce in 2021-2022**
 - P8 (G8): 200K → currently 110K → close by the end of 2020 ? Continue to manufacture panels for IT?
 - P9-8 (G8): 80K. Continue to manufacture panels for IT.
 - E4 OLED (G8): 75K**
 - Guangzhou LCD (G8): 230K. Key plant for panels.
 - Guangzhou OLED (G8): 60K → 90K by the end of 2021.**
 - P10 OLED (G10.5): 30K in 2023 → 45K. Technological and funding issues.**
 - Taiwanese brands: AUO could close part of G6/G8. AUO and INX seem set for IPS shift, shift to IT, and drop TV applications.
 - Japanese brands: Panasonic already at ¼ of peak. Sharp to close G4/G4.5. SDP/SIO Guangzhou to work hard for Samsung and other business.
 - China: Focused on lifting output at G10.5, G8.6/8.7, boost for M/S.
- **OLED: OLED suffering due to large price difference with LCD, but SDC's re-entry into this space should be tailwind, The key is whether investments are made from phase 2**
 - LGD: Going it alone. Profitable at operating line, but lacks the means to cut prices by 1%-10%. Almost 3x as expensive as LCD. Making every effort to get the funds for investing in G10.5.
 - SDC: Finally decides to invest in QD-OLED(30K). Tailwind for OLED camp. Will boost production capacity to 90K? Will jump to QNED?
 - China/Japan: CSOT close to finalizing investment in inkjet factory. BOE could follow suit. JOLED in a key position.

Current and short-term panel demand estimates by size and application (as of March 2021)

- Lengthening of the tight supply-demand period driven by demand recovery and glass tightness, sustained rise in prices and completely overshooting.

Major LCD panels's S/D and price trends by size(↑up, ↓down, in the next 3month)

	Current demand	Future supply	S/D Balance	Price trend	Expected balance:
NBPC					
15.6"W	↑	↑	Tight	Up→Flat	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="width: 15px; height: 15px; background-color: #f8d7da; margin-bottom: 5px;"></div> Oversupplied <div style="width: 15px; height: 15px; background-color: #fff3cd; margin-bottom: 5px;"></div> Balanced <div style="width: 15px; height: 15px; background-color: #d1ecf1; margin-bottom: 5px;"></div> Tight/Shortage </div>
>17"W	→	→	Tight	Up→Flat	
Monitor					
18.5"W/19"W	↑	→	Tight	Up→Flat	
21.5"W/22"W	↑	↑	Tight	Up→Flat	
23"/23.6"/24"W	↑	↑	Tight	Up→Flat	
TV					
32"W	↑	→	Tight	Up→Flat	
40"/42"/43"W	↑	→	Tight	Up→Flat	
48"/49"/50"W	↑	→	Tight	Up→Flat	
55"W	↑	→	Tight	Up→Flat	
65"W	↑	→	Tight	Up→Flat	
75"W	↑	→	Tight	Up→Flat	

- NB/MNT/TV demand rebound stronger than expected in Europe/US: Retail and brand inventories low
- Stay-at-home trend: Upbeat sales of all TV sizes (rather than just 43" and smaller), IT strong overall
- Continued supply-demand tightness: Tight conditions expected through 21Q1-Q2 due to glass supply issue. Cautious of a pullback (impact by price hike) in 2H.

Source: Mizuho Securities Equity Research

Panel prices: unprecedented rate-of-climb from July 2021. Pay close attention to the impact on demand.

Recent Panel Prices -US\$-

Appli	Size	Actual Price									
		Jan.2014	Mar.2015	Apr.2016	Apr.2017	Jul.2018	Jan.2019	Jan.2020	Mar.2020	Jun.2020	Mar.2021
Notebook	15.6"W (ELED)	36	37.5	28	31	28	27	24	26	26	38
Monitor	21.5"W (ELED)	70	72	48	53	46	45	41	41	41	59
TV	32"HD (Open cell)	78-80	94-98	50-55	68-73	44-47	39-45	30-32	35-40	30-33	73-78
	43"FHD (Open cell)	140-145	143-147	86-96	147-155	77-80	77-82	66-69	73-79	65-68	124-129
	50"FHD/4K(Open cell)	201-205	195-205	130-145	165-180	100-105	95-100	82-87	90-97	83-88	168-173
	55"4K (Open cell)	n/a	290-310	n/a	210-220	145-155	138-148	99-103	107-112	103-108	189-199
	65"4K (Open cell)	n/a	540-560	n/a	390-410	210-235	200-225	160-165	170-180	160-170	230-250
	75"4K (Open cell)	n/a	n/a	n/a	n/a	n/a	n/a	280-300	295-305	270-300	330-360

- Supply/demand was tight until March and prices rose due to the closing of South Korean factories, the creation of new TV models and the impact of COVID-19 (concerns over a decrease in supply).
- Drop from April: TV production has fallen short of expectations and final demand has dropped sharply. Supply/demand for panels will turn to excess and prices will drop.
- Increase from July: Final demand unexpectedly strong, demand increasing for TV brand panels. Supply unchanged as supply/demand balance tightens
- Current price: much higher than the level 2 ½ years ago (July 2018) for 55"and below!
- In future?: expected to be slow down once and drop, but the prices might to keep hiking till May due to Corning + NEG glass supply issue.
- Around May is the key?:There is a risk that the demand decreases after TV prices hike. It could affect panel demand-prices in 2H 2021.

Source: Mizuho Securities Equity Research

Flat Panel Display Industry : Outlook and focus points

■ **Large panels:** 2021 positive for LCDs. Longer term, negative surface-area growth in LCDs. After that, OLED or LCD+Mini LED?

- Demand: For IT applications, favorable trend through 2Q 2021; continued recovery for TVs also. However, risk of a pullback from latter part of 2Q 2021 onward.
- Supply: New G10.5 lines behind schedule, on the other hand, LGD's P7 pushed from June 2021 to end-2022, SDC's T8 pushed from March to December 2021. Production capacity to increase drastically from +2.3%(estimated before COVID-19) to +9.4%.
- SDC startup delay: Capacity utilization depends on whether for Samsung VD only or not, but impact on total demand/supply will amount to a few percent.
- Glass/DDIC supplies: Glass supply shortage due to furnace issues at Corning's Hefei plant, power outage at NEG and accident at ACG. Driver IC shortage is getting even more severe.
- Supply/demand + prices: Some tightening in 2021, but monitor impact of higher prices on demand. Relatively expensive at 2x+ for 32" and 1.8x for 55"; 20-25% decline would actually be preferable.
- LCD valuations: In the near term, positive for both panel makers (prices and surface area both up) and materials suppliers (surface area up).
- Longer-term outlook: Chinese to lead in LCDs (status up). LCD surface area to decline in the medium to long term. Materials suppliers is harsh (by varying degrees).
- Migration to OLED: LGD struggling on price gap with LCD; invest in SDC (QDOLED) G8 Phase2 CSOT's entrance (w/ JOLED) is positive. Demand for materials is trending upward.
- Mini LED (BL+LCD): Opportunity if migration to OLED stalls. 2021-23 is window of opportunity. Business opportunities in LED, film, and sheets.

Flat Panel Display Industry : Factors behind changes in large FPD surface area (supply-demand)

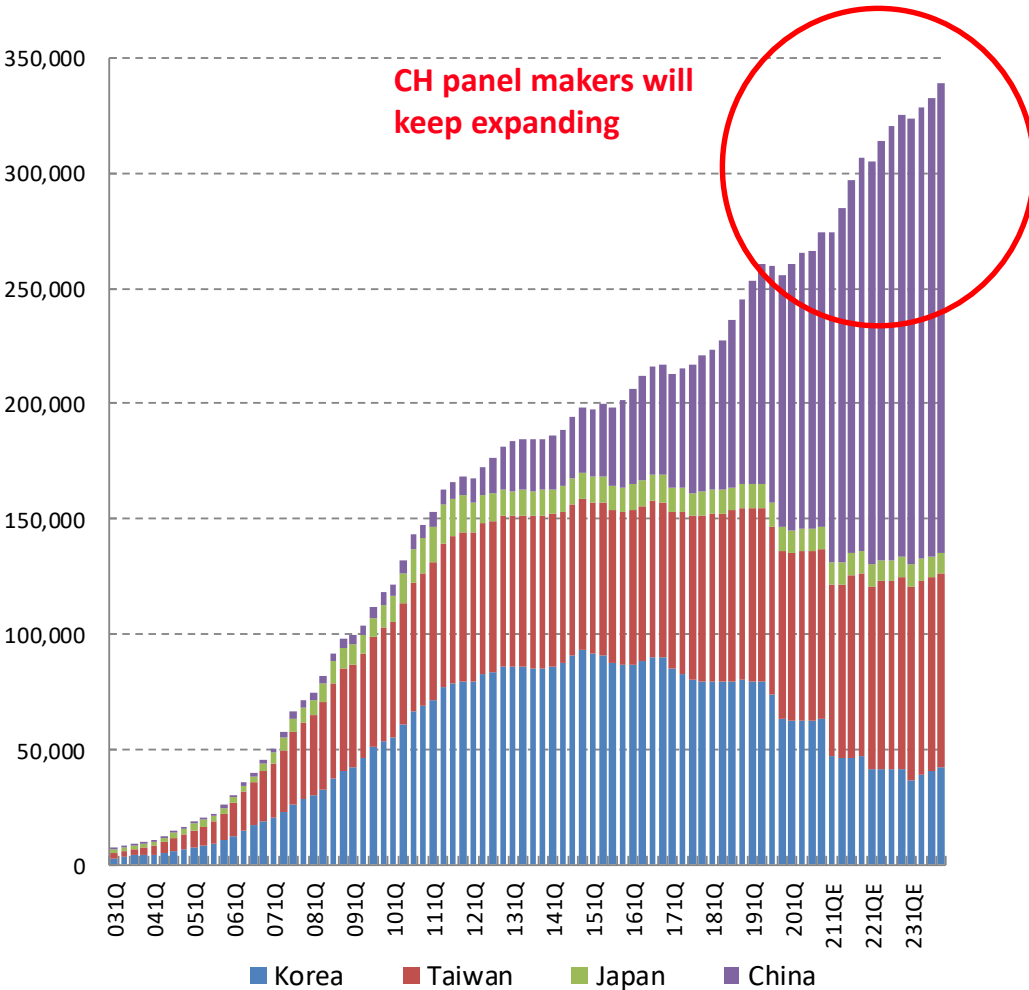
	Capacity	Change factors (equipment)	Change factors (materials)	Demand	Change factors
2020	+3.6%	Delays in G10.5 equipment deliveries, startup↓	From 3Q glasss and DDIC constraints↓	+4.0%	From 2Q, NB/MNT↑ From 3Q, TV↑
2021	+9.4%	Same as above↓ continued SDC T8 operations↑	Glass tight through 2Q DDIC tight all year ↓	+7.3%	Through 2Q: NB/MNT↑; level from 3Q From 2Q: higher TV picks↓, US(↓), others(↑)
2022	+8.9%	G8 used equipment plants↑ Continued operation of LGD LCD↑	DDIC, Polarizer etc	+3.2%	Depens on TVs (continued replacement demand in developed markets, recoveries in emerging markets)
2023	+4.8%	Same as above↑ CSOT t9↑, LGD G10.5↓	DDIC, Polarizer etc	+1.0%	Depens on TVs (continued replacement demand in developed markets, recoveries in emerging markets)

- ◆ 2H20: Supply-demand tighter on supply constraints + rebound in demand; prices up sharply.
- ◆ 1H21: Production capacity likely to increase more than expected due to postponed SDC operation and other reasons, on the other hand, the supply side is severer because of materials shortage. Possibly to be further tight supply-demand balance and price hike. As for demand, NB/MNT are fine, but TV demand might be impacted by price increases (particularly in the US/China).
- ◆ 2H21: Supply-side risks other than DDIC likely to ease. On the demand side, depends on COVID-19, impact of TV price increases, and status of recoveries in markets other than the US.
- ◆ Panel prices: Best-case scenario for industry as a whole is if prices decline through May-Jul 2021 on TV demand contraction, and then stabilize in 2H on a subsequent recovery in demand.
- ◆ Worst-case scenario: Panel prices keep rising through 1H, resulting in a rapid decline in TV demand and inventory accumulation, culminating in severe price and production corrections from July onward.

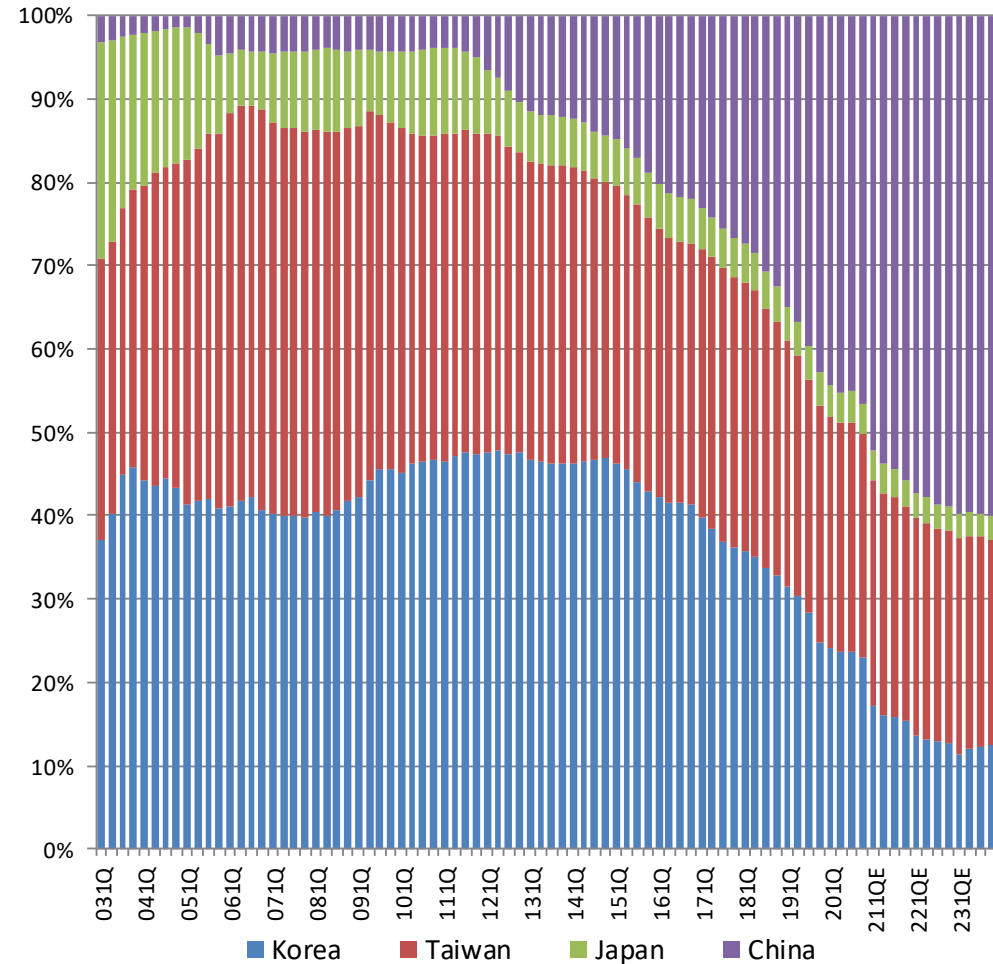
Source: Mizuho Securities Equity Research

Large LCD capacity(by region): grow and accelerate by investment in G10.5, China set to overtake South Korea

Yielded Production Capacity forecast by Region (K/M, 15inch equiv.)



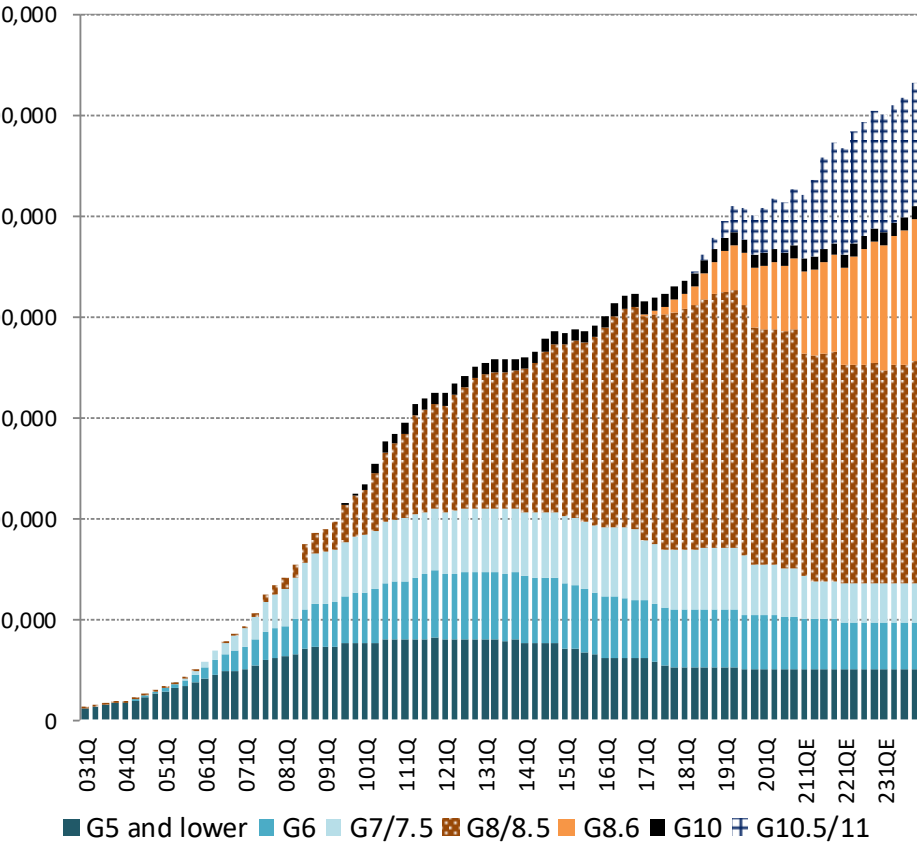
Yielded Production Capacity forecast by Region (area basis)



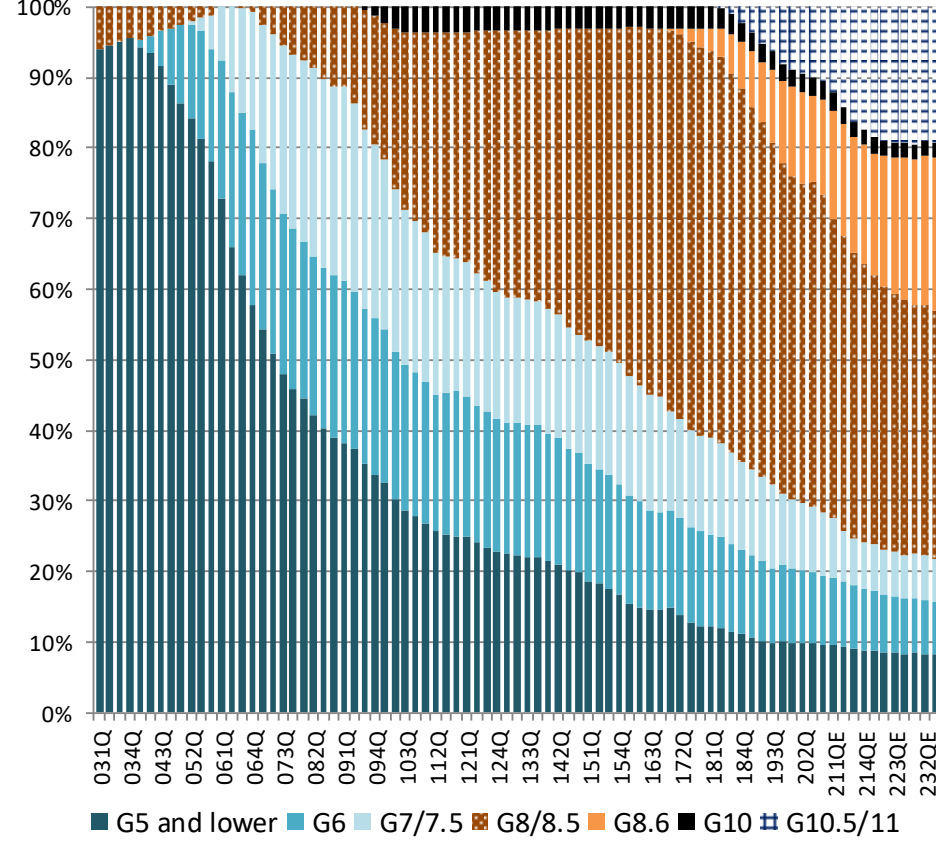
Source: Mizuho Securities Equity Research

Large LCD capacity(by generation)

Yielded Production Capacity forecast by Generation (K/M, 15inch equiv.)



Yielded Production Capacity forecast by Generation (area basis)

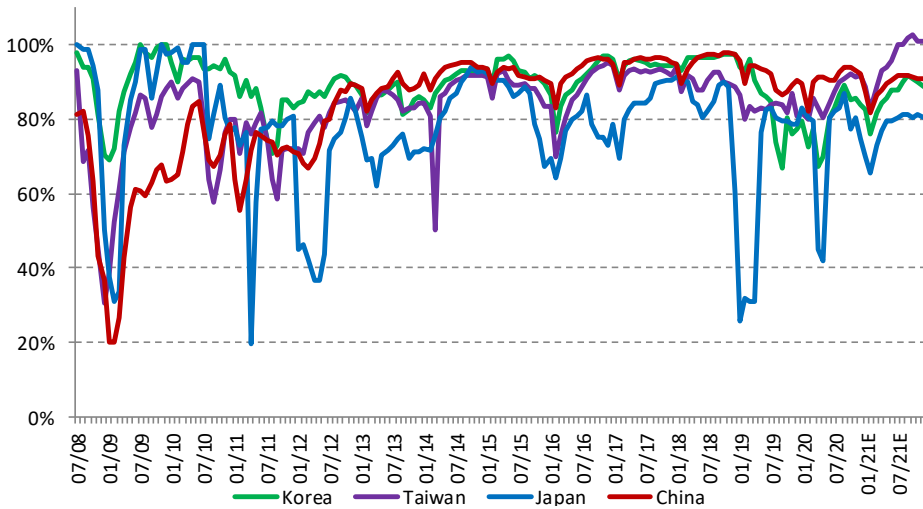


➤ G7 and lower plants to be converted for IT or closed?

Source: Mizuho Securities Equity Research

Panel supply-and-demand balance outlook assumptions:

Estimated utilization ratio for each country (The ratio of actual production amount to total capacity)



2013: Surface area output +7.6% YoY > demand of +5.2%
Utilization rates: 1Q 83%, 2Q 86%, 3Q 86%, 4Q 84%

2014: Production capacity +4.6%, Surface area output +8.8% YoY < demand of +10.7%
Utilization rates: 1Q 80%, 2Q 89%, 3Q 92%, 4Q 93%

2015: Production capacity +6.3%, Surface area output +6.2% YoY < demand of +7.3%
Utilization rate: 1Q 91%, 2Q 94%, 3Q 90%, 4Q 88%

2016: Production capacity +7.5%, Surface area output +4.5% YoY > demand of +4.7%
Utilization rates: 1Q 80%, 2Q 87%, 3Q 92%, 4Q 95%

2017: Production capacity +1.4%, surface area output +6.9% > demand +6.3%
Utilization rates: 1Q 92%, 2Q 94%, 3Q 94%, 4Q 94%

2018: Production capacity +7.9%, surface area output +7.9% < demand +8.6%
Utilization rates: 1Q 93%, 2Q 93%, 3Q 95%, 4Q 94%

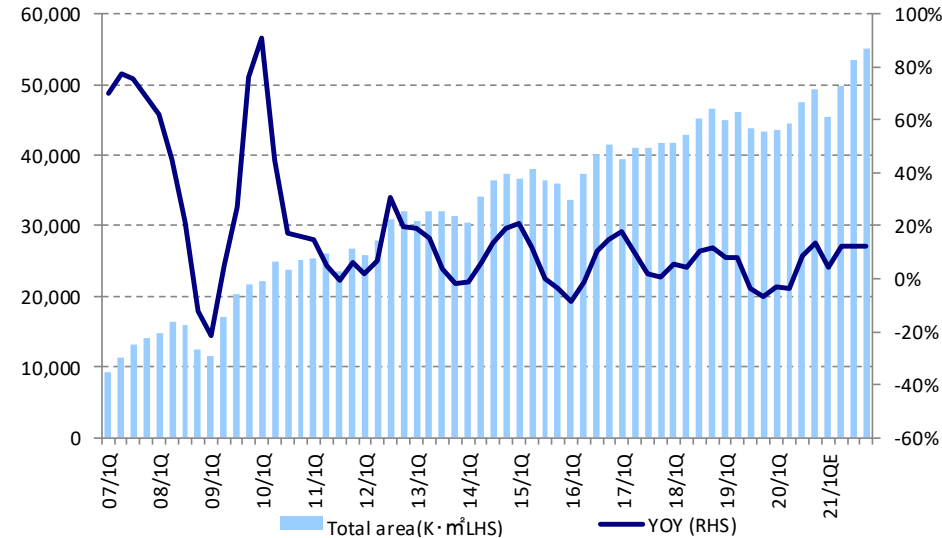
2019: Production capacity +11.2%, surface area output +1.5% < demand +5.0%
Utilization rates: 1Q 88%, 2Q 88%, 3Q 84%, 4Q 85%

2020: Production capacity +3.6%, surface area output +4.0% > demand +4.0%
Utilization rates: 1Q 83%, 2Q 83%, 3Q 89%, 4Q 89%

2021: Production capacity 9.4%, surface area output +11.0% > demand +7.3%
Utilization rates: 1Q 80%, 2Q 88%, 3Q 90%, 4Q 90%

2022: Production capacity +8.9%, surface area output +3.8% > demand +3.2%

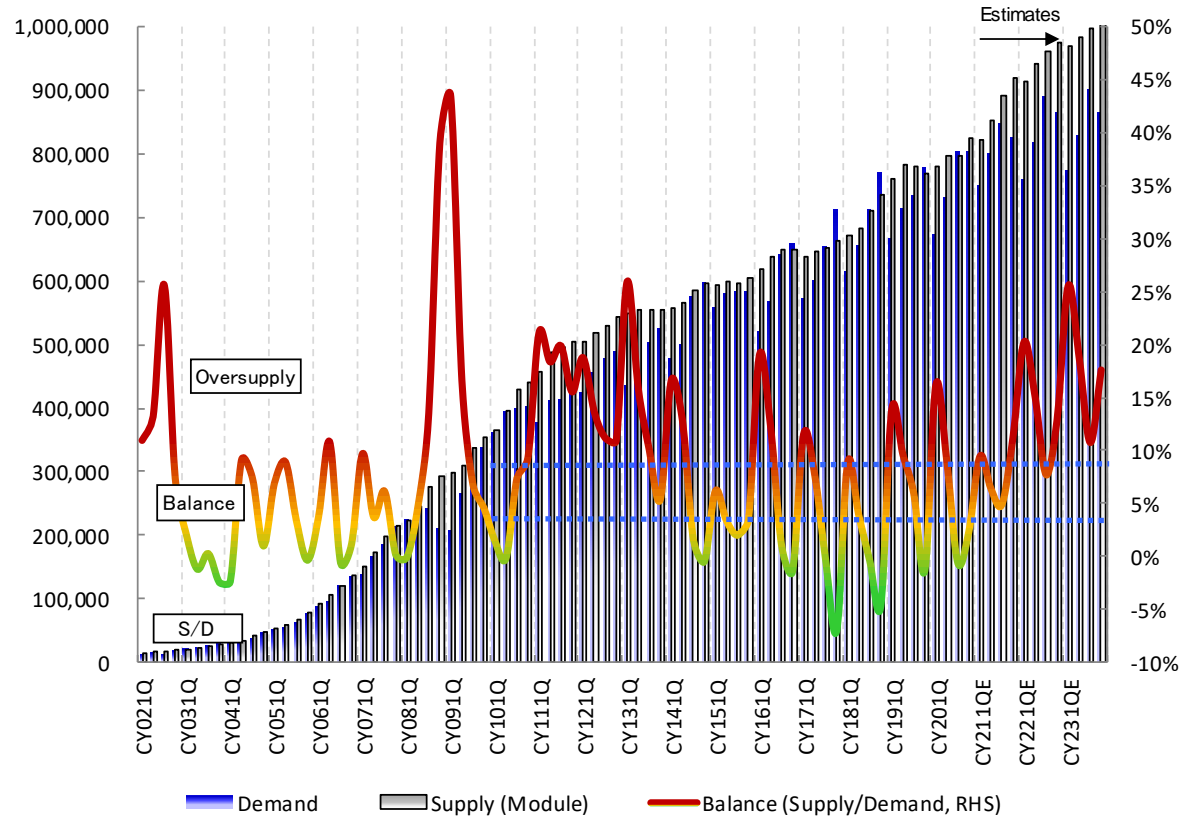
Estimated area production of large TFT panels for each quarter (K m²)



Source: Mizuho Securities Equity Research

Large FPD S/D forecast (Latest), likely to be balance easing in 2H 2021 due to increasing capacity

(15-inch equivalent)



Note: Yield considered but shortage of components and material is not considered based on the assumption of 100% utilization ratio components and material is not considered based on on the assumption of 100% utilization ratio.

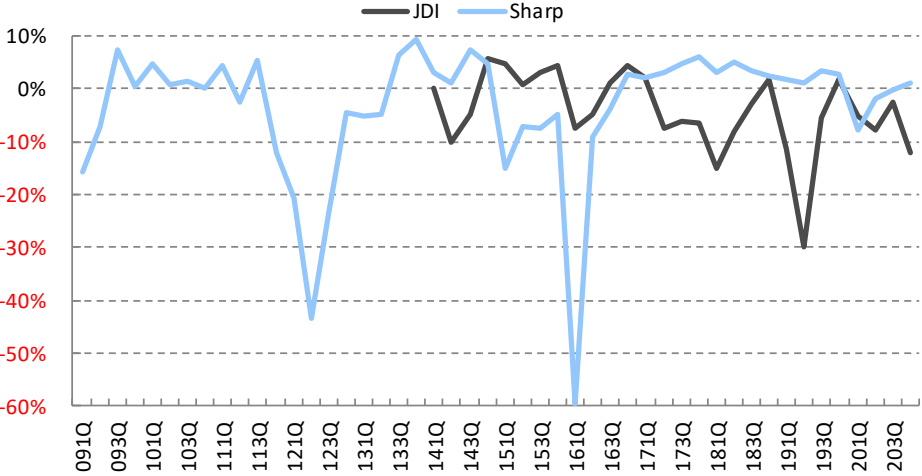
Full production capacity vs demand forecasts: Fundamentally, 1H surplus followed by 2H tightening. Having said that, psychological factors such as the consensus outlook of panel manufacturers, set manufacturers and distributors, as well as general market speculation, may also play a role in determining 'acceptable' inventory level, and may also significantly impact panel demand.

See flat or slightly tighter demand in 2H if 1H production levels are appropriate (scenario 1); excess 1H production suggests 2H oversupply (scenario 2). Supply/demand balance to improve in 2H after zigzagging in 2020 due to COVID-19. In 2021 production capacity > demand due to postponement of SDC/LGD fabs and Chinese improving capabili, but shortage of glass substrate and semicon such as could be hindrance.

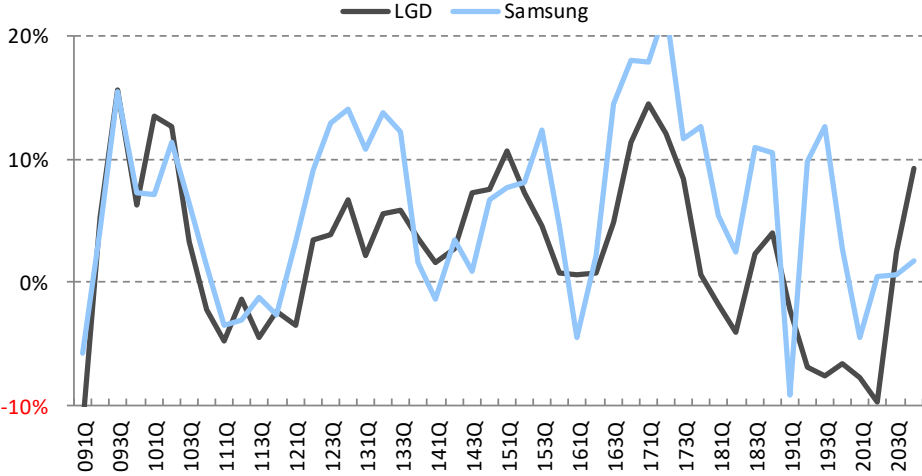
Source: Mizuho Securities Equity Research

Operating margin of major FPD makers (CY)

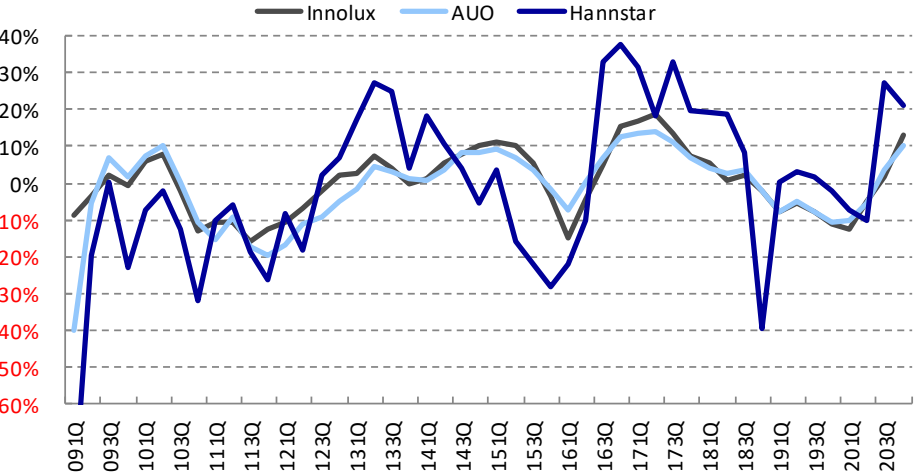
Japanese Panel Makers



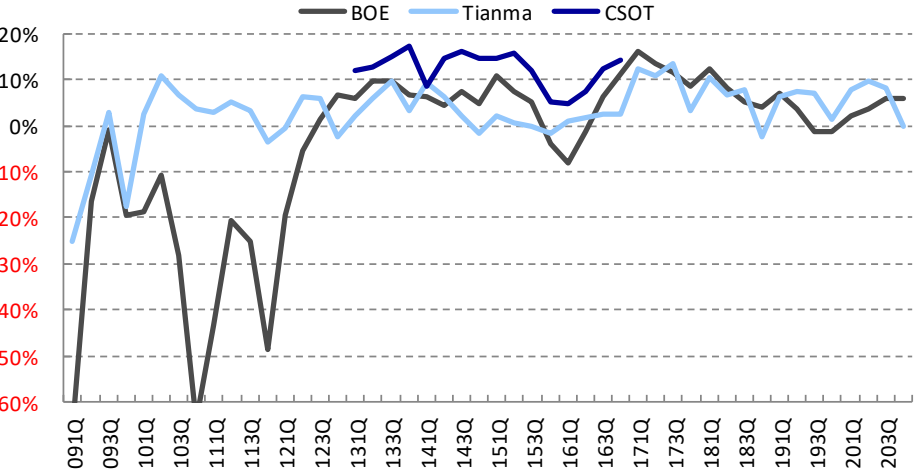
Korean Panel Makers



Taiwanese Panel Makers



Chinese Panel Makers



Source: Compiled by Mizuho Securities Equity Research from company data, Bloomberg LP

Note: OP in Chinese accounting rule include Investment loss and return. CSOT: Net margin.

Assumptions underlying panel supply-demand forecasts: changes in demand forecasts

	2011	2012	2013	2014	2015	2016	2017	2018		2019		2020 Forecast			2021 Forecast			2022 Forecast	
	Actual	Actual	Actual	Actual	Actual	Actual	Actual	Actual	YOY	Actual	YOY	As of			As of			As of	
												20/07	21/01	YOY	20/07	21/01	YOY	21/01	YOY
Tablet	61M	145M	225M	230M	203M	186M	175M	161M	-8%	135M	-16%	160M	140M	+4%	157M	152M	+9%	140M	-8%
NBPC	204M	202M	162M	167M	1557M	155M	158M	158M	+0%	162M	+3%	166M	203M	+25%	166M	215M	+6%	215M	+0%
Monitor	180M	168M	150M	142M	130M	129M	125M	124M	-1%	125M	+1%	131M	152M	+22%	132M	156M	+3%	155M	-1%
TV	205M	207M	209M	223M	223M	223M	217M	220M	+1%	222M	+1%	209M	222M	+0%	216M	223M	+0%	224M	+0%

↑ Demand growth on a surface area basis was +38% YoY in 2010, +5.3% in 2011, +12.5% in 2012, +5.2% in 2013, +10.7% in 2014, +7.3% in 2015, +3.5% in 2016, +6.3% in 2017, +8.6% in 2018, +5.0% in 2019, +4.0% in 2020 and forecast that it will be at +7.3% in 2021, +3.2% in 2022 and +1.0% in 2023

- NB: Short break of tailwind from Win10 replacement, but demand likely to be strong due to WFH, gaming, education(Chromebook), etc.
- Tablets: Demand is getting to be strong due to WFH and educational needs.
- Monitors: Shift towards added value including WFH demand, large screen (over 24 inch), Hi-def (4K), monitors for game, curved screen, 21:9 etc.
- TVs: In 2020 strong sales in US due to stay-at-home demand, but weak in developing countries. The keys in 2021 are US trends, recovery in emerging countries and accelerating replacement in Japan/Europe. Positive impact by government payment likely to continue till April in US, but risk in 2H2021.

Source: Mizuho Securities Equity Research

Panel supply/demand assumption: focus on the trend after stay-at-home demand

Panel Supply demand (estimate / forecast)

2015		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	203M	-12%	232M	-16%
	NB	157M	-6%	165M	-10%
	Monitor	130M	-8%	144M	-6%
	TV	223M	+0%	264M	+7%

2019		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	135M	-16%	165M	-5%
	NB	162M	+3%	172M	+2%
	Monitor	125M	+1%	142M	+3%
	TV	222M	+1%	278M	+1%

2016		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	186M	-8%	191M	-18%
	NB	155M	-1%	163M	-1%
	Monitor	129M	-1%	141M	-2%
	TV	223M	+0%	261M	-1%

2020E		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	140M	+4%	187M	+13%
	NB	203M	+25%	210M	+22%
	Monitor	152M	+22%	162M	+14%
	TV	222M	-0%	263M	-5%

2017		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	175M	-6%	179M	-6%
	NB	158M	+2%	167M	+2%
	Monitor	125M	-3%	140M	-1%
	TV	217M	-3%	265M	+2%

2021E		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	152M	+9%	191M	+2%
	NB	215M	+6%	228M	+9%
	Monitor	156M	+3%	173M	+7%
	TV	223M	+0%	272M	+3%

2018		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	161M	-8%	174M	-3%
	NB	158M	+0%	169M	+1%
	Monitor	124M	-1%	138M	-1%
	TV	220M	+1%	275M	+4%

2022E		Demand			
		Set	yoy	Panel	yoy
	Tablet PC	140M	-8%	178M	-7%
	NB	215M	+0%	227M	-0%
	Monitor	155M	-1%	172M	-1%
	TV	224M	+0%	276M	+1%

Source: Mizuho Securities Equity Research

Flat Panel TV market outlook: forecast increasing volume due to stay-at-home = accelerating replacement and peak out in 2022

Total FPTV Market (M Units)		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
Flat TOTAL		4	6	10	19	33	65	89	115	152	207	221	220	218	229	225	223	217	223	222	222	222	224	221	217
CRT TOTAL		140	143	152	164	155	133	106	85	52	37	23	16	10	6	2	2	0	0	0	0	0	0	0	0
FlatTV Ratio		3%	4%	6%	10%	18%	33%	46%	57%	74%	85%	91%	93%	96%	97%	99%	99%	100%	100%	100%	100%	100%	100%	100%	100%
30-39inch		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	2	7	22	33	45	60	78	86	93	97	84	81	73	71	69	62	58	51	49	44	40
	PDP	0	0	0	0	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40-49inch		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	0	1	7	17	25	34	54	63	67	65	75	77	84	78	72	62	56	52	49	46	44
	PDP	0	0	1	2	5	7	7	8	9	11	9	5	2	1	0	0	0	0	0	0	0	0	0	0
	RPTV	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OLED																				0.2	0.7	0.7	1.3	1.4
50-59inch		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	0	0	0	1	2	4	8	10	11	18	28	32	36	37	48	61	67	72	74	76	76
	PDP	0	0	0	0	1	2	3	3	4	6	6	6	5	4	2	0	0	0	0	0	0	0	0	0
	RPTV	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OLED														0.0	0.3	0.5	1.0	1.6	1.9	1.9	2.7	2.9	3.0	3.1
60-69 +larger		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020E	2021E	2022E	2023E	2024E
	LCD	0	0	0	0	0	0	0	0	0	1	2	3	5	8	10	12	15	19	27	32	37	41	42	46
	PDP	0	0	0	0	0	0	0	0	1	1	1	2	1	1	0	0	0	0	0	0	0	0	0	0
	RPTV	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	OLED															0.3	0.6	0.6	1.0	1.2	1.5	2.7	3.8	5.3	6.7

2024 Forecast-

Cross Over point

- a) Break in increasing size: The plan of stimulating demand of 75"/80" and over is required.
- b) OLED: Expecting 11m. price competition with mini LED LCD, shift to 8K, and developing panels under 48" are the key.

Source: Mizuho Securities Equity Research

TV/FPD shipment forecast by brand/Panel maker: expect only a small decline for 2020 and a recovery in 2021

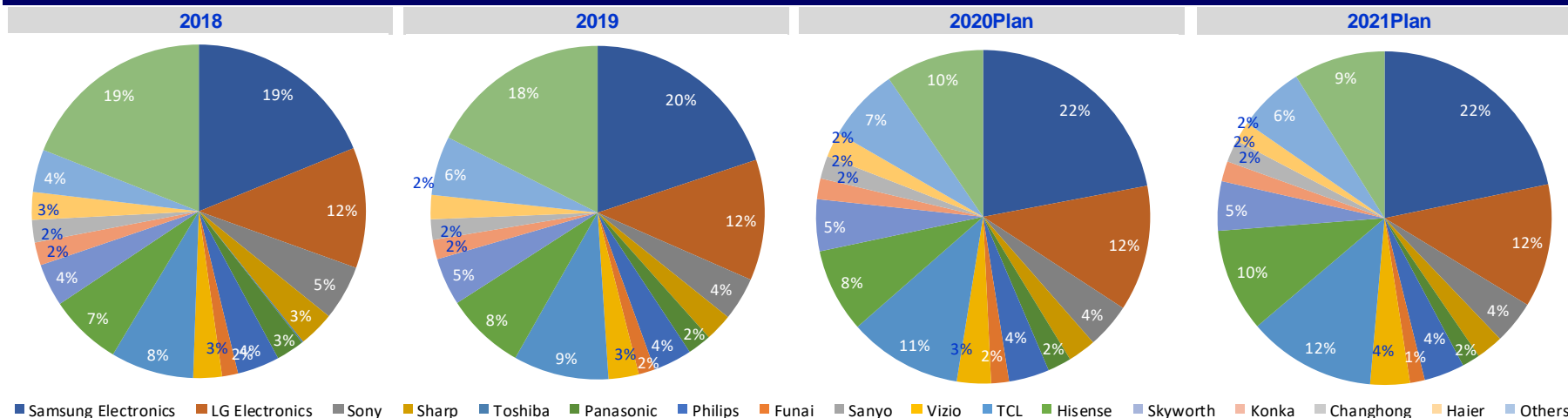
LCD TV Shipment forecast by brands

(mn units)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020 Plan	2020 F	2021 Plan
Samsung Electronics	36.5	40.0	43.0	48.0	47.0	47.0	43.1	41.4	44.1	46.0	49.4	50.0
LG Electronics	23.8	26.7	29.0	31.0	28.0	27.0	26.0	25.7	26.0	25.5	25.1	27.5
Sony	17.5	14.9	12.5	13.5	12.5	12.5	12.5	11.7	9.3	9.1	9.0	9.6
Sharp	10.0	8.3	7.5	7.0	6.9	4.7	8.9	7.6	5.9	5.7	6.0	6.0
Toshiba	14.5	12.0	7.8	6.3	3.7	0.9	0.7	0.3	0.0	0.0	0.0	0.0
Panasonic	9.8	8.0	7.0	5.8	6.7	5.7	6.1	6.0	5.1	4.8	4.8	4.0
Philips / AOC	7.0	7.3	7.2	7.3	7.5	7.5	8.5	9.0	8.3	8.2	8.6	9.0
Funai	5.9	6.6	6.0	5.2	4.1	3.7	3.0	3.4	3.5	3.6	3.1	3.3
Sanyo	4.2	2.7	2.2	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vizio	5.3	5.5	6.5	7.5	7.8	8.4	5.8	6.1	6.5	6.9	8.1	8.8
TCL	10.0	11.1	12.3	12.0	13.0	13.7	15.4	17.7	20.5	23.0	24.0	28.5
Hisense	9.3	9.5	9.8	11.0	12.4	13.5	12.9	15.5	17.1	17.0	19.6	23.0
Skyworth	7.3	8.5	9.0	11.5	10.4	11.0	9.5	9.1	10.2	10.5	10.8	11.0
Konka	4.7	5.7	6.2	9.3	5.3	5.5	5.3	4.9	4.2	4.2	4.2	4.5
Changhong	5.0	5.6	5.8	5.7	6.8	7.3	5.9	4.8	4.4	4.6	4.3	5.0
Haier	5.2	5.5	5.4	4.9	6.4	6.4	6.5	5.9	5.2	5.1	4.5	4.5
Xiaomi	0.0	0.0	0.0	0.0	0.9	1.0	2.4	9.1	12.7	14.9	14.0	14.9
Others	29.0	29.1	31.8	35.5	43.6	47.2	44.5	41.8	39.0	19.9	24.5	20.4
Total	205.0	207.0	209.0	223.0	223.0	223.0	217.0	220.0	222.0	209.0	220.0	230.0

TV Panel shipment forecast by panel makers

(mn units)	2013	2014	2015	2016	2017	2018	2019	2020 Plan	2020 F	YoY	2021 Plan	YoY
Samsung Display	50	55	53	47	40	39	32	20	20	-38%	6	-68%
LG Display	53	52	54	51	51	43	43	26	24	-40%	26	-1%
AUO	31	29	27	28	27	26	24	22	20	-8%	20	-9%
Innolux	40	48	50	41	42	43	41	41	42	0%	41	0%
Sharp	13	14	11	8	8	9	6.5	7	9	8%	16	129%
Panasonic	4	5	7	5	1	1	0	0	0	-	0	-
BOE	13	14	35	44	44	52	53	54	51	2%	55	2%
CSOT	20	24	27	33	39	38	41	40	41	-2%	40	0%
CEC Group			0	3	7	10	23	27	28	17%	29	7%
HKC			0	0	6	11	18	32	31	78%	40	25%
Others	5	3	4	3	0	3	0.5	0	0	-	0	-
Total	229	244	268	263	265	275	282	269	265	-5%	273	1%

Market Share



Source: Mizuho Securities Equity Research

LCD vs. OLED: To avoid direct battle with China, Koreans likely to focus on OLED/ μ LED

■ LCD side: (major brands whose flagship models are LCD): Samsung, TCL, Sony, Hisense, Vizio

- Panel suppliers: SDC, AUO, INX, CSOT (VA), LGD, BOE (IPS), plus CEC, HKC, etc. etc.
- Products (1): To compete with OLED, (1) high peak luminance (2000cd+), (2) 8K, (3) extra large, including 65/75/82/85/98, etc.
- Products (2): To offset weaknesses of LCD, (1) more advanced BL (mini LED, Local Dimming), (2) QD sheet, (3) viewing angle compensation, (4) Dual Cell, etc.
- Marketing: High-end LCDs to rebound and exceed OLED outside of Japan thanks to Samsung VD's aggressive strategy
- China G10.5 mass production: increased supply of 65"/75", lower prices, more brands producing (particularly 2nd tier and lower). Differentiation within the LCD space is difficult.

■ OLED side (major brands whose flagship models are OLED): LGE, Sony, Panasonic, Philips, Skyworth, etc.

- Panel suppliers: LG Display only. Total supply of around 3.7m in 2020, 7.5m in 2021 (100% from 8G plant). 48"/55"/65"/77"/83" 4K, 77"/88" 8K.
- Products (1): Effective strategy to fully tout strengths of OLED, including deeper blacks, motion properties, thinness, and internal speakers.
- Products (2): Retail for roughly the price of a 10" larger LCD. Premium price. Successful in Japan, struggling in Europe with LCD counter attack.
- Products (3): Panel prices more than 2x LCD price. The issue is increasing price competitive power
- 8K and large screens: 8K panels smaller than 65" are difficult under LGD's structure. Low-cost 75" also unlikely before 10.5G mass production.
- OLED competition: By volume, LGE > Sony > Panasonic, Philips, Skyworth. Costs also differ; LGE has lowest retail pricing, others in a quandary.

■ Outlook: Samsung Display's re-entrance into OLED market, LGD's investment capacity is key to OLED market expansion

- LGD: CF tight, but prioritizing capex budget for expansion of G8 (Guangzhou) and G10.5 (Paju). Eyes 13m/year by 2024.
- Samsung Display: Plan to switch 3/4 of G8 (T8-1/2) to QD-OLED (270K A-Si→Oxide-based 30K/M × 3=90K) However, only first 30k are confirmed and additional investment is TBC. Will it confirm +30k or +60k investment by 2Q2021 with cooperation of VD?
- Samsung VD: μ LED development, mass produce 146" for BtoB, release 75" 4K for TVs. If μ LED, possible to follow same strategy as for LCD-TVs. But cost is an issue.
- Chinese brands: BOE and CSOT will have two G10.5 plants, but part of the capacity may be converted over to OLED?
- Korean brands: May unveil new concepts not possible with LCDs, such as super-large, rollable, foldable, etc.

TV prices in US

	Display	Size(inch)	Resolution	Brand	Product	Price							
High-end	OLED	77	4K	Sony	XBR77A9G	\$4,498	Low-end	LCD	75	4K	Sceptre	U750CV-U	\$648
High-end	OLED	77	4K	LGE	OLED77C9PUB	\$4,500	Low-end	LCD	70	4K	RCA	RTU7074	\$600
High-end	OLED	65	4K	Sony	XBR65A9G	\$2,798	Low-end	LCD	65	4K	Sceptre	U650CV-U	\$380
High-end	OLED	65	4K	LGE	OLED65C9PUA	\$2,200	Low-end	LCD	60	4K	Sharp	LC-60Q7380U	-
High-end	OLED	55	4K	Sony	XBR55A9G	\$2,298	Low-end	LCD	55	4K	Insignia	NS-55DF710NA21	\$350
High-end	OLED	55	4K	LGE	OLED55CXPUA	\$1,500	Low-end	LCD	55	4K	Sharp	LC-55LBU711U	\$315
High-end	LCD	85	4K	Sony	XBR85X950H	\$3,798	Low-end	LCD	50	FHD	Sceptre	X405BV-FSR	\$138
High-end	LCD	85	4K	Samsung	QN85Q70TAFXZA	\$2,798	Low-end	LCD	50	4K	Sceptre	U515CV-U	\$200
High-end	LCD	82	8K	Samsung	QN82Q800TAFXZA	\$4,998	Low-end	LCD	43	FHD	Sceptre	X435BV-F	\$148
High-end	LCD	82	4K	Samsung	QN82Q70TAFXZA	\$2,598	Low-end	LCD	43	4K	RCA	RTU4300	\$200
High-end	LCD	75	8K	Samsung	QN75Q800TAFXZA	\$3,498	Low-end	LCD	40	FHD	RCA	RLDED4016A	\$170
High-end	LCD	75	4K	Sony	XBR75X950H	\$2,598	Low-end	LCD	40	4K	Element Electronics	E4SC4018RKU	-
High-end	LCD	75	4K	Samsung	QN75Q60RAFXZA	-	Low-end	LCD	32	FHD	Sceptre	X325BV-FSR	\$120
High-end	LCD	75	4K	LGE	75SM9070PUA	-	Low-end	LCD	32	4K	Sceptre	X322BV-SR	\$88
High-end	LCD	65	8K	Samsung	QN65Q800TAFXZA	\$2,698	(as of Jan 2021)						
High-end	LCD	65	4K	Sony	XBR65X950H	\$1,598							
High-end	LCD	65	4K	Samsung	QN65Q90RAFXZA	-							
High-end	LCD	65	4K	LGE	65SM9000PUA	-							
High-end	LCD	55	8K	Samsung	QN55Q900RBFXZA	\$2,300							
High-end	LCD	55	4K	Sony	XBR55X950H	\$1,198							
High-end	LCD	55	4K	Samsung	QN55Q90RAFXZA	-							
High-end	LCD	55	4K	LGE	55SM9000PUA	-							

※ - : out of stock

Source: Mizuho Securities Equity Research from Best Buy and Walmart HP

4K2K Panels: Accelerating penetration, Copper+Oxide will be the key toward 8K

	Size									2013	2014	2015	2016	2017	2018	2019	2020
	~30"	32"~39"	40"~49"	50"~59"	60"~69"	70"~79"	80"~89"	90"~100"	100"~	Prod. (K)	Prod. (K)	Prod. (K)	Prod. (K)	Prod. (K)	Prod. (K)	Prod. (K)	Prod. (K)
										Actual	Actual	Actual	Actual	Actual	Actual	Actual	Forecast
Samsung			40"/49"	55"	65"	75"	82"	98"		140	4,200	11,700	15,000	21,000	23,500	19,000	14,000
LGD			43"/49"	50"/55"/55"	65"/65"	75"/77"	84"	98"		140	5,100	11,500	19,000	27,000	24,500	22,000	17,500
AUO			43"	50"/55"	65"	75"	85"			400	1,700	3,700	7,900	11,000	13,500	15,500	16,000
Innolux	28"(I T)	39.5"	40"/43"	50"/58"	65"	75"	85"		100"	2,100	6,700	6,100	7,700	10,500	13,500	13,500	19,500
Sharp		32"(I T)			60"	70"	80"/85"(8K)		120"	70	500	1,300	2,100	4,500	4,000	3,500	4,500
Panasonic	20"(I T)									-							
BOE			43"/49"	55"	65"	75"		98"	110"	80	500	3,600	4,300	7,000	12,000	19,000	28,000
CSOT			49"	55"	65"		85"			350	1,300	2,500	4,400	7,000	9,000	12,500	14,000
CEC Group				50"/55"/58"		70"							700	2,500	5,000	15,000	20,000
HKC				50"/58"												1,700	8,000
TTL										3,280	20,000	40,400	61,100	90,500	108,000	121,700	141,500

Number in RED : OLED

- Innolux was the pioneer (mainly in 60Hz) with a strong market share in China, but LGD (with 120Hz and RGBW), and SDC (120Hz) have caught up and the tables have turned.
- BOE and CSOT pursue 49", 55" and 65" panels. BOE also pursues RGBW. SDP (G10) switching 60"/70"/80" to 4K. Introduces 8K from 2017.
- Volume: 120m on panel base; slightly over 40% is 4K. Roughly 50% in 2020.
- Due to falling panel prices and narrower price spread versus FHD, virtually all 49" and larger and majority of 43" and larger likely to switch to 4K.
- Toward 8K: copper wiring process+Oxide could be required. LGD/Samsung/Sharp/AUO leaders in copper wiring. INX at last introducing via G8.6. Sharp leader for Oxide, followed by LGD, Samsung, AUO, BOE.

Source: Mizuho Securities Equity Research

8K4K Panels: Faster growth or Slower growth?

	Size									2018	2019	2019	2020
	~30"	32"~39"	40"~49"	50"~59"	60"~69"	70~79"	80~89"	90"~100"	100"~	Prod. (K)	Prod. (K)	Prod. (K)	Max Prod. (K)
											Prelim.	Forecasts	Forecasts
Samsung				55"	65"	75"	82"	98"		25	250	170	350
LGD					65"	75"	88"			-	50	30	80
AUO				55"	65"	75"	85"			0	80	5	200
Innolux					65"	75"	85"						30
Sharp					60"	70"	80"			8	25	10	30
Panasonic										-			
BOE					65"	75"				-	30	2	20
CSOT						75"							15
CEC Group													
TTL										33	435	217	725

Number in RED : OLED

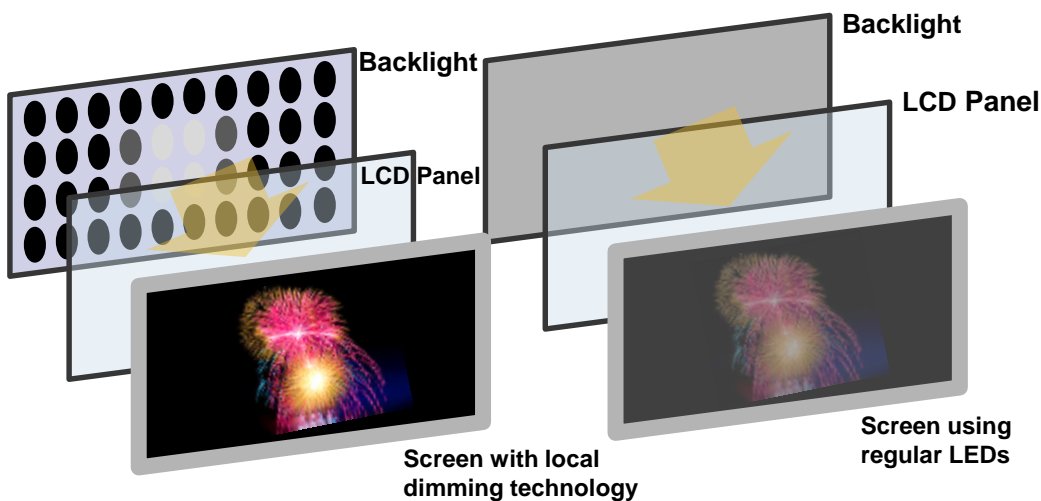
- LCD strength: Currently difficult to make 8K panels for 70" or smaller with OLED. Stronghold is LCD in combination with 80" and bigger
- SDP(Sharp) pioneer, to mass manufacture 60" in addition to 80"/70" with SDP G10
- Samsung Display: Depends on VD strategy. Initially planned for 200K in 2018, but downturn in 2018 and 2019
- AUO: To mass manufacture in earnest from 2019 to VD, Sony, Hisense, TCL
- BOE, CSOT: Plans to manufacture with G10.5. However, order will be 4K60Hz→4K120Hz, and then 8K in 2020 or later.
- LGD: Undetermined LCD 8K strategy, since LGD primarily focuses on OLED

Source: Mizuho Securities Equity Research

Mini LED Outlook

What's Mini LED ?

- The main feature of mini LEDs is that they are smaller (100-200µm chip size) than regular LEDs (300-350µm); micro LEDs are even smaller at under 100µm
- Growing adoption of mini LEDs as backlight of LCD panels:
- In smartphone and other thin displays, edge-lit LEDs (LEDs are aligned along the edge of the display to spread light over the entire light guiding panel) are used; the downside of this technology is “contrast.” Although backlit LEDs improve contrast, “thickness” impedes their adoption beyond TVs and other thick displays.
- However, using mini LEDs in backlit LEDs with “local dimming” technology not only improves contrast, the “thickness” issue of backlit LED displays is resolved with the smaller LED chip size.
- Alternative technology to OEL
- Mini LEDs to compete with OLED given their superior contrast, luminescence, and low energy consumption compared with conventional LCDs



Source: Mizuho Securities Equity Research from company data and media reports

Current status

- Taiwan's AU Optronics Corp. (AUO) began volume production of gaming monitors using a mini LED backlight from 2H 2018
- In January 2019, ASUS announced PA32UCX, a new ProArt series display model using a mini LED backlight with 1000 local dimming zones
- China's display maker Unilumin announced the start of volume production of 0.9mm mini LED displays; the displays can also be used for large video walls (commercial, public spaces, etc.)
- US start-up Rohinni formed a joint venture with Canada's Magna International and China's BOE to develop mini LED backlights for automotive displays

Challenges

- Mini LEDs cost less to make than micro LEDs, but are estimated to cost nearly 10x that of OLEDs. The challenge going forward is lowering cost through volume manufacturing.

Cost of 10.1-inch HD display (2018/12, IHS Markit)

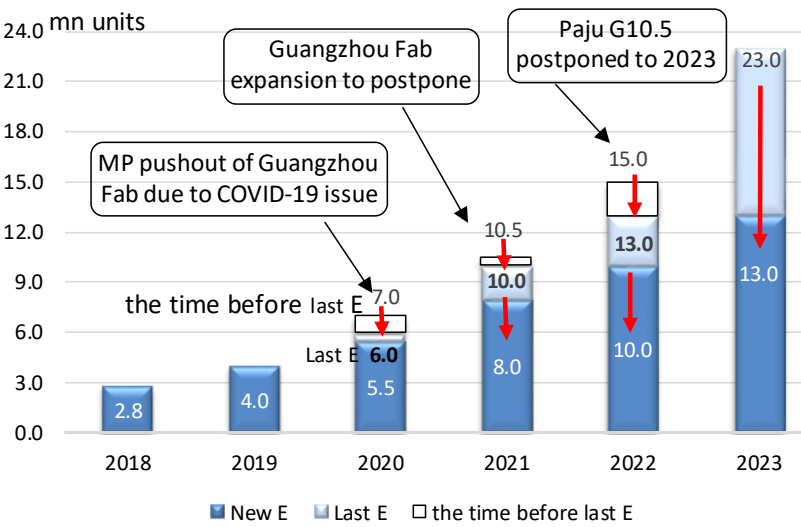
	LCD	OLED	LCD w/Mini LED BLU	RGB Micro LED
	10.1" 1366x768 IPS on a-Si	10.1" 1280x800 RGB on LTPS	10.1" 1540x720 IPS on a-Si (6,720 chips)	10.1" 1366x768 with 50 micrometer chip >\$400 (RGB LED chips only)
Manufacturing cost	\$22.80	\$36.80	\$212	>\$400 (RGB LED chips only)
Gap to LCD	-	× 1.6(\$14)	× 10(\$189)	× >10(>\$380)

OLED TV Panel Shipment Forecast By Brand: downturn in 2020 and possible to recovery by price stay in 2021?

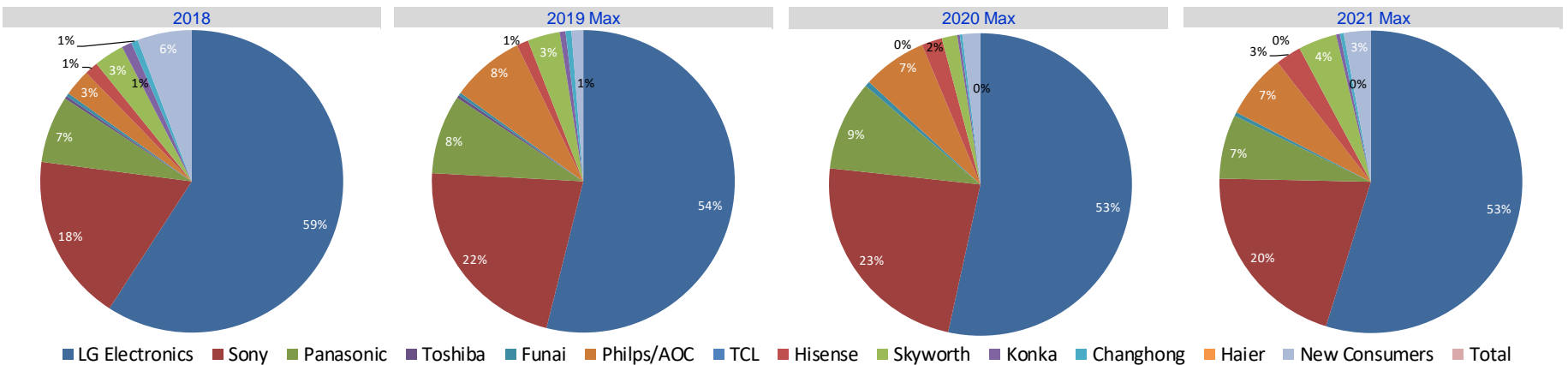
OLED TV Shipment forecast by brands

(mn units)	2014	2015	2016	2017	2018	2019	2020F Max	2020F Max (Revised)	2021F Max
LG Electronics	0.1	0.3	0.7	1.2	1.7	1.7	2.1	2.0	4.0
Sony				0.2	0.5	0.7	0.9	0.9	1.5
Panasonic				0.1	0.2	0.3	0.4	0.4	0.5
Toshiba				0.0	0.0	0.0	0.0	0.0	0.0
Funai				0.0	0.0	0.0	0.0	0.0	0.0
Sharp				0.0	0.0	0.0	0.1	0.1	0.2
Philps/AOC			0.0	0.0	0.1	0.3	0.4	0.3	0.5
TCL									
Hisense					0.0	0.0	0.2	0.1	0.2
Skyworth		0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.3
Konka			0.0	0.0	0.0	0.0	0.0	0.0	0.0
Changhong			0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haier									
New Consumers	0.0	0.0	0.0	0.1	0.2	0.0	0.4	0.1	0.2
Total	0.1	0.4	0.7	1.7	2.8	3.2	4.7	3.7	7.5

LG Display OLED panel capacity forecast



Market Share



Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2018 – as of Oct.2018)

(M Units)

	Sharp /SDP	Pana-LCD	Samsung	LGD	AUO	Innolux	BOE	CEC	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung			17.2	0.3	5.2	7.8	7.2		4.8	1.2	43.7	41.7	42.5
Sony	0.2		3.1	3.7	0.9	0.4	3.9		0.1		12.3	12.5	13.5
Sharp	7.5					3.7					11.2	10.0	15.0
Philips/TPVision			1.3	2.8	2.7	0.8	1.4		0.7		9.7	10.0	11.0
LGE	0.6			15.8		3.6	7.4		0.3	0.4	28.1	27.5	28.0
Toshiba				0.2		0.4					0.6	0.5	0.8
Panasonic				2.9		2.8	0.6				6.3	6.2	6.5
Vizio	0.2		0.2	0.8	0.8	1.5	2.7				6.2	6.0	6.5
Funai(+Sanyo/Philps US)			0.2	1.3		1.5	0.5	0.2			3.7	3.7	4.0
Hisense			1.6	1.3	5.9	2.1	3.3	0.2	3.7	0.2	18.3	18.0	19.0
Skyworth				4.9		4.8	2.9	0.4	1.7	0.2	14.9	14.5	16.0
TCL			3.1	1.8	2.7	1.9			17.9		27.4	23.0	25.0
Haier			1.3			1.9	2.2				5.4	6.5	7.0
Konka			1.3	2.1			3.6	0.4		0.3	7.7	6.0	6.5
Changhong			0.8	1.7	2.6	0.9	1.9	0.6	2.2		10.7	6.5	7.0
Other(Vestel, BB, CNC, TPV etc)	0.9	1.5	8.8	4.8	5.2	6.5	10.4	8.5	7.3	8.3	62.2	35.0	40.0
FCST Total	9.4	1.5	38.9	44.4	26.0	40.6	48.0	10.3	38.7	10.6	268.4	227.6	248.3
Panel Makers' Capacity	10.0	3.0	39.0	46.0	26.5	41.0	48.0	11.0	39.0	11.0	274.5		

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2019 – as of Nov.2018)

(M Units)

	Sharp /SDP	Pana-LCD	Samsung	LGD	AUO	Innolux	BOE	CEC	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung			13.4	0.8	5.8	7.2	6.6	1.5	5.1	1.9	42.3	42.0	43.0
Sony	0.1		2.6	3.9	0.7	0.6	4.5		0.2		12.6	12.0	13.0
Sharp	6.5					3.7					10.2	13.0	15.0
Philips/TPVision			0.8	2.3	2.7	0.3	3.3	1.0	0.5		10.9	10.0	11.0
LGE	0.9			16.7		3.8	6.6	0.4	0.3	0.8	29.5	29.0	31.0
Toshiba						0.4					0.4	0.5	0.7
Panasonic				2.2		3.2	0.8				6.2	6.5	7.0
Vizio	0.8		0.3	0.2	0.8	3.9	0.8				6.8	6.7	7.5
Funai(+Sanyo/Philps US)			0.2	0.8		1.5	0.9	0.3			3.7	3.5	4.0
Hisense			1.6	1.6	5.6	1.8	4.4	0.2	4.0	0.6	19.8	18.0	19.0
Skyworth				4.5		4.5	3.2	0.8	1.9	0.3	15.2	13.5	14.5
TCL			3.1	2.0	2.5	2.0			21.0		30.6	25.0	27.0
Haier			1.4			2.0	2.8				6.2	6.5	7.0
Konka			1.3	1.8			3.1	0.9		0.3	7.4	6.8	6.5
Changhong			0.5	1.4	2.3	0.9	1.7	0.9	2.2	0.2	10.1	7.5	8.0
Other(Vestel, BB, CNC, TPV etc)	1.1	0.5	4.8	6.1	5.8	4.2	14.5	15.0	5.8	12.0	69.8	55.0	60.0
FCST Total	9.4	0.5	30.0	44.3	26.2	40.0	53.2	21.0	41.0	16.1	281.7	255.5	274.2
Panel Makers' Capacity	10.0	1.0	30.0	44.0	26.5	40.0	53.0	27.0	41.0	17.0	289.5		

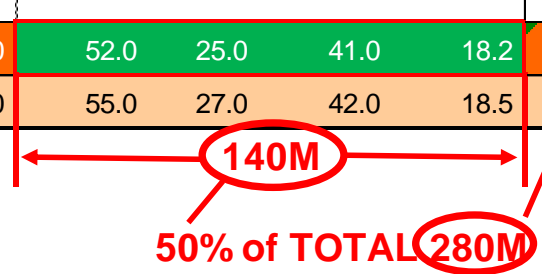
BP = capacity

Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2019 – as of Aug.2019)

(M Units)

	Sharp /SDP	Pana-LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/CCPD	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung			16.1	0.4	6.2	5.2	7.1	1.9	5.1	2.4	44.4	43.0	44.0
Sony			2.3	2.9	0.7	0.3	4.2		0.2		10.6	10.5	10.7
Sharp	3.1					3.2					6.3	7.4	8.5
Philips/TPVision			0.7	1.7	1.7	0.3	3.3	4.7	0.5		12.9	10.0	11.0
LGE	1.0			13.5		1.7	8.4		0.2	1.4	26.2	27.0	28.0
Toshiba						0.4					0.4	0.5	0.7
Panasonic				2.1		2.8	0.8				5.7	5.7	6.3
Vizio	0.4		0.3	0.2	0.8	3.9	1.2				6.8	6.7	7.5
Funai(+Sanyo/Philps US)			0.1	1.1		0.8	1.1				3.1	2.8	3.2
Hisense			1.3	0.8	5.6	2.1	4.5	1.6	3.2	0.5	19.6	18.0	19.5
Skyworth				5.1		6.1	3.3	0.7	2.1	0.3	17.6	13.5	14.5
TCL	0.1		2.4	2.0	3.3	2.0		0.5	21.2		31.5	25.0	27.0
Haier			1.4			1.9	2.7				6.0	6.0	6.5
Konka			1.2	1.8			3.1	0.7		0.5	7.3	6.3	6.5
Changhong			0.5	0.8	1.0	0.9	1.6	0.9	1.3	0.4	7.4	6.5	8.0
Other(Vestel, BB, CNC, TPV etc)	1.1	0.1	4.7	9.1	5.7	9.4	10.7	14.0	7.2	12.7	74.7	55.0	60.0
FCST Total	5.7	0.1	31.0	41.5	25.0	41.0	52.0	25.0	41.0	18.2	280.5	243.9	261.9
Panel Makers' Capacity	8.4	1.0	31.0	42.0	26.0	41.0	55.0	27.0	42.0	18.5	291.9		



BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2020 – as of Oct.2019)

(M Units)

	Sharp /SDP	Pana-LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/CCPD	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung			9.5	0.8	6.7	5.9	7.5	4.5	6.8	3.8	45.5	44.0	46.0
Sony			2.1	2.2	0.8	0.2	4.6		0.6		10.5	10.2	11.0
Sharp	4.9					3.4					8.3	7.7	8.5
Philips/TPVision			0.3	1.3	1.8	0.1	2.7	5.0	0.4		11.6	10.0	11.0
LGE	1.3			11.4		2.1	10.2	0.6	0.1	3.1	28.8	28.5	30.0
Panasonic				1.4		2.9	1.6				5.9	5.5	6.0
Vizio	0.5			0.2	0.7	3.9	1.2				6.5	6.5	7.5
Funai(+Sanyo/Philps US)				0.9		1.1	1.1				3.1	2.9	3.3
Hisense	0.2		0.9	0.4	5.7	2.5	5.8	0.5	3.9	0.5	20.4	18.5	19.5
Skyworth				4.4		6.7	3.4	0.7	2.2		17.4	14.5	15.5
TCL	0.2		1.8	0.6	2.8	4.3		2.1	18.4		30.2	26.0	27.0
Haier			0.5			2.2	2.7				5.4	5.5	6.0
Konka			0.3	1.1			3.9	0.4		0.5	6.2	6.0	6.5
Changhong			0.3	0.1	1.0	1.3	2.4	1.3	1.6	0.5	8.5	8.0	8.0
Other(Vestel, BB, CNC, TPV etc)	1.3	0.1	6.3	3.4	4.5	7.7	12.1	14.0	7.5	16.0	72.9	50.0	55.0
FCST Total	8.4	0.1	22.0	28.2	24.0	44.3	59.2	29.1	41.5	24.4	281.2	243.8	260.8
Panel Makers' Capacity	8.5	1.0	22.0	28.5	25.0	45.0	60.0	30.0	42.0	25.0	287.0		

← 154M →
55% of TOTAL 281M

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2020 – as of Feb.2020)

(M Units)

	Sharp SDP-SIO	Pana- LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/ CCPD	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung	1.5		9.5	0.3	6.9	6.2	7.9	5.1	7.3	4.4	49.1	46.0	48.0
Sony			1.9	2.0	0.8	0.2	4.6		0.6		10.1	10.0	10.5
Sharp	4.9					2.7					7.6	7.0	7.5
Philips/TPVision			0.3	0.9	1.8	0.1	2.7	5.0	0.4		11.2	10.0	10.1
LGE	1.3			11.1		1.7	11.7	0.3	0.1	3.3	29.5	28.5	30.0
Panasonic				1.4		2.4	1.4				5.2	5.0	6.0
Vizio	0.4			0.2	0.7	4.0	1.5				6.8	6.5	7.0
Funai(+Sanyo/Philps US)				0.9		1.3	1.3				3.5	3.2	3.5
Hisense	0.2		0.7	0.2	5.9	2.5	5.8	1.1	4.1	0.5	21.0	18.5	19.5
Skyworth	0.1			4.0		6.5	3.4		2.0		16.0	14.5	15.5
TCL	0.1		1.4	0.3	2.5	4.3		2.4	18.2		29.2	26.0	28.0
Haier			0.5			2.3	2.7				5.5	5.5	6.0
Konka			0.3	0.8			3.9	0.2		0.5	5.7	5.5	6.0
Changhong			0.3	0.1	0.9	1.2	2.4	1.3	1.9	0.5	8.6	8.0	8.0
Other(Vestel, BB, CNC, TPV etc)	1.5		6.1	2.6	3.5	7.7	8.5	11.0	7.3	16.0	64.2	50.0	55.0
FCST Total	10.0	0.0	21.0	24.8	23.0	43.1	57.8	26.4	41.9	25.2	273.2	244.2	260.6
Panel Makers' Capacity	11.0	0.0	21.0	25.0	23.0	43.5	58.0	28.0	42.0	33.0	284.5		

← 151M →
55% of TOTAL 273M

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2020 – as of Dec.2020)

(M Units)

	Sharp SDP-SIO	Pana- LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/ CCPD	CSOT	HKC	TTL panel demand	TTL production
Samsung	1.4		12.8	0.3	6.4	5.1	6.4	4.4	8.1	5.2	50.1	49.4
Sony			1.7	2.6	0.8	0.2	3.1		0.8		9.2	9.0
Sharp	2.2			0.1		1.9					4.2	6.0
Philips/TPVision				0.7	1.2	1.0	2.7	5.2		0.7	11.5	8.6
LGE	1.4			11.1		2.7	10.3			3.1	28.6	25.4
Panasonic				1.4		2.4	1.4				5.2	4.8
Vizio	0.4				1.9	4.0	1.9				8.2	8.1
Funai(+Sanyo/Philps US)			0.4	0.4		1.1	1.5				3.4	3.1
Hisense	0.4		0.5	0.1	5.3	2.7	6.2	2.9	4.2	0.4	22.7	19.6
Skyworth				3.2		4.8	4.1		1.1	1.1	14.3	10.8
TCL			1.6	1.0	1.9	5.7		3.4	18.0	0.6	32.2	24.0
Haier			0.5			1.4	3.0				4.9	4.5
Konka			0.2	0.3			2.9	0.6		2.1	6.1	4.2
Changhong			0.2			1.8	0.7	0.8	2.6	0.4	6.5	4.3
Other(Vestel, BB, CNC, TPV etc)	3.2		1.9	4.4	2.0	6.9	6.6	10.9	6.2	17.4	59.5	38.2
FCST Total	9.0	0.0	19.8	25.6	19.5	41.7	50.8	28.2	41.0	31.0	266.5	220.0
Panel Makers' Capacity	9.0	0.0	20.0	26.0	19.5	42.0	51.0	28.5	41.5	32.0	269.5	

151M
57% of TOTAL 267M

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2021 – as of Dec.2020)

(M Units)

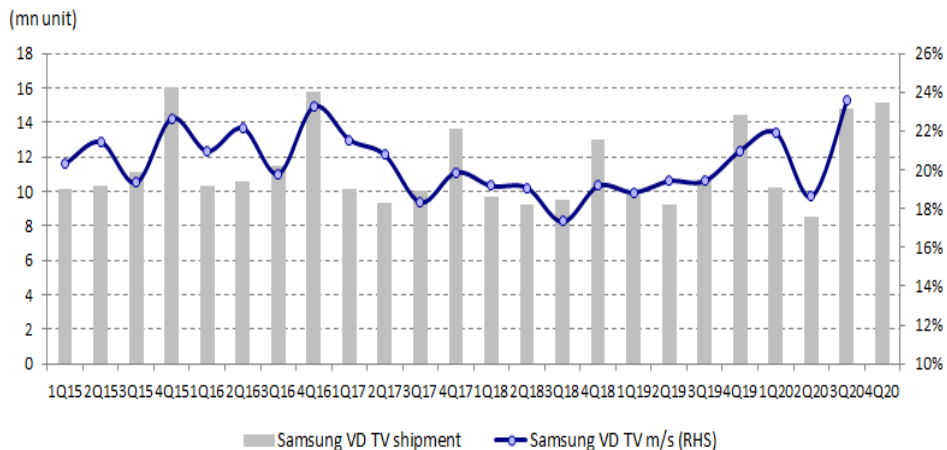
	Sharp SDP-SIO	Pana- LCD	Samsung	LGD	AUO	Innolux	BOE	CHOT/ CCPD	CSOT	HKC	TTL panel demand	TTL production	Aggressive Plan
Samsung	5.4		6.4	0.8	6.5	6.1	8.6	6.2	9.8	7.8	57.6	50.0	52.0
Sony				1.9	0.9	0.2	3.9		2.1		9.0	9.6	10.5
Sharp	3.2			0.2		2.7					6.1	6.0	6.5
Philips/TPVision				1.2	1.1	1.0	2.1	5.2		0.8	11.4	9.0	9.5
LGE	1.4			11.5		3.0	10.9	0.8		5.8	33.4	27.5	29.0
Panasonic				1.0		2.1	1.4				4.5	3.5	4.5
Vizio	0.3				1.9	4.0	2.1				8.3	8.1	9.0
Funai(+Sanyo/Philps US)				0.2		1.0	1.7				2.9	3.3	3.5
Hisense	0.4			0.1	5.9	2.7	6.6	4.8	3.1	1.7	25.3	23.0	25.0
Skyworth				3.8		4.7	4.6		0.4	1.6	15.1	11.0	12.0
TCL					2.0	6.4		2.5	17.5	2.5	30.9	28.5	30.5
Haier						1.2	2.9				4.1	4.5	5.0
Konka				0.2			3.5	1.0		2.5	7.2	4.5	5.0
Changhong						2.2	2.0	1.6	3.2	1.8	10.8	5.0	5.5
Other(Vestel, BB, CNC, TPV etc)	5.3			4.8	1.7	3.6	4.6	6.9	3.9	15.5	46.3	35.8	40.0
FCST Total	16.0	0.0	6.4	25.7	20.0	40.9	54.9	29.0	40.0	40.0	272.9	229.3	247.5
Panel Makers' Capacity	16.0	0.0	8.0	26.0	20.0	41.0	54.5	29.0	41.0	40.0	275.5		

← 163M →
61% of TOTAL 267M

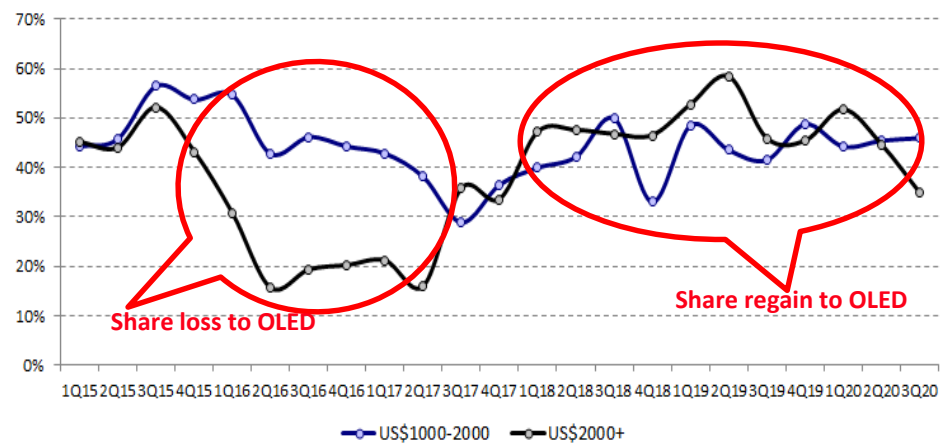
BP = capacity
Source: Mizuho Securities Equity Research

Samsung VD: Status quo

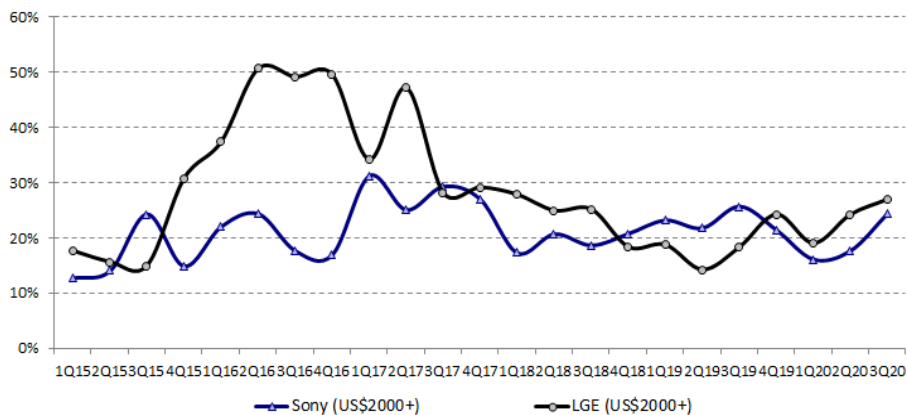
Samsung VD's global TV shipment and m/s



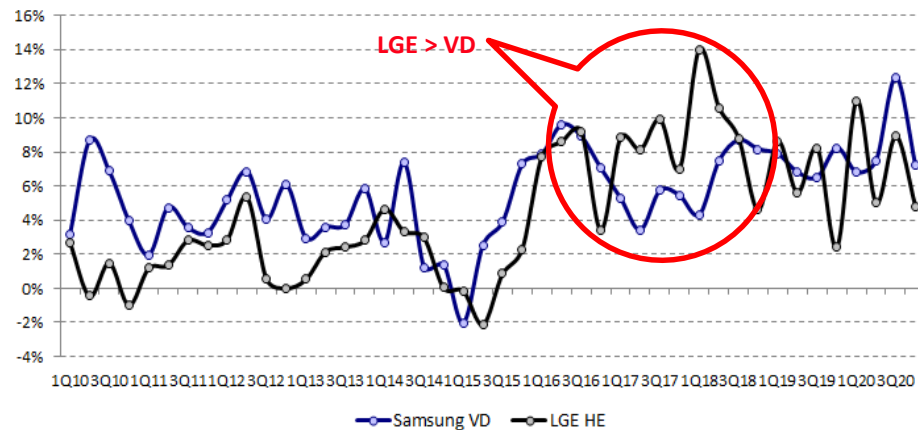
Samsung VD's high-end TV m/s trend



Sony and LGE TV m/s trend



OPM comparison: Samsung VD vs. LGE HE



Source: Compiled by Mizuho Securities Equity Research from company data, IHS

Samsung VD: Outlook and Strategy

Major takeaways post 4Q20 earnings

- SEC's TV shipment increased 8% YoY to 15.1mn in 4Q20 from 14.0mn in 4Q19. In 2020, SEC VD continued to gain market shares, in light of: 1) ultra large size promotion; 2) rather aggressive pricing for QLED TV (especially aiming to gain shares from OLED TVs); and 3) improving on-line channel distribution.
- Due to hikes in LCD panel pricing and increasing marketing costs, SEC's VD OPM decreased to 7% in 4Q20, but still higher than LGE's HE OPM of 4%.

Keep focusing on QLED, but turning positive on QD-OLED?

- After announcing investment of KRW13tn on QD-OLED until 2025 in Oct 19, SDC is planning to ramp up 30K/M QD-OLED capacity by 1H22.
- Although SEC's VD wants to focus on QLED and Neo QLED, we view that the company is turning gradually positive to adopt QD-OLED TV in order to enhance premium product line-ups. This will potentially provide SDC with positive momentums for the 2nd phase of QD-OLED investment (additional 30K/M).

SEC's launching Neo QLED, mini-LED TV line-ups

- In CES 2021, SEC VD unveiled Neo QLED (mini LED TV).
- QN900: 8K, 65"/75"/85"
- QN800: 8K, 65"/75"/85"
- QN90/95: 4K, 50"/55"/65"/75"/85"
- QN85: 55"/65"/75"/85"
- Competing against OLED with narrow-frame LCD, local dimming control Mini LED BL. Clearly superior in brightness.

75"+/8K/2000cd+ TV to compete against OLED

- **In order to compete against OLED, Samsung will focus more on: 1) ultra large size (75"+), 2) 8K, 3) super high peak brightness TV (2000cd+), which OLED is difficult to do or not very cost competitive.**
- **If VD adopts QD display in 2022 or after, VD has to change its strategy again. 8K QD display can be producible, but 75"+ QD display costs should be much higher than QLED. μ LED can be achievable 75"+ 8K, but its cost will be higher than QD display and 75" 8K will have even higher technology barriers for R&D.**
- **μ LED of 75" or more to be introduced for TVs. Strengths in brightness, contrast, video display characteristics, etc. Costs are an issue.**

Source: Mizuho Securities Equity Research from company data

Samsung Display: Income statement and balance sheet summary

Samsung Display: Income statement summary

(KRW tn)			
	2017	2018	2019
Sales	34.29	32.32	30.96
COGS	25.30	26.44	26.05
Gross profit	8.99	5.88	4.90
<i>GP Margin (%)</i>	36%	22%	19%
SG&A	3.72	3.36	3.44
R&D	2.13	2.16	2.28
Other SG&A	1.60	1.19	1.16
Operating profit	5.27	2.52	1.47
<i>OP Margin (%)</i>	15%	8%	5%
Depreciation	5.15	6.51	6.59
Amortization	0.12	0.12	0.29
EBITDA	10.54	9.15	8.35
<i>EBITDA Margin (%)</i>	31%	28%	27%
Non-operating income (expense)	0.25	0.36	0.37
Net interest income (expense)	0.08	0.13	0.25
Interest income	0.21	0.26	0.32
Interest expense	0.13	0.13	0.07
Foreign exchange gains (losses)	0.20	(0.05)	0.00
Foreign exchange gains	1.10	0.77	1.18
Foreign exchange losses	0.90	0.82	1.18
Net income from associates	0.01	0.00	0.00
Other non-operating income (expense)	(0.02)	0.28	0.13
Pre-tax profit (income before tax)	5.52	2.88	1.84
Income taxes	0.87	0.64	0.70
Minority interest	0.05	0.02	0.01
Net income	4.59	2.22	1.13
<i>NP Margin (%)</i>	13%	7%	4%

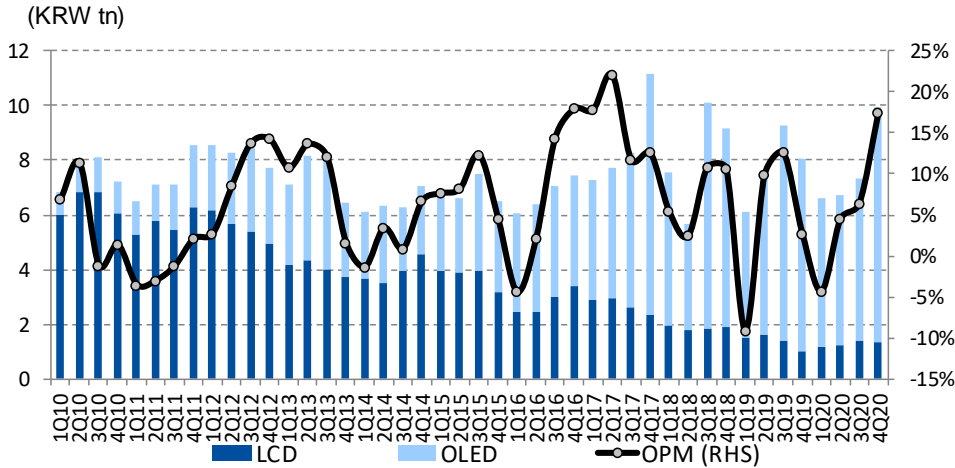
Samsung Display: Balance sheet summary

(KRW tn)			
	2017	2018	2019
Assets	59.20	54.48	53.73
Current assets	21.32	20.14	23.39
Cash&cash equivalents	0.82	0.68	0.67
Short-term financial instruments	11.34	11.64	14.69
Net account receivables	5.18	3.60	3.72
Inventories	2.32	1.90	1.48
Other current assets	1.66	2.31	0.00
Non-current assets	37.88	34.34	30.34
Investments in affiliates and JVs	0.21	0.21	0.21
Net PP&E	30.47	26.83	22.50
Net intangibles	0.53	0.54	1.25
Other non-current assets	6.68	6.77	0.00
Liabilities	18.11	11.23	9.17
Current liabilities	12.28	5.96	5.48
Accounts payable	2.19	1.84	1.32
Short-term debt and current portion of long-term debt	5.82	1.71	1.48
Other current liabilities	4.27	2.41	0.00
Non-current liabilities	5.83	5.27	3.69
Long-term debt	4.90	3.99	2.85
Other long-term liabilities	0.93	1.27	0.00
Shareholders' equity	41.09	43.26	53.73
Total common equity	40.57	42.74	44.02
Capital Stock	1.31	1.31	1.31
Capital Surplus	24.31	24.31	24.31
Retained earnings	14.15	16.39	17.53
Other capitals	0.81	0.72	0.88
Minority interest	0.52	0.52	0.54

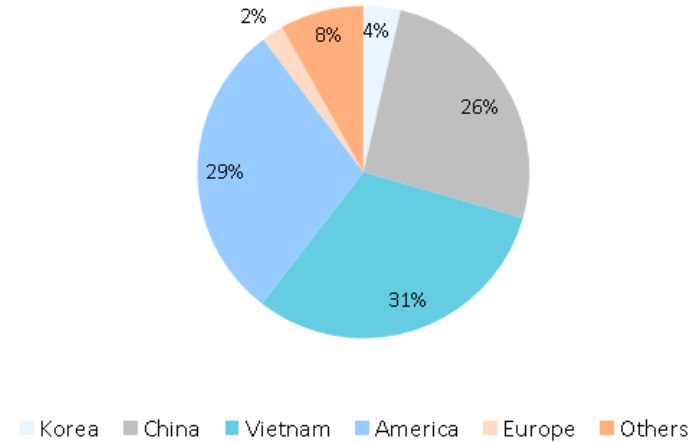
Source: Compiled by Mizuho Securities Equity Research from company data

Samsung Display: Financial analysis

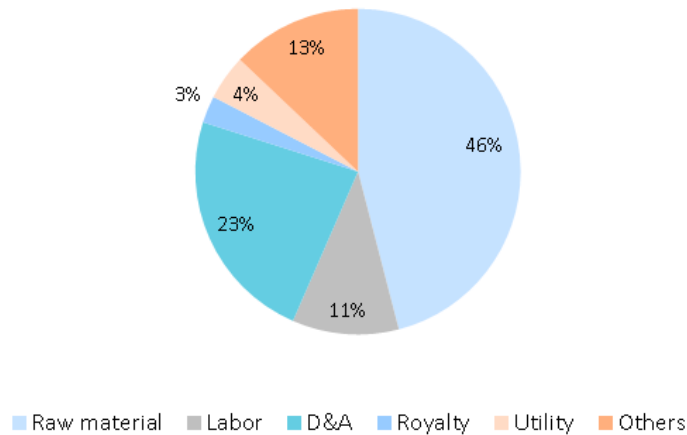
Samsung Display: Sales and OPM trends



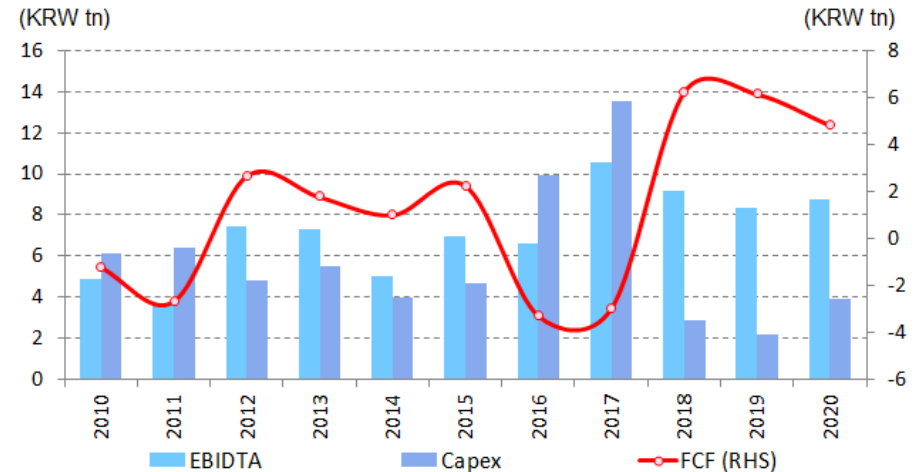
Samsung Display: Sales by region (2019A)



Samsung Display: Operating cost breakdown (2019A)



Samsung Display: EBITDA/Capex/FCF trend



Source: Compiled by Mizuho Securities Equity Research from company data

Samsung Display : Earnings Trend

Earnings estimates

	(KRW tn)								
	2013	2014	2015	2016	2017	2018	2019E	2020E	2021E
Sales	29.5	25.6	27.4	26.8	34.3	32.3	32.9	40.7	52.6
LCD	16.3	15.7	14.9	11.3	10.7	7.4	5.9	4.5	3.7
OLED	13.2	10.0	12.5	15.5	23.6	24.9	27.0	36.2	48.9
OP	2.8	0.6	2.2	2.1	5.4	2.5	2.0	4.8	5.0
LCD	0.2	0.3	0.9	(0.4)	1.4	(0.2)	(1.3)	(0.5)	(0.5)
OLED	2.6	0.3	1.3	2.5	4.0	2.7	3.3	5.4	5.5
OP Margin	10%	2%	8%	8%	16%	8%	6%	12%	10%
LCD	1%	2%	6%	-4%	13%	-2%	-22%	-12%	-12%
OLED	20%	3%	10%	16%	17%	11%	12%	15%	11%
NP	2.7	1.2	1.8	1.6	4.6	2.2			
NP Margin	9%	4%	7%	6%	14%	7%			

Balance sheet

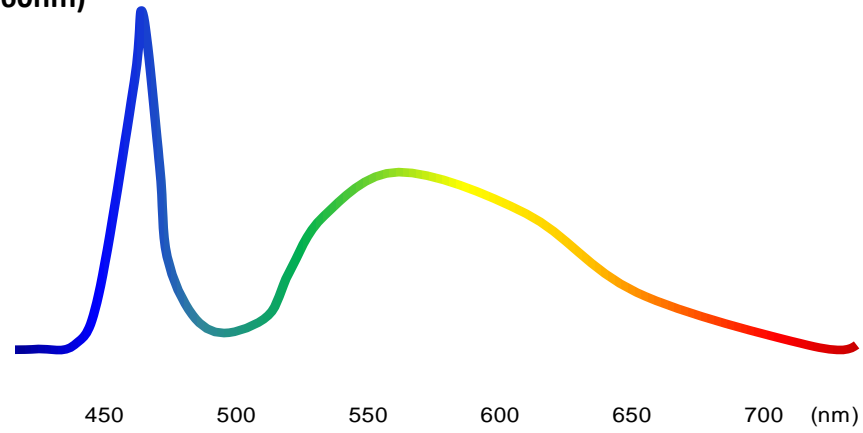
	(KRW tn)	
	2017	2018
Assets	59.2	54.5
Current assets	21.3	20.1
Cash&cash equivalents	0.8	0.7
Short-term financial instruments	11.3	11.6
Net account receivables	5.2	3.6
Inventories	2.3	1.9
Other current assets	1.7	2.3
Non-current assets	37.9	34.3
Investments in affiliates and JVs	0.2	0.2
Net PP&E	30.5	26.8
Net intangibles	0.5	0.5
Other non-current assets	6.7	6.8
Liabilities	18.1	11.2
Current liabilities	12.3	6.0
Accounts payable	2.2	1.8
Short-term debt and current portion of long-term debt	5.8	1.71
Other current liabilities	4.3	2.4
Non-current liabilities	5.8	5.3
Long-term debt	4.9	4.0
Other long-term liabilities	0.9	1.3
Shareholders' equity	41.1	43.3
Total common equity	40.6	42.7
Capital Stock	1.3	1.3
Capital Surplus	24.3	24.3
Retained earnings	14.1	16.4
Other capitals	0.8	0.7
Minority interest	0.5	0.5

Source : Compiled by Mizuho Securities Equity Research from company data

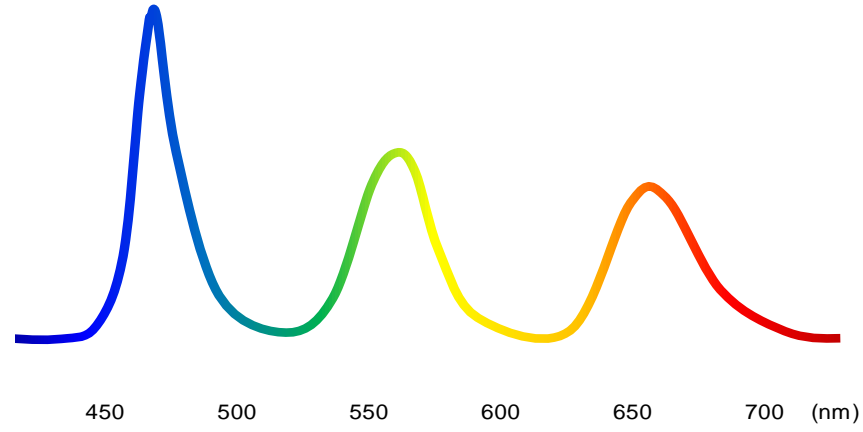
Quantum Dot (QD): background information

- Light (photon) = electromagnetic waves+particles. Short wavelengths = more energy. Visible radiation wavelengths=400nm (blue) to 700nm (red). Blue light has shorter wavelengths and thus produce higher amount of energy.
- **PL (Photoluminescence)**...the emission of light after excitation (absorption of photons) from another light source. Currently used in QD-LCD.
- **EL (Electroluminescence)**...physical phenomenon in which a material emits light when electricity is passed through it. LED, OLED and the under-development QLED are all based on this principle. Strictly speaking, “organic EL” refers to the physical phenomenon (EL through organic compound), so OLED (=organic light-emitting diode) is the correct term when referring to panels.
- **White LED**...most commonly used type is color conversion using blue LED + yellow phosphor. This creates white light with a two peak spectrum at 465nm 560nm (see right). Used as a LCD backlight light source. As passing it through a color filter (RGB) results in some leakage of intermediate colors such as orange and yellow, it is difficult to reproduce high purity colors (especially for green and red) with it. The color gamut produced by LCDs is said to be 20-35% of the gamut that the human eye is capable of recognizing.
- **Quantum dot**...semiconductor particles measuring several nanometers across. They contain a core and a shield (protective layer). They can be made to exhibit the PL characteristic of specific wavelength peaks according to the material and the molecule structure (mainly diameter). The majority of those in commercial production absorb blue light and emit green or red lights.
- The current most efficient QD particles use cadmium (Cd), but Cd is a toxin and so raises environmental concerns (RoHS). It is approved for use in Europe and some regions under certain conditions due to the lack of a substitute technology.
- **QD-LCD**...Converting the backlight light wavelengths into three primary colors (RGB) using a film that includes QD results in an LCD panel capable of displaying higher color rendering and wider color gamut. The use of QD including Cd is said to produce the same or greater color rendering and color gamut versus OLED. According to QD Vision, Cd-based QD is capable of displaying 105% NTSC color gamut performance, vs 82% for OLED and 72% for white LED.

White LED spectral distribution (blue LED=465nm + yellow phosphor =560nm)



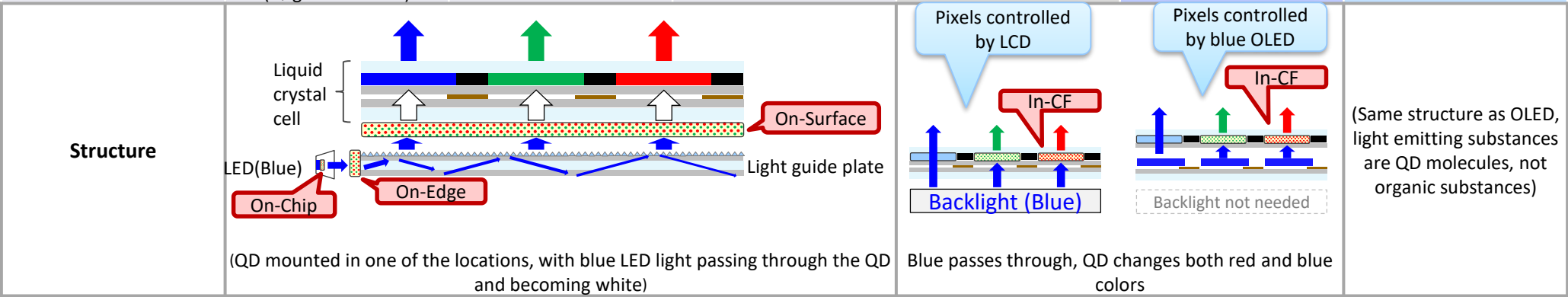
Spectral distribution after QD penetration (peak for RGB)



Source: Mizuho Securities Equity Research

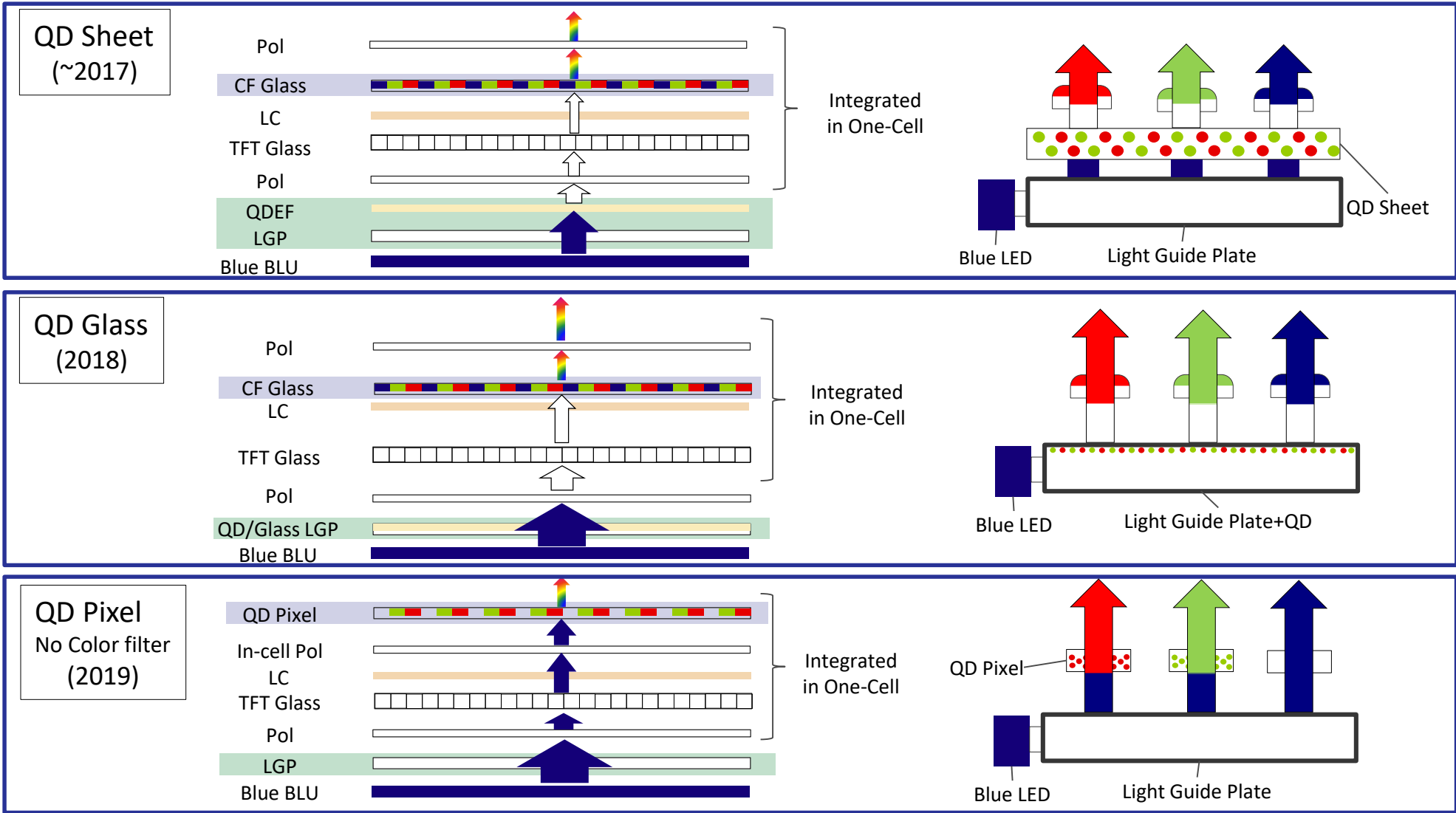
Quantum Dot (QD): various QD-LCD types, QLED practical application still some way off

	Quantum Dot LCD (PL)				QD(PL)+ OLED(EL)	QLED (EL)
	On-surface	On-edge	On-chip	QD-CF		
Form	Film	Tube	Chip	Integrate with CF	Integrate with CF	Thin film
Location	Between backlight and LCD cell	Entrance of LGP (within backlight unit)	On LED chip (within LED package)	Within color filter	Within color filter	Same as OLED
Merits	Easy to mount	Controls QD usage volume	Low QD usage volume	Higher permeability (high luminance/energy saving) Light emission from external light (UV) emits light	Higher permeability (high luminance/energy saving) Light emission from external light (UV) emits light	Printing process production a possibility? Mostly inorganic substances so stable
Issues/demerits	Highest QD usage, still expensive	Takes up bezel space in small/medium-sized displays	Needs to be heat resistant. Short life.	Still at R&D stage	Oxide substrates cost, blue's life and brightness, QDCF manufacture and prevention of optical dispersion	R&D stage Materials such as HIL, HTL, ETL, EIL still underdeveloped
Firms	3M "QDEF" (Nanosys), LMS "QLAS" (Nanosys), Dow chem.(Nanoco), Merck "ABEF" (Qlight Nanotech)	QD Vision "Color IQ"	Pacific Light Technologies, Quantum Materials	Samsung Display give up development	Samsung Display decide the investment in MP	-



Source: Mizuho Securities Equity Research

QD-LCD Technology Roadmap

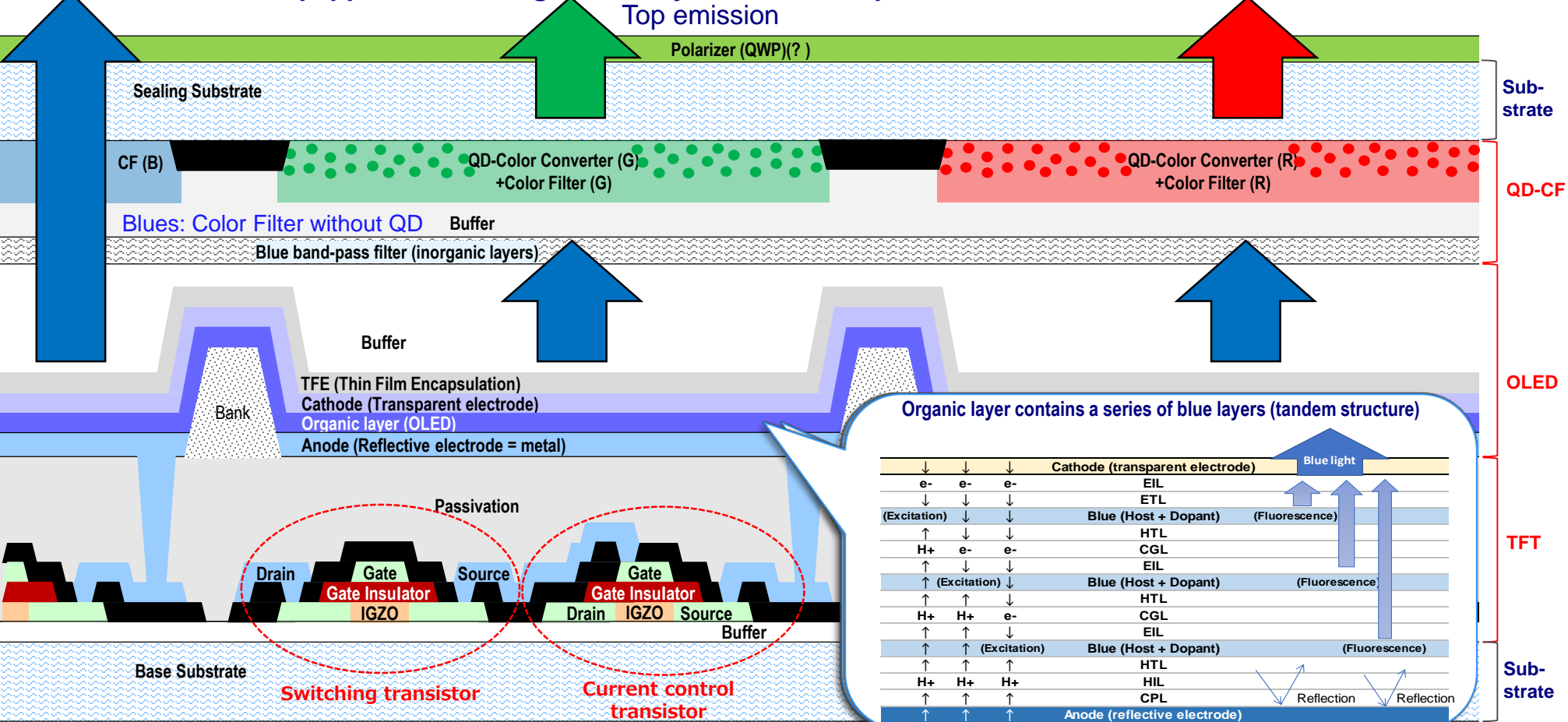


Source: Mizuho Securities Equity Research

Expected structure of Samsung Display's QD-OLED: Cross section diagram

Top emission model (light emitted from TFT substrate and out opposite side). OLED layer constructed of many blue layers (tandem structure). Reds and greens created through color filters. Color filters also work to reduce glare. Two glass layers (including on sealed side) (?). Is a black matrix needed? Isn't anti-glare (circulatory polarizing plates) needed?

⇒ Blue color filter is equipped to reduce glare. Likely to need band-pass filter, too.



Note: Conceptual diagram; actual structure may differ
 Source: Mizuho Securities Equity Research, based on US patent #9722001

JOLED: Outline

Company outline

- Formed from the merger of Sony and Panasonic's organic EL display panel development businesses (Jan 2015)
- The Innovation Network Corporation of Japan (INCJ) has a 54% stake in the company (Mizuho Securities estimates), with Denso 16%, CSOT Japan 11%, Toyota Tsusho 5%. Sumitomo Chemical, Sony, Panasonic and Screen Holdings have less than 3% stake.
- FY3/20 sales of ¥1.9b (FY3/19 sales of ¥1.4b), OP of ¥28.4b loss and NP of ¥37.3b loss. Total asset of ¥100.5b and net asset of ¥65.2b.

Organic EL panel production method

Vaporization method		Printing method
Samsung Display, JDI, LG Display	Firms	JOLED, CSOT, LG Display
Coated with vaporized luminescent materials	Characteristics	Coated with liquid luminescent materials
Smartphones	Applications	Tablets, Monitors and TVs
Compatible with high-resolution panel	Advantages	Lower cost as no need for vacuum unit
Installation of high cost vacuum unit	Challenges	High-resolution panel mass production technology ink technology that preserves luminescence properties

Performance and Looking ahead

- Start of prototype line at JDI's Ishikawa plant G4.5 in Aug. 2016**
 - Total investment of roughly ¥20b, first global production of medium-sized organic EL panels using printing technology
 - Working with JDI on luminescent material evaluation and production-related technology and sales
 - JDI announced in Dec. 2016 that they would buy some shares owned by INCJ and plan to subsidiary by 51% investment ratio, but put off the implementation again and again. Finally transferred shares to INCJ
 - Held an exhibition in May. 2017 and displayed panels for 21.6" monitor produced by printing method
- 2H 2018: Scheduled to start limited mass production**
 - Integrated production of 10-30" panels up to module stage using 4.5 generation LTPS substrates
 - Start mass production of 21.6": for high-end monitors incl. medical and graphic. Aiming for mid-sized panel such as automobile and PC in future
 - Expects to use oxide semiconductor TAOS (transparent amorphous oxide semiconductor; now in development). Also aiming for large-size TV panels
- 2019: Will construct G5.5 mass production line with ¥100b capital procurement (utilizing JDI's beautiful G5.5). Will test mid-size panel mass production and 55" panels. Plan of mass production with 20k/m. Mass production for a while in 2021.**
- 2021: targets mass production of 27/32" monitors(Rigid) and 14"-class automobile(Rigid).Planning to mass produce automotive Flex in near future.**
- June 2020: Joint development of panels for CSOT and TV, investment of ¥20b + ¥10b loan. Will start trial production of 65" 8K panel (circuitboard is TAOS). Based on this, CSOT may decide to invest in t8 mass production plant (G8.6) in Guangzhou.**

Source: Mizuho Securities Equity Research, based on company materials and media reports

Hon Hai Group's large-scale FPD strategy

- **SDP: Terry Gou's independent company (may sell at later stage) . Hon Hai to lead way for large FPDs. In 2017 the Hon Hai Group (Sharp/SDP)**
 - In 2017 the Hon Hai Group (Sharp/SDP) In 2017 the Hon Hai Group (Sharp/SDP) stopped supplying panels to Samsung VD, and has continued to focus on supporting Sharp brands, but revised its strategy for SH brand sales expansion after failure of "Sky Tiger" plan. Set to aggressively expand sales to LGE, Vizio, Xiaomi, Hisense, TCL, etc.
 - Changes in demand outlook: Sharp TV and aforementioned external sales alone will not fill SDP demand. Needs to pursue volume or there may be capacity surplus at Sakai + SIO Guangzhou.
 - INX's position: Large-scale panels + assembly of completed products. Support sales of SDP/ SIO Guangzhou panels according to Hon Hai's strategy.
 - SH's position: Brand + small/medium-sized panels (LTPS, IGZO, OLED)
 - Selling SDP to Sharp? : Shelved for now→Even if it is sold, actual power is likely to remain. In essence, Sharp chairman Tai Jeng-wu Dai will carry out "contract management".
- **Change in full-blown competition with Samsung Electronics(VD)!!!**
 - SDP & SIO Guangzhou: Start to supply panels again from 2020. Starting 55/65/70/75"shipments in 2021.
 - INS: Still keep supplying large amount of panels.
 - Expectations of Terry Gou and Samsung VD come into alignment: Like to use sufficient panel capacity of SDP/ SIO Guangzhou = want to increase VA suppliers other than Chinese ones.
- **Aggressive expansion in production capacity: Ramped up capex plans in China, the US, and India, but changes steadily taking place as strategies take concrete form**
 - Plans to invest in four plants originally used for G10.5 LCD (two in China, one in the US, one in India) Guangzhou mass production pushed back to 2Q 2020. In the US, was supposed to be stopping G10.5 and investing in G6 Oxide LCD plant (automotive, NB, etc.; led by Sharp) but called off? LCD module, die cast, memory plants also a possibility.
 - OLED: Sharp Sakai to carry out R&D/small-scale production (G4.5 only). Zheng Province OLED G6 will disappear too. After buying JDI's Ishikawa D3 plant, could also expand in OLED market in the future.
 - Core reasons behind expansion in non-Chinese bases: Hon Hai may become less likely to receive support from Chinese regional governments due to efforts to boost competition from Chinese companies in FPDs and brand businesses. Hon Hai itself still focused on China, but for the group as a whole, must locate new sites in consumer markets such as the US and India. Sharp to also play a vital role in acquiring or establishing alliances with other Japanese companies (particularly firms related to automation, robotics).

Hon Hai & Sharp: better to separate roles in components/products business

■ Why Sharp?: Japanese firm has the technology and businesses to drive further growth at the Hon Hai Group

- Hon Hai Group: Cash rich, with 2019 FCF of 5.9b USD. Electronics Manufacturing Services (EMS) business active in almost all possible markets, including games, telecommunications equipment, tablets. Smartphones, TVs, and PCs. Samsung, LGE and some Chinese brands focusing on in-house production, and limited growth of Hon Hai.
- Requirements for future growth: Only two possible routes: 1) improved sales per unit among existing customers and products (moving into electric equipment components); and 2) expanding operations and entering new areas of business, including retail services, telecom services, medical equipment, automobiles, automation, and robotics. Sharp's displays and camera modules can contribute to the former, while its home appliances and copier operations can contribute to the latter.
- Key for the future: It hinges on the management led by CEO Tai and COO Nomura. How will the company be able to stem outflow of human resources? Ideal structure would be: products business is managed by Sharp itself (from design to sale), components business is mainly manufactured by Sharp, while Hon Hai Group handles sales and marketing.
- Requirements for an earnings recovery: Recovery in ability to generate OP of ¥100b through stronger management and fixed cost reductions. However, reviewing its business portfolio, organizational structure, and production facilities is still required.
- Expanding sales: There's a limit to fixed cost reductions; needs significant sales increase from accelerated investments in each field. The companies are increasing production at existing firms and expanding sales by utilizing Hon Hai's sales channels for both products such as TVs and white goods, and components such as displays and semiconductors. However, we think it would be better to conduct separate management of products and components. Regardless of finished products such as TV and white goods, parts such as displays and semiconductors, increase production at existing factories and sales expansion using Hon Hai's sales channel will be conducted, but as stated above, different management methods for finished products and parts are desirable
- Displays: Plants likely to be reduced to Kameyama No. 1 facility (LTPS), Kameyama No. 2 Facility (Oxide), SDP/SIO Guangzhou (A-Si). Planned to invest in mass production plant (¥124b/50K for G6/mass production in 2019) after Sakai Flex OLED (about ¥48b/G4.5) but has been effectively derailed. After buying JDI's D3 plant, might it conceivably expand into OLED or μ LED with JDI or another company? Kameyama 1 to make LTPS for iPhone/automotive. Kameyama 2 to focus on Oxide LCD for tablets, PCs, MNT, etc. What will it do about SDP?
- B-to-C brands (TVs, mobile phones, white goods): Will this be managed by Hon Hai? There is some degree of difficulty in providing after-sales service, interacting with distribution clients, managing inventory, and branding. HonHai should specialize in designing mechanisms, procuring, manufacturing, and supporting logistics, etc., and Sharp should handle upstream development/planning/design and sales marketing.
- B-to-B business: The copier business is attractive, but is also difficult to manage. Company could recover some funds invested through its sale. Difficult to maintain solar power, semiconductor, and LED operations as they currently stand. Semiconductor business hopes to open China plant.
- Camera modules: focus on how company handles this area. Investing in automation at plant in Vietnam (including for Deal Cameras), with a possible aim to again improve share among AAPL suppliers. How to bring together Sharp's development capacity and Vietnam plants (high share for iPhone Dual Cam), Kantatsu's lens development ability (supplies some iPhone applications), Hon Hai Group's China plants (iPhone FrontCam) and group company resources?

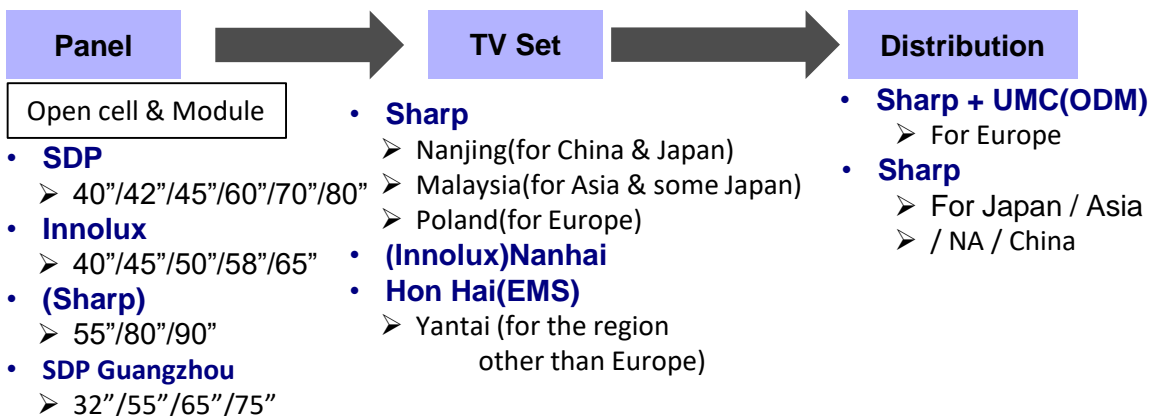
“Skytiger plan” → Revisions to plan due to widening losses, panel production capacity surplus

Overview of “Skytiger plan” → Plan suspended/retracted

- ❑ **Hon Hai to take over retailing all China-made Sharp TVs**
 - Channels include big-box stores, e-commerce, Hon Hai real estate business
- ❑ **Hon Hai takes on inventory risk in China (total losses of over ¥100b)**
 - Could see higher utilization rates for Sharp assembly plants
 - Sales growth achieved through lower prices has hit a wall, changed strategy from quantity to quality
 - Panel production capacity at SDP+Guangzhou is surplus due to the control TV sales expansion



Product flow: from components to products to retail



TV sales — results and forecasts —

(M units)	FY16	FY17	FY18	FY19 Mizuho E	FY20 Mizuho E
Total	5.4	9.2	7.0	6.0	6.4
Japan	1.7	1.5	1.6	1.5	1.7
N. America	0	0	0	0.0	0.0
Europe	0.2	1.6	1.6	1.6	1.5
China	2.0	3.9	1.4	0.7	0.7
Others	1.7	2.2	2.4	2.2	2.5

- ✓ EU expansion on UMC acquisition
- ✓ Big increases in China from “Skytiger plan”, but plan retracted due to increase in losses
- ✓ In North America company will co-exist with Hisense, the current licensee through 2020.

Reference — Sharp TV sales prices in China (the lowest prices) —

Size (inch)	17/10 (RMB)	18/02 (RMB)	18/04 (RMB)	18/07 (RMB)	18/10 (RMB)	19/01 (RMB)	19/3 (RMB)	19/8 (RMB)	20/1 (RMB)
40	1,556	1,487	1,444	1,415	1,499	1,499	1,535	1,549	1,198
45	1,832	1,479	1,440	1,398	2,049	1,599	1,886	1,479	1,499
50	2,350	1,600	2,099	1,822	2,399	2,349	2,278	2,249	1,969
60	3,974	3,017	2,455	2,362	2,598	3,388	3,277	2,879	1,999
65	6,299	4,999	5,199	4,588	4,799	4,958	5,999	6,699	5,849
70	6,389	5,657	4,545	4,012	5,799	5,966	5,630	5,499	4,899

Source: Mizuho Securities Equity Research from company data

LG Display – Earnings Trend(upper:full year, lower:quarter)

LG DISPLAY CO LT

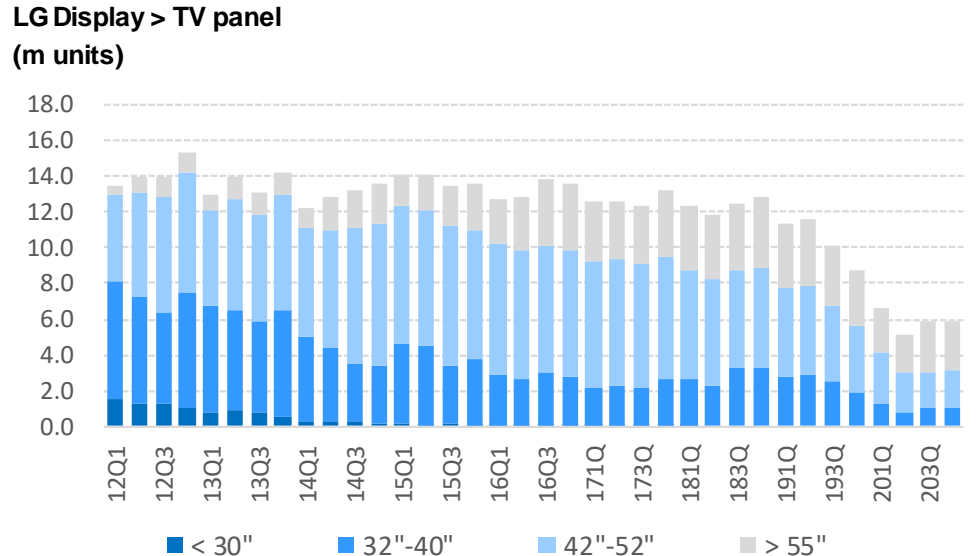
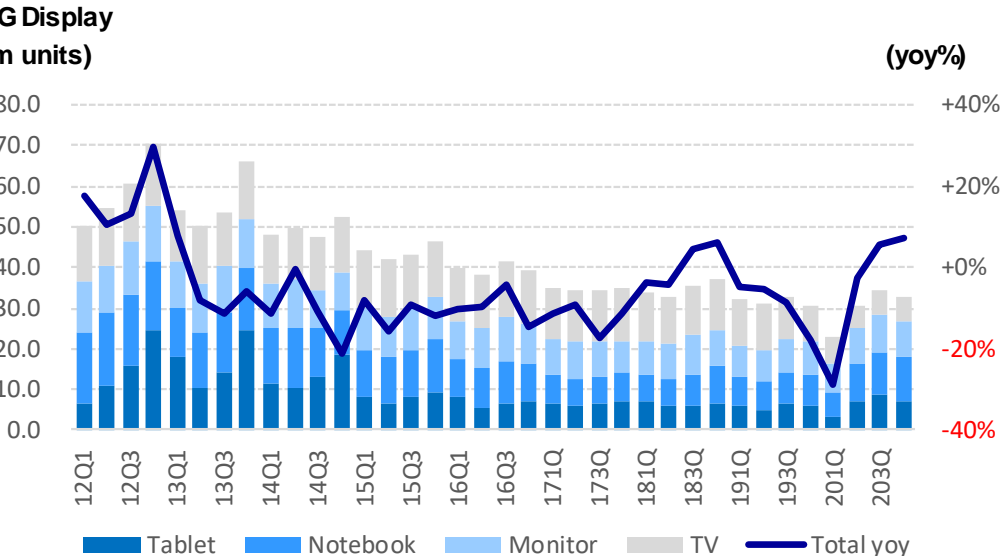
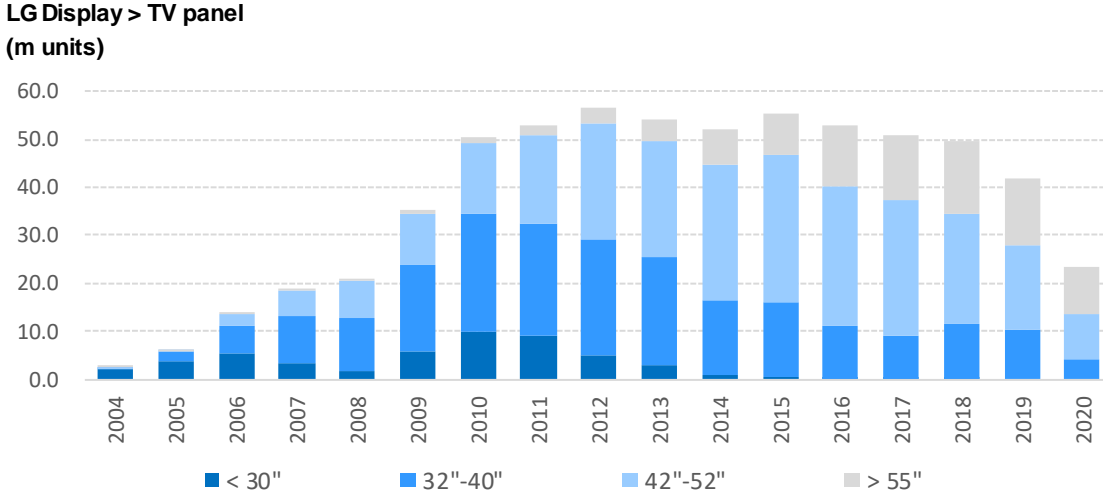
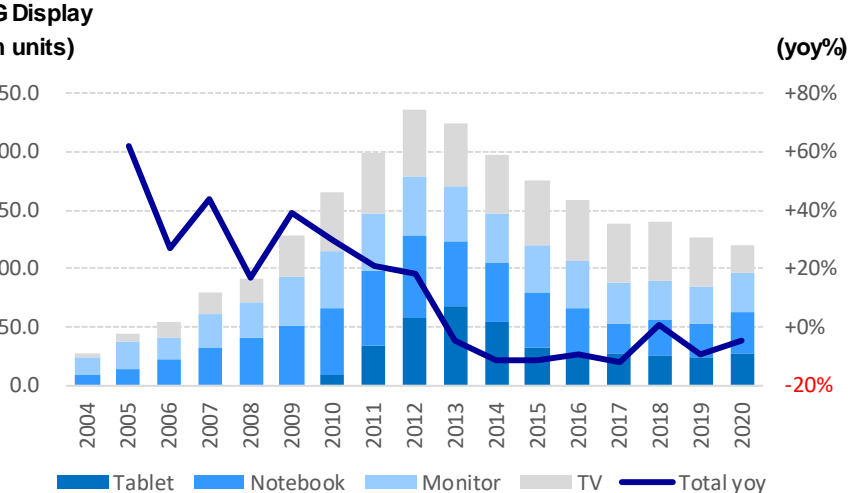
	FY09/12	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12	FY20/12
Sales	15,792	22,073	21,947	26,140	24,708	25,136	25,095	22,855	24,590	22,126	20,151	20,573
(Seq%)	+5%	+40%	-1%	+19%	-5%	+2%	-0%	-9%	+8%	-10%	-9%	+2%
Gross profit	2,018	3,228	1,093	2,669	3,207	3,599	3,814	3,234	4,748	2,805	1,604	2,244
(Gross margin)	12.8%	14.6%	5.0%	10.2%	13.0%	14.3%	15.2%	14.1%	19.3%	12.7%	8.0%	10.9%
Operating profit	879	1,461	-690	811	1,064	1,290	1,437	1,131	2,178	84	-1,167	-25
(Operating margin)	5.6%	6.6%	-3.1%	3.1%	4.3%	5.1%	5.7%	4.9%	8.9%	0.4%	-5.8%	-0.1%
Net profit	881	1,000	-697	207	389	859	855	782	1,595	-188	-2,429	-76
ROE	11.6%	11.0%	-7.3%	2.3%	4.1%	8.2%	8.2%	7.2%	13.2%	-1.5%	-22.4%	-0.8%
Oper_CF	3,274	4,255	3,318	4,059	3,290	2,723	2,433	3,191	5,993	4,082	2,330	1,949
Invest_CF	-3,598	-3,936	-3,163	-3,276	-4,130	-3,280	-2,438	-2,802	-5,742	-6,983	-5,805	-1,976
Fin_CF	-98	385	-257	-54	-363	432	-117	306	673	2,685	4,309	776
FCF	309	-22	-353	531	115	-111	342	-30	160	-3,139	-3,616	-262
EBITDA	3,119	3,992	2,609	4,781	4,568	4,608	4,422	3,736	5,023	3,316	2,005	3,486
(EBITDA margin)	19.8%	18.1%	11.9%	18.3%	18.5%	18.3%	17.6%	16.3%	20.4%	15.0%	9.9%	16.9%
Dep&Amot	2,240	2,531	3,299	3,970	3,505	3,318	2,985	2,606	2,844	3,232	3,172	3,511
R&D	881	967	1,187	1,219	1,531	1,698	1,368	1,227	1,692	1,877	1,525	933
Inventory	1,440	1,968	2,000	2,247	1,836	2,520	2,000	1,894	2,202	2,417	1,776	1,994
(days)	27	28	33	30	30	32	33	31	30	38	38	33
Net debt to equity ratio	0.26	0.27	0.30	0.21	0.27	0.29	0.28	0.25	0.21	0.44	0.90	0.87
Net assets	8,670	9,827	8,742	9,626	10,255	10,780	10,805	11,144	14,036	13,369	10,813	11,698
Liabilities	8,345	11,369	12,972	13,363	10,370	10,231	8,396	9,455	13,284	16,425	19,989	20,513
Assets	17,014	21,196	21,714	22,990	20,625	21,011	19,200	20,600	27,320	29,794	30,801	32,211

LG DISPLAY CO LT

	18/6	18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9	20/12
Sales	5,194	5,442	6,161	5,224	4,591	4,876	5,464	3,962	4,352	5,672	6,678
(Seq%)	-2%	+5%	+13%	-15%	-12%	+6%	+12%	-27%	+10%	+30%	+18%
Gross profit	432	793	1,053	562	413	253	385	233	105	712	1,245
(Gross margin)	8.3%	14.6%	17.1%	10.8%	9.0%	5.2%	7.0%	5.9%	2.4%	12.5%	18.6%
Operating profit	-211	125	248	-117	-316	-366	-359	-304	-424	138	613
(Operating margin)	-4.1%	2.3%	4.0%	-2.2%	-6.9%	-7.5%	-6.6%	-7.7%	-9.7%	2.4%	9.2%
Net profit	-275	3	130	-54	-470	-351	-1,532	-167	-401	26	509

Source: Compiled by Mizuho Securities Equity Research from Bloomberg

LG Display – Large-size panel shipment volume

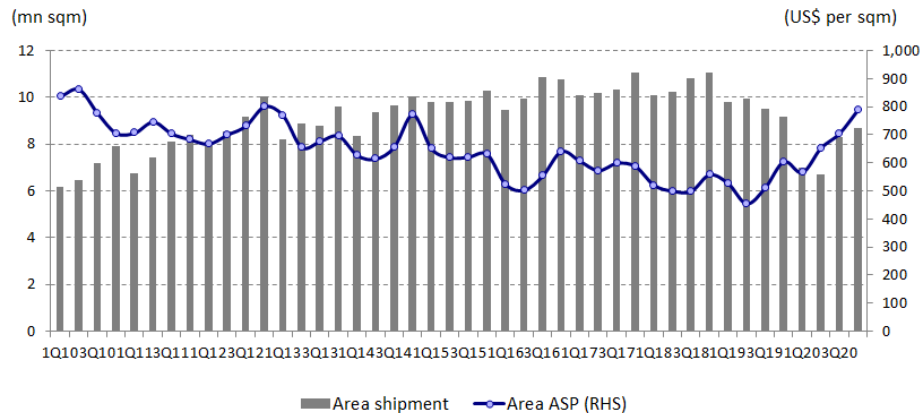


Source: Mizuho Securities Equity Research from company data

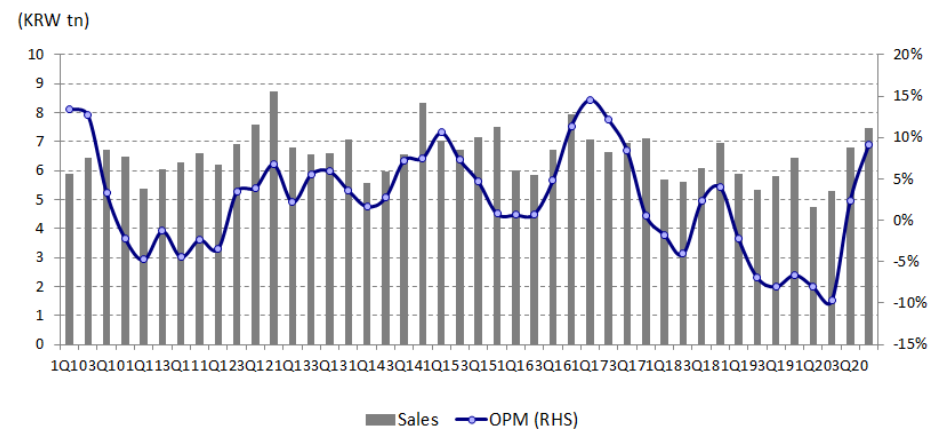
LG Display: Key takeaways from 4Q20 earnings result

- **LGD posted strong earnings growth in 4Q20, driven by solid shipment growth and ongoing ASP expansion**
 - ✓ LGD reported 4Q20 earnings with revenue of KRW7.5tn (up16% YoY and up 11% QoQ) with OP of KRW685bn, which surprised on the upside. For 4Q20, LGD's area shipment increased another 5% QoQ (followed by +23% QoQ in 3Q20) with stronger LCD demand recovery as well as OLED capacity ramping up at the CO fab while its area ASP inclined by 12% QoQ to US\$790 per sqm with rebounding LCD panel pricing as well as increase in OLED TV.
 - ✓ In light of substantial increase in sales, LGD was able to enhance its profitability in 4Q20. For 4Q20, LGD posted GPM of 19% (up 6.1ppt QoQ) and OPM of 9% (up 6.8ppt QoQ). On the other hand, LGD's EBITDA margin increased to 24% in 4Q20 from 19% in 3Q20, mainly due to strong volume growth and ASP enhancement.
- ✓ **Pro-active expansion of large OLED sales through 2021**
 - ✓ LGD shipped OLED TV units of 4.3mn in 2020, which is fairly lower than its original guidance of 6mn at the beginning of 2020. Despite ongoing losses in its OLED TV business in the near term, we believe LGD will continue to cut prices for its existing clients including LGE, Sony, Panasonic, Skyworth, and Sharp to ensure it has enough demand to produce 7m–8m units in 2021, facing intensifying competition from QLED and mini-LED TVs. In the mid/long-term, we believe LGD will focus on the mid-sized market (i.e. 48" and below, 4K or FHD) in light of structural difficulties in achieving 8K resolutions and increasing brightness.

LGD's shipment and ASP trend



LGD's revenue and OPM trend



Source: Compiled by Mizuho Securities Equity Research from company data

LG Display: Revenue trend analysis

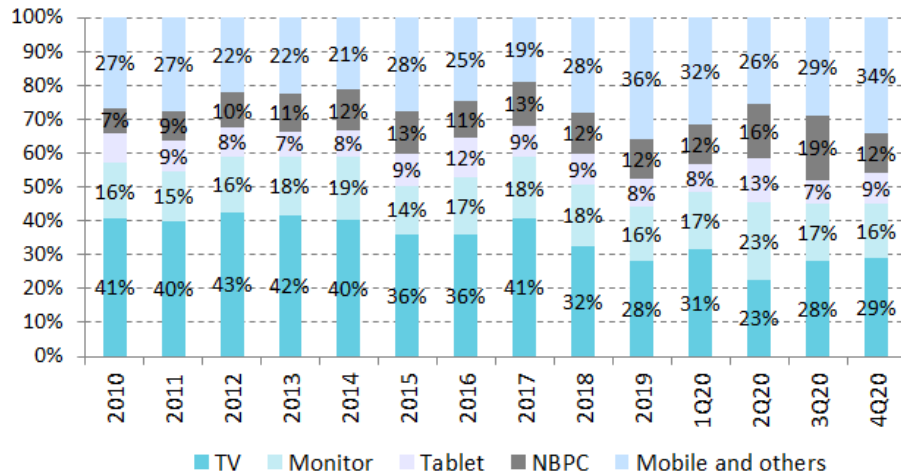
➤ LGD's revenue mix trend by applications

- ✓ LGD's TV revenue portion sharply declined from 2010 to 2016, as a consequence of dramatic increase in revenue contribution from mobile applications. In light of gradually increasing OLED TV sales, TV revenue portion in its sales rebounded for 2017 and 2018. However, we expect its TV sales portion to sharply decrease again for the next couple of years as a consequence of sizable restructuring expected in its LCD TV business.
- ✓ Within LGD's revenue, TV portion slightly increased to 29% in 4Q20 from 28% in 3Q20 along with the CO fab ramp-up and LCD panel price recovery. As of 4Q20, monitor, NBPC, and tablet accounted for 16%, 12%, and 9%, respectively.

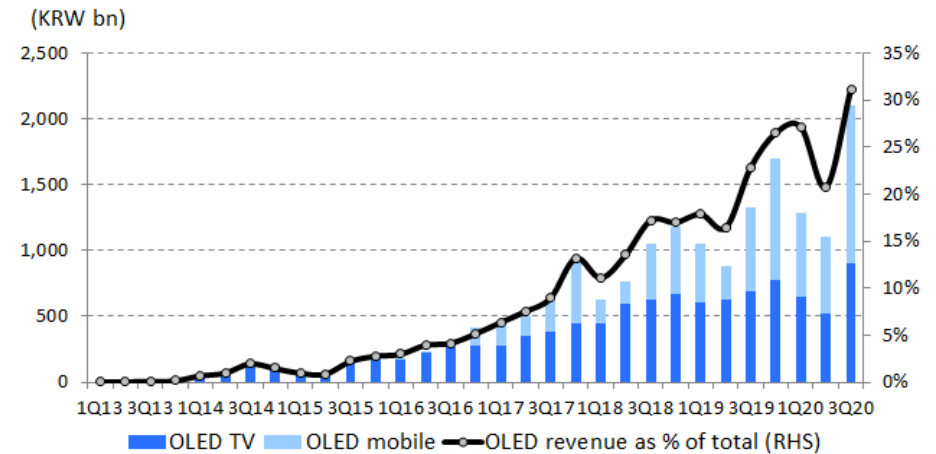
➤ LGD's revenue mix trend by products

- ✓ We anticipate that revenue contribution from OLED will keep increasing rapidly for the next couple of years as a result of: 1) further ramp up of OLED capacity in the CO fab; and 2) dramatic reduction in LCD TV capacity with restructuring program. Along with capacity ramp-up of OLED TV (60K at the CO fab) and P-OLED (additional 15K at E6), OLED's contribution in LGD's revenue sharply increased to 42% in 4Q20 from 31% in 3Q20.

LGD's revenue mix by applications



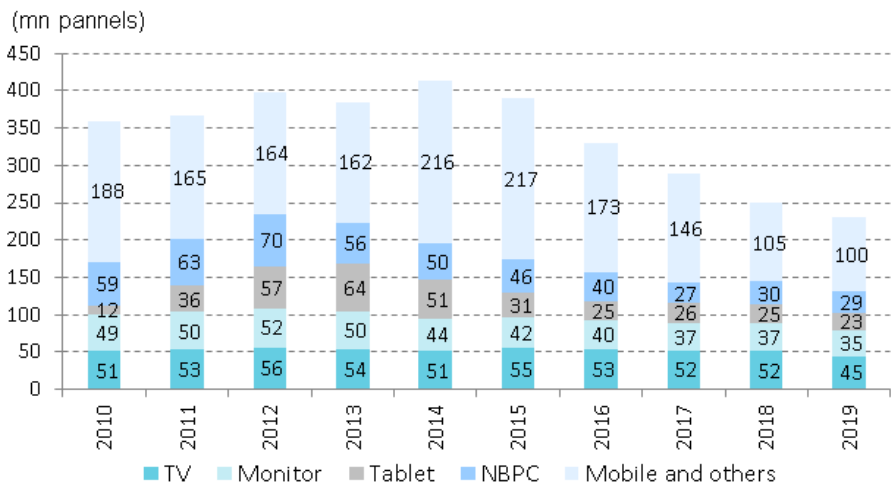
LGD's OLED revenue trends



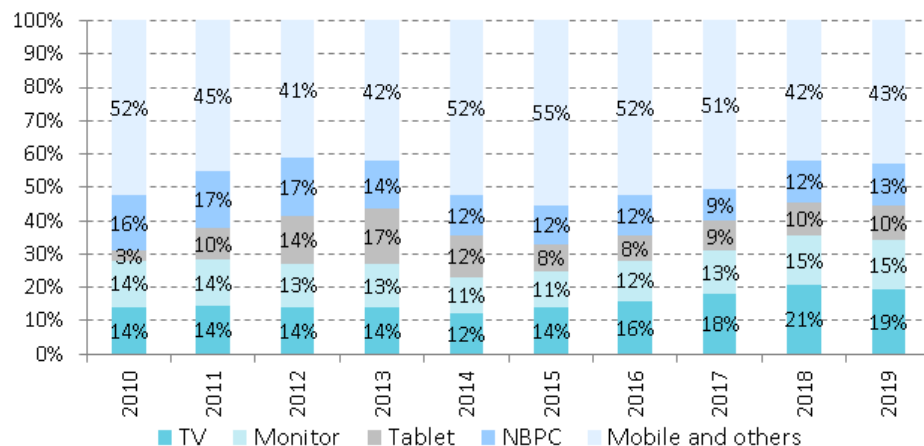
Source: Compiled by Mizuho Securities Equity Research from company data

LG Display: Revenue trend analysis

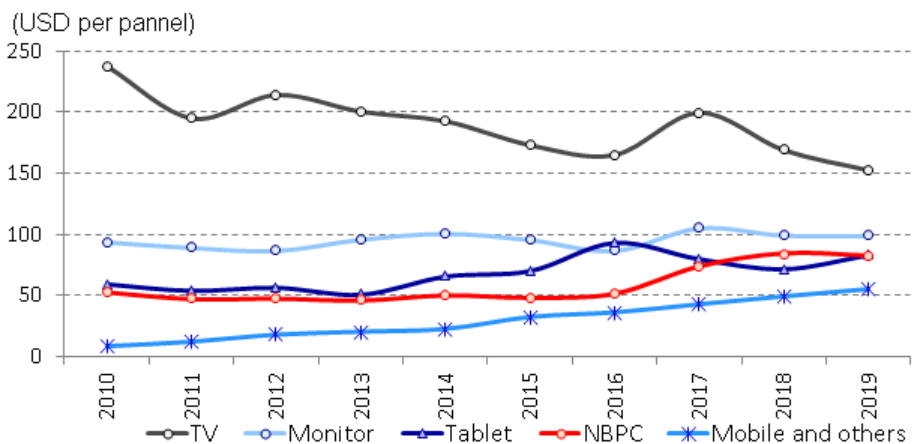
LGD's panel shipment trend by applications



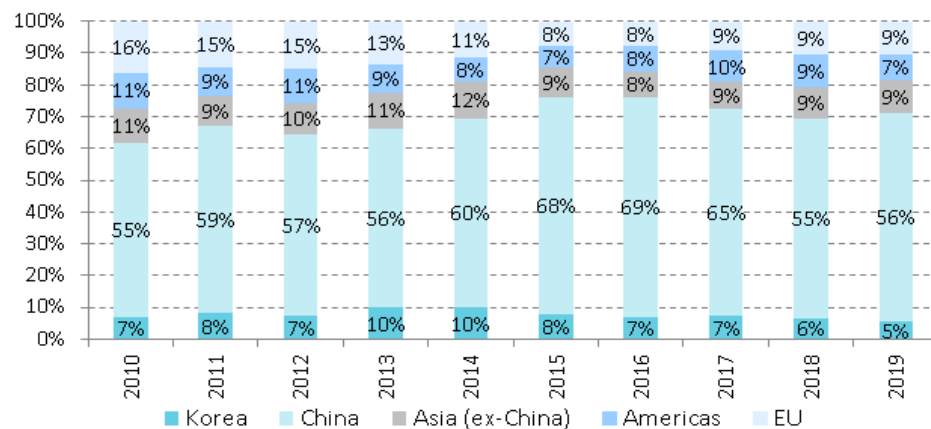
LGD's panel shipment mix trend by applications



LGD's panel ASP trend by applications



LGD's revenue mix trend by regions



Source: Compiled by Mizuho Securities Equity Research from company data

LG Display: Cost trend analysis

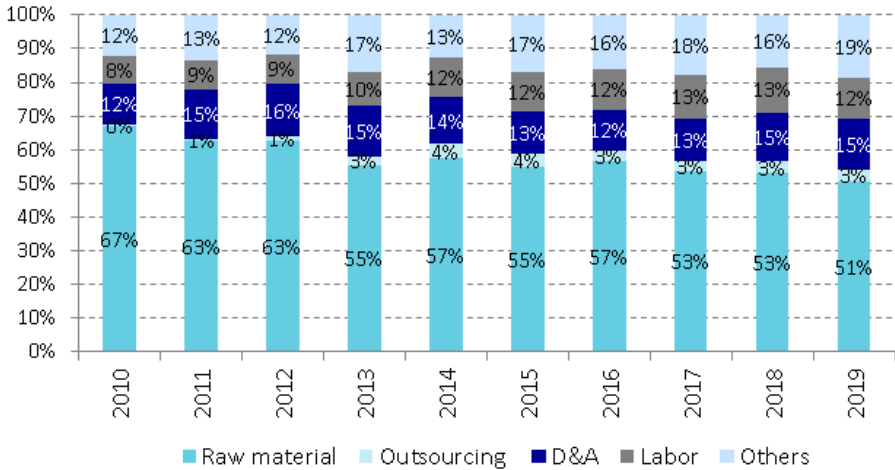
➤ LGD's operating cost mix trend

- ✓ LGD has been lowering raw material cost portion since 2010, chiefly in light of ongoing efforts in cost reductions from raw material supply chains as well as increase in OLED sales contribution.
- ✓ In 2019, LGD booked impairment cost of KRW1.6tn for small-mid OLED panel (KRW1.4tn) and OLED lighting (KRW0.2tn). Although LGD's P-OLED can lower annual depreciation burden by KRW300-400bn for the next 4-5 years in light of the impairment cost, we do not expect LGD's P-OLED business to turnaround in 2020 given its small scale.

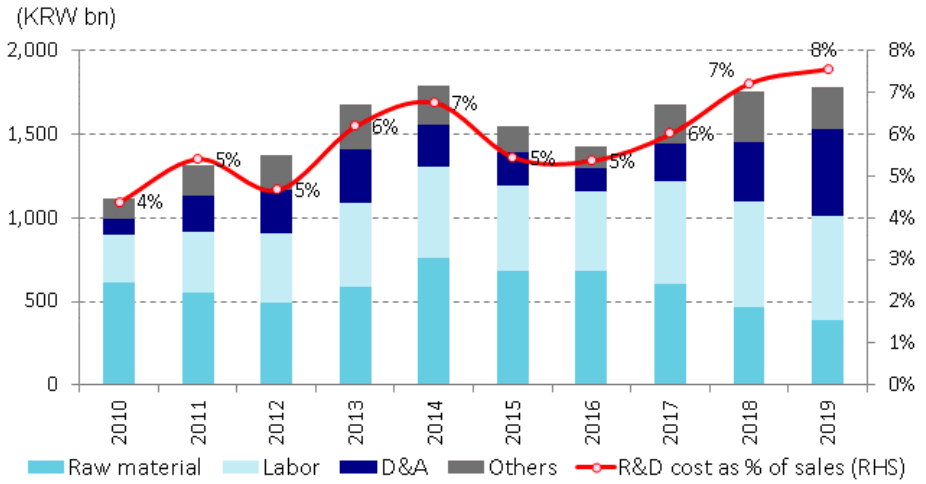
➤ LGD's R&D cost trend

- ✓ Despite challenging business environment, LGD continues to increase R&D costs in order to prepare future growth opportunity in OLED and new applications including automotive and public display.
- ✓ For 2019, LGD spent R&D cost of KRW1.8tn, which accounted for 7.6% of sales for the period. In terms of R&D cost mix, raw material expense represented 22% while labor cost and D&A cost accounted for 35% and 29%, respectively, for 2019.

LGD's operating cost breakdown trend



LGD's R&D cost trend



Source: Compiled by Mizuho Securities Equity Research from company data

LG Display: Employee trend analysis

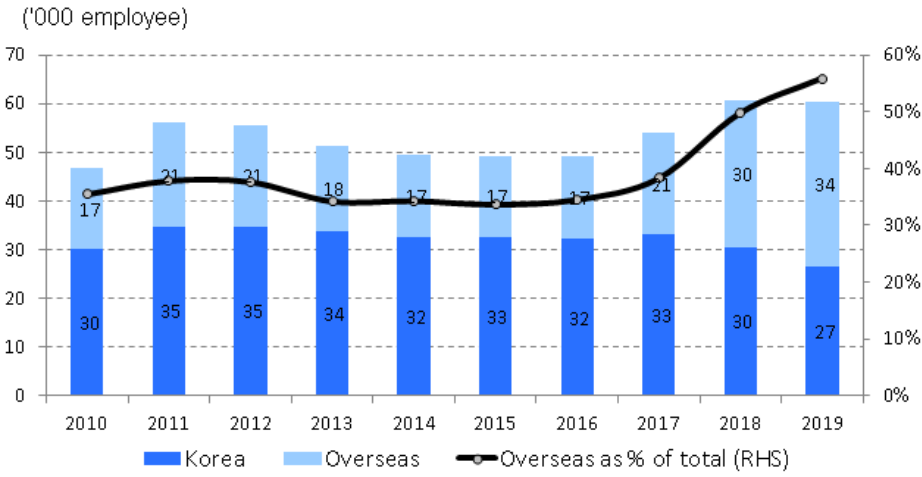
➤ LGD's employee trend by region

- ✓ Despite restructuring in Korea, LGD's number of employee slightly decreased to 60,429 in 2019 from 60,615 in 2018, as a consequence of increase in overseas employee.
- ✓ In terms of regional mix for LGD's employee, its domestic employee decreased by around 3,800 while the number of overseas employee increased by 3,600, especially in China, for 2019.

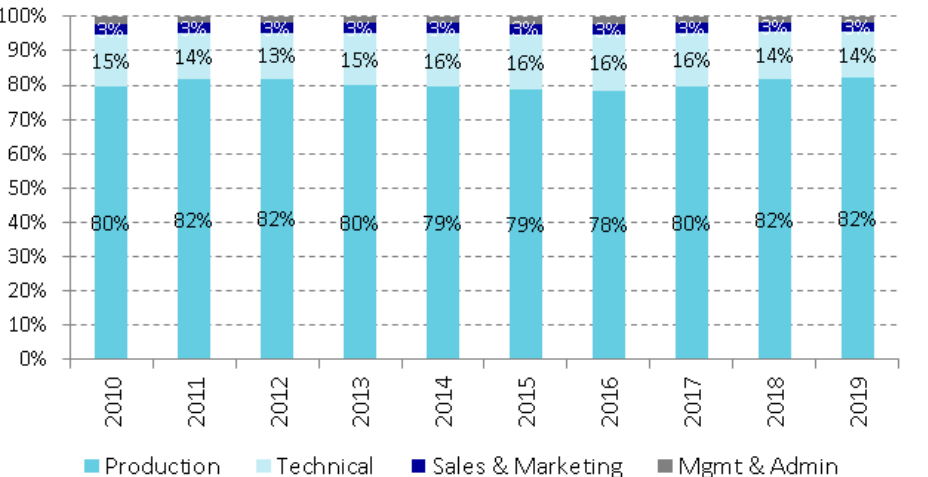
➤ LGD's employee trend by job function

- ✓ As of 2019, around 49.6 thousand workers are involved in production, representing 82% of total employee, while technical and sales and marketing accounted for 14% and 3%, respectively.
- ✓ LGD halted G8 LCD production at the end of 2019 and the company intends to halt G7 LCD production sometime during 2020. In this regard, we expect LGD's domestic employee will continue to decrease while overseas employee will likely increase in 2020 along with capacity ramp up at its new Guangzhou plant.

LGD's employee trend by region



LGD's employee trend by job function



Source: Compiled by Mizuho Securities Equity Research from company data

LG Display: FCF and balance sheet trend analysis

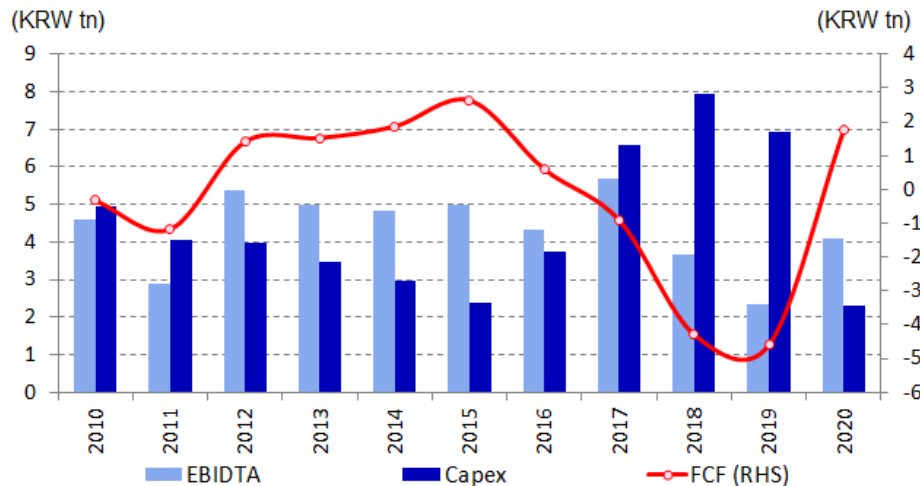
➤ LGD's EBITDA/Capex/FCF trend

- ✓ LGD has significantly increased its capex spending since 2017, mainly for OLED capacity expansion. For 2020, LGD lowered its annual capex amount further to KRW2.3tn (even lower than its previous guidance of from KRW2.7-2.8tn), which can be mostly attributable to its efforts to minimize capex.
- ✓ Meanwhile, LGD's EBITDA started to decline rapidly from 2018 due to worsening profitability along with further pricing pressure from structural oversupply in the LCD industry.
- ✓ For 2018-2019, LGD's accumulated FCF reached KRW8.9tn as a consequence of increasing capex together with decreasing EBITDA. In 2020, LGD was able to post positive FCF of KRW1.8tn, in light of dips in capex.

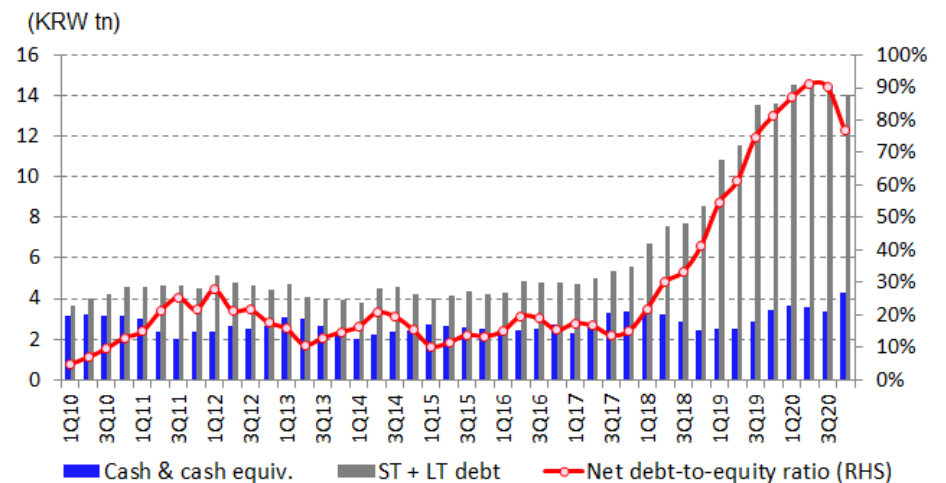
➤ LGD's cash/debt/net debt-to equity ratio trend

- ✓ Although LGD maintained healthy balance sheet until 2017 in light of relatively stable FCF trends, its balance sheet has deteriorated substantially since 2018 due to sharp increase in debt amount along with negative FCF.
- ✓ As of 4Q20, LGD has cash & cash equivalent of KRW4.3tn with total debt amount of KRW14.1tn, which can translate into net debt-to-equity ratio of 77% (improved from 91% at 2Q20).

LGD's EBITDA/Capex/FCF trend



LGD's net debt-to equity ratio trend



Source: Compiled by Mizuho Securities Equity Research from company data

AU Optronics – Earnings Trend(upper : full year, lower : quarter)

AU OPTRONICS COR

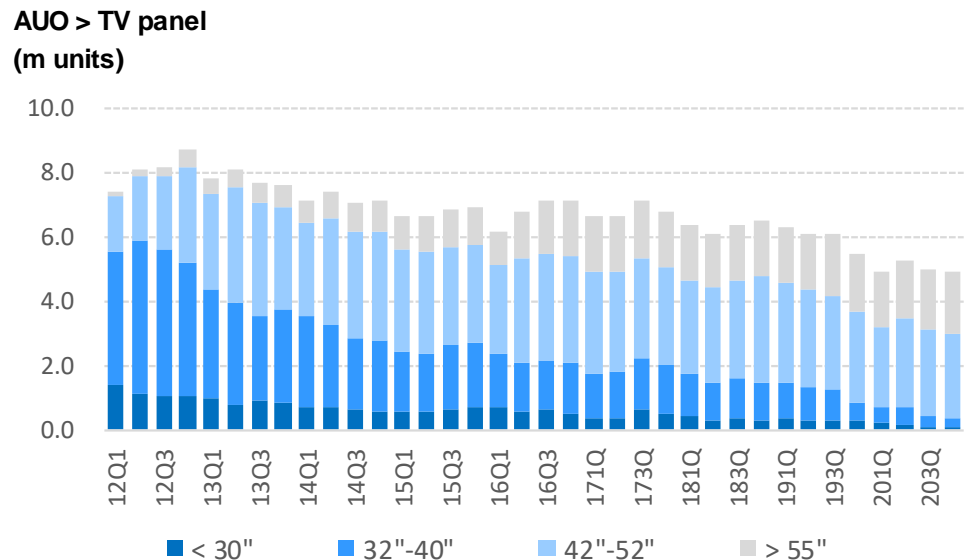
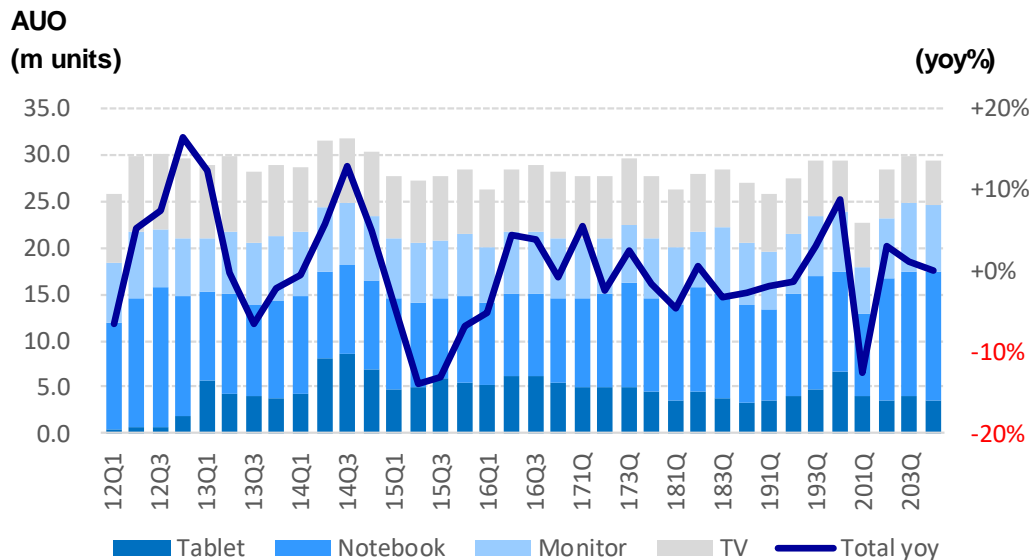
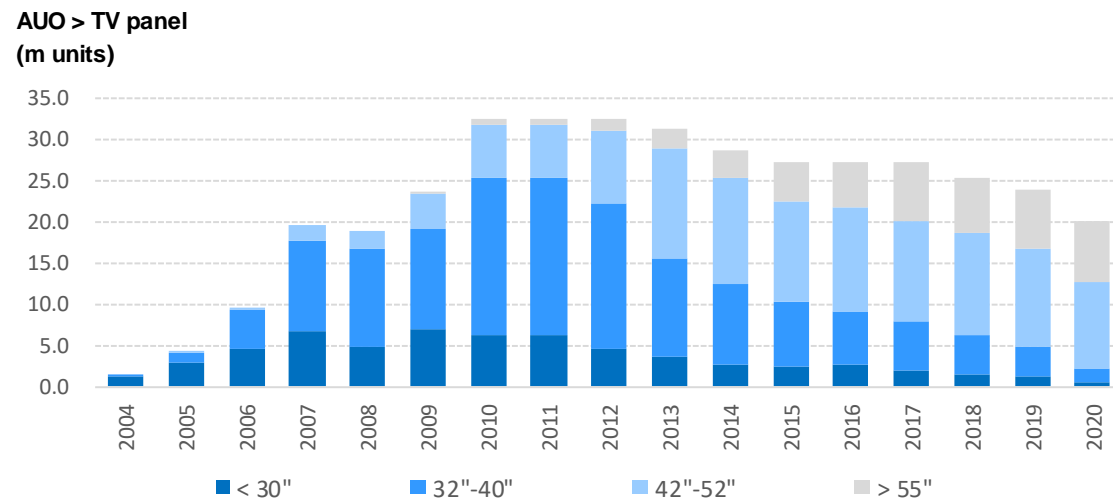
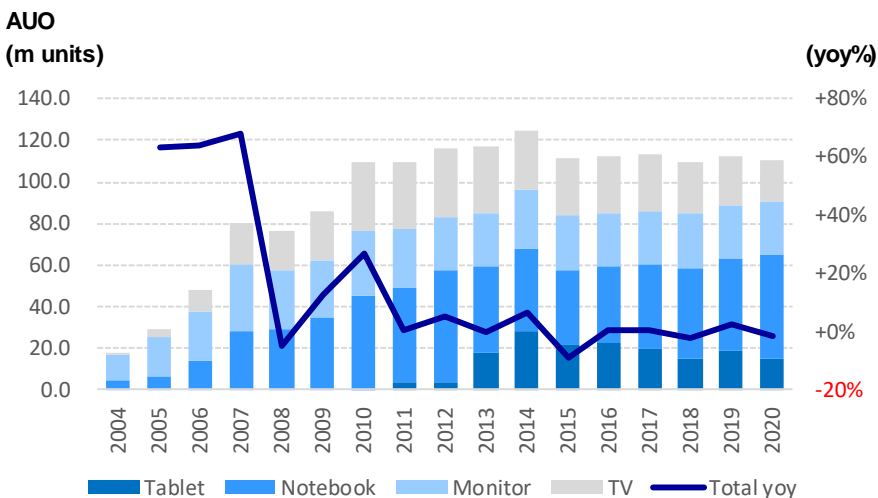
	FY09/12	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12	FY20/12
Sales	10,883	14,845	12,920	12,799	14,025	13,466	11,351	10,213	11,211	10,210	8,701	9,203
(Seq%)	-19%	+36%	-13%	-1%	+10%	-4%	-16%	-10%	+10%	-9%	-15%	+6%
Gross profit	213	1,153	-959	-444	1,145	1,600	1,255	1,070	2,007	934	15	773
(Gross margin)	2.0%	7.8%	-7.4%	-3.5%	8.2%	11.9%	11.1%	10.5%	17.9%	9.1%	0.2%	8.4%
Operating profit	-462	334	-1,962	-1,306	279	731	552	383	1,287	221	-663	71
(Operating margin)	-4.2%	2.2%	-15.2%	-10.2%	2.0%	5.4%	4.9%	3.7%	11.5%	2.2%	-7.6%	0.8%
Net profit	-811	213	-2,085	-1,851	141	582	155	243	1,064	337	-621	115
ROE	-9.7%	2.5%	-25.9%	-31.0%	2.7%	10.2%	2.7%	4.3%	16.6%	4.9%	-10.1%	1.9%
Oper_CF	1,728	2,883	494	1,209	1,672	2,091	1,953	1,139	2,773	1,334	671	874
Invest_CF	-2,043	-2,712	-1,971	-1,460	-782	-432	-1,000	-1,312	-1,436	-1,145	-910	-601
Fin_CF	376	-43	1,522	-202	-901	-1,472	-1,051	214	-522	-1,379	604	61
FCF	-121	194	-1,443	-256	815	1,531	900	-296	1,331	180	-285	345
EBITDA	2,234	3,139	1,024	1,240	2,423	2,608	2,056	1,615	2,484	1,357	511	1,273
(EBITDA margin)	20.5%	21.1%	7.9%	9.7%	17.3%	19.4%	18.1%	15.8%	22.2%	13.3%	5.9%	13.8%
Dep&Amot	2,696	2,805	2,986	2,545	2,143	1,877	1,504	1,232	1,198	1,136	1,174	1,202
R&D	187	204	293	335	287	302	280	282	324	317	318	349
Inventory	1,227	1,529	1,581	1,467	1,261	1,152	966	854	838	860	784	952
(days)	33	34	44	43	35	33	34	33	28	30	34	34
Net debt to equity ratio	0.37	0.34	0.68	0.99	0.66	0.34	0.17	0.25	0.04	0.09	0.25	0.20
Net assets	8,595	9,683	7,306	5,562	5,981	6,337	6,217	6,163	7,592	7,099	6,285	6,898
Liabilities	10,871	11,901	12,926	13,117	10,527	8,523	6,712	7,104	7,287	6,291	7,009	7,599
Assets	19,466	21,584	20,232	18,679	16,509	14,860	12,928	13,267	14,879	13,390	13,294	14,497

AU OPTRONICS COR

	18/6	18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9	20/12
Sales	2,520	2,643	2,500	2,164	2,252	2,247	2,033	1,783	2,124	2,492	2,868
(Seq%)	-1%	+5%	-5%	-13%	+4%	-0%	-10%	-12%	+19%	+17%	+15%
Gross profit	244	282	132	8	64	-9	-49	-12	57	264	486
(Gross margin)	9.7%	10.7%	5.3%	0.4%	2.8%	-0.4%	-2.4%	-0.7%	2.7%	10.6%	16.9%
Operating profit	71	100	-47	-165	-110	-174	-214	-181	-114	90	295
(Operating margin)	2.8%	3.8%	-1.9%	-7.6%	-4.9%	-7.8%	-10.5%	-10.1%	-5.4%	3.6%	10.3%
Net profit	42	141	9	-120	-86	-128	-290	-166	-99	98	296

Source: Mizuho Securities Equity Research from Bloomberg

AU Optronics – Large-size panel shipment volume



Source: Mizuho Securities Equity Research from company data

Innolux – Earnings Trend(upper : full year, lower : quarter)

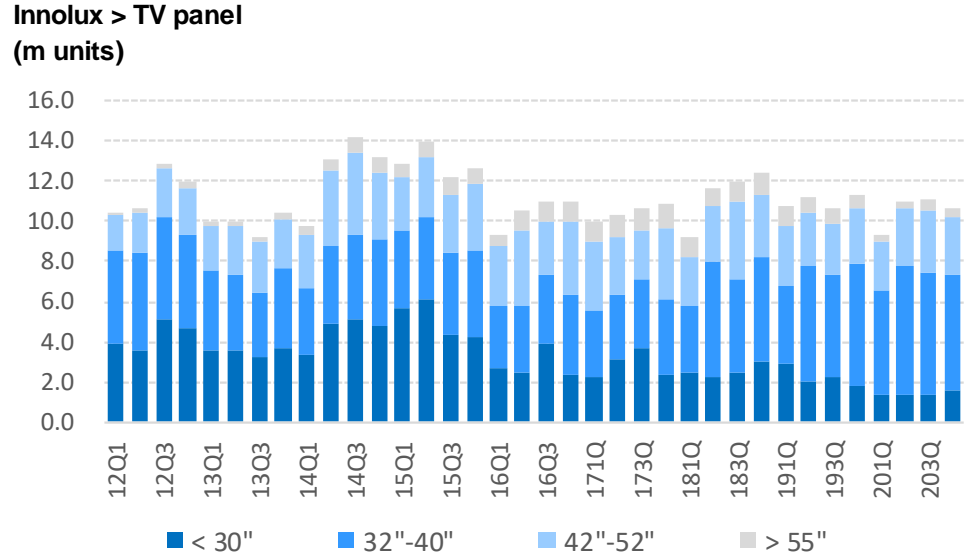
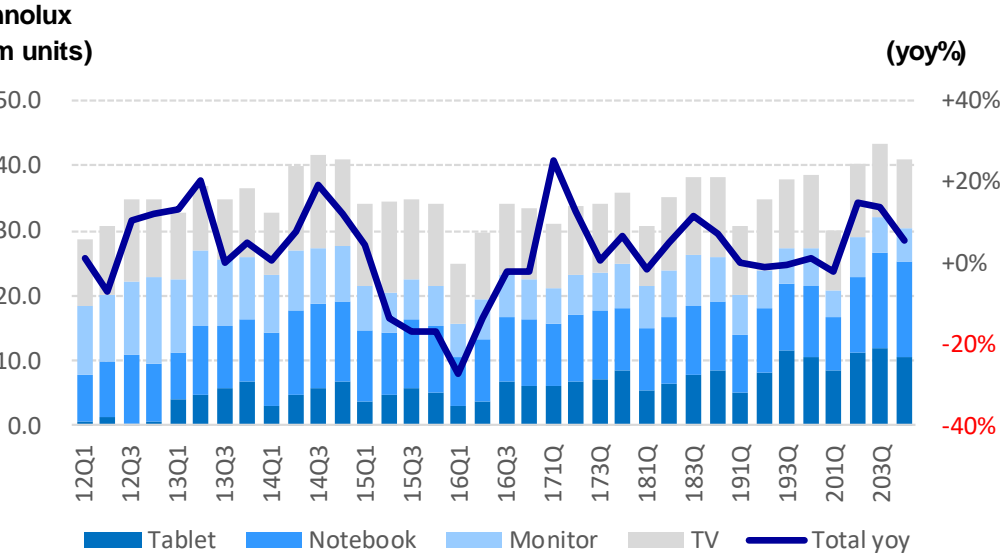
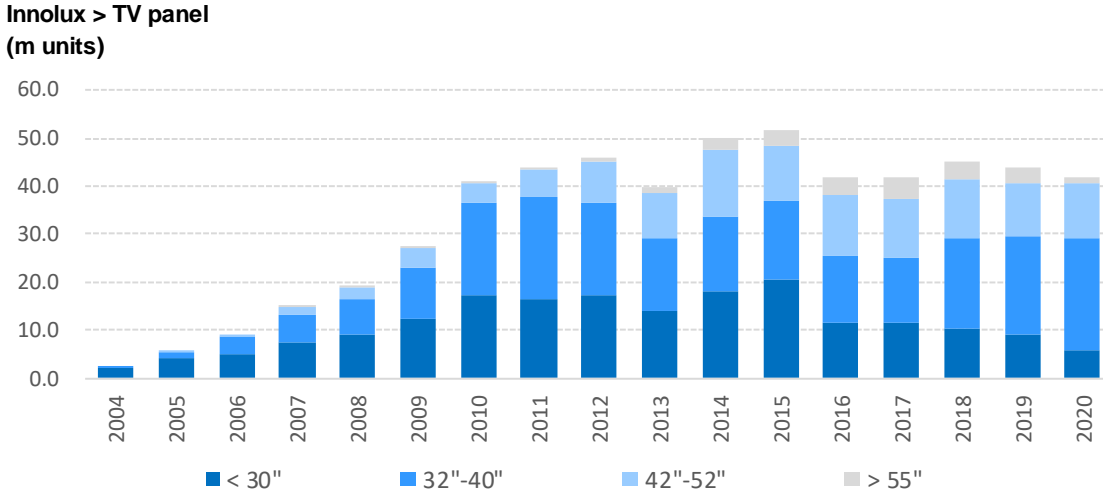
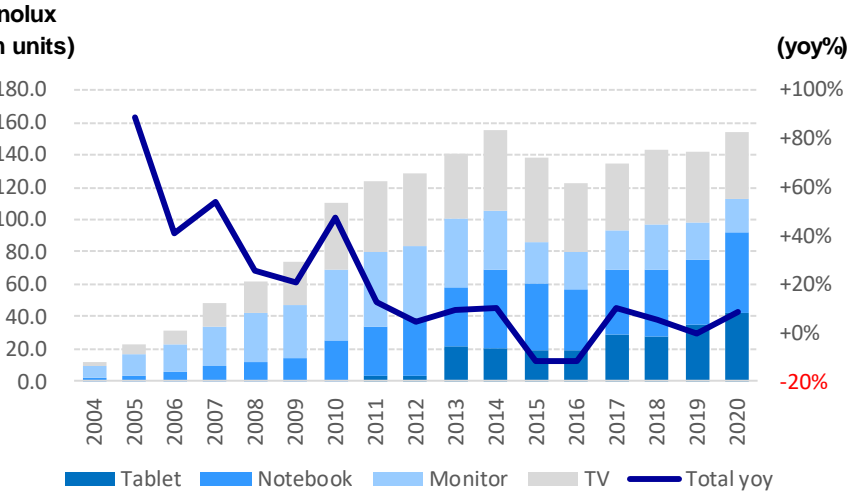
(USD mn)

INNOLUX		FY09/12	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12	FY20/12
Sales		4,989	15,669	17,356	16,354	14,239	14,142	11,470	8,910	10,821	9,272	8,156	9,167
	(Seq%)	-2%	+214%	+11%	-6%	-13%	-1%	-19%	-22%	+21%	-14%	-12%	+12%
Gross profit		128	687	-1,198	152	1,272	1,662	1,469	810	2,260	890	98	809
	(Gross margin)	2.6%	4.4%	-6.9%	0.9%	8.9%	11.8%	12.8%	9.1%	20.9%	9.6%	1.2%	8.8%
Operating profit		-105	-151	-2,133	-668	517	929	707	199	1,546	160	-645	62
	(Operating margin)	-2.1%	-1.0%	-12.3%	-4.1%	3.6%	6.6%	6.2%	2.2%	14.3%	1.7%	-7.9%	0.7%
Net profit		-73	-471	-2,193	-1,011	172	715	341	58	1,217	74	-565	56
ROE		-2.5%	-8.4%	-28.3%	-16.3%	2.8%	10.3%	4.7%	0.8%	15.1%	0.9%	-7.2%	0.7%
Oper_CF		334	2,482	957	1,489	2,387	3,350	2,524	1,036	2,726	1,778	474	766
Invest_CF		-1,341	-1,730	-2,418	-271	-429	-466	-677	-1,291	-730	-3,336	226	-1,452
Fin_CF		330	-33	1,275	-1,651	-1,849	-1,998	-2,429	-277	-990	491	-671	408
FCF		-872	-567	-596	819	1,768	2,673	1,752	-334	1,904	228	-329	63
EBITDA		240	2,371	1,235	2,267	3,139	2,938	2,394	1,484	2,649	1,351	491	1,269
	(EBITDA margin)	4.8%	15.1%	7.1%	13.9%	22.0%	20.8%	20.9%	16.7%	24.5%	14.6%	6.0%	13.8%
Dep&Amot		345	2,522	3,368	2,935	2,622	2,009	1,687	1,285	1,103	1,190	1,136	1,207
R&D		71	288	353	412	413	402	454	345	425	403	403	413
Inventory		654	2,203	1,958	1,449	1,694	1,069	917	722	1,020	1,008	1,018	1,099
	(days)	44	33	44	38	40	36	32	34	29	40	45	42
Net debt to equity ratio		0.11	0.90	1.41	1.34	0.81	0.26	0.03	0.09	-0.14	0.07	0.03	0.10
Net assets		2,960	9,017	6,559	5,901	6,526	7,248	7,056	6,977	8,909	8,331	7,760	8,456
Liabilities		2,685	15,381	16,013	13,778	10,518	8,012	4,714	4,491	5,074	5,127	4,602	5,054
Assets		5,645	24,399	22,572	19,679	17,044	15,260	11,771	11,468	13,983	13,458	12,362	13,510

INNOLUX		18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9	20/12
Sales		2,410	2,343	1,944	2,031	2,030	2,151	1,673	2,237	2,538	2,742
	(Seq%)	+8%	-3%	-17%	+4%	-0%	+6%	-22%	+34%	+13%	+8%
Gross profit		242	145	28	75	38	-45	-30	62	236	560
	(Gross margin)	10.1%	6.2%	1.5%	3.7%	1.9%	-2.1%	-1.8%	2.8%	9.3%	20.4%
Operating profit		58	-46	-149	-107	-156	-234	-206	-112	45	353
	(Operating margin)	2.4%	-2.0%	-7.7%	-5.3%	-7.7%	-10.9%	-12.3%	-5.0%	1.8%	12.9%
Net profit		62	-23	-121	-95	-125	-225	-175	-160	52	356

Source: Mizuho Securities Equity Research from Bloomberg

Innolux – Large-size panel shipment volume



Source: Mizuho Securities Equity Research from company data

NLT Technologies (now : Tianma Japan) – Earnings Trend

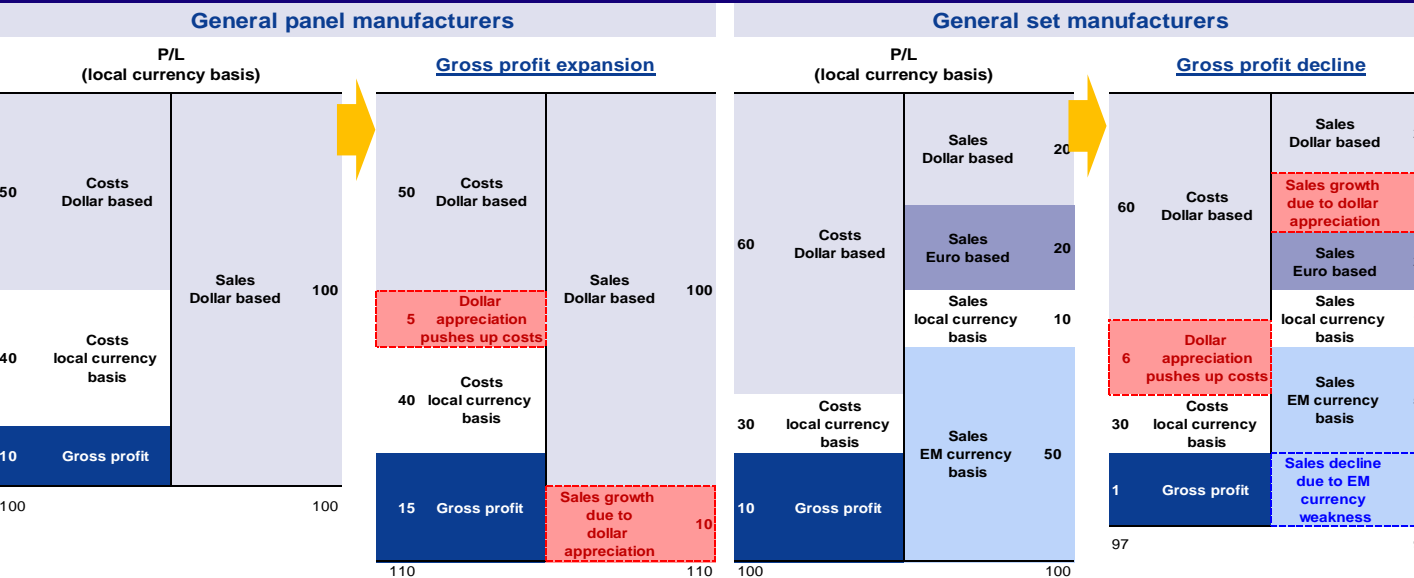
JPY mn	2011	2012	2013	2014	2015	2016	2017	2018	2019
B/S									
Current Assets	13,120	8,874	14,128	13,995	14,718	17,128	13,968	14,729	14,459
Fixed Assets	931	1,124	1,094	1,473	1,937	2,510	2,272	1,749	1,340
Property, plant and equipment	592	530	449	897	1,444	2,120	1,991		
intangibles	234	478	504	431	336	207	99		
investments and other assets	105	116	142	145	157	183	182		
Total assets	14,051	9,998	15,222	15,468	16,655	19,638	16,241	16,478	15,799
Current liabilities	10,660	8,777	10,040	8,596	8,532	10,823	7,854	7,577	6,941
Fixed liabilities	2,877	2,535	2,695	3,322	3,434	3,498	3,586	3,657	3,650
Total liabilities	13,537	11,312	12,735	11,918	11,965	14,321	11,440	11,234	10,591
Capital stock	514	-1,314	2,487	3,550	4,690	5,317	4,800	5,244	5,208
Total net assets	514	-1,314	2,487	3,550	4,690	5,317	4,800	5,244	5,208
Total liabilities and net assets	14,051	9,998	15,222	15,468	16,655	19,638	16,241	16,478	15,799
P/L									
Sales	21,475	22,888	27,859	32,879	34,327	30,376	30,539		
Sales cost	19,871	21,141	23,212	27,812	29,314	26,414	28,541		
Gross profit	1,604	1,747	4,647	5,067	5,013	3,962	1,997		
Selling and administration costs and ge	3,015	3,774	3,426	3,627	3,656	3,107	2,673		
OP	-1,411	-2,027	1,221	1,440	1,357	855	-675		
Ordinary profit	-1,900	-1,539	1,920	1,690	1,250	805	-506		
NP	-1,850	-1,828	1,801	1,584	1,140	627	-516		

Note: P/L has not been disclosed from 2018 on.
Source: Mizuho Securities Equity Research from Kampo

4. Appendix : Mid/Large sized panel and its applications

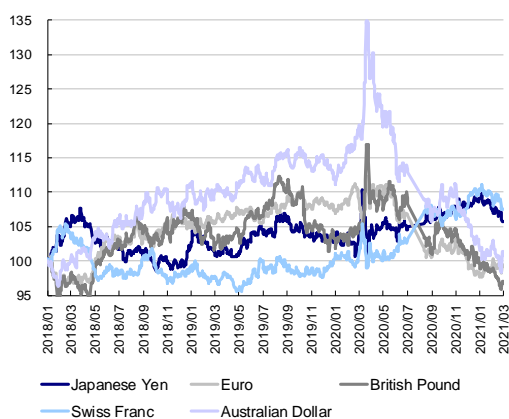
Impact of changes in FX rates (against US\$): contrasting impact on panel/set manufacturers

P/L impact (simple calc) from dollar only appreciation (+10%) & EM currency weakness (-10%)

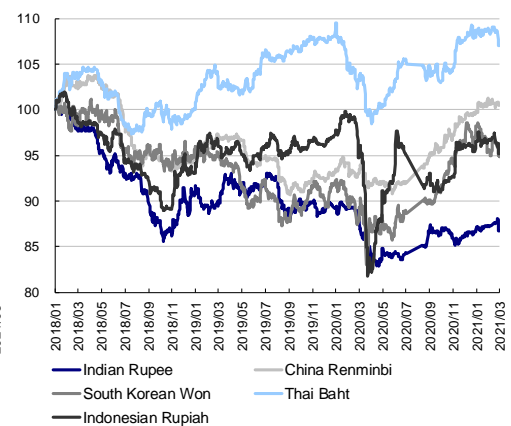


Exchange rate against US\$	End 2019	End 2020	Early Mar.	YTD cGg%	
Japanese Yen	USD/JPY	109	103	107	-3%
Euro	EUR/USD	1.12	1.22	1.21	-1%
British Pound	GBP/USD	1.33	1.37	1.40	+2%
Swiss Franc	USD/CHF	0.97	0.89	0.91	-3%
Australian Dollar	AUD/USD	0.70	0.77	0.77	+1%
Indian Rupee	USD/INR	71.4	73.1	73.5	-1%
China Renminbi	USD/CNY	6.96	6.53	6.47	+1%
South Korean Won	USD/KRW	1,156	1,087	1,124	-3%
Thai Baht	USD/THB	29.8	30.0	30.4	-1%
Indonesian Rupiah	USD/IDR	13,866	14,050	14,235	-1%
Brazilian Real	USD/BRL	4.02	5.19	5.60	-7%
S. African Rand	USD/ZAR	14.0	14.7	15.0	-2%
Turkish Lira	USD/TRY	5.95	7.43	7.40	+0%
Polish Zloty	USD/PLN	3.79	3.74	3.74	-0%
Mexican Peso	USD/MXN	18.9	19.9	20.8	-4%
Russian Ruble	USD/RUB	62.0	74.2	74.6	-0%

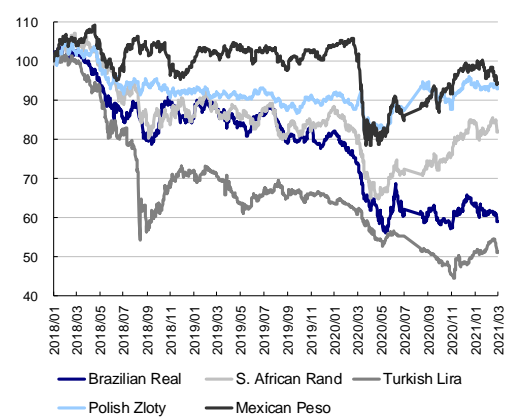
Exchange rate against US dollar (start 2018 =100)
Developed countries



Asian countries



Emerging countries



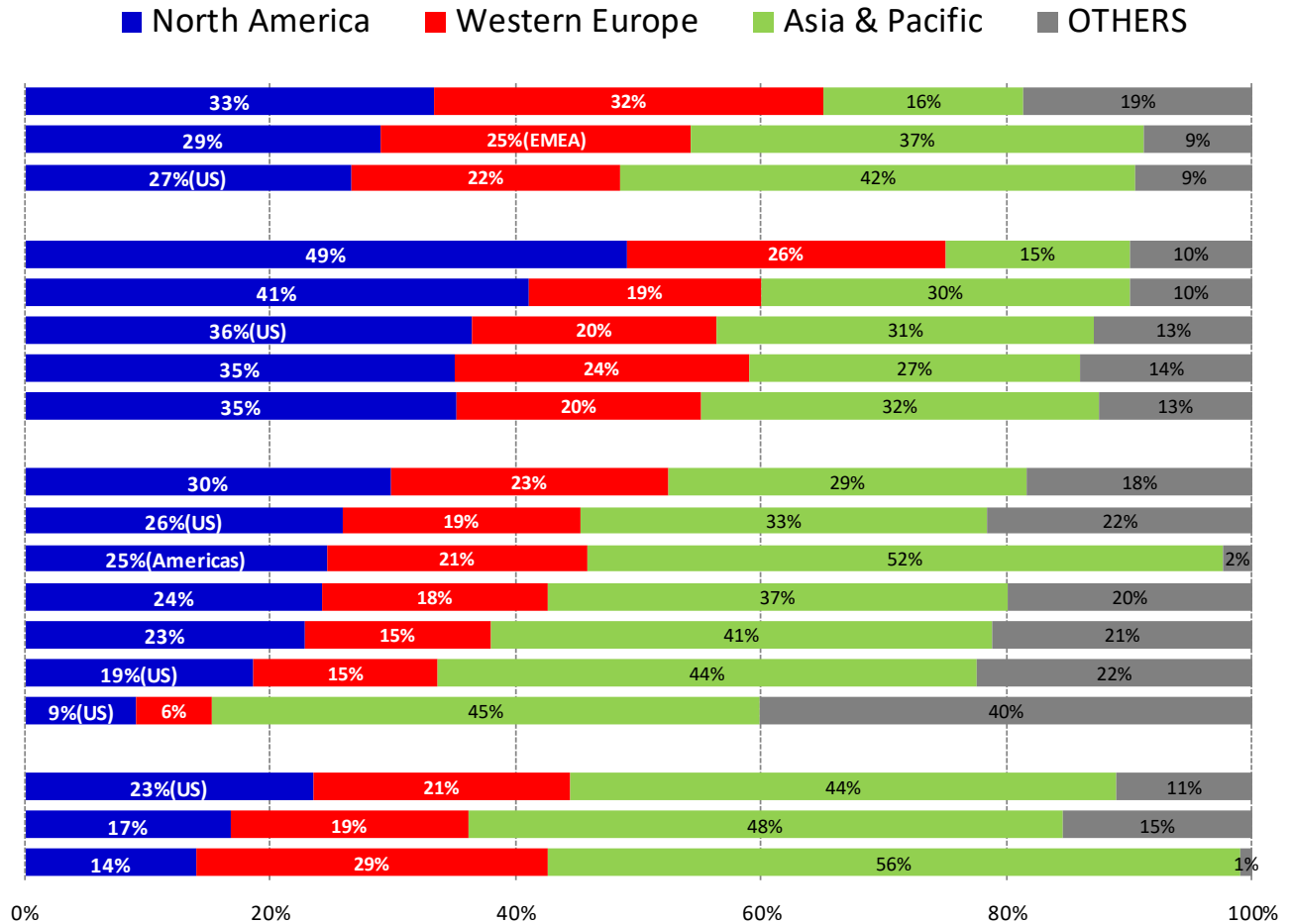
Russia



Note: Figures are conceptual diagrams using gross margins of 10% for convenience; margins generally different than diagrams suggest.
Source: Compiled by Mizuho Securities Equity Research from Bloomberg LP

Regional market share for major products (2015)

Market Size (USD mn)	
Misc	15,000
Box Office	38,300
Game	68,376
Software Spending	
Server	412,182
Copier	55,636
IT Spending	44,390
Laser beam printer	2,092,901
Market Size (qty)	
Inkjet printer	7,797
Tablet PC	47,946
Interchangeable Lens Camera	4,783
PC	173,998
TV	99,338
Smartphone	425,145
Feature Phone	13,456
Vehicle (K units)	89,387
Excavator (K units)	155
Solar PV (MW)	38,352

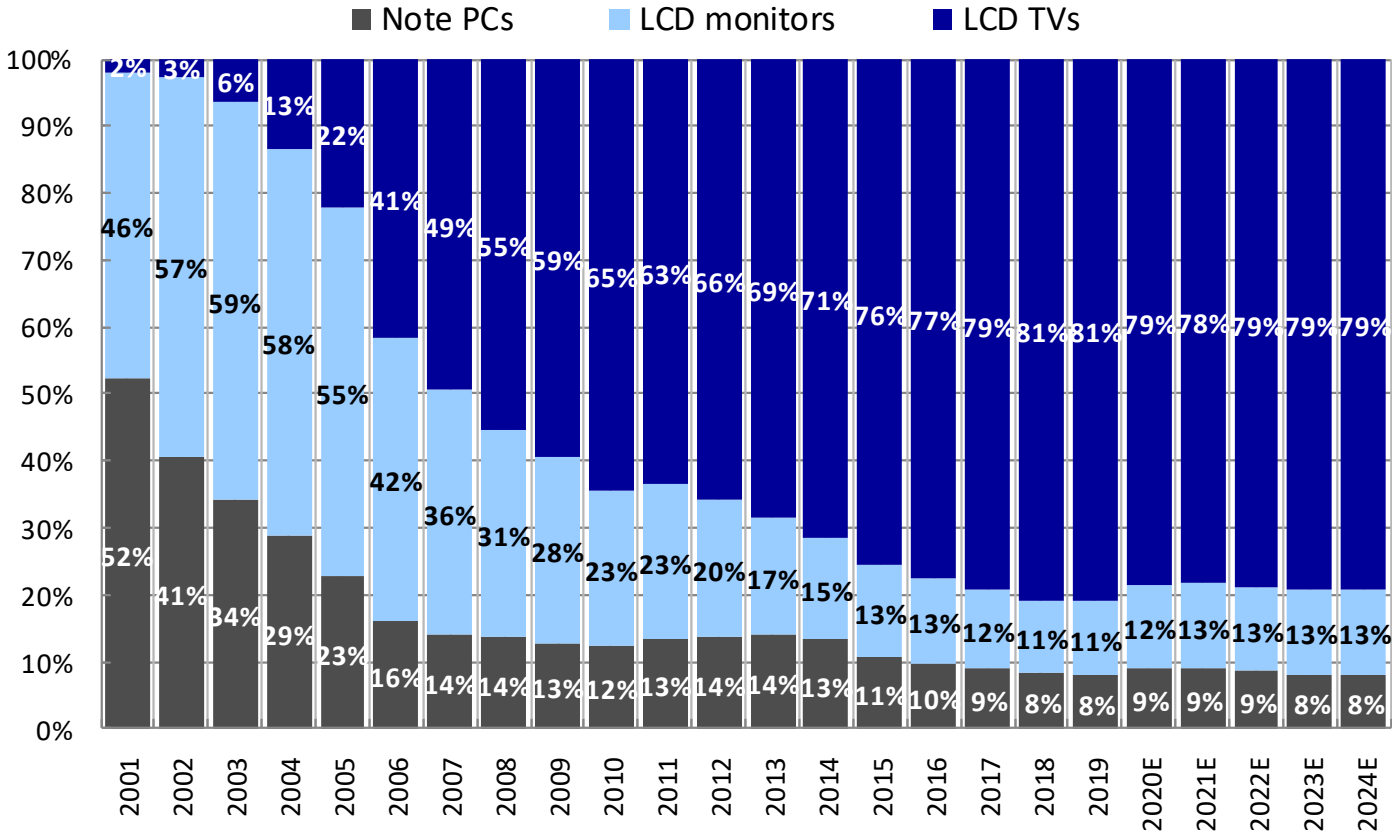


Note: For interchangeable lens cameras, 'N. America' figures refer to the Americas, and 'Western Europe' figures include Eastern Europe. Game includes digital distribution game. The market share for Server is for 2014. Software Spending and IT Spending figures are for 2014 and Solar PV figures are for 2013. Vehicle figures are estimated by Mizuho Securities Equity Research as of 2015. JPY based data is converted to USD using the average forex rate (¥120.9/\$) for the year.

Source: Compiled by Mizuho Securities Equity Research from IDC, Gartner, Bloomberg LP, SolarPower Europe, SEIA, CIPA, MPAA, Famitsu, company data

Worldwide large TFT-LCD panel demand by application

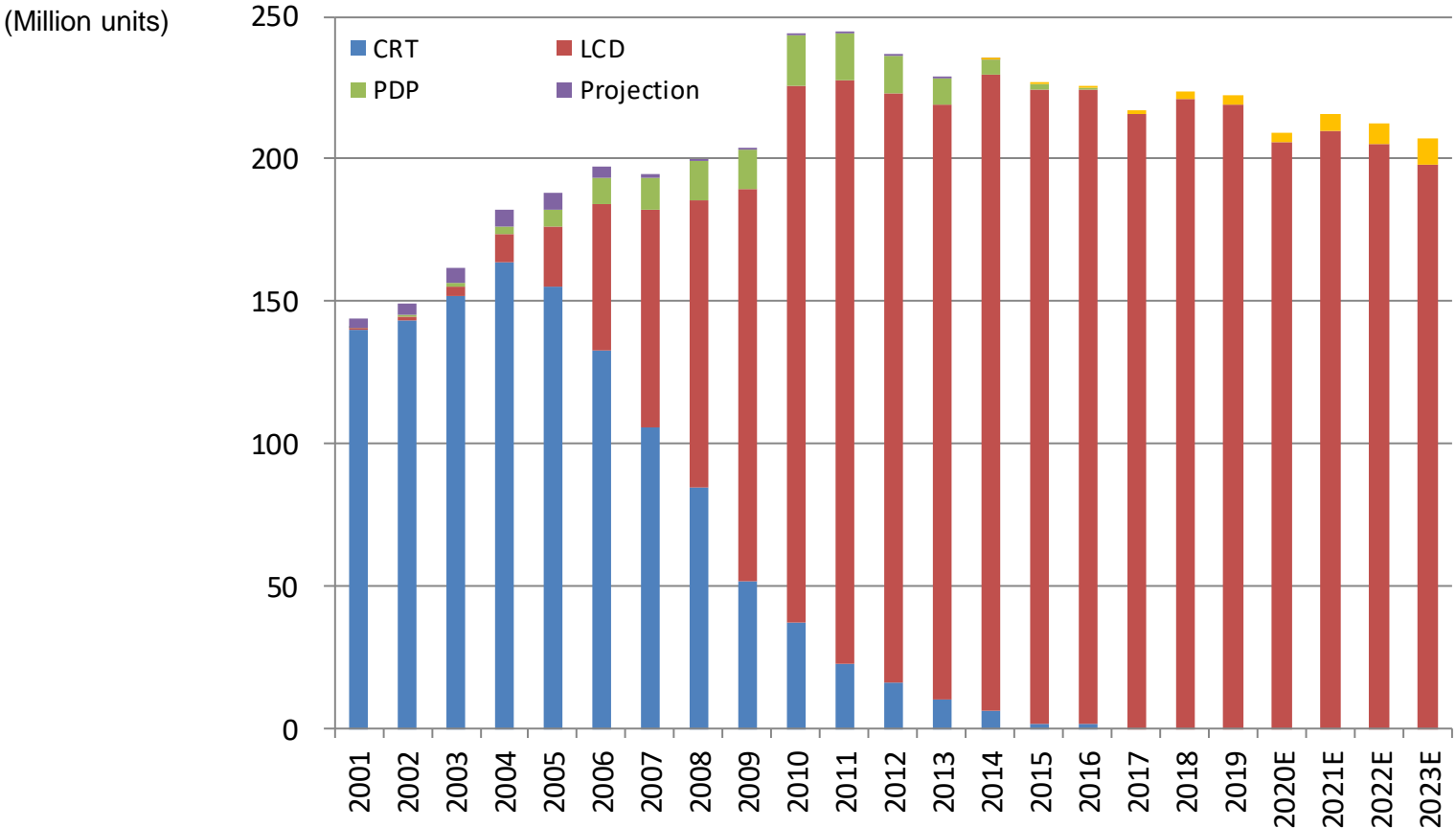
Large-sized TFT LCD panels output breakdown by application (surface area)



- 2005: PCs account for 78% of demand, TVs for only 22%.
- TV ratio rose sharply from 2006 onward, then reversed in 2008; forecast to be 80% in 2017.

Source: Mizuho Securities Equity Research

TV market outlook: Volume on a slow decline

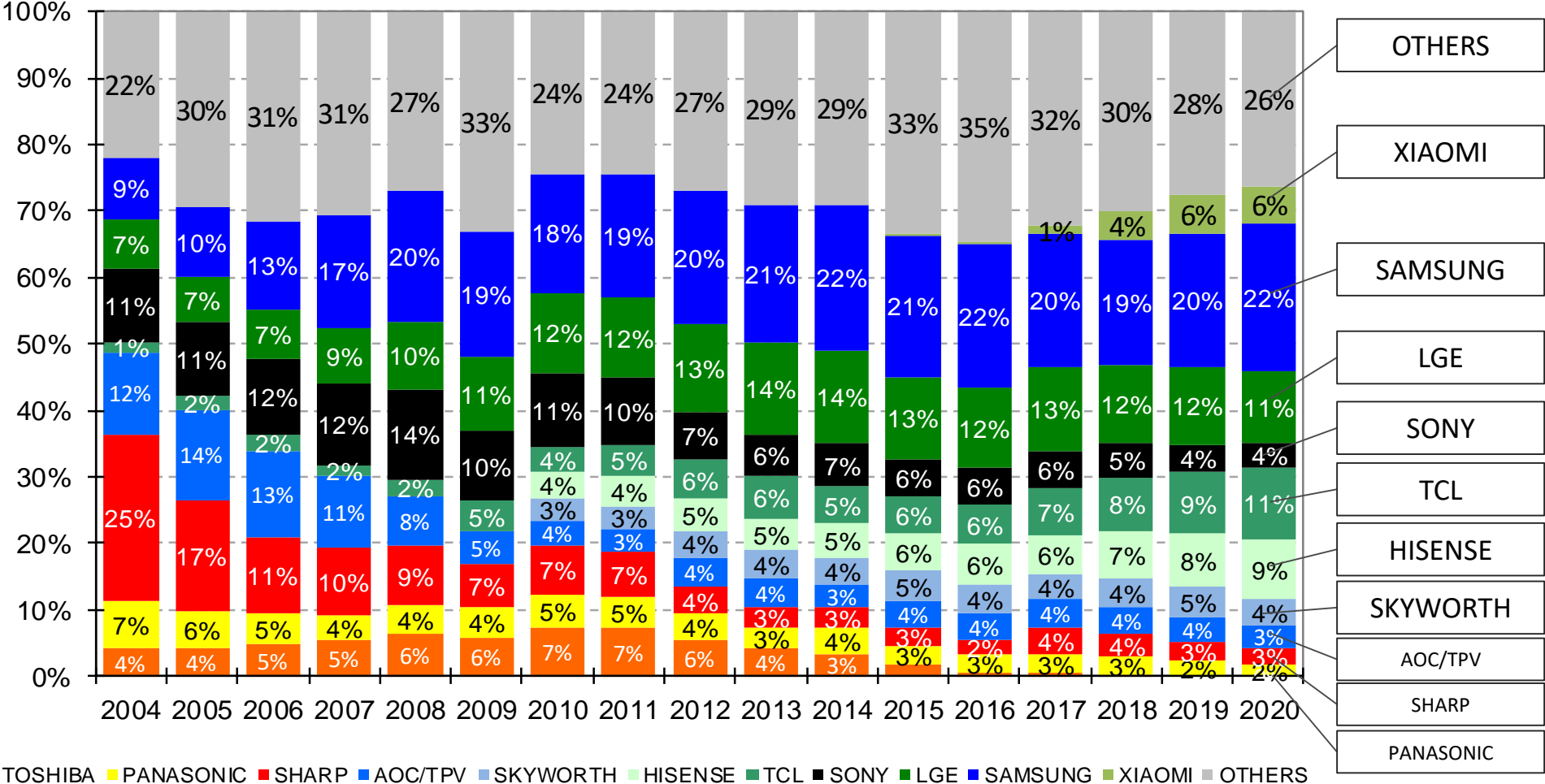


- While faster proliferation in emerging markets and advanced economy upgrade demand are both key, improvement has been sluggish given the strong dollar (impacting the former) and market conditions (saturation and constant feature-set improvements affect emerging market proliferation).
- Competition from monitors in 43" and below; mainly cheap products. Will market growth be sustained on area basis with spread of 55" and above?

Source: Mizuho Securities Equity Research

Worldwide LCDTV Market Share

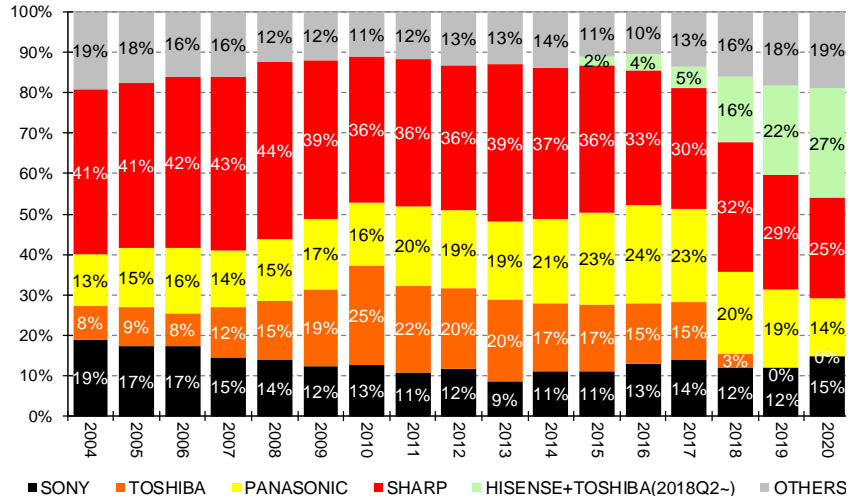
WorldWide LCDTV Shipment by Brand



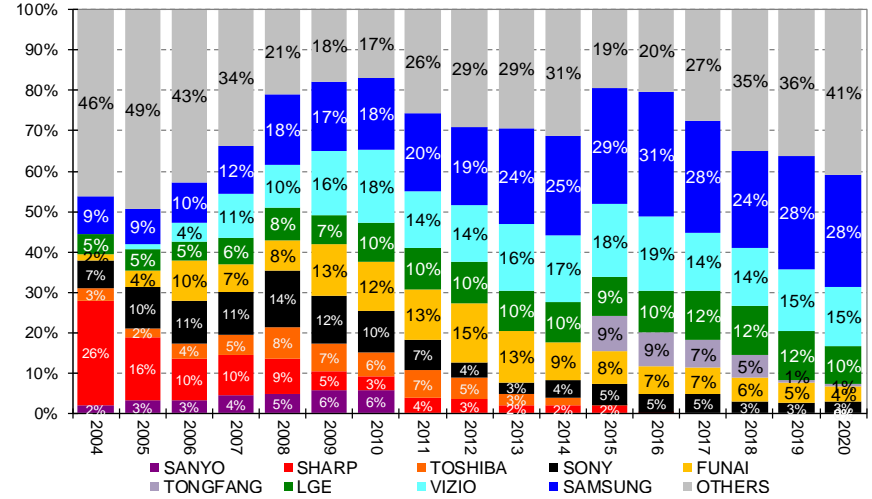
Note: After 2010, HISENSE and SKYWORTH separated from OTHERS. XIAOMI also separated from OTHERS after 2015.
 Source: Compiled by Mizuho Securities Equity Research from IHS

LCDTV Market Share(1)

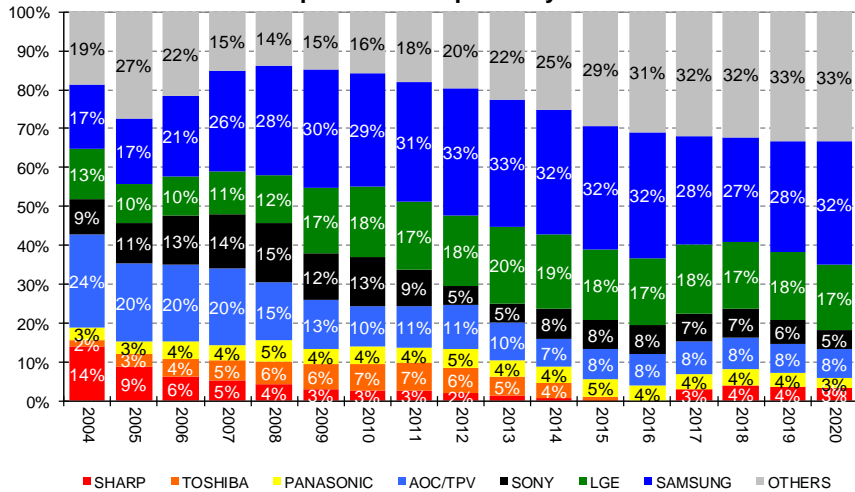
Japan LCDTV Shipment by Brand



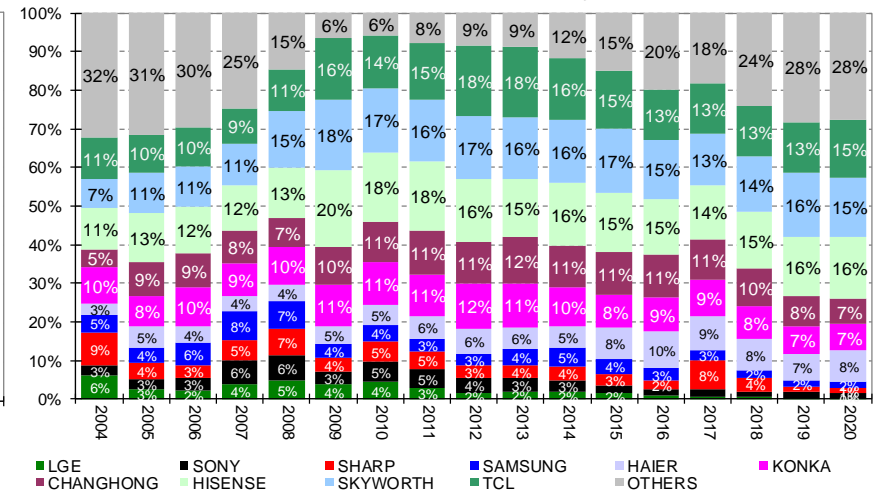
North America LCDTV Shipment by Brand



Europe LCDTV Shipment by Brand



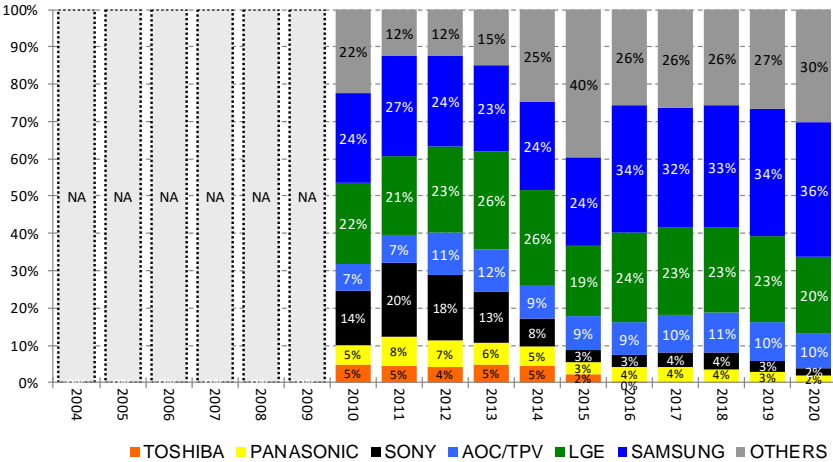
China LCD TV Shipment Share by Brand



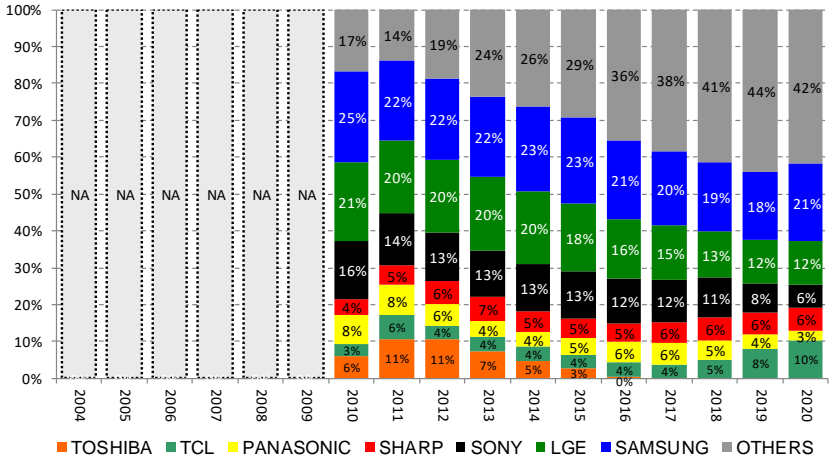
Note: After 2015, HISENSE separated from OTHERS for Japan LCD TV shipment.
 Source: Compiled by Mizuho Securities Equity Research from IHS

LCDTV Market Share(2)

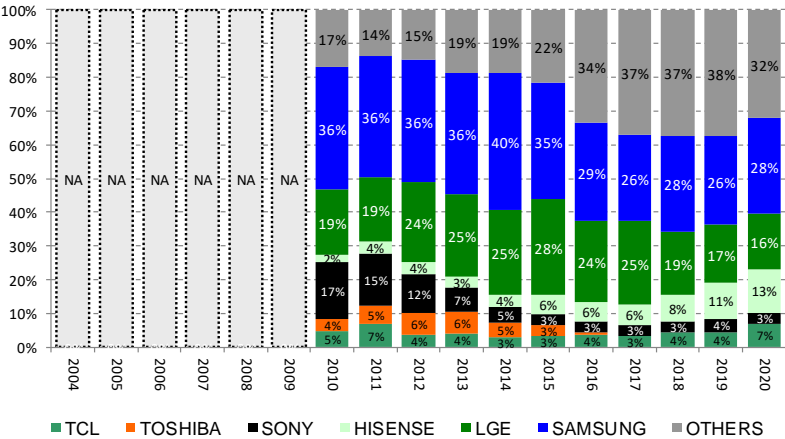
Latin America LCDTV Shipment by Brand



Asia Pacific LCDTV Shipment by Brand

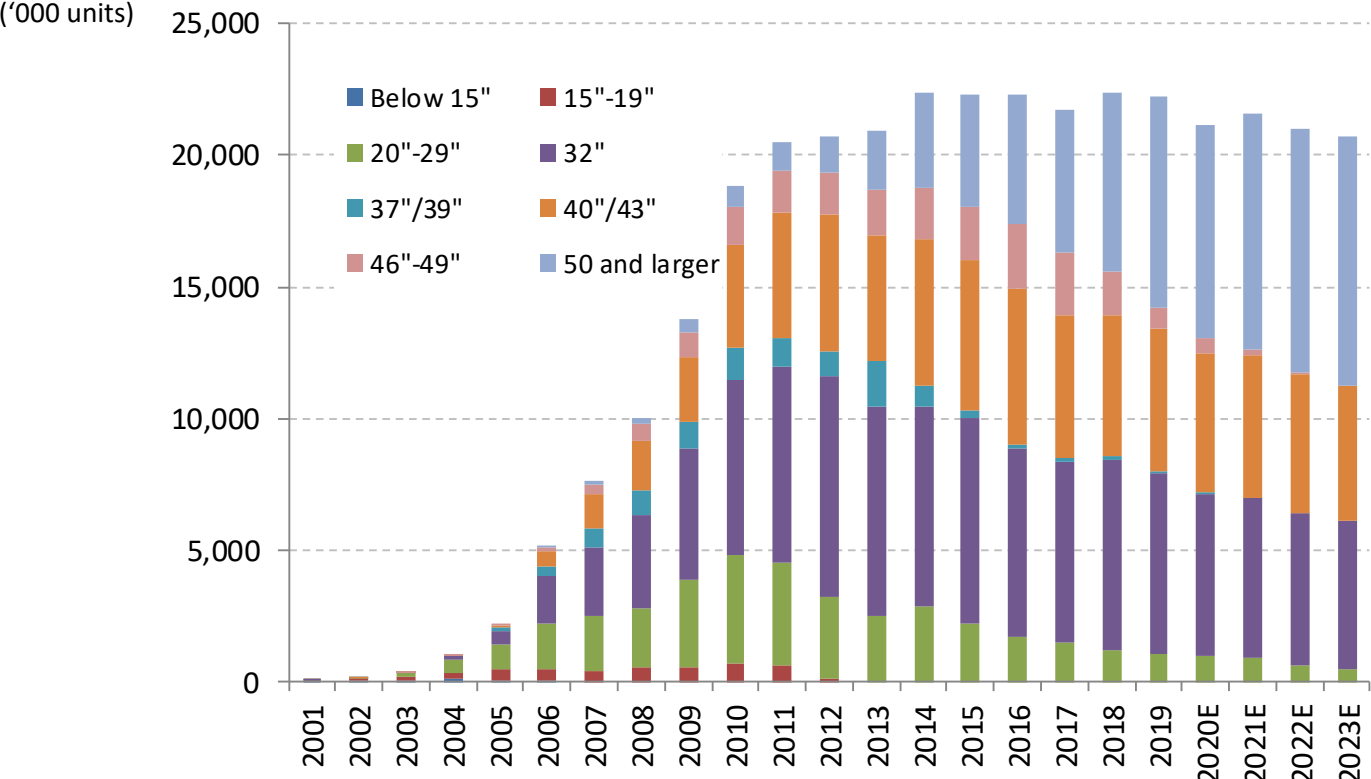


Middle East and Africa LCDTV Shipment by Brand



Source: Compiled by Mizuho Securities Equity Research from IHS

LCD TV market: Hardly expect growth in emerging countries needed for increased volume; reliant on increasing size only

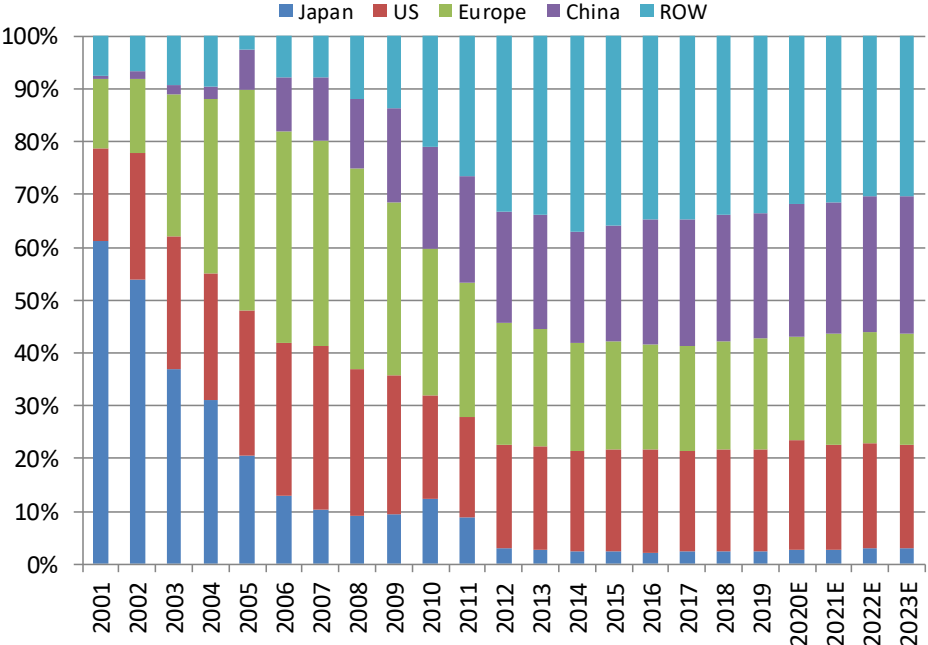


- **Volume** : Although affected by COVID-19, this was offset by stay-at-home demand and reached 222m in 2020. Expecting 223m in 2021 and 224 in 2022.
- **Average screen size**: Expansion of 1"/year decelerating. Is 50" the limit? Contraction trends for 32/43/50/55/65/75 as size variations decline.
- **70"+** still a niche market. Proliferation may progress as prices drop in US/China (\$800 and below)
- **4K**: 50"+ models have spread throughout the market. Still, 8K cost, content, and infrastructure remain issues. Proliferation could take time.

Source: Mizuho Securities Equity Research

LCD TV market outlook: By region and panel size

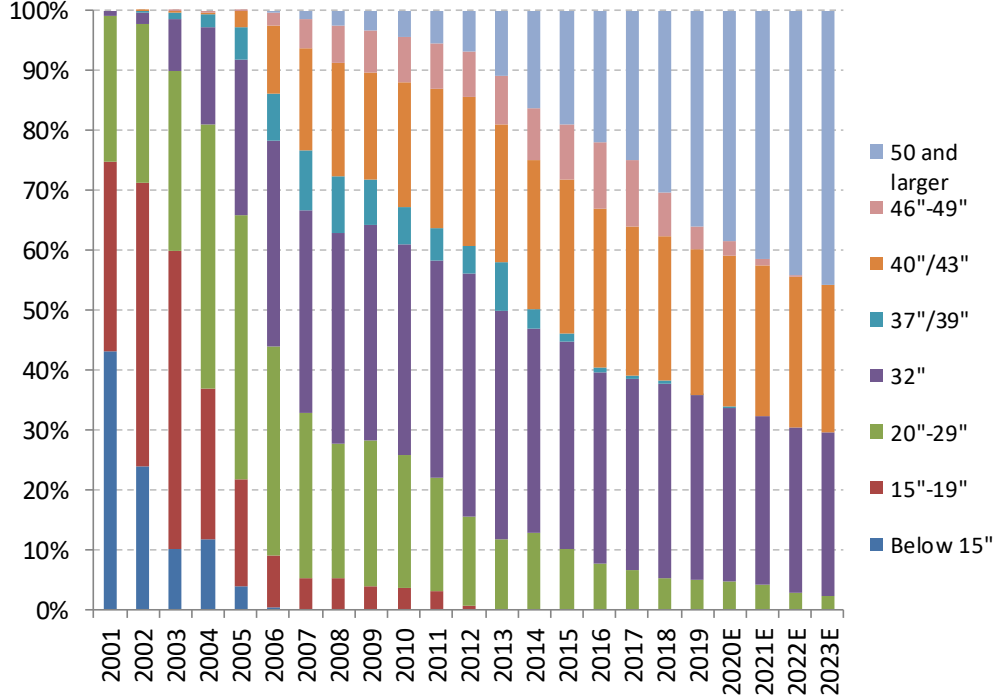
LCD-TV market forecast by region



- N. America/Western Europe: No major volume expectations, so size and value are key
- China: Stable at 50M
- Japan: Around 6M of replacement by Eco-point. Strong sales for high-end models
- Asia/Eastern Europe/Middle East/Latin America: Driving growth in volume, but ...

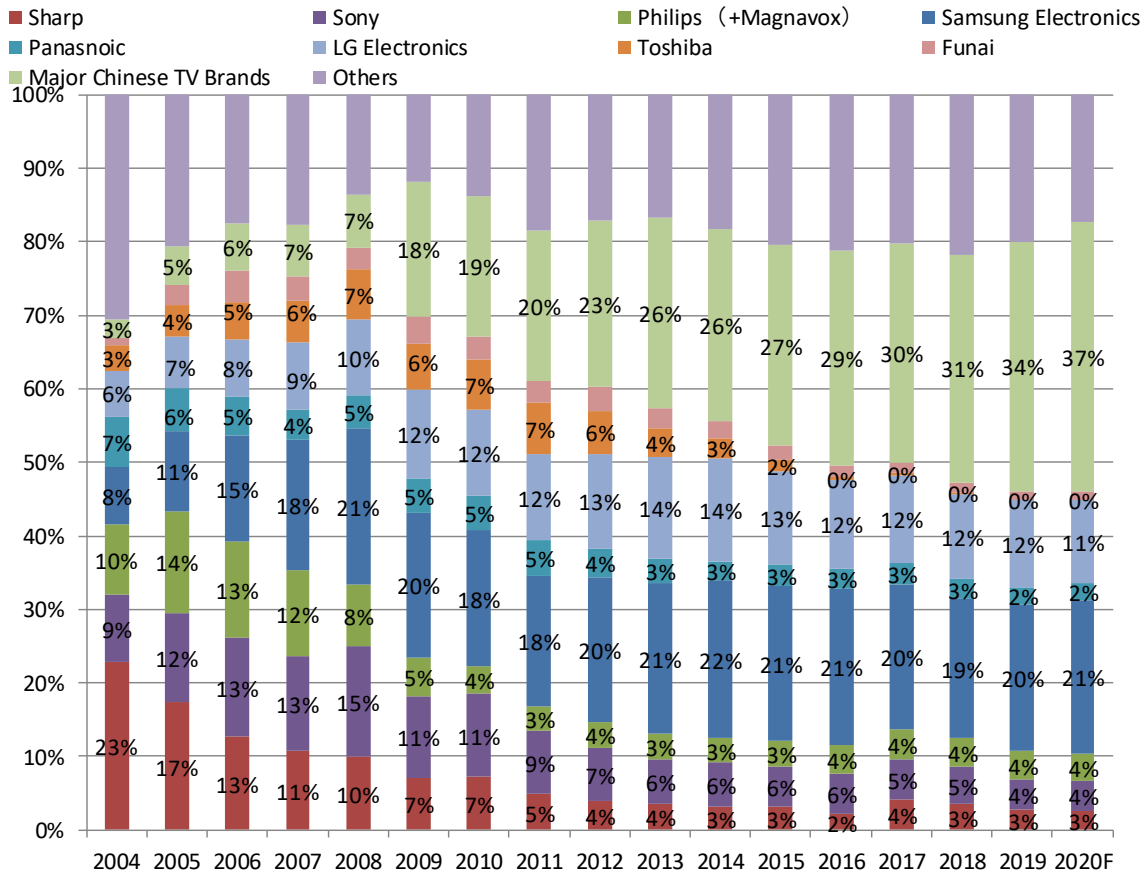
- 32"/43": Unexpectedly resilient
- 50-55": Becoming the major sizes together with 32"/43"
- 65"4K: Commoditization continuing
- 70"+: Still a premium market; Will a lower-priced commodity market come to be?

LCD TV market forecast by size (breakdown in unit)



Source: Mizuho Securities Equity Research

LCD TV market outlook: Moving toward Samsung/LGE/China triangle



- Tier1(M/S 20%+) • • • Samsung, China brand
- Tier1.5(M/S 10-20%) • • • LGE
- Tier2(M/S 5-10%) • • • TCL, Sony, Hisense, Skyworth
- Tier3 (<5%) • • • Konka, Changhong, VIZIO, Philips/AOC, Xiaomi, Panasonic

Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand(2008)

(M Units)

	Sharp	Panasonic LCD	Samsung	LGD	AUO	CMO	CPT	Others	TTL Panel demand	TTL Production	Aggressive plan
Samsung			11.0		5.0	5.8	0.7		22.5	21.0	25.0
Sony	0.4		10.0		4.8	0.8			16.0	14.5	20.0
Sharp	9.8					0.1			9.9	9.3	12.0
Philips	1.0			4.8	1.9	2.2		0.3	10.2	9.3	11.5
LGE	0.6			6.8	1.5	1.0	0.3	0.3	10.5	9.8	14.0
Toshiba	0.7	0.4	2.1	1.5	0.5	0.5			5.7	5.5	9.0
Panasonic		3.8	0.3	0.8		0.1			5.0	4.5	6.0
JVC			0.1	0.1	0.6	0.1			0.8	0.6	1.5
Vizio	0.1			2.0	0.9	0.3			3.3	3.1	5.5
Polaroid			0.1		0.8	1.1	0.2	0.2	2.4	2.0	4.0
Syntax				0.2					0.2	0.2	2.0
Funai				0.1		2.6	0.8	0.1	3.6	3.3	4.0
Sanyo	0.3				1.3	0.4		0.4	2.4	2.0	2.5
China	0.6	0.3	0.5	1.6	0.3	2.0	0.5	2.8	8.6	8.2	14.0
Others	0.3	0.2		2.0	1.0	1.3	0.2	2.0	7.0	6.5	12.0
DBF total	13.8	4.7	24.1	19.9	18.6	18.3	2.7	6.1	108.0	99.8	143.0
Panel maker's	19.0	5.5	25.0	22.0	21.0	21.0	3.0	6.5	123.0		

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2010)

(M Units)

	Sharp	Panasonic LCD	Samsung	LGD	AUO	CMO	CPT	Others	TTL Panel demand	TTL Production	Aggressive plan
Samsung	0.2		18.5		7.0	8.5	1.0		36.2	35.0	40.0
Sony	1.8		15.5	0.1	3.5	1.5			22.4	21.5	25.0
Sharp	12.0				0.2	0.3			12.5	12.0	18.0
Philips	2.6			5.0					7.6	7.4	10.0
LGE	1.6	0.2		17.5	3.2	0.6			23.4	22.6	27.0
Toshiba	0.2		4.0	4.5	1.5	2.8			13.0	12.0	15.0
Panasonic		7.5		2.6	0.2	0.3			10.6	9.7	11.0
JVC				0.1	0.3	0.2			0.6	0.5	1.0
Vizio	0.1			5.3	0.6	0.1			6.6	6.3	10.0
Funai	0.1	0.7	0.4		0.9	4.6	0.9		7.6	6.8	8.0
Sanyo		0.1		1.0	1.5	0.3		0.6	3.5	3.3	4.5
China	0.5	1.2	5.0	7.0	8.0	10.0	2.0	4.0	37.7	35.0	45.0
Others	1.5	0.8	3.7	4.5	4.9	3.5	2.5	1.0	22.9	18.0	13.0
DBF total	20.6	10.5	47.1	47.6	31.8	32.7	6.4	5.6	204.6	190.1	228.5
Panel maker's BP	25.0	11.0	50.0	50.0	32.0	36.0	7.0	5.0	223.0		

BP = capacity
Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2012)

(M Units)

	Sharp	Pana-LCD	Samsung	LGD	AUO	CMI	CPT	IVO	BOE	CEC	CSOT	Others	TTL panel demand	TTL production	Aggressive Plan
Samsung	1.8		23.5		6.9	4.9			2.1		1.6		40.8	40.5	42.0
Sony	0.2		9.4	1.4	1.0	3.6							15.6	15.2	15.0
Sharp	6.5					0.8				0.1			7.4	7.4	8.0
Philips	0.5		1.0	5.2	0.6				0.2				7.5	7.2	8.0
LGE	0.1	0.4		22.8	2.9	1.2			0.3				27.7	26.5	29.0
Toshiba			4.7	4.3	2.4	2.9							14.3	14.0	16.0
Panasonic		3.1		3.5	0.7	2.2							9.5	9.0	11.0
Vizio	0.5			3.2	0.8	1.9							6.4	6.0	6.5
Funai		1.5	0.5		0.2	3.9			1.1				7.2	6.8	8.0
Sanyo				0.4	0.9	2.0			0.3				3.6	3.5	4.0
Hisense		0.9	1.4	1.7	1.9	3.1			1.4	0.2	0.7		11.3	10.6	12.0
Skyworth				4.0	1.2	4.0			0.6	0.4	0.2		10.4	9.5	10.5
TCL			3.8	0.4	2.2	2.0					5.2		13.6	13.2	15.0
Haier			0.6	0.7	1.9	1.6			1.3		0.2		6.3	6.3	8.0
Konka			1.1	1.8		2.5			1.0	0.3	0.3		7.0	6.6	8.0
Changhong			1.2	1.6	2.4	1.8			0.5	0.2	0.2		7.9	6.6	7.5
Others(Vestel, BB, TPV etc)	0.3	0.0	7.2	5.0	6.3	6.5	0.5		3.4	0.9	1.7		31.8	27.0	33.0
DBF total	9.9	5.9	54.4	56.0	32.3	44.9	0.5	0.0	12.2	2.1	10.1	0.0	228.3	215.9	241.5
Panel maker's BP	12.0	7.0	60.0	60.0	38.0	50.0	3.0	0.0	12.5	5.0	10.0		257.5		

BP = capacity

Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2014)

(M Units)

	Sharp	SDP	Pana-LCD	Sam sung	LG D	AUO	Inno lux	BO E	CEC	CSO T	Others	TTL panel dem and	TTL production	Aggressive Plan
Sam sung	3.7			26.5		6.4	3.5	2.7		5.5	1.5	49.8	48.5	49.0
Sony	0.5			6.5	2.1	4.5	0.5					14.1	14.0	15.0
Sharp	5.6						1.5		0.5	0.1		7.7	7.5	8.0
Philips	0.2			1.1	3.1	1.0	0.9	0.2		0.5		7.0	7.0	8.0
LG E	2.8				24.7	1.8	3.0	0.8		1.1		34.2	33.0	34.0
Toshba				1.5	2.9	0.1	2.2			0.2		6.9	6.7	8.0
Panasonic		1.0		0.4	2.4	0.1	2.9	0.1				6.9	6.2	7.0
V iz b	1.2				2.2	1.3	2.8					7.5	7.5	8.0
Funai		1.8		0.2	0.6		1.9	0.6		0.3		5.4	5.2	7.0
Sanyo					0.1	0.4	0.6	0.4		0.2		1.7	1.5	2.0
H isense		1.7		2.5	1.2	2.8	3.6	1.5	0.1	1.2		14.6	11.5	12.0
Skyworth	0.1			0.5	4.8	1.1	4.5	1.2	0.5	0.9		13.6	10.0	11.0
TCL				3.7	0.2	2.2	2.9			9.0		18.0	15.0	16.0
Haier	0.1			1.2	0.5	1.5	1.1	1.2	0.2	0.4		6.2	5.8	6.5
Konka				1.2	1.5		2.7	2.3	0.5	0.4		8.6	7.2	8.0
Changhong				1.1	1.6	2.8	1.2	0.6	0.2	0.9		8.4	7.9	9.0
Other (Vestel, BB, TPV etc)	0.3	0.2		8.6	3.6	3.5	12.5	2.9	1.4	3.3		36.3	33.0	40.0
FCST Total	14.4	4.7		55.0	51.5	29.5	48.3	14.5	3.4	24.0	1.5	247.3	227.5	248.5
Panel makers' Capacity	14.5	5.0		55.0	51.5	29.0	49.0	14.5	3.5	24.0	2.0	248.5		

BP = capacity

Source: Mizuho Securities Equity Research

TV panel : Estimated Panel demand by brand (2016)

(M Units)

	Sharp /SDP	Pana-LCD	Sam sung	LG D	AUO	Inno lux	BO E	CEC	CSOT	O thers	TTL panel dem and	TTL production	Aggressive Plan
Sam sung	3.7		15.8		5.6	11.4	9.8		7.1		53.4	47.5	49.0
Sony	0.2		4.8	2.9	2.4	0.3	1.9				12.5	12.5	13.0
Sharp	2.2		0.8	0.1		1.8					4.9	5.0	5.0
Philips/TPV ison			1.7	2.6	2.2	0.9	0.5		0.6		8.5	7.5	8.0
LGE	0.5			17.7	0.9	2.7	4.4		0.8		27.0	28.0	29.0
Tosh ba				0.5		0.4					0.9	0.8	1.0
Panasonic		0.5	0.2	2.4		2.4	0.7				6.2	6.0	6.5
V izo	0.9		1.2	0.6	2.1	1.2	1.3				7.3	8.1	8.8
Funai(+Sanyo US)		1.2	0.2	0.9		0.9	0.9				4.1	3.8	5.4
H isense	0.1	1.8	3.7	1.3	4.8	2.4	2.1		2.4		18.6	16.8	17.5
Skyworth				6.7	0.1	4.6	1.9	0.3	1.4		15.0	14.4	16.0
TCL			3.7	0.3	1.3	1.5			12.3		19.1	18.7	19.8
Haier			1.4	0.2	0.2	1.8	1.5				5.1	4.8	5.0
Konka			2.7	2.9	0.3	0.6	2.6	0.3	0.5		9.9	7.5	8.5
Changhong			0.8	2.6	2.7	0.3	1.5	0.3	1.4		9.6	9.2	10.0
O ther(Vestel BB, TPV etc)	0.3	1.2	10.3	9.4	5.3	7.9	14.5	3.6	6.1		58.6	30.6	65.0
FCST Total	7.9	4.7	47.3	51.1	27.9	41.1	43.6	4.5	32.6	2.6	260.7	221.2	267.5
Panel makers' Capacity	8.4	6.5	55.0	55.0	32.0	46.0	44.0	5.7	33.0	3.0	288.6		

BP = capacity
Source: Mizuho Securities Equity Research

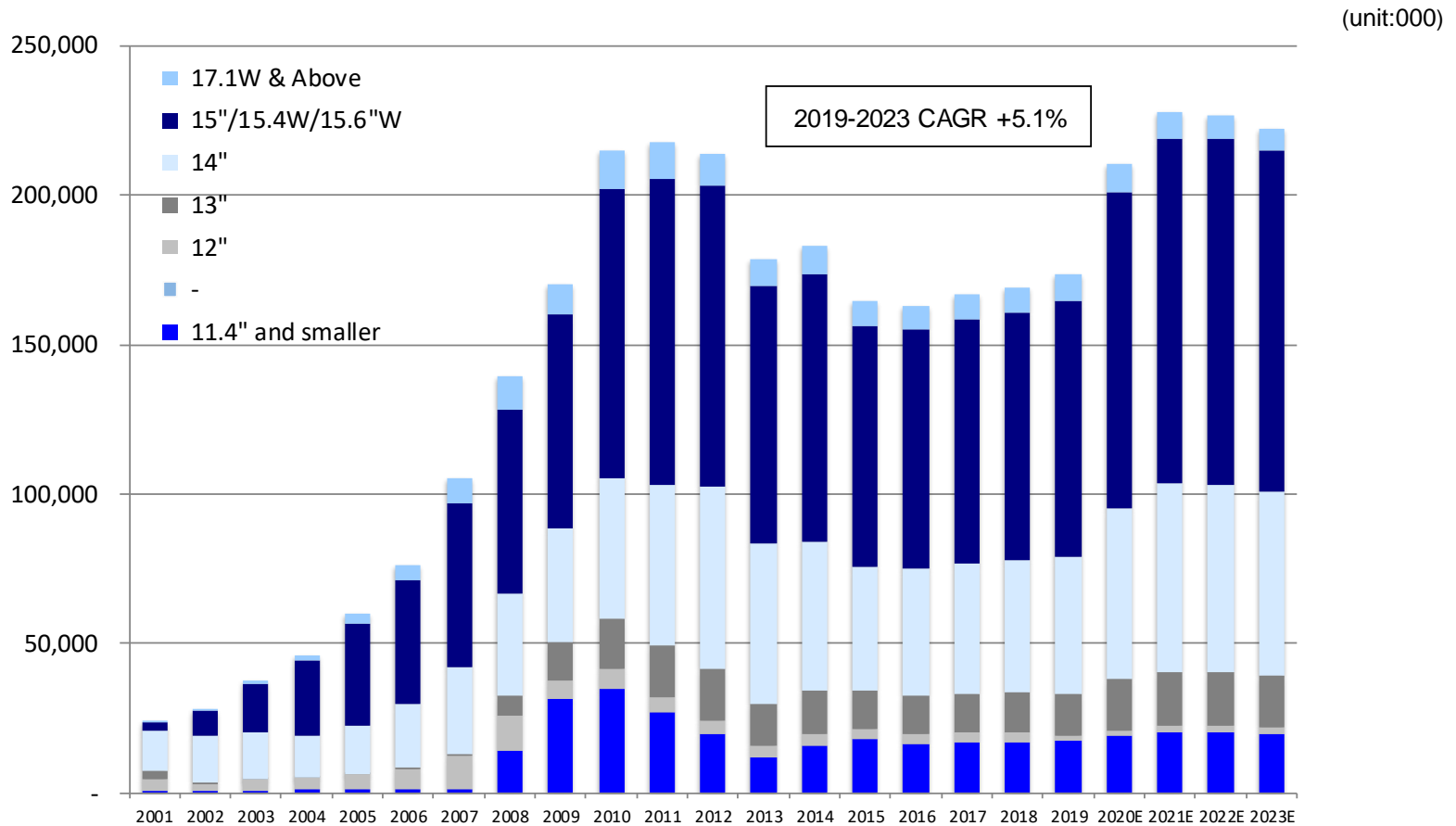
TV panel : Estimated Panel demand by brand (2017)

(M Units)

	Sharp /SDP	Pana-LCD	Sam sung	LG D	AUO	Inno lux	BO E	CEC	CSOT	HKC	TTL panel dem and	TTL production	Aggressive Plan
Sam sung	0.3		15.1	0.2	6.3	10.2	8.3		7.3		47.7	43.5	47.0
Sony	0.2		4.1	3.8	1.9	0.1	2.9				13.0	12.8	13.0
Sharp	7.4					4.8					12.2	8.6	11.0
Philips/TPV ison			1.5	2.4	2.5	0.7	3.8		0.6		11.5	10.3	11.0
LG E	0.8			16.8	0.5	2.8	6.6		0.8	0.1	28.4	26.5	27.0
Tosh ba				0.3		0.3					0.6	0.5	1.0
Panasonic				3.1		2.9	0.3				6.3	6.0	6.5
V iz b	0.3		0.8	1.3	2.2	0.6	2.1				7.3	6.5	8.0
Funa i(+Sanyo/Phips US)			0.5	1.5		1.6	0.4				4.0	3.7	4.5
H isense			1.5	1.3	5.3	1.6	2.5	0.3	4.1		16.6	15.5	19.0
Skyw orth				5.8		5.8	2.2	0.4	2.3	0.2	16.7	15.5	18.5
TCL			2.9	1.1	0.9	1.3			15.8		22.0	17.5	20.0
Haier			0.9			1.5	1.7				4.1	7.5	8.0
Konka			1.7	2.4	0.2	0.5	2.9	0.2	0.3	0.2	8.4	6.5	10.5
C hanghong			0.6	1.9	2.7	0.8	1.3	0.5	1.5		9.3	7.5	10.0
Other(Veste l, BB, TPV etc)	0.9	1.0	9.0	6.4	3.7	4.9	8.5	4.8	4.4	4.5	48.1	35.0	40.0
FCST Total	9.9	1.0	38.6	48.3	26.2	40.4	43.5	6.2	37.1	5.0	256.2	223.4	255.0
Panel Makers' Capacity	10.0	3.0	39.0	49.0	26.5	41.0	43.0	6.5	38.0	5.5	261.5		

BP = capacity
Source: Mizuho Securities Equity Research

NBPC market outlook: Sudden re-expansion from stay-at-home and remote-work demand



• Replacement cycle shorter on remote-work and stay-at-home demand: 203m in 2020, 215m in 2021. Possible reflexive decline from 2023.

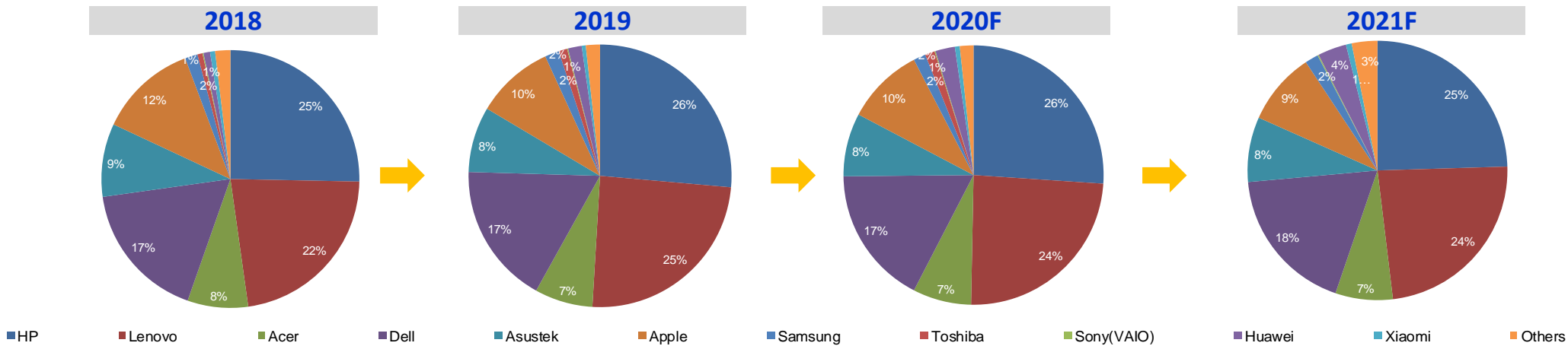
• Polarization: \$500 low-end (incl. Chromebook) and over \$1,000 high-end (gaming laptops) models popular.

Source: Mizuho Securities Equity Research

Notebook PC Forecast By Brand: +26% YoY in 2020 and further rise in 2021?

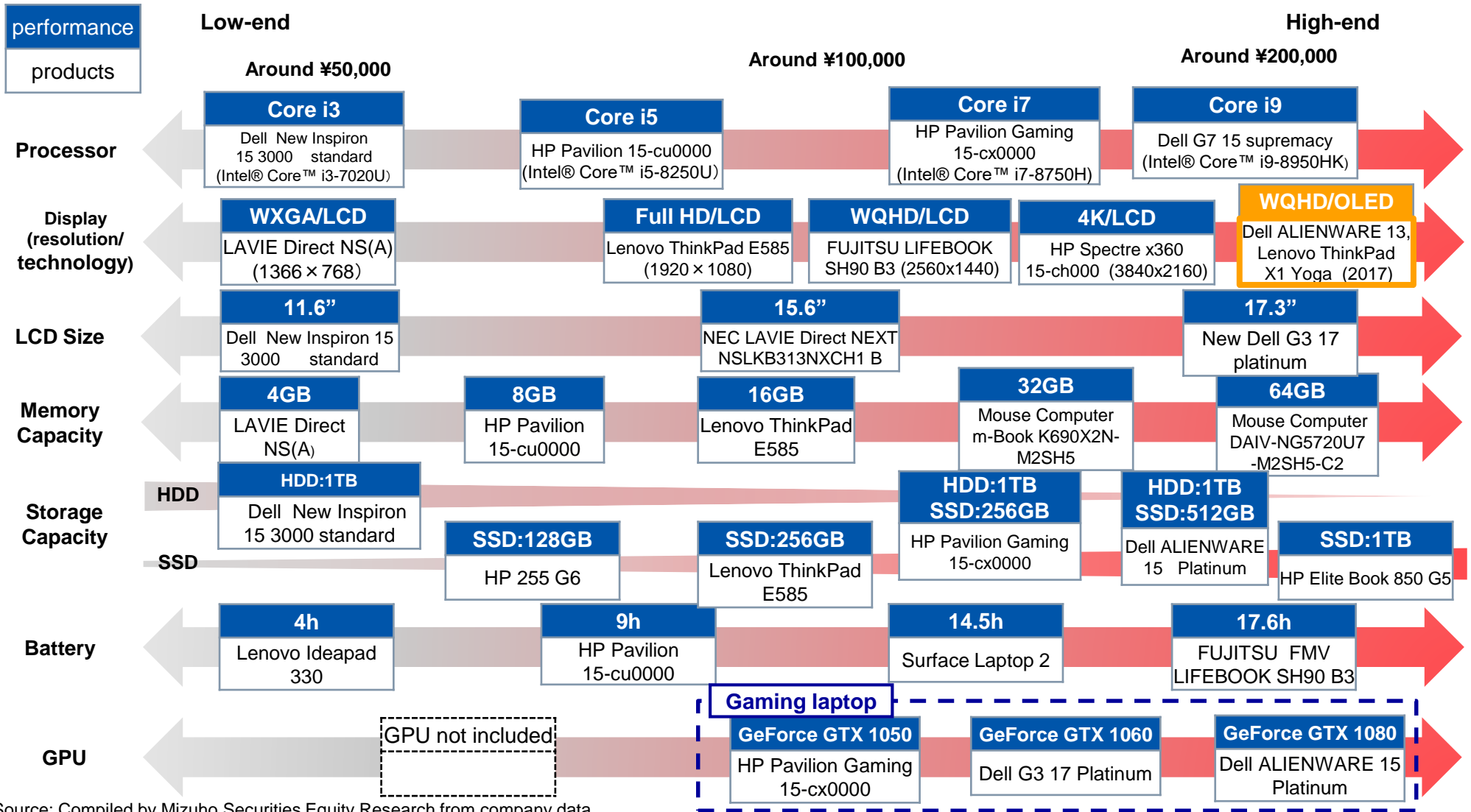
(in mm)	2011	2012	2013	2014	2015	2016	2017	2018	YoY	2019	YoY	2020 Plan	2020 F	YoY	2021 F	YoY	
HP	35.0	33.0	28.0	32.0	32.0	34.6	38.2	40.0	+5%	42.5	+6%	43.0	51.5	+21%	54.0	+5%	HP
Lenovo	22.0	27.0	26.5	31.5	32.0	32.5	35.5	35.5	0%	39.5	+11%	40.0	49.5	+25%	52.5	+6%	Lenovo
Acer	27.0	25.0	17.0	18.0	14.8	12.5	12.0	12.0	0%	11.5	-4%	12.0	15.0	+30%	16.0	+7%	Acer
Dell	26.0	21.0	19.0	20.5	19.5	21.5	24.0	27.5	+15%	28.0	+2%	28.5	38.5	+38%	40.5	+5%	Dell
Asustek	17.5	19.5	16.0	18.5	18.0	16.0	15.5	14.5	-6%	13.0	-10%	13.0	17.0	+31%	17.5	+3%	Asustek
Apple	14.5	15.5	12.5	15.5	17.5	14.5	16.5	19.5	+18%	15.5	-21%	16.0	19.0	+23%	21.5	+13%	Apple
Samsung	12.5	14.0	10.0	4.5	3.5	3.0	2.8	2.5	-11%	2.8	+12%	2.5	3.5	+25%	4.0	+14%	Samsung
Toshiba	16.0	14.5	12.5	11.0	6.1	2.0	1.0	1.0	0%	1.7	+70%	2.0	0.0	-100%	0.0	-	Toshiba
Sony(VAIO)	8.7	7.3	5.5	1.4	0.3	0.2	0.2	0.2	0%	0.2	0%	0.2	0.3	+50%	0.3	0%	Sony(VAIO)
Huawei/Honor	-	-	-	-	-	-	0.1	1.3	+1200%	2.7	+108%	4.0	7.5	+178%	8.0	+7%	Huawei/Honor
Xiaomi	-	-	-	-	-	0.2	0.7	1.0	+43%	0.8	-20%	1.0	1.5	+88%	2.0	+33%	Xiaomi
Others	24.8	25.2	15.0	14.0	14.0	18.2	11.5	3.0	-74%	2.8	-7%	2.8	6.7	+139%	5.7	-15%	Others
Total	204.0	202.0	162.0	166.9	157.7	155.0	158.0	158.0	0%	161.0	+2%	165.0	210.0	+30%	222.0	+6%	Total

Market Share



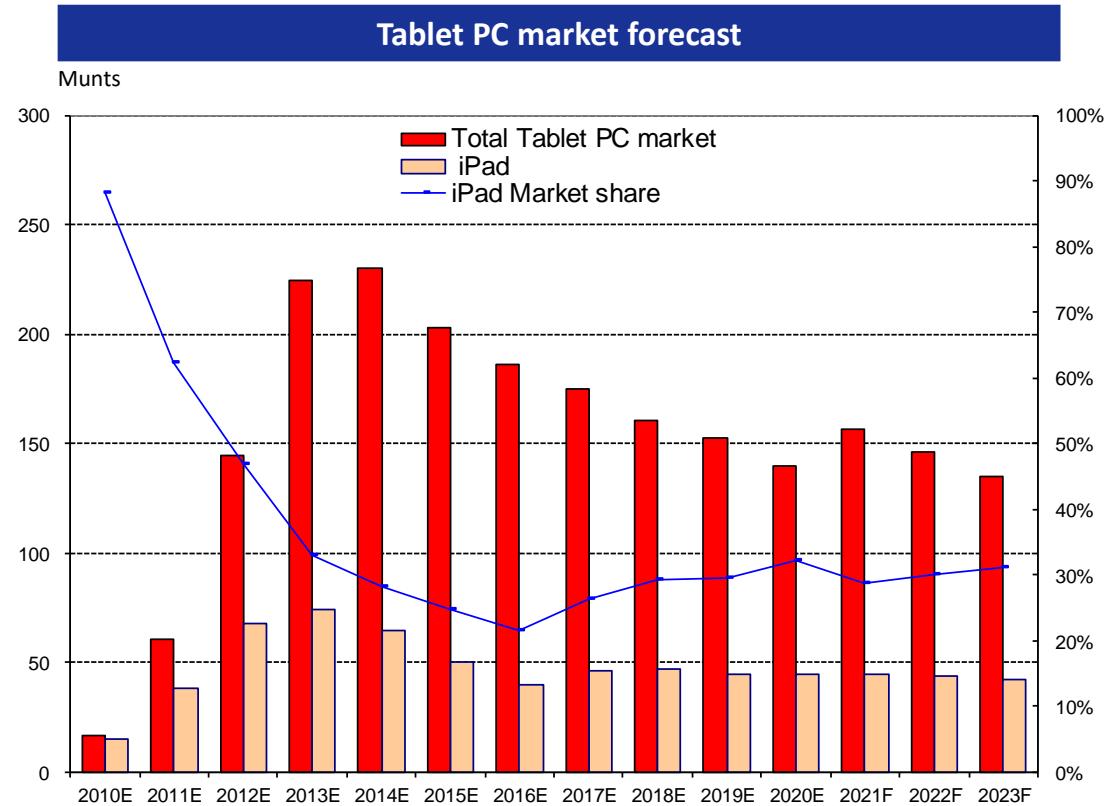
Source: Mizuho Securities Equity Research

Notebook PC: Prices and spec



Source: Compiled by Mizuho Securities Equity Research from company data

Tablet PC market forecast: Apple wins. MSFT/Amazon enjoy some share

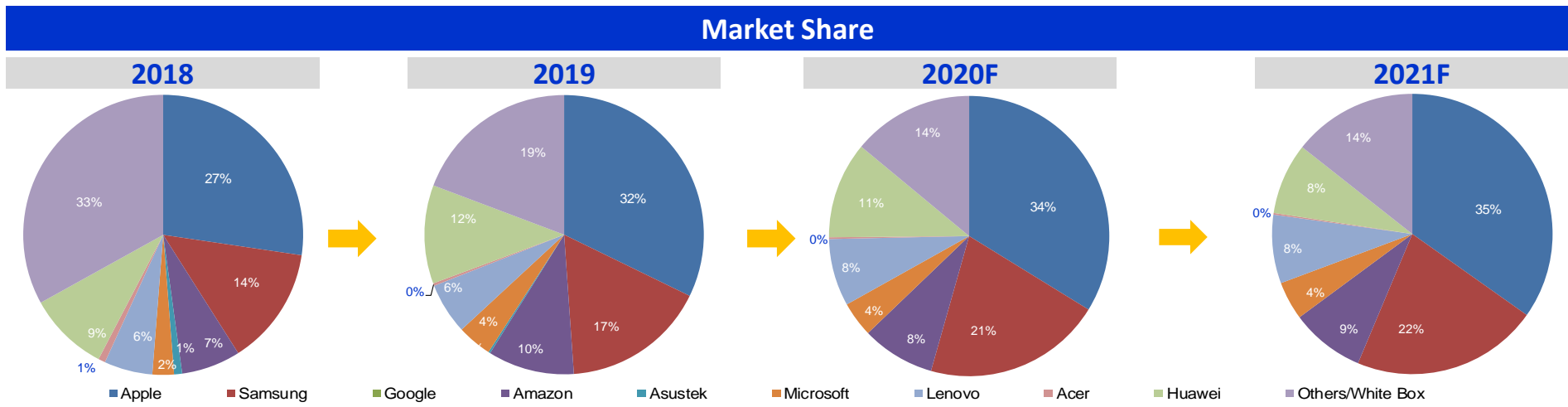


- **2010: 17m, 2011: 61m. 2012: 145m, 2013: 225m; momentum was tremendous, but...**
- **Declining since 2015. 135m in 2019. Bottomed at 140m in 2020 on remote-work and education demand. Expect growth to continue in 2021.**
- **Bipolarization of models into high end model as NB replacements and low end.**

Source: Mizuho Securities Equity Research

Tablet PC Forecast By Brand: strong for iPad/Samsung/Surface!

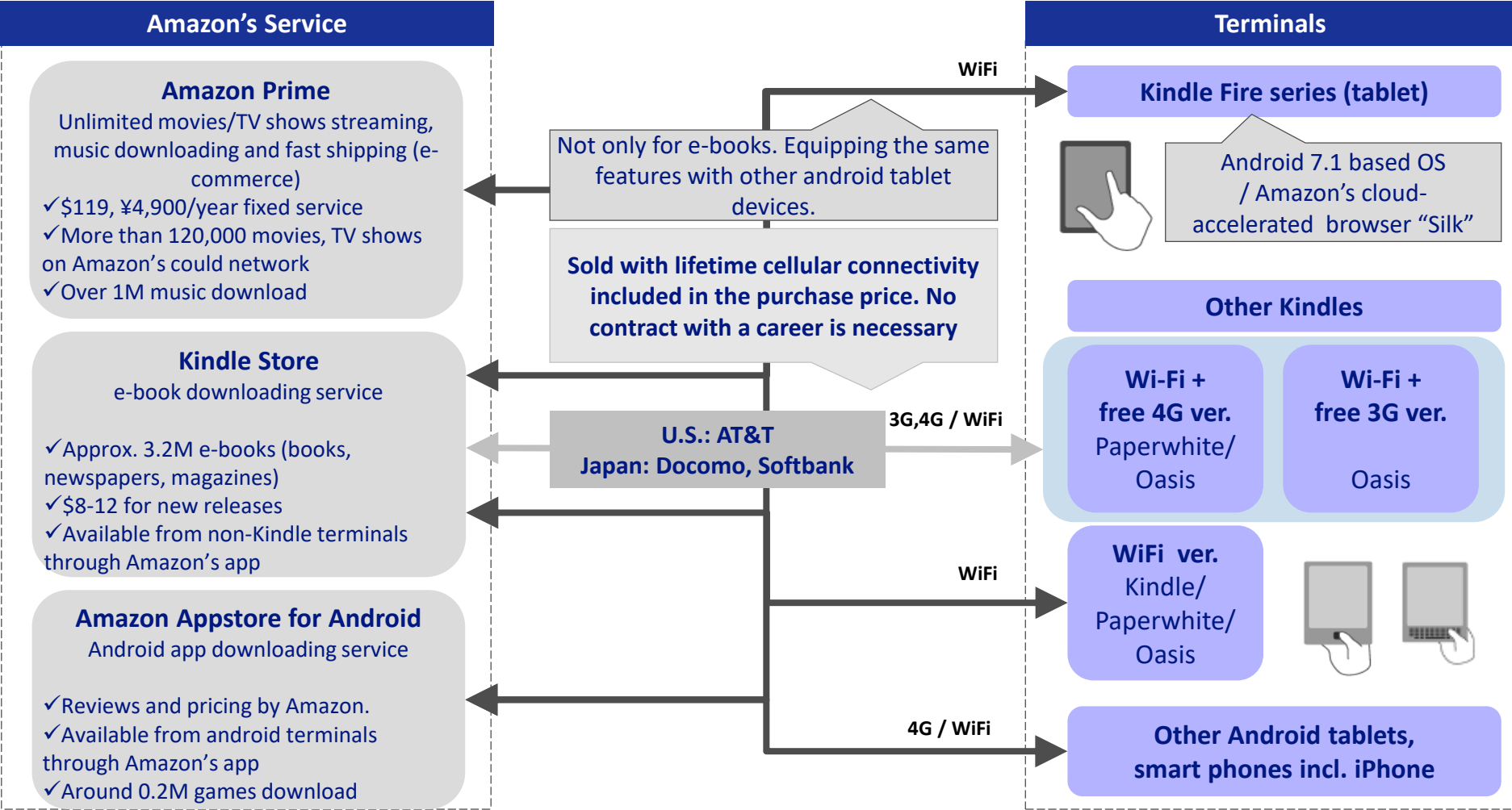
(in mm)	2012	2013	2014	2015	2016	2017	2018	YoY	2019	YoY	2020 Plan	2020 F	YoY	2021 F	YoY	
Apple	67	74	65	50	40	46	44	-4%	43.5	-1%	43	50.0	+15%	55.0	+10%	Apple
Samsung	14	41	39	35	25	25	22	-12%	22.5	+2%	21	30.5	+36%	34.0	+11%	Samsung
Google	5	7	5	3	1	0	0	-	0	-	0	0.0	-	0.0	-	Google
Amazon	11	8	4	10	11.5	12.4	11	-11%	13.5	+23%	10	12.5	-7%	13.5	+8%	Amazon
Asustek	3	6	9	6	4.2	3.4	1.5	-56%	0.3	-80%	0	0.0	-100%	0.0	-	Asustek
Microsoft	1.5	4	4	6	4.2	4	4	0%	5.4	+35%	5	6.0	+11%	7.0	+17%	Microsoft
Lenovo	2	7	12	13	12.1	11	9	-18%	8.0	-11%	8	11.5	+44%	12.5	+9%	Lenovo
Acer	1	5	6	3	3.7	2.6	1.3	-50%	0.4	-69%	0.2	0.3	-25%	0.3	0%	Acer
Huawei/Honor	1.1	1.5	3.0	6.5	9.6	12.5	15	+20%	15.4	+3%	17	16.5	+7%	13.0	-21%	Huawei/Honor
Others/White Box	30 - 40	71.5	83.0	70.5	74.7	58.1	53.2	-8%	26.0	-51%	20.8	20.7	-20%	22.7	+10%	Others/White Box
Total	145	225	230	203	186	175	161	-8%	135	-16%	125	148	+10%	158	+7%	Total



Source: Mizuho Securities Equity Research

Overview of Amazon Kindle

Amazon offers the low-cost android tablet Kindle Fire with the cloud based movie/music subscription service and eBook reader Kindle



Source: Compiled by Mizuho Securities Equity Research from company data

Amazon Kindle Devices (Fire Series)

Life time for a model has become two years

	Fire (2015)	Fire HD 6 (2014)	Fire7 (2019)	Fire HD 8 (2018)	Fire HD 8/ 8Plus (2020)	Fire HD 10 (2019)	Fire HDX 8.9" (2014)	
Display	7 inch 1024 x 600 (171ppi) IPS	6 inch 1280 x 800 (252ppi) IPS	7 inch 1024 x 600 (171 ppi) IPS	8 inch 1280 x 800 (189ppi)	8 inch 1280 x 800 (189 ppi) IPS	10.1 inch 1920 x 1200 (224 ppi)	8.9inch 2560x1600 339ppi IPS (LTPS)	
CPU	Quad-core 1.3GHz	Quad-core 1.5GHz	Quad-core 1.3GHz	Quad-core 1.3GHz	Quad-core 2.0GHz	Octa-core 2GHz	Quad-core 2.5GHz	
Camera	Front-facing HD camera (720P) + Rear-facing camera (2MP)	Front-facing HD camera (720P) + Rear-facing camera (2MP)	Front-facing HD camera (2MP) + Rear-facing camera (2MP)	Front-facing HD camera (2MP) + Rear-facing camera (2MP)	Front-facing HD camera (2MP) + Rear-facing camera (2MP)	Front-facing HD camera (2MP) + Rear-facing camera (2MP)	Front-facing HD camera (720P) + Rear-facing camera (2MP)	
Battery	7 hours	8 hours	最大7時間	10 hours	最大12時間	12 hours	12 hours (18 hours when reading)	
Conne-c-tivity	WiFi	WiFi	WiFi	WiFi	WiFi	WiFi	4G LTE + WiFi	WiFi
Size	191x115x10.6 mm 313g	169x103x10.7 mm 290g	192x115x9.6 286g	214x128x9.7 369g	202x137x9.7 355g	262x159x9.8 504g	231x158x7.8m m 389g	231x158x7.8m m 375g
Storage	8GB	8GB / 16GB	32GB / 64GB	16GB / 32GB	32GB / 64GB	32GB / 64GB	16GB / 32GB / 64GB	
Price	8GB \$49	8GB \$99 16GB \$119	16GB \$49.99 32GB \$69.99	16GB\$79.99 32GB\$109.99	16GB \$89.99 32GB \$119.99	32GB \$149.99 64GB \$189.99	16GB \$- 32GB \$499 64GB \$529	16GB \$- 32GB \$- 64GB \$429

Without ads: +\$15

Source: Compiled by Mizuho Securities Equity Research from company data

Amazon Kindle Devices (E-reader Series)

	Kindle (2019)	Paperwhite (2018)	Oasis (2019)	Voyage (2014)[End of sales]
Interface / page turning scheme	Touchscreen	Touchscreen Force sensor / no page turning button	Touchscreen Page-turn button + PagePress force sensor	Touchscreen Page-turn button + PagePress force sensor
Launch	Apr 2019 (10 th gen.)	Dec 2018 (10 th gen.)	Jul 2019 (10 th gen.)	Oct 2014
Display & resolution	6 inch 167 ppi 16-levels grayscale Glare-free display	6 inch 300 ppi 16-levels grayscale Glare-free display	7 inch 300ppi 16-levels grayscale Glare-free display	6 Inch (1440 x 1080) 300 ppi 16-levels grayscale Glare-free display
Built-in light	No→Yes No Adaptive light sensor	Yes No Adaptive light sensor	Yse + Adaptive light sensor	Yes + Adaptive light sensor
Color adjustment light	No	No	Yse	No
waterproof	No	IPX8	IPX8	No
Size	160 × 113 × 8.7mm 174g	167 × 116 × 8.18mm 182g(WiFi)、 191g(WiFi+4G)	159 x 141 x 3.4-8.4mm 188g	162 x 115 x 7.6mm 180g 188g (3G)
Storage	8GB	8GB/32GB	8GB/32GB	4GB
Battery Life (single charge)	Weeks	Weeks	Up to 6 weeks	Weeks
Charge Time	4 hours	3 hours	3 hours	4 hours
Connectivity	WiFi(802.11b/g/n)	WiFi(802.11b/g/n)/ 4G	Wi-Fi(802.11b/g/n)/4G	Wi-Fi (802.11b/g/n)/ 3G
Price(WiFi)	\$89.99	\$129.99(8GB)、\$159.99(32GB)	\$249.99(8GB)、\$279.99(32GB)	\$199
Price(WiFi+3G/4G)	-	\$(8GB)、\$249.99(32GB)	\$269.99(8GB)、\$299.99(32GB)	\$269

Without ads +\$20

Source: Mizuho Securities Equity Research from company data

What is Amazon Echo / Dash?

Amazon Echo overview

- ❑ "Alexa" voice-based assistance device with Internet connectivity using Amazon.com's Alexa (AI with voice recognition)
- ❑ Only available to Amazon Prime members initially at the launch in November 2014, in June 2015, started general service in the US, released products with Japanese support on 15 November 2017
- ❑ Voice-based life assistance
 - Sets alarms and timers and shop on Amazon with voice instructions (Just putting items in cart → **Payment with voice instructions (resulting in completion of upbeat Dash service)**)
 - Obtain weather information and news, conduct simple searches, and change lighting
 - Supports **conversations between Echo devices** (inside and outside the house) and collaboration with **smart home electronics, built-in temperature sensor**
- ❑ Media player with voice control
 - Use Amazon Prime, TuneIn, iHeartRadio, and other music and radio services
 - Use Pandora, Spotify, and other music streaming services

Echo Series

- ✓ **Echo Dot**
 - Echo **compact model**
 - Clock presented on the LED display (only in the "with clock" model)
- ✓ **Echo Flex**
 - **Plugs into outlets, supporting Alexa use in various locations**
 - **Also supports conversations between Echo devices (inside and outside the home)**

Diagram showing the Echo series devices and their generations:

- Echo** (4th generation, released in October 2020)
- Echo Plus** (2nd generation)
- Echo** (3rd generation)
- Echo Show 10** (3rd generation, release scheduled in 2020)
- Echo Show** (2nd generation)
- Echo Dot** (3rd generation)
- Echo Spot** (No longer available)
- Echo Flex** (4th generation, released in October 2020)

- ✓ **Echo Show**
 - 2nd-generation line-up 5.5", 8", and 10.1"
 - Provides news, YouTube, monitoring camera images, song lyrics, calendar, and other information, supports video conversations too
 - 3rd-generation features include automated expansion of a person **with automated framing** and 350° rotation in response to voice and movement
- ✓ **Echo Plus** (no new model plans)
 - Connects to **smart home electronics and functions as a hub (Zigbee compliance)**
 - Echo support from the 4th generation, not supported by Echo dot
 - Confirms room temperature with a built-in **temperature sensor**
 - Echo support from the 4th generation, not supported by Echo dot

Products	Price (USD)	Features
Amazon Echo (4th)	99.99	Stationary speaker with connectivity
Echo Show 10 (3rd)	249.99	Stationary Echo with a display
Echo Dot (4th)	49.99	Compact Echo with a clock display feature (\$59.99), premium sound (\$99.99)
Echo Flex	24.99	Plugs into an outlet and supports use of Alexa in various locations

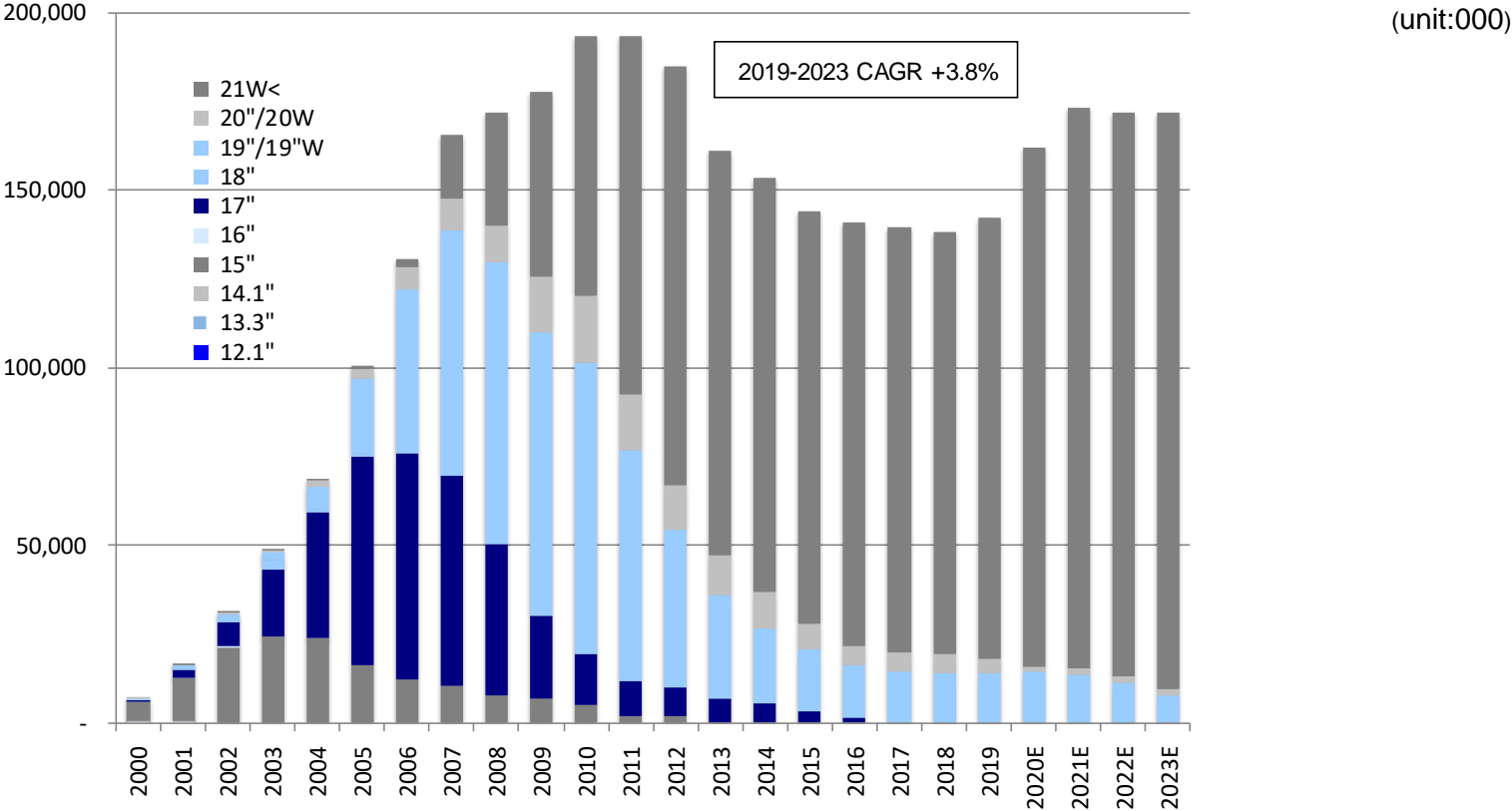
Amazon Dash overview

- ❑ **What is Amazon?**
 - Button-type device for single-touch ordering of Amazon products (service ended in Aug.2019)
 - Coverage: 100 brands, more than 1,400 types (Japan, as of June 2017)
 - Daily goods, food and beverages, pet and baby products, snacks, alcoholic beverages
 - Start US service in March 2015 only for Prime members, \$4.99 for one device
- ❑ **What is AWS IoT button?**
 - Button that can be freely programmed (**sales finished**)
 - Allows customization of the ordered product in contrast to Dash
 - Can be used for other applications too
 - Unlocking the car, home electronics controller



Source: Compiled by Mizuho Securities Equity Research from company data. Photos came from Amazon.com website.

LCD monitors: Difficult to see higher volumes but expect larger screens, more hi-def monitors



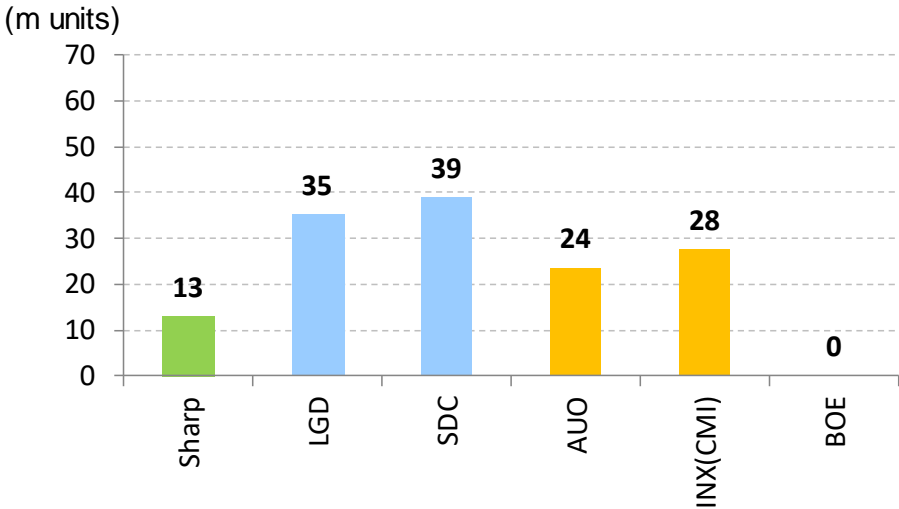
- 180m peak in 2011, 2015 saw bottom of 130m, and roughly in flat since 2016.
- Getting larger:23"+ 16:9 aspect ratio becoming mainstream. Shift to 4K resolution.
- Value-added: Expecting 4K2K monitor market expansion for business, game, other applications; 21:9 aspect promising.
- Expect growth caused by some reasons incl. WFH demand, 131m in 2020 and 132m in 2021.

Source: Mizuho Securities Equity Research

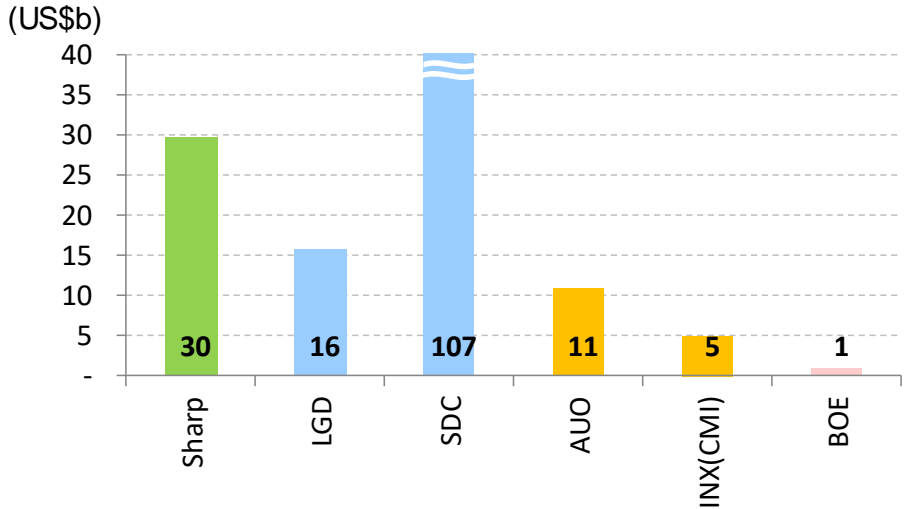
5. Panel Makers' Financial Performance

Major data of panel makers in 2009

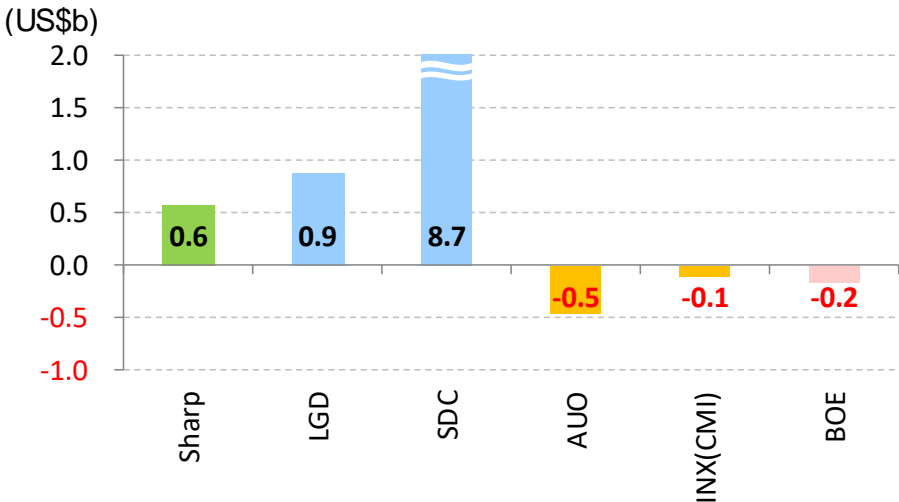
TV panel shipment units - 2009



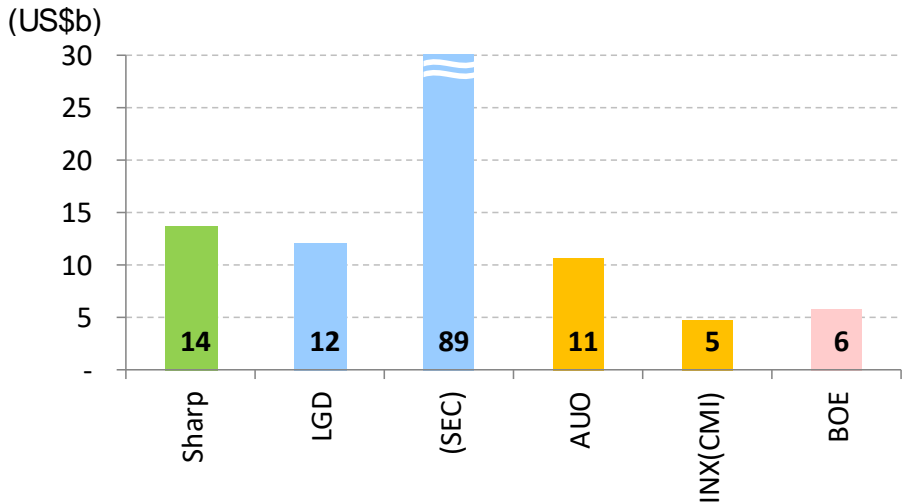
Sales Revenue - 2009



Operating income - 2009



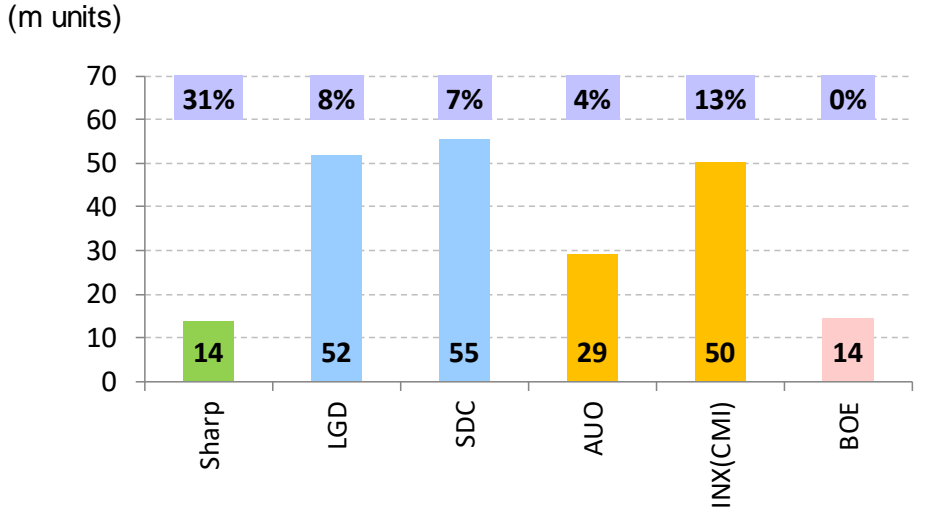
Market cap - 2009



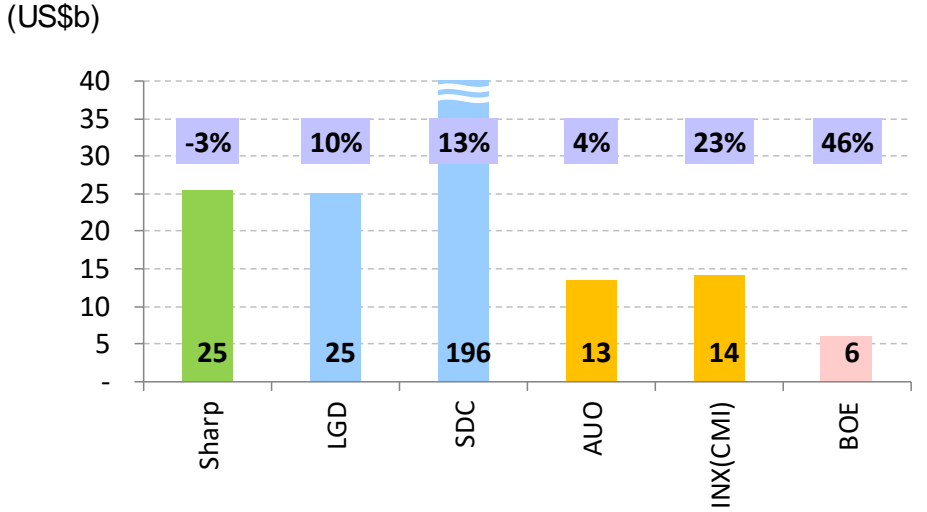
Source: Mizuho Securities Equity Research, from Bloomberg

Major data of panel makers in 2014

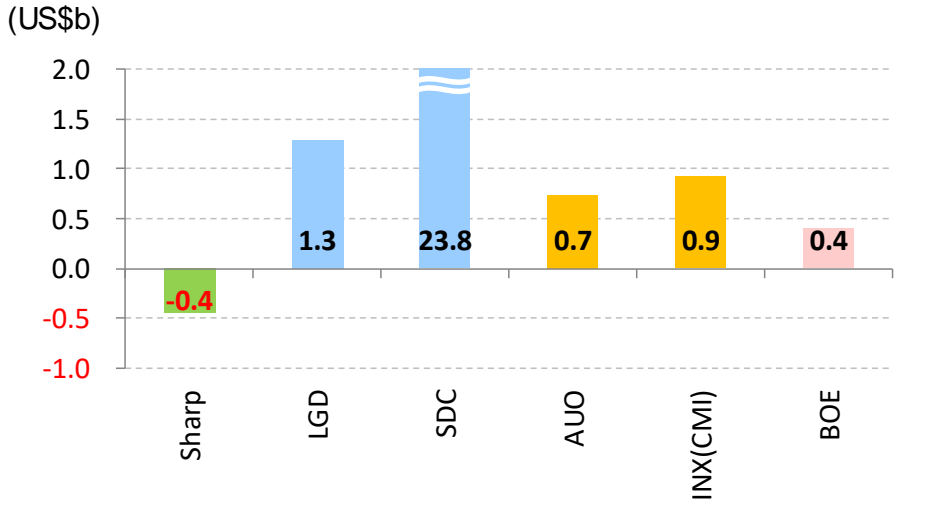
TV panel shipment units & 5 year CAGR - 2014



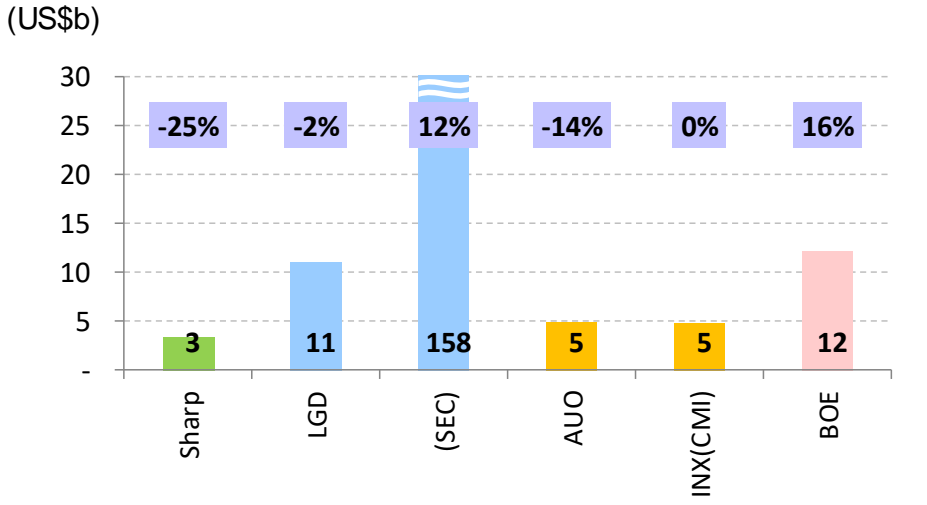
Sales Revenue & 5 year CAGR - 2014



Operating income & 5 year CAGR - 2014



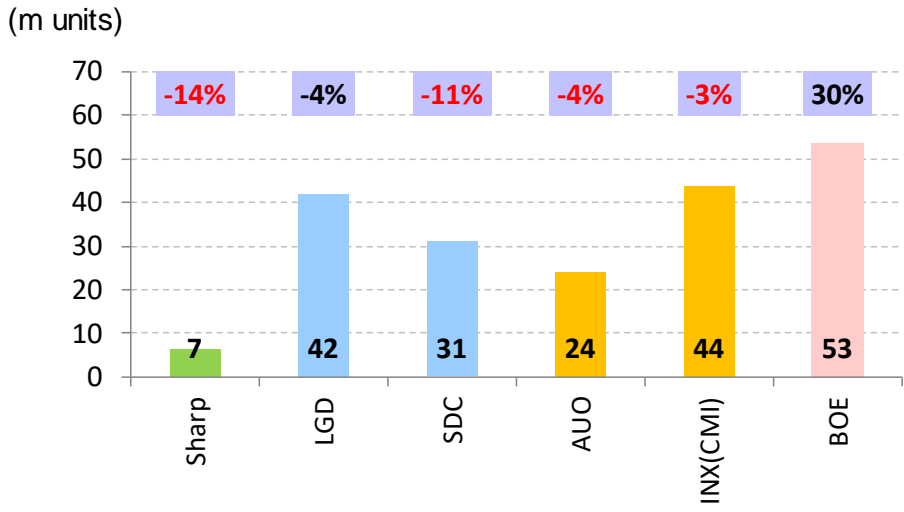
Market cap & 5 year CAGR - 2014



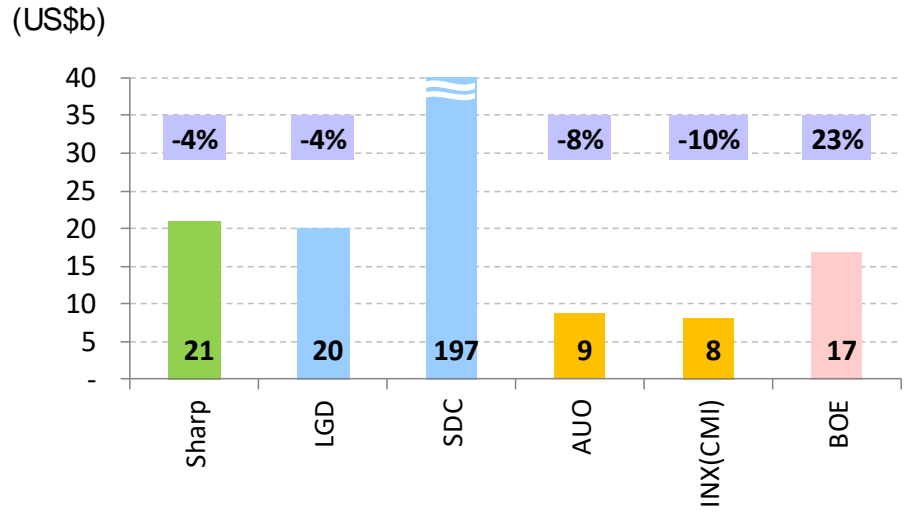
Source: Mizuho Securities Equity Research, from Bloomberg

Major data of panel makers in 2019

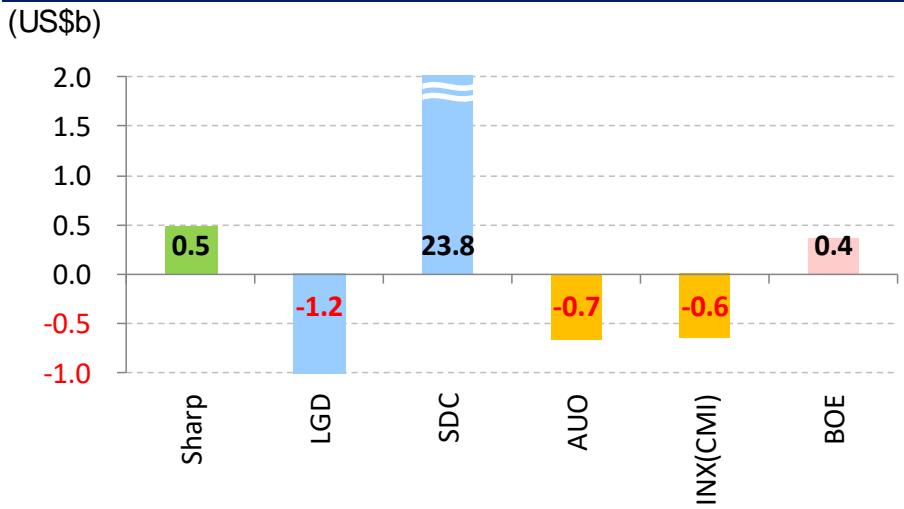
TV panel shipment units & 5 year CAGR - 2019



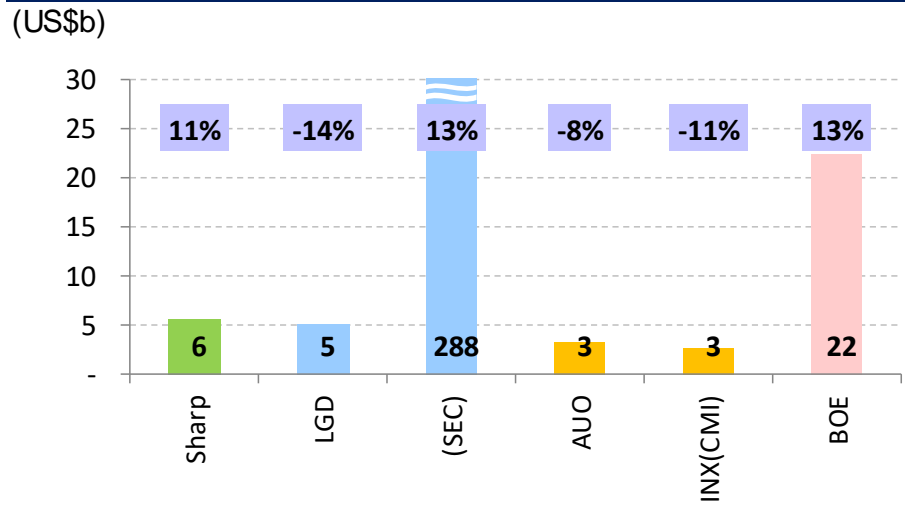
Sales Revenue & 5 year CAGR - 2019



Operating income & 5 year CAGR - 2019

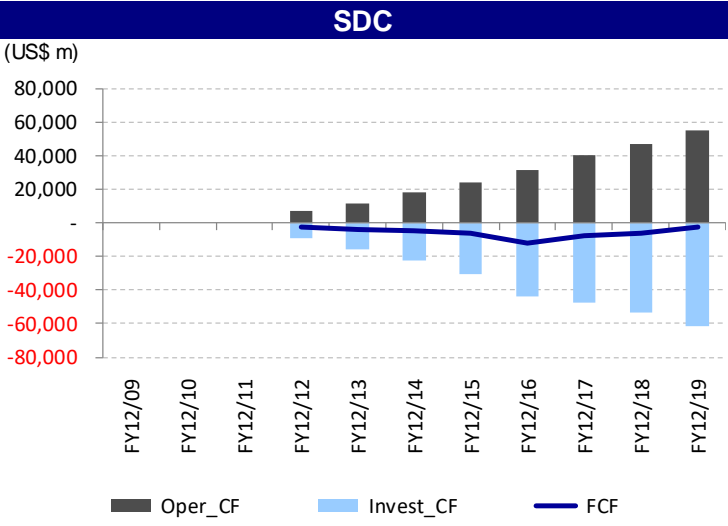
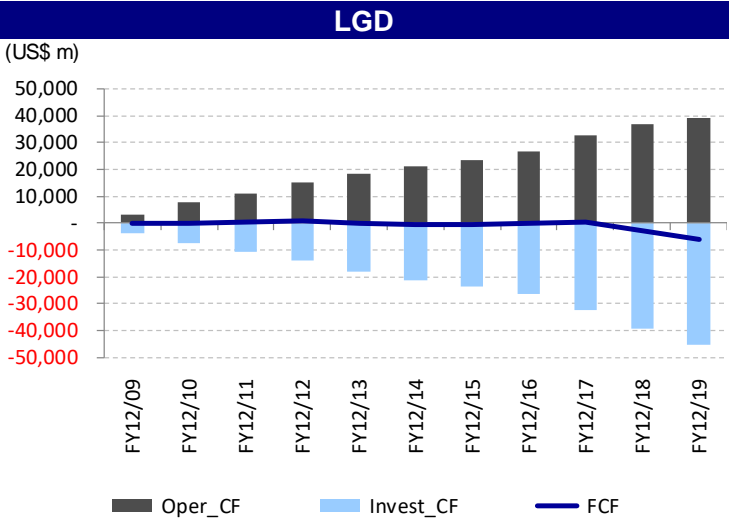
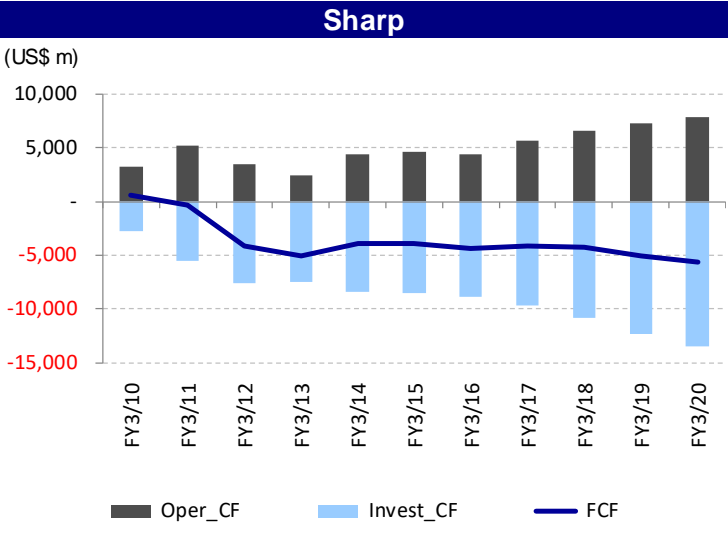
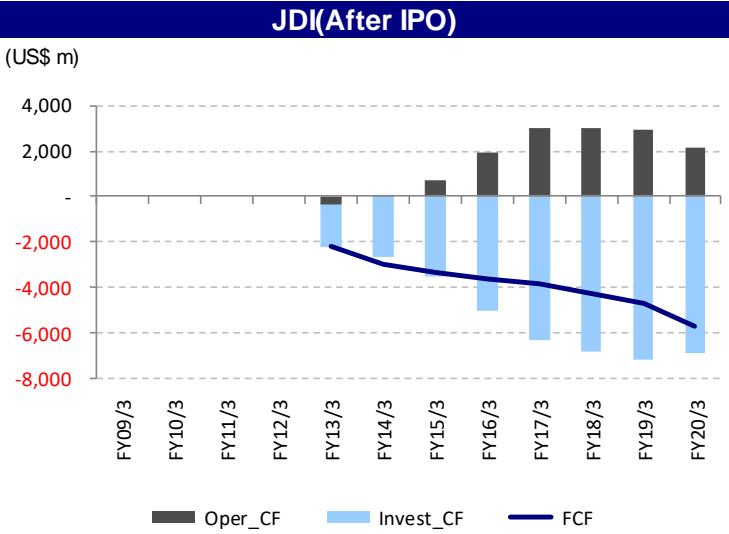


Market cap & 5 year CAGR - 2019



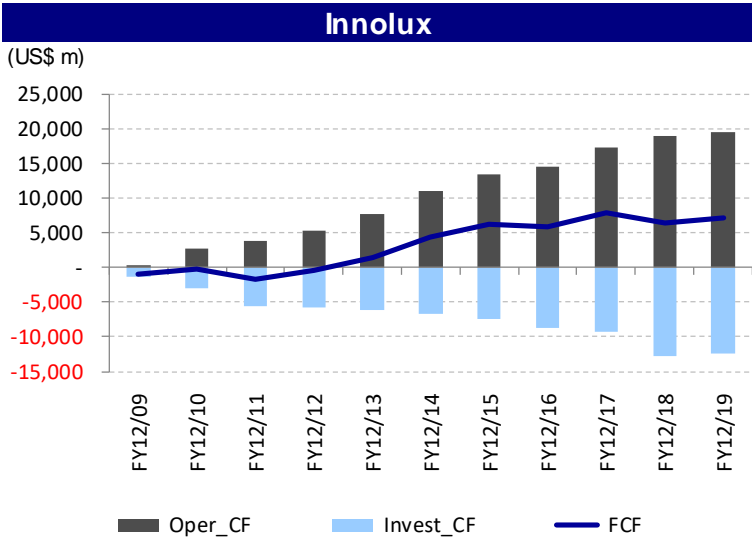
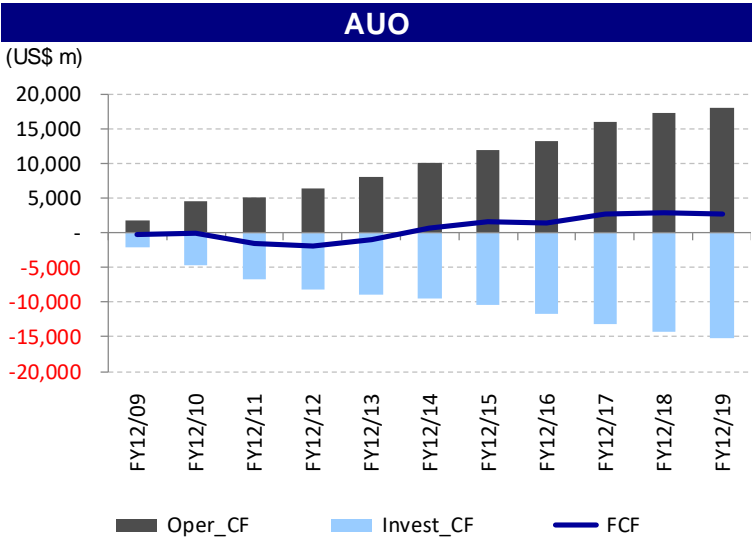
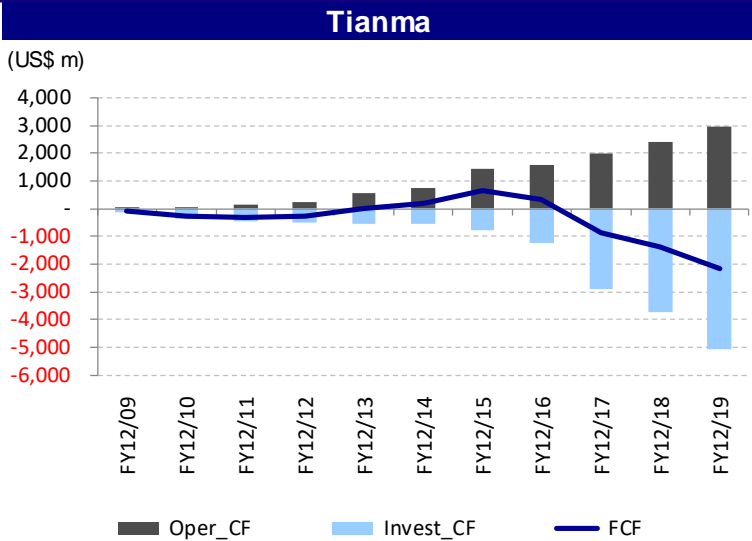
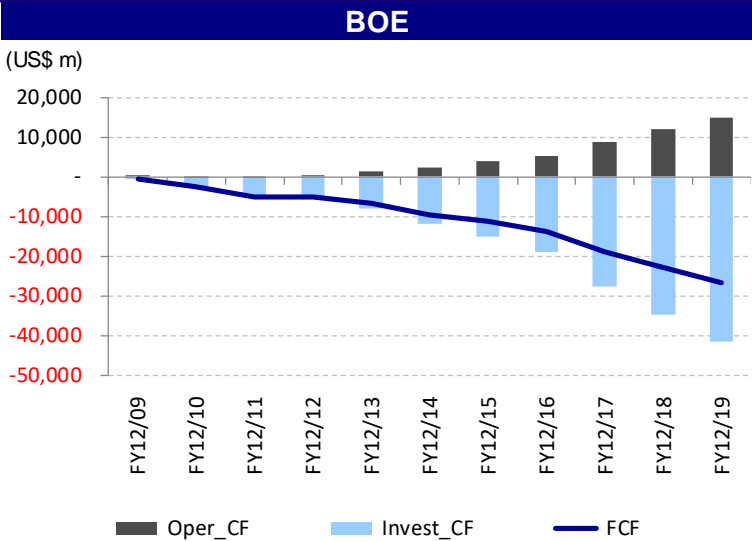
Source: Mizuho Securities Equity Research, from Bloomberg

Accumulated free cash flow (2008-) – Display manufacturers (1)



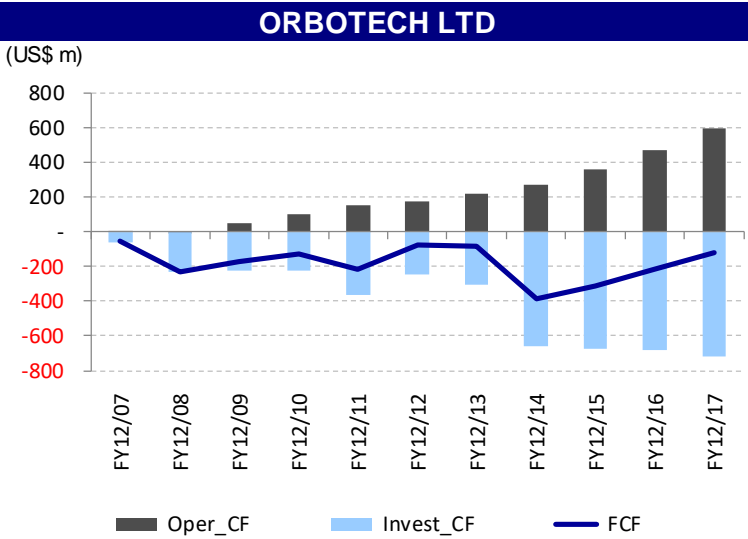
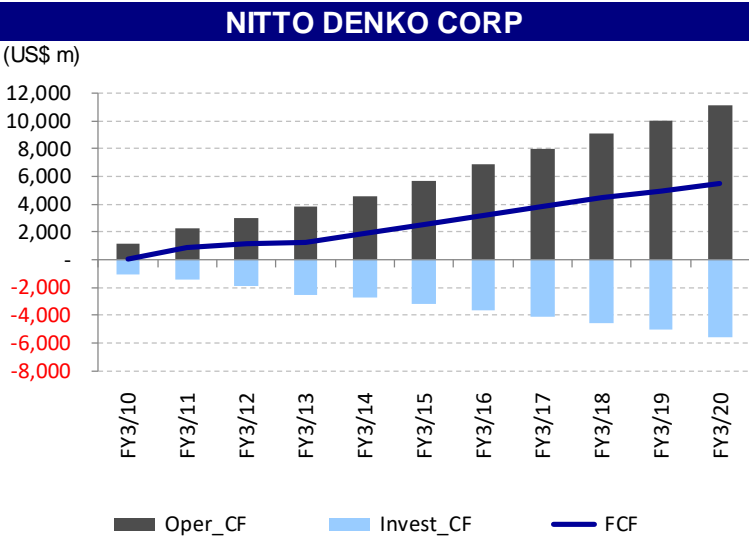
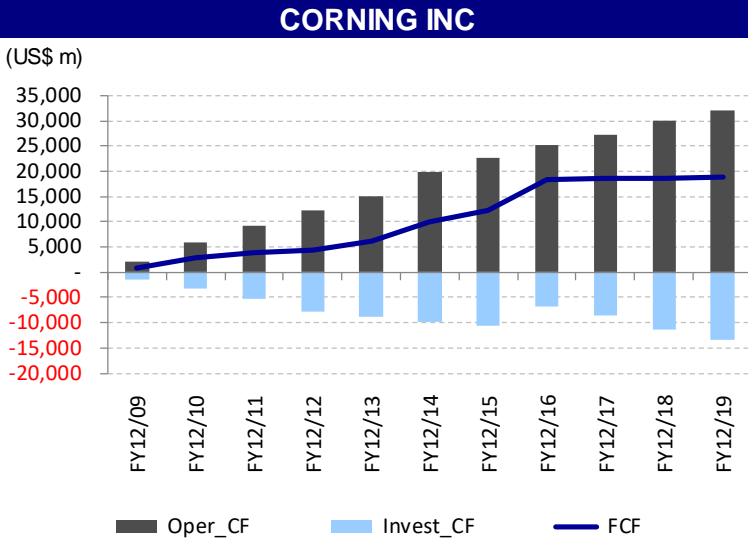
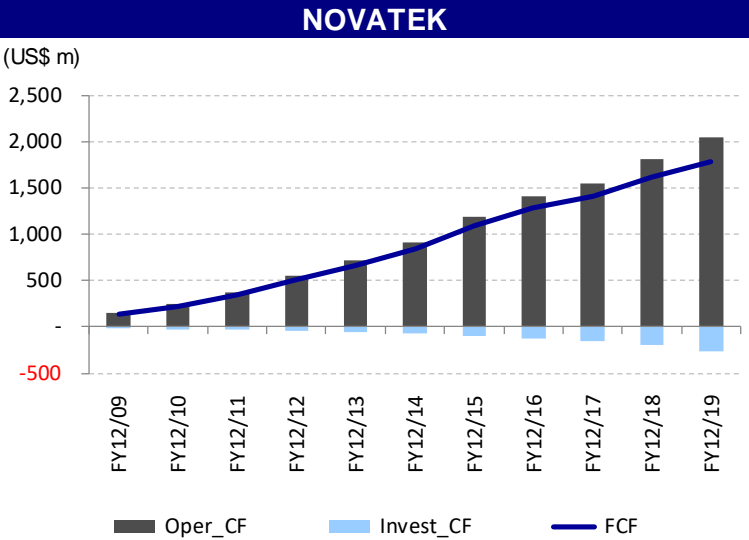
Source: Mizuho Securities Equity Research, from Bloomberg

Accumulated free cash flow (2008-) – Display manufacturers (2)



Source: Mizuho Securities Equity Research, from Bloomberg

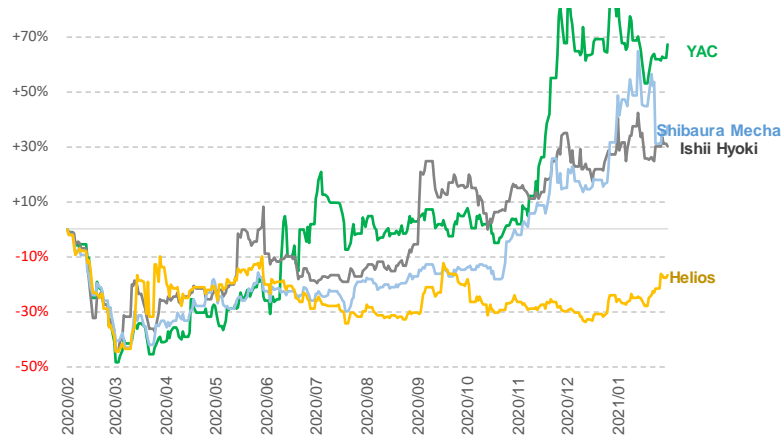
Accumulated free cash flow (2008-) – FPD material & component makers



Source: Mizuho Securities Equity Research, from Bloomberg

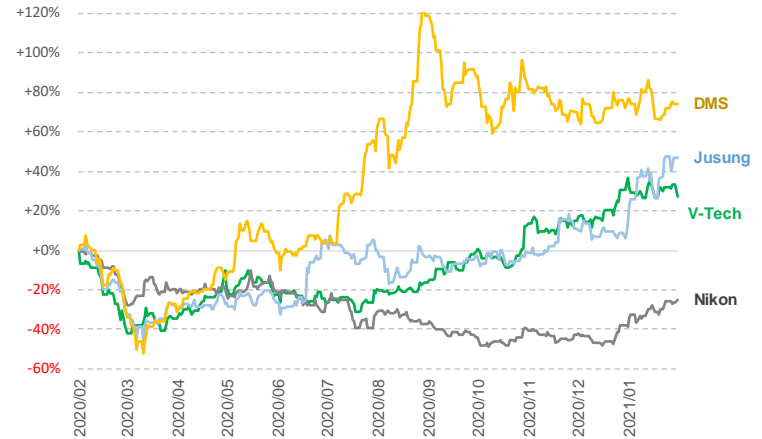
FPD supply-chain: share price trend (1)

LCD equip (1)



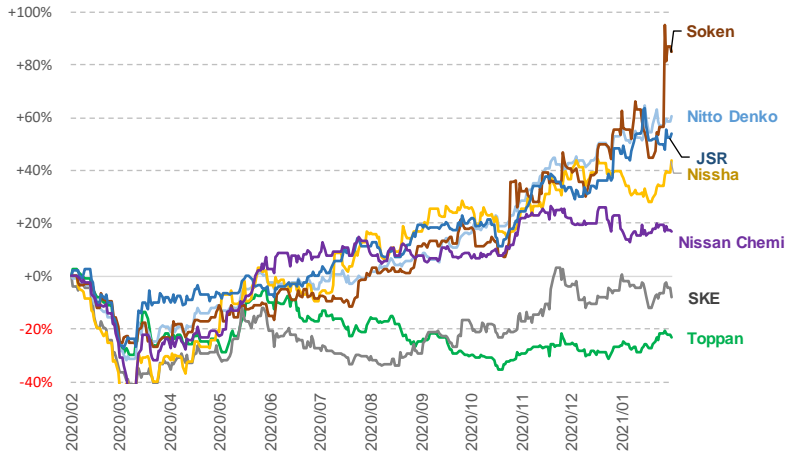
performance	YAC	Ishii Hyoki	Shibaaura Mecha	Helios
1YR	+67%	+30%	+37%	-17%
YTD	-1%	+7%	+16%	+21%

LCD equip (2)



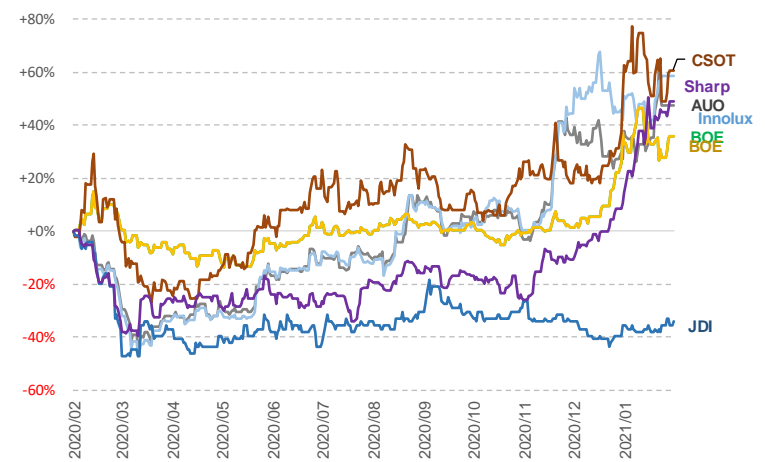
performance	V-Tech	Nikon	Jusung	DMS
1YR	+27%	-25%	+47%	+74%
YTD	+6%	+40%	+34%	+1%

LCD material



performance	Toppan	SKE	Nitto Denko	Nissha	Soken	JSR	Nissan Chemi
1YR	-23%	-8%	+61%	+44%	+85%	+54%	+17%
YTD	+8%	+0%	+7%	+1%	+23%	+13%	-7%

LCD mnf

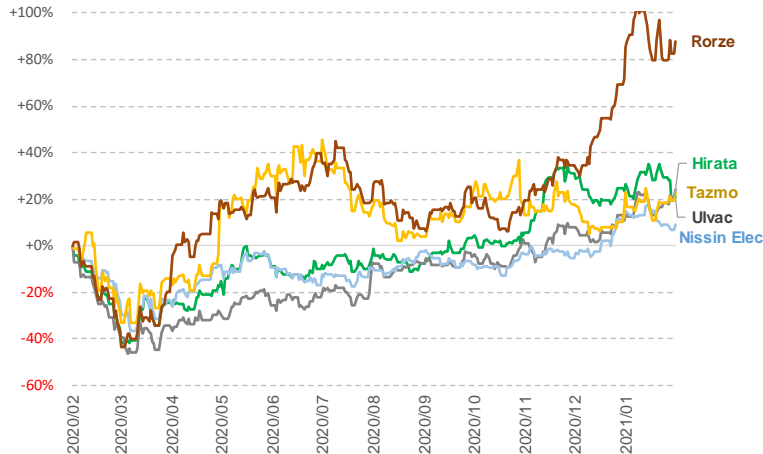


performance	BOE	AUO	Innolux	BOE	CSOT	JDI	Sharp
1YR	+36%	+48%	+59%	+36%	+61%	-34%	+49%
YTD	+24%	+15%	+4%	+24%	+29%	+11%	+49%

Source: Mizuho Securities Equity Research, from Bloomberg

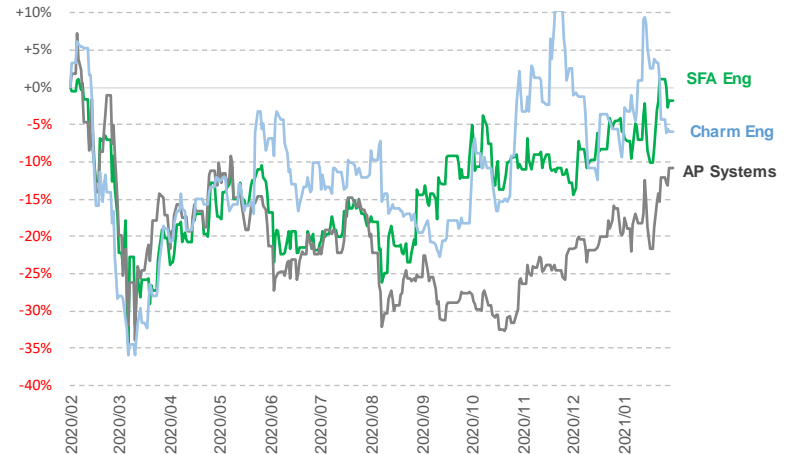
FPD supply-chain: share price trend (2)

OLED equip (1)



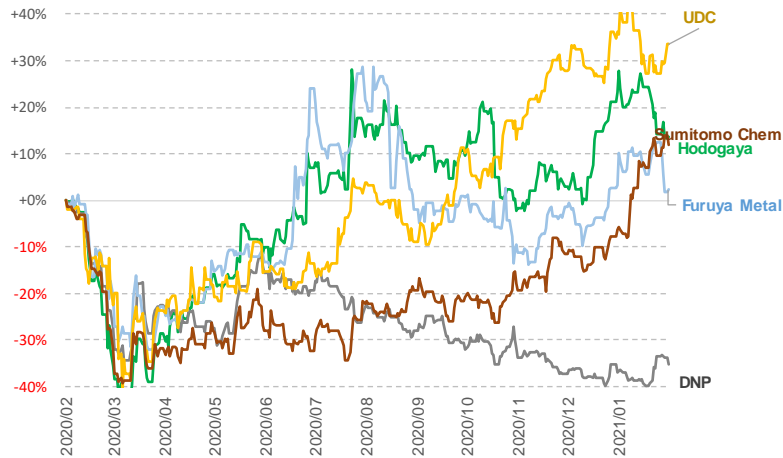
performance	Hirata	Ulvac	Nissin Elec	Tazmo	Rorze
1YR	+21%	+24%	+9%	+22%	+88%
YTD	+2%	+17%	+7%	+13%	+21%

OLED equip (2)



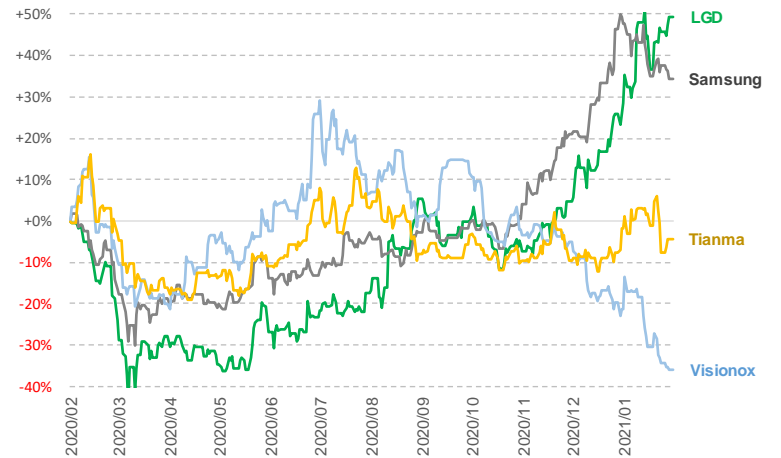
performance	SFA Eng	AP Systems	Charm Eng
1YR	-2%	-11%	-6%
YTD	+7%	+11%	-2%

OLED material



performance	Hodogaya	DNP	Furuya Metal	UDC	Sumitomo Chem
1YR	+14%	-35%	+2%	+33%	+12%
YTD	-1%	+5%	+6%	+5%	+24%

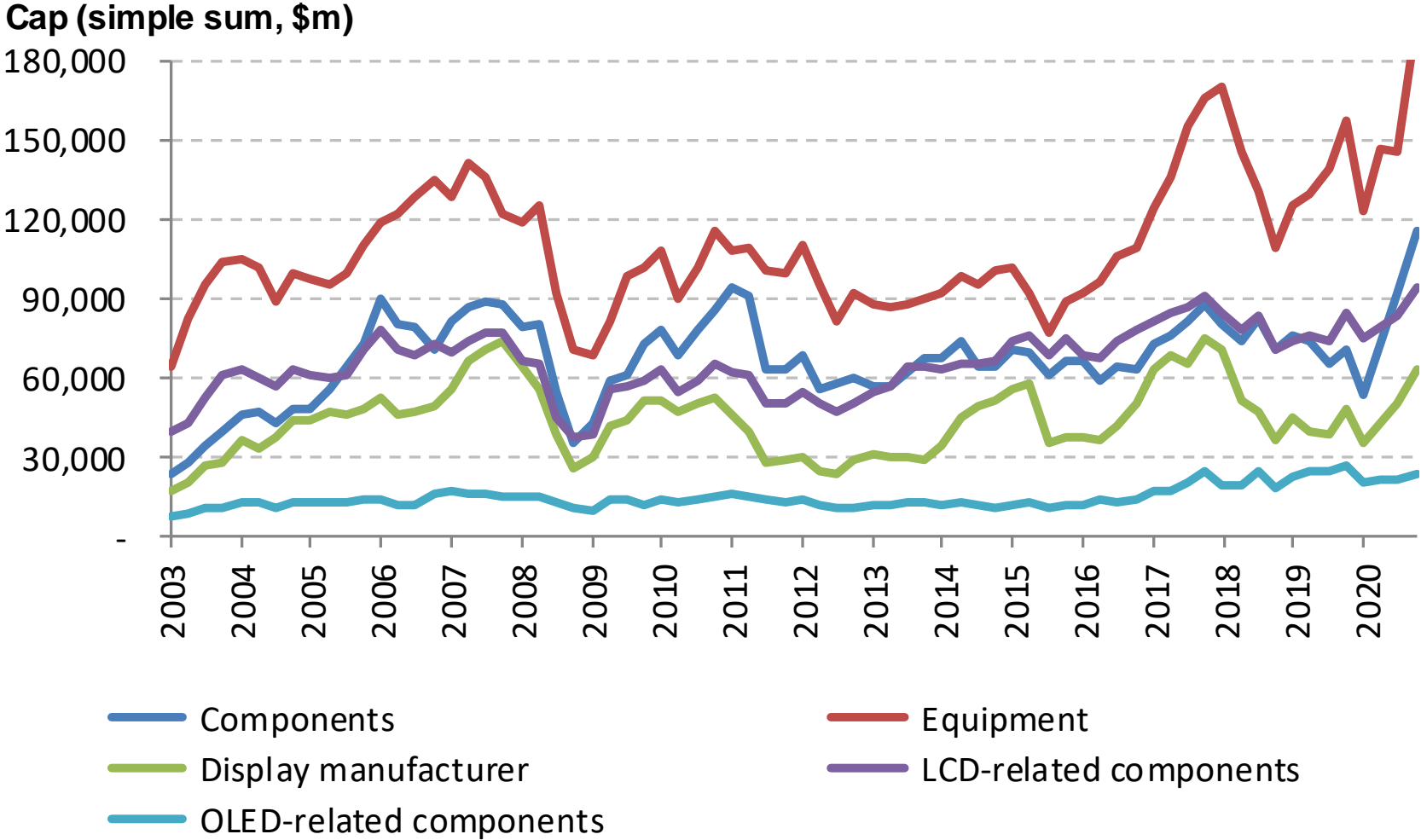
OLED mnf



performance	LGD	Samsung	Visionox	Tianma
1YR	+49%	+34%	-36%	-4%
YTD	#N/A	#N/A	#N/A	#N/A

Source: Mizuho Securities Equity Research, from Bloomberg

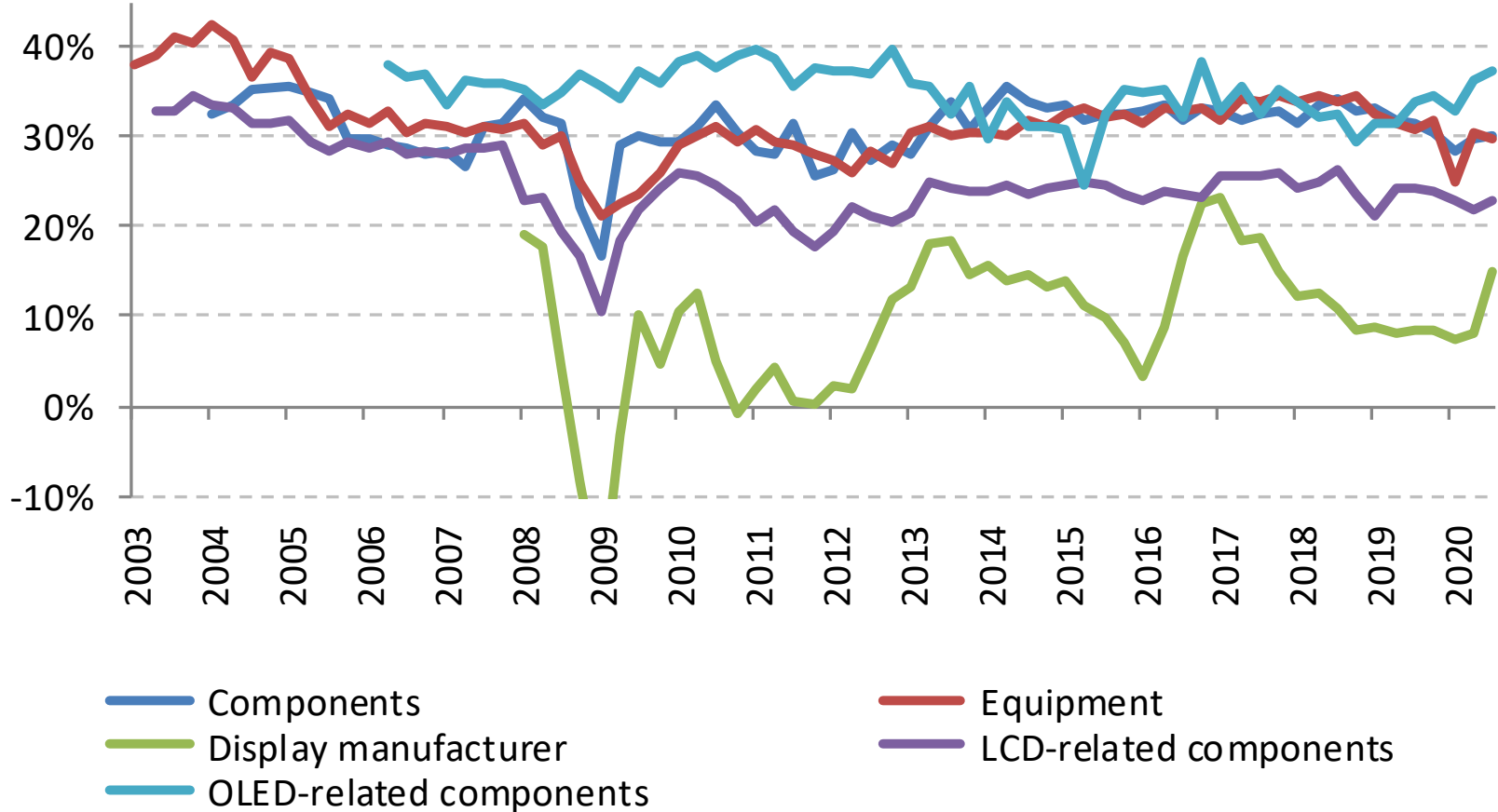
FPD supply-chain: market cap trend



Source: Mizuho Securities Equity Research, from Bloomberg

FPD supply-chain: GP margin trend

Gross margin (simple average)



Source: Mizuho Securities Equity Research, from Bloomberg

6. Capacity Expansion Forecast

FPD capacity forecast of Japanese makers

	Technology	Gen.	Substrate size (mm)	Max. capacity ('000/mth)	Current Capacity ('000/mth)	Start of production	Remarks & Technology alliance partners
Japan							
Sharp/SDP							
Mie No.2	A-Si	4.0	680x880	90	90	1Q01	Auto, Industrial
Ferri NF4	LTPS/Oxide	3.5	620x750	18	0	4Q02	Closed
Mie No.3	LTPS	4.5	730x920	100	60	2Q03	Smartphone, Game, OLED backplane for Sakai
Kameyama Fab2	A-Si/Oxide	8.0	2160x2460	50	50	3Q06	NB/Tablet/MNT/Auto, full conversion to Oxide
Kameyama LTPS Fab1	LTPS	6.0	1500x1850	22	22	3Q12	Smartphone/Auto
Hakusan	LTPS	6.0	1500x1850	50	25	1Q21	Bought from JDI, with Apple
Sakai Fab1	A-Si	10.0	2880x3130	80	80	3Q09	40"/42"/60"/65"/70"/120"
Sakai OLED	OLED	4.5	730x920	15	15	4Q18	Smartphone
Sakai Fab2	OLED	6.0	1500x1850	45	0	TBD	Pilot (5K)+Mass Production(45K in total)/Suspended
Japan Display							
Higashiura	LTPS	3.5	600x720	22	22	4Q99	OLED Backplane/NB, VR etc
Ishikawa D1	LTPS	4.5	730x920	40	40	3Q06	Automotive/OLED Backplane
Nomi D2	LTPS	5.5	1300x1500	25	0	2Q12	Closed, LTPS line transferred to JOLED as backplane
Ishikawa OLED Test Line	OLED	4.5	730x920	10	0	3Q14	Closed
Mobara V3	LTPS	4.5	730x920	20	20	3Q01	Process for Pixel Eyes
Mobara J1	LTPS	6.0	1500x1850	50	45	2Q13	Smartphone/Auto
Hakusan D3	LTPS	6.0	1500x1850	50	0	3Q16	Sold to Apple and Sharp
Mobara OLED(test/small MP line)	OLED	6.0	1500x1850	3	3	3Q19	Apple Watch Panels(Flex OLED, G6 Half Cut)
Hakusan OLED(Mass Production line)	OLED	6.0	1500x1850	30	0	TBD	OLED process for smartphone
JOLED							
Ishikawa (Test/Small MP Line)	OLED	4.5	730x920	5	3	3Q16	Inkjet RGB(Tablet/Monitor) , Rigid/Flex
Nomi	OLED	5.5	1300x1500	20	20	2Q21	Inkjet RGD, Rigid/Flex Auto/MN/TV
Panasonic LCD							
Himeji Fab1	A-Si	8.0	2200x2500	50	10	2Q10	Auto, Industrial, to be shut down in 213Q

Acquired by AAPL/SH

Notes:1) Light blue denotes fabs that plan to start production or expand input to full production from 2020, 2) Violet denotes fabs that are suspended or closed, 3) Includes planning stages, company estimates, does not take account of possibility of materialization. It is possible that plans could see new additions, changes, delays, and suspensions, etc.

Source: Compiled by Mizuho Securities Equity Research from company data

FPD capacity forecast of Korean makers

	Technology	Gen.	Substrate size (mm)	Max. capacity ('000/mth)	Current Capacity ('000/mth)	Start of production	Remarks & Technology alliance partners	
Korea								
Samsung Display								
	Cheonan L5-1	A-Si	5.0	1100x1250	110	0	3Q02	Closed
	Cheonan L5-2	A-Si	5.0	1100x1250	110	0	2Q03	Closed
	Cheonan L6	A-Si	5.0	1100x1300	160	0	4Q03	Closed
	Tangeong T7	A-Si	7.0	1870x2200	140	0	2Q05	Closed
LCD capacity reduction ↓ Conversion to QD OLED	Tangeong T7-2	A-Si	7.0	1870x2200	180	100	3Q08	Monitor/TV, to be closed in Apr-21
	Tangeong T8	A-Si	8.0	2200x2500	80	0	3Q07	Monitor/TV, 90K closed in 3Q19, rest of 80K in 1Q21
	Tangeong T8-2	A-Si	8.0	2200x2500	170	110	3Q10	production extended to 4Q21, w 110K/M capacity
	Chaonan A1	LTPS/OLED	4.5	730x920	60	60	2Q07	Smartphone/Tablets
	Tangeong A2	LTPS/OLED	5.5	1300x1500	202	202	2Q11	Smartphones, +22K in A2/V1
	Tangeong A3	LTPS/OLED	6.0	1500x1850	135	135	2Q15	Smartphones, capacity to be reduced due to more value added processes
	Tangeong A4 (in L7-1)	LTPS/OLED	6.0	1500x1850	60	30	1Q19	Smartphones(Max60K using LCM fab?)
	Tangeong A5	LTPS/OLED	6.0	1500x1850	180	0	2Q23	Smartphones(New building)
	Tangeong A6	Oxide/OLED	8.0	2200x2500	90	0	TBD	Foldable/IT Panels(New building)
	Tangeong T8 QD-OLED	Oxide-QD OLED	8.0	2200x2500	120	0	4Q21	Conversion from T8-1/2(Phase1: 30K, Phase2: 30K Max 90K)
CSOT acquired	Tangeong V1/V2	LTPS/OLED	8.0	2200x2500	60	0	TBD	converted to A2-Extension line
	Suzhou Fab1 (China)	A-Si	8.0	2200x2500	150	0	1Q14	JV with Suzhou Gov, sold to CSOT
	Tangeong T9	A-Si	8.0	TBD	60	0	TBD	TV/IT
LG Display								
	AP2 (G4.5)	LTPS	4.5	730x920	85	22	2Q11	Smartphone
	AP3 (G6)	LTPS	6.0	1500x1850	32	32	4Q13	Smartphones/Partially converted to E5 BP, reduced to 32K in 17
	AP2 OLED	OLED	4.5	730x920	22	22	3Q13	Watch, Smartphone
	E5 OLED	OLED	6.0	1500x1850	30	15	1Q17	Smartphone, Automobile, P1:7.5K, P2:7.5K, P3:15K
	Kumi P4	A-Si	5.0	1000x1200	155	0	2Q02	Closed
	Kumi P5	A-Si	5.0	1100x1250	150	80	2Q03	Tablet/NB
	Kumi P6	A-Si	6.0	1500x1850	70	45	3Q04	to be shut down in 2Q21?
Capacity reduction	Paju P7	A-Si	7.5	1950x2250	240	150	1Q06	Production extended to 4Q21, possibly into 22
	Paju P8	A-Si	8.0	2200x2500	230	130	1Q09	Production extended to 4Q21, possibly into 22
	P9-1	A-Si	8.0	2200x2500	120	90	2Q12	Monitor/Tablet/TV
	E4 OLED	Oxide/OLED	8.0	2200x2500	80	80	3Q14	48"/55"/65"/77" TV
	P10 (Large size: LCD)	A-Si/Oxide	10.5	2940x3370	30	0	2Q19	suspended
	Guangzhou(Large size: OLED)	Oxide/OLED	8.0	2200x2500	120	60	3Q20	55"/65"/77"/48" TV Phase1:90K Phase2: 30K
	P10 (Large size:OLED)	Oxide/OLED	10.5	2940x3370	45	0	3Q23	65"/75" TV Phase1:WOLED, Phase2:U?
	E6/P10 OLED	LTPS/OLED	6.0	1500x1850	60	30	3Q19	Tablet/Smartphone
	P7(conversion from A-Si)	Oxide/OLED	7.5	1950x2250	60	0	2023	TBD
	P8(Conversion from A-Si)	Oxide/OLED	8.0	1320x1500	60	0	2023	TBD
	Guangzhou Fab1 (China)	A-Si	8.0	2200x2500	120	120	3Q14	JV with Guangzhou City, Skyw orth
	Guangzhou Fab2 (China)	A-Si	8.0	2200x2500	120	110	1Q16	JV with Guangzhou City, Skyw orth
	Nagpur Fab(India)	A-Si	8.0	2200x2500	120	0	TBD	LG PRI turnkey business with Tw instar/suspended

Notes:1) Light blue denotes fabs that plan to start production or expand input to full production from 2020, 2) Violet denotes fabs that are suspended or closed, 3) Includes planning stages, company estimates, does not take account of possibility of materialization. It is possible that plans could see new additions, changes, delays, and suspensions, etc.

Source: Compiled by Mizuho Securities Equity Research from company data

FPD capacity forecast of Taiwanese makers

	Technology	Gen.	Substrate size (mm)	Max. capacity ('000/mth)	Current Capacity ('000/mth)	Start of production	Remarks & Technology alliance partners
Taiwan							
AU Optronics							
HsinchuL3	LTFS/OLED	3.5	610x720	20	20	2Q12	Smartphone/Watch etc, Inkjet Test line
Singapore G4.5	LTFS/OLED	4.5	730x920	40	40	1Q13	Smartphone/Watch etc
Longtan L5A+L5B	A-Si	5.0	1100x1250	120	120	2Q03	Mid-sized/NB/Monitor
Taichung L6A	A-Si	6.0	1500x1850	150	150	2Q05	NB/Monitor/TV, conversion to Oxide
Taichung L5C	A-Si	5.0	1100x1300	140	140	3Q05	Tablet/NB
Taichung L7A	A-Si	7.5	1950x2250	110	110	2Q08	Monitor/TV
Taichung L7B-Located in L7B-	A-Si	7.5	1950x2250	70	70	3Q09	TV
Taichung L8A-Located in L7B-	A-Si/Oxide	8.0	2200x2500	50	50	2Q09	TV
Houli L8B	A-Si	8.0	2200x2500	180	130	2Q11	TV, 20K to be covered to IPS for IT panels
AU Optronics, Ex.Quanta Display							
Linko L5D	A-Si	5.0	1100x1300	80	80	2Q03	NB/Monitor
Longtan L6B	A-Si/Oxide	6.0	1500x1850	125	125	3Q08	50K covered to IPS, all IT panels
Innolux, Ex. Chimei Optoelectronics							
Tainan Fab3	A-Si	5.0	1100x1300	180	180	3Q03	Tablet/NB/Monitor
Tainan Fab4	A-Si	5.5	1300x1500	205	205	2Q05	Monitor/TV
Tainan Fab5	A-Si	5.0	1100x1300	200	200	3Q06	Tablet/NB/Monitor
Tainan Fab7	A-Si	7.5	1950x2250	140	140	2Q08	Monitor/TV
Tainan Fab6	A-Si	6.0	1500x1850	245	245	2Q08	Monitor/TV
Kaohsiung Fab8	A-Si	8.0	2200x2500	70	70	1Q10	TV
Kaohsiung Fab8-2 Plan1	LTFS	6.0	1500x1850	24	24	3Q16	Small and mid sized(Bought from Hon Hai)
Kaohsiung Fab8-2 Plan2	A-Si	8.6	2250x2600	60	45	4Q16	TV: 45"/50/58"
Innolux, Ex. Innolux							
Chunan T1	A-Si	5.0	1100x1300	90	90	1Q05	Small and Mid sized
Chunan T0	A-Si	4.5	730x920	40	20	1Q05	Small and Mid sized
Chunan T2	A-Si	6.0	1500x1850	120	120	3Q09	Monitor/TV, to be expanded to 170K
Innolux, Ex. TPO							
Chunan Fab1	LTFS	3.5	620x750	60	60	2Q02	Small and Mid sized
Chunghwa Picture Tube							
Longtan L1-A/B	A-Si	4.5	730x920	180	0	3Q03	Stopped operation
Longtan L2	A-Si	6.0	1500x1850	100	0	2Q07	Stopped operation
Hannstar Display							
Tainan Fab1	A-Si	5.0	1200x1300	130	130	1Q05	Small and Mid sized

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Source: Compiled by Mizuho Securities Equity Research from company data

FPD capacity forecast of Chinese makers 1

	Technology	Gen.	Substrate size (mm)	Max. capacity ('000/mth)	Current Capacity ('000/mth)	Start of production	Remarks & Technology alliance partners
China							
BOE-OT							
B1:Beijing Fab1	A-Si	5.0	1100x1300	50	50	3Q08	Small size
B2:Chengdu Fab	A-Si	4.5	730x920	50	41	1Q10	Small size
B4:Beijing Fab2	A-Si	8.0	2200x2500	140	140	3Q11	Mid-sizes/TV
B3:Anhui-Hefei Fab1	A-Si	6.0	1500x1850	90	90	4Q10	small size
B5:Anhui-Hefei Fab2	A-Si/Oxide	8.0	2200x2500	140	140	1Q14	Oxide process to be introduced, Tablet/TV
B5:Anhui-Hefei Fab2(OLED)	OLED	8.0	2200x2500	4	4	2016	Tset Line
B6:Ordos Fab1	LTPS/OLED	5.5	1300x1500	50	50	2Q14	Smartphone/Tablet/TV
B8:Chongqing Fab1	A-Si/Oxide	8.0	2200x2500	160	160	2Q15	Tablet/NB/Monitor/TV
B7:Chengdu	LTPS/flex OLED	6.0	1500x1850	45	45	3Q17	Small mid sizes
B9:Hefei	A-Si	10.5	2940x3370	160	140	1Q18	43"/65"/75"TV
B10:Fuqing	A-Si	8.0	2200x2500	170	170	2Q17	TV
B11:Mianyang	LTPS/flex OLED	6.0	1500x1850	45	45	3Q19	Small mid sizes
B12:Chongqing	LTPS/flex OLED	6.0	1500x1850	45	0	3Q21	Small mid sizes/Foldable
B15:Fuzhou	LTPS/flex OLED	6.0	1500x1850	45	0	3Q23	Small mid sizes
B16:Chengdu	LTPS/flex OLED	6.0	1500x1850	90	0	TBD	Small mid sizes/Suspended?
B15:Hefei or Fuzhou	Oxide/OLED	8.0	2250x2500	90	0	TBD	TV-TBD
B17:Wuhan	A-Si	10.5	2940x3370	160	120	1Q20	TV
Nanjing B18	Oxide/A-Si	8.0	2200x2500	90	75	3Q15	Bought from CEC group
Chengdu B19	A-Si/Oxide	8.7	2290x2620	150	150	2Q18	Bought from CEC group
B20:Wuhan or Chongqing	Oxide/OLED	10.5 or 8	TBD	90	0	TBD	TV
I/O							
Kunshan Fab1	A-Si	5.0	1100x1300	120	120	1Q07	Small mid sized
TBD	A-Si/Oxide	6.0	1500x1850	60	0	TBD	IT
CEC Panda Group							
Nanjing Fab1	A-Si	6.0	1500x1850	95	95	3Q11	Monitor/TV, Sharp's Kameyama Fab1 Facility + 20K
BOE Acquired Nanjing Fab2	Oxide/A-Si	8.0	2200x2500	90	0	3Q15	Sold to BOE
Xiayang Fab1	A-Si	8.6	2250x2610	150	150	2Q18	Development by their own
BOE Acquired Chengdu Fab4	A-Si/Oxide	8.7	2290x2620	150	0	2Q18	Sold to BOE
Jinan	A-Si/Oxide	10.5	2940x3370	60	0	TBD	JV with Someone? At FS stage
Century Display							
Shenzhen Fab1	A-Si	5.0	1200x1300	50	50	3Q09	Smartphone/NB/Monitor
Shenzhen Fab2	LTPS	5.0	1200x1300	40	40	1Q12	Smartphone

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Source: Compiled by Mizuho Securities Equity Research from company data

FPD capacity forecast of Chinese makers 2

	Technology	Gen.	Substrate size (mm)	Max. capacity ('000/mth)	Current Capacity ('000/mth)	Start of production	Remarks & Technology alliance partners
China							
Chinastar(TCL Group)							
Shenzhen T1	A-Si	8.0	2200x2500	160	160	1Q12	TV
Shenzhen T2	A-Si	8.0	2200x2500	160	160	2Q15	TV
Wuhan T3	LTPS	6.0	1500x1850	52	52	1Q16	Small Mid sizes
Wuhan T4	LTPS/Flex OLED	6.0	1500x1850	45	15	2Q19	Small Mid sizes
Wuhan T5	Oxide/LTPS	8.0	2200x2500	30	0	TBD	NB/Monitor
Shenzhen T6	A-Si	10.5	2940x3370	110	105	1Q19	TV
Shenzhen T7	A-Si	10.5	2940x3370	120	30	4Q20	TV/to be converted to Oxide-OLED?
Shenzhen T8	Oxide/OLED	6.0	1500x1850	30	0	3Q22	Suspended.Replaced by CSOT-JOLED joint R&D
Shenzhen T8	Oxide/OLED	8.0	2200x2500	60	0	2Q24	TV (Inkjet OLED)
Shenzhen T9	A-Si	8.6	2250x2600	180	0	1Q23	IPS-Oxide Panels for Monitor/NB/TV
Suzhou Fab(Ex. Samsung Display)	A-Si	8.0	2200x2500	150	130	1Q14	Bought from Samsung Display
HKC							
Chongqing H1	A-Si	8.6	2250x2600	100	90	2Q17	32"/50"/58" TV
Chuzhou H2	A-Si	8.6	2250x2600	155	150	4Q19	TV
Manyang H4	A-Si	8.6	2250x2600	180	90	4Q20	Monitor/TV/Mobile(IPS panels)
Changsha H5	A-Si/ (Oxide/OLED)	8.6	2250x2600	180	0	3Q21	TV, to convert into OLED in the future
H6(Location TBD)	A-Si	8.6	2250x2600	90	0	TBD	TV
Hehui							
Shanghai Fab1	LTPS/OLED	4.5	730x920	15	15	2Q15	Smartphone
Shanghai Fab2	LTPS/Flex OLED	6.0	1500x1850	45	30	1Q19	Smartphone
Tianma							
Xiamen Fab1	LTPS	5.5	1300x1500	35	35	2Q13	Smartphone
Xiamen Fab2	LTPS	6.0	1500x1850	45	45	3Q16	Smartphone/CF capacity 60K
Xiamen Fab3	LTPS/Flex OLED	6.0	1500x1850	45	0	1Q22	TBD
Chengdu	A-Si	4.5	730x920	30	30	3Q11	Mobile and others
Wuhan	A-Si	4.5	730x920	30	30	3Q11	Mobile and others
Shanghai Fab1	A-Si	4.5	730x920	35	30	4Q16	Smartphone
Shanghai Fab2	OLED process	5.5	1300x1500	5	5	4Q16	Smartphone
Wuhan	LTPS/OLED	6.0	1500x1850	38	30	1Q18	P1:15K, P2:15K, P3:7.5K(suspended)
Tianma(Jonhon Optronic)							
Shanghai Fab1	A-Si	5.0	1100x1300	70	70	1Q05	Small and Mid sized /Monitor
GoVisionox							
Kunshan V1	LTPS/OLED	5.5	1300x1500	15	15	2Q18	Smartphone
Guan V2	LTPS/Flex OLED	6.0	1500x1850	60	15	4Q18	Smartphone, Module fab in Bazhou
Hefei V3	LTPS/Flex OLED	6.0	1500x1850	60	0	2Q21	Smartphone
Guangzhou or Chengdu V4	LTPS/Flex OLED	6.0	1500x1850	60	0	3Q23	Smartphone
Trenso							
Liuyang Fab1	LTPS/OLED	6.0	1500x1850	30	0	TBD	Changsha Gov+Lens tech/Suspended
Truly							
Huizhou G4.5	A-Si	4.5	730x920	60	60	1Q17	Equipments bought from Samsung L4
Huizhou G4.5(OLED)	LTPS/OLED	4.5	730x920	15	15	1Q17	Smartphone→Non smartphone
Shang ei G5	A-Si	5.0	1100x1250	90	65	4Q18	Equipments from Samsung L5
Meishan G5	A-Si/LTPS	5.0	1100x1300	100	0	2021	Equipments from Samsung L6?Conversion to LTPS?
Meishan G6	LTPS/OLED	6.0	1500x1850	30	0	TBD	TBD
Infintech							
Jian G5.5(LTPS)	A-Si	5.5	1300x1500	30	0	2021	smartphone/suspended
Jian G6(OLED)	Oxide/OLED	6.0	1500x1850	30	0	TBD	TBD
Royole							
Shenzhen Fab1	Oxide/Flex OLED	5.5	1300x1500	30	5	2Q18	Foldable Smartphone

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Source: Compiled by Mizuho Securities Equity Research from company data

FPD capacity forecast of Chinese / Indian makers (Taiwan-related)

	Technology	Gen.	Substrate size (mm)	Max. capacity ('000/mth)	Current Capacity ('000/mth)	Start of production	Remarks & Technology alliance partners
China							
FVO							
Kunshan Fab2	LTPS	6.0	1500x1850	50	25	1Q17	AUO+Kunshan Government
Tianyi Display/Hon Hai Group							
Zhengzhou Fab1	LTPS/OLED	6.0	1500x1850	60	0	TBD	Suspended
Guizhou Fab1	LTPS/OLED	6.0	1500x1850	60	0	TBD	Suspended
Guangzhou Fab1	A-Si/Oxide?	10.5	2940x3370	150	60	2Q20	JV with Guangzhou Gov/ 65"/75"/55"/32"TV
Nanjing Fab1	A-Si/Oxide?	10.5	2940x3370	90	0	TBD	TBD
MDT							
Fuzhou Fab1	Oxide/A-Si	6.0	1500x1850	90	60	3Q18	Smartphone/Tablet
Incoflex							
Xian Fab1	LTPS/OLED	6.0	1500x1850	30	0	1Q22	Suspended ?
TJO							
Huzhou Fab1	A-Si	8.0	2200x2500	90	0	4Q22	Equipment from SDC T8, IT/TV
Laibao							
Wuhan Fab1	A-Si	8.0	2200x2500	60	0	2025	Equipment from Panasonic/DNP
India							
Hon Hai Group							
India Fab plan1	A-Si	10.5	2940x3370	90	0	TBD	TV/Suspended
India Fab plan2	LTPS	6.0	1500x1850	60	0	TBD	Smartphone/Suspended
Vedanta Group							
India Fab plan1	A-Si	8.0	2200x2500	60	0	2024 ?	TV
US							
Hon Hai Group							
US Fab plan1	A-Si/Oxide?	10.5	2940x3370	90	0	TBD	Suspended
US Fab plan2	Oxide	6.0	1500x1850	TBD	0	TBD	Auto, PC, Tablets, starting from less than 15K

Notes: 1) Light blue denotes fabs that plan to start production or expand input to full production from 2020, 2) Violet denotes fabs that are suspended or closed, 3) Includes planning stages, company estimates, does not take account of possibility of materialization. It is possible that plans could see new additions, changes, delays, and suspensions, etc.

Source: Compiled by Mizuho Securities Equity Research from company data

Projected schedule of FPD capacity expansion (Korea)

Company	Fab	Gen.	substrate size	Designed Capacity/M	Phase	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024		2025					
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Samsung Display for Smartphone for Foldable/IT? QDOLED New Project QNED	A2 (LTPS/OLED)	5.5	1300x1500mm	200K	Phase4									MI	MP	+30K(in V1 Fab) Push out(+22Q)																			
	A3 (Flex OLED)	6.0	1500x1850mm	135K	Phase1					MI	MP	+15K Push out(+9Q)																							
					Phase2																														
					Phase3																														
					Phase4																														
					Phase5																														
	A4(L7-1)	6.0	1500x1850mm	60K	Phase1																														
	Phase2																																		
	A5 (Flex OLED)	6.0	1500x1850mm	90K	Phase1																														
	Phase2																																		
Phase3																																			
A6 (OXIDE/OLED)	8.0	2200x2500mm	60K	Phase1																															
Phase2																																			
T8-1 Conversion (OXIDE/QDOLED)	8.0	2200x2500mm	30K																																
T8-2 Conversion (OXIDE/TBD)	8.0	2200x2500mm	30K~60K																																
T9? (OXIDE/TBD)	8.0	TBD	30K																																
LG Display	Paju E4 (OXIDE/OLED)	8.0	2200x2500mm	75K (WOLED)	Phase1																														
	Phase2																																		
	Phase3																																		
	P9-1	8.0	2200x2500mm	120K																															
	Kumi P6-3 (LTPS)	6.0	1500x1850mm	LCD 40~17K OLED 30K	Phase1																														
					Phase2																														
	E5 (OLED) Phase1																																		
	E5 (OLED) Phase2																																		
	P10 (OXIDE/OLED)	10.5	2940x3370mm	60K (OLED)	Phase1																														
	Phase2																																		
Phase3																																			
Phase1																																			
Phase2																																			
E6 (Flex OLED)	6.0	1500x1850mm	60K	Phase3																															
Phase4																																			
Paju P7 Conversion (OXIDE/OLED)	7.5	1950x2250mm	60K (WOLED)																																
Paju P8 Conversion (OXIDE/OLED)	8.0	2200x2500mm	60K (WOLED)																																

LCD / LTPS OLED / LTPS G7.5 ≤
 LCD / OXIDE OLED / OXIDE G6.0 ≥

Source: Compiled by Mizuho Securities Equity Research from company data

Projected schedule of FPD capacity expansion (China3)

Company	Fab	Gen.	substrate size	Designed Capacity/M	Phase	2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023		2024		2025					
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Tianma	Xiamen (LTPS)	5.5	1300x1500mm	35K	Phase1+2	MI→		MP→	+35K Push out(+5Q)																										
		6.0	1500x1850mm	40K	Phase3							MI	MP	+30K Push out(+3Q)																					
	Xiamen (LTPS/OLED)	6.0	1500x1850mm	45K	Phase1																	MI	MP	+15K											
					Phase2																			MI	MP	+15K	+15K Push out(+2Q)								
					Phase3																					MI	MP	+15K	+15K						
Shanghai (OLED process)	5.5	1300x1500mm	4K									MI	MP	+4K Push out(+2Q)																					
Wuhan (Flex OLED)	6.0	1500x1850mm	38K	Phase1																	MI	MP	+15K Push out(+8Q)												
				Phase2																															
				Phase3																															
Visionox	Kunshan(LTPS/OLED)	5.5	1300x1500mm	15K	Phase1/2																														
	Guan V2 (Flex OLED)	6.0	1500x1850mm	30K	Phase1																														
					Phase2																														
					Phase3																														
					Phase4																														
Hefei V3 (Flex OLED)	6.0	1500x1850mm	30K	Phase1																	MI	MP	+15K Push out(+1Q)												
				Phase2																		MI	MP	+15K Push out(+2Q)											
Ever display	Guangzhou or Chengdu V4 (Flex OLED)	6.0	1500x1850mm	30K																															
	Shanghai Fab1 (LTPS/OLED)	4.5	730x920mm	15K																															
	Shanghai Fab2 (LTPS/OLED)	6.0	1500x1850mm	45K	Phase1																														
				Phase2																															
				Phase3																															
Truly	Huizhou (A-Si)	4.5	730x920mm	60K																															
	Huizhou (LTPS/OLED)	4.5	730x920mm	30K																															
	Shanwei (A-Si)	5.0	1100x1300mm	90K																															
	Meishan (LTPS)	5.0	1100x1300mm	50K																															
	Meishan (LTPS/OLED)	6.0	1500x1850mm	30K																															
Infintech	Jian Fab1 (A-Si)	5.5	1300x1500mm	50K																															
CPTT (CMDT)	Putian (OXIDE/A-Si)	6.0	1500x1850mm	90K	Phase1																														
Royole	Shenzhen Fab1 (Flex OLED)	5.5	1300x1500mm	15K																															
	Shenzhen Fab2 (Flex OLED)	6.0	1500x1800mm	30K																															

LCD / LTPS OLED / LTPS G7.5 ≤
 LCD / OXIDE OLED / OXIDE G6.0 ≥

Source: Compiled by Mizuho Securities Equity Research from company data

7. China holds the key

Chinese FPD-related industries: Development history / Greatly strategic

■ Market creation (~2011): largest market. Important customers for panel makers

- Encouragement of consumer electronics uptake in rural sector: targets more or less achieved for promotion of CRT TV replacement. Promotion to replace consumer electronics products: promoting diffusion of 40"+ panels and energy-saving products, replacement of CRT TVs
- Government promotion of energy-efficient products: New energy regulations have led to switching to LED-backlit panels, replacement buying in urban areas
- Organization of large purchasing groups by domestic firms + gov't : ensure volume and favourable prices, increase communication capability with component makers

■ Promoting TFT plant investment (decline in A-Si): regional government + investment from domestic makers, promoting JVs with Taiwanese and Japanese makers

- Domestic makers: investment in many new plants throughout China due to funds from regional governments + delivery of maker technology. Same method as SMIC.
- Foreign makers: LCM only → starting with Sharp + Panda, LGD, SDC make G8 investment, AUO makes G6(LTPS) investment.
2013: presence increases sharply due to 5% import duties +BOE/CSOT G8 mass production

■ Turning to parts: acknowledging differences in technological capability, first attempting to bring overseas manufacturer, then to encourage domestic makers.

- Multiple 8G factories to operate: Benefit for parts makers to create factory in vicinity. Principle of market mechanism + favourable gov't policies should also help.
- Local content regulations: Could parts become subject to import tariffs as well? → Taxation on products that can be produced in China, including polarized plating, glass.
- Public and private basic material makers could expand overseas, possibly investing in/acquiring overseas manufacturers.

■ New fields (OLED/LTPS/Oxide): Domestic makers, including BOE, Tianma and CSOT lead

- PoTechnology/patents: focus on the company, domestic R&D institutions, equipment and component manufacturers, human resources secured from overseas. Also note new movements afoot, including investment in Kateeva, collaboration between industry, government, and academia.
- CEC Panda and Sharp JV: G8 mass production of Oxide in 4Q 2015, becoming a touchstone thereafter. →BOE acquired two flagship fabs.
- Industry reorganization: focus for BOE on large, small to medium-sized, Tianma on small to medium-sized, CSOT on large. Companies also involved in finished brand-name products.
- Subsidies for 8K-compatible TVs to promote 8K broadcasting?: In addition to technological advances, there will also be support (for the switch to OLED) for the domestic LCD industry.

BOE: Outline of large-scale capital increase via third-party allotment (roughly ¥750bn)

July 2013: Announces plan for capital increase via third-party allotment (roughly RMB46bn)

April 2014: Decides terms for and implements new share issuance

- Number of new shares: Roughly 21.77bn
- Issue price: RMB2.09/share
- Issuance proceeds: About RMB45.7bn (roughly ¥750bn)
- Dilution rate: 61.7%
- Market capitalization: RMB77.2bn (15 July 2014)

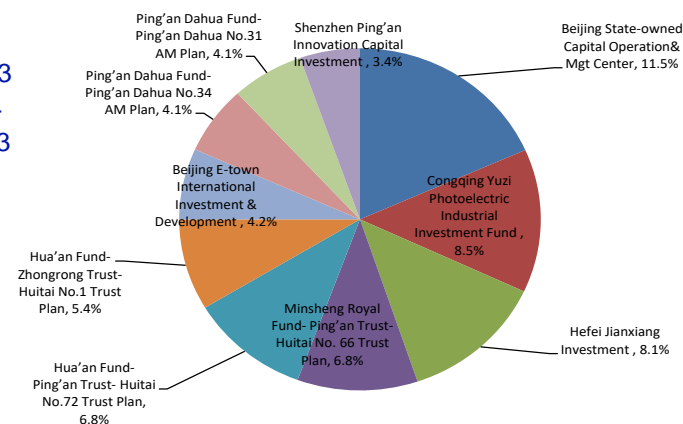
Participants in 3rd party offering	# of New Share	Required Capital(CNY)
Hua'an Fund Management	4,285,714,284	8,999,999,996
Beijing State-owned Capital Operation and Management Center	4,063,333,333	8,532,999,999
Congqing Yuzi Photoelectric Industrial Investment Fund	3,000,000,000	6,300,000,000
Ping'an Dahua Fund Management	2,857,142,856	5,999,999,998
Hefei Jianxiang Investment	2,857,142,857	6,000,000,000
Minsheng Royal Fund	2,380,952,380	4,999,999,998
Shenzhen Ping'an Innovation Capital Investment	1,190,476,190	2,499,999,999
Fortune SG Fund Management	657,142,857	1,380,000,000
Chongqing Jiangbeizui Central Business District Investment Group	238,095,238	500,000,000
Huarong Securities	238,095,238	500,000,000
Total	21,768,095,233	45,712,999,989

Uses of proceeds	Total investment value	Allocation of proceeds of capital raising
Hefei: G8.5 oxide TFT	28,500	13,000
Hefei touch panel (OGS)	5,400	2,500
Ordos G5.5 AMOLED	22,000	4,000
Chongqing G8.5 oxide TFT	32,800	15,200
Replenishment of working capital	2,800	2,800
Total (mn RMB)	91,500	37,500

Progress

- Started operations at end-December 2013
- Scheduled to start production in 3Q 2014
- Started operations at end-November 2013
- Construction began in July 2013

Shareholder composition after capital increase

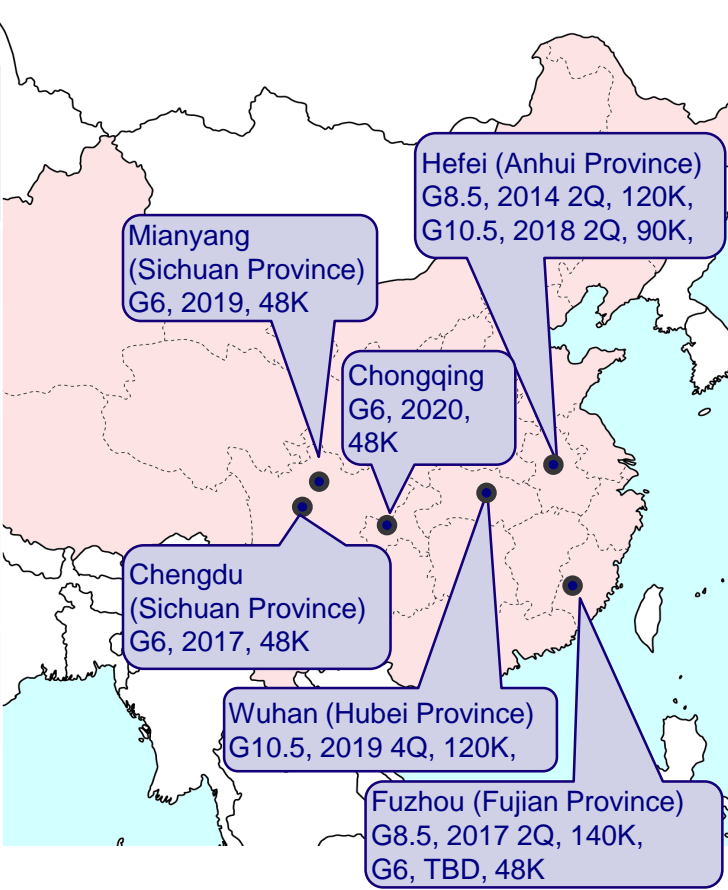


Source: Compiled by Mizuho Securities Equity Research from company data

Chinese investment in FPD plants (example of BOE Technology)

- Central government tariffs have created barriers to entry for overseas firms, which benefits local companies (with local production) in the Chinese domestic competitive environment. At the same time, local governments in China have enacted support for companies in terms of business management and business funding, in what is a double-layered support structure. BOE announced in Dec 2018 that it is investing in the fourth G6 OLED fab.
- While BOE in April 2015 announced a huge investment totaling ¥1.3t for two plants (a G8.5 plant in Fuzhou and a G10.5 plant in Hefei) and published in August 2017 another one of nearly ¥800b for a G10.5 plant in Wuhan, every investment will be joint enterprises receiving local government funding. BOE will be burdened by roughly 10% of the total investment.
- The construction of BOE's new plants will essentially be undertaken as a joint venture. However, BOE has in the past received a one-time injection of capital into the parent company.

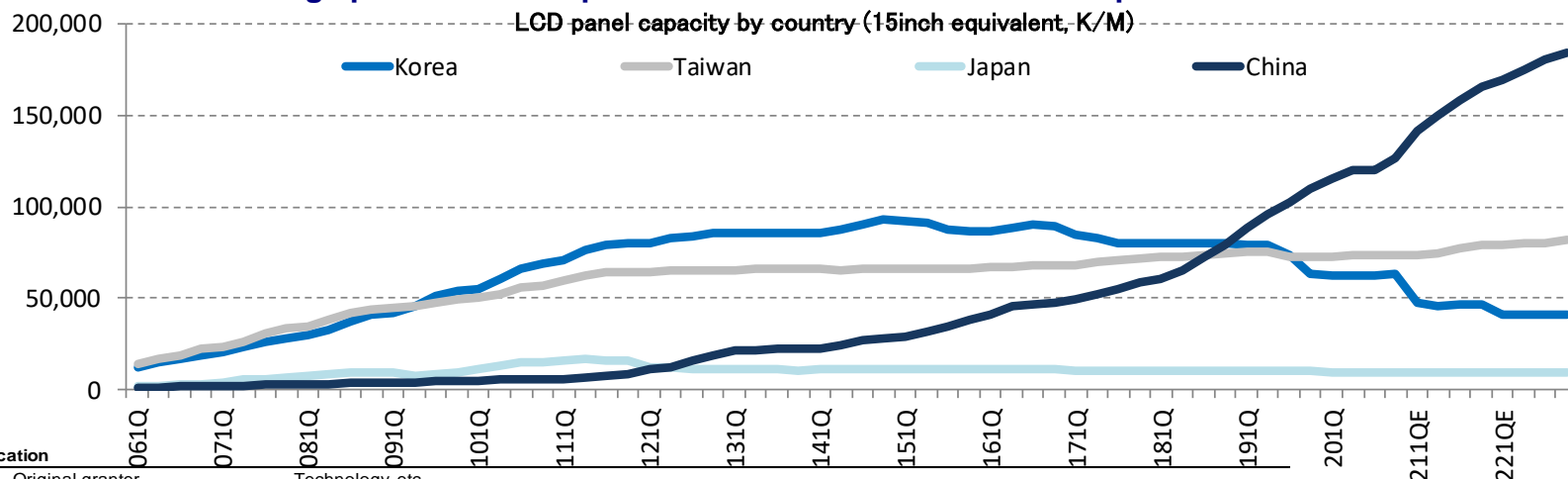
Breakdown of financing arrangements (% of total investment)	Fuzhou G6 (announced in December 2018)	Chongqing G6 (announced in March 2018)	Wuhan G10.5 (announced in August 2017)	Mianyang G6 (announced in October 2016)	Chengdu G6 (announced in February 2016)	Hefei G10.5 (announced in April 2015)	Fuzhou G8.5 (announced in April 2015)	Hefei G8.5 (announced in August 2012)
Technology	LTPS/Flex OLED	LTPS/Flex OLED	A-Si	LTPS/Flex OLED	LTPS/Flex OLED	A-Si	A-Si	A-Si
Amount invested by BOE (own funds)	CNY11.3bn (24%)	CNY10bn (22%)	CNY6bn (13%)	CNY6bn (13%)	n/a	CNY4bn (10%)	CNY3bn (10%)	CNY7bn (25%)
Municipal gov't/ designated investment companies (offered by groups of banks, etc.)	CNY14.7bn (32%)	CNY16bn (34%)	CNY20bn (43%)	CNY20bn (43%)	n/a	CNY18bn (45%)	CNY15bn (50%)	CNY10bn (35%)
Financing (sub-total)	CNY26bn (56%)	CNY26bn (56%)	CNY26bn (57%)	CNY26bn (56%)	CNY13bn (53%)	CNY22bn (55%)	CNY18bn (60%)	CNY17bn (60%)
Debt arrangements (syndicate loans from groups of banks, etc.)	CNY20.5bn (44%)	CNY20.5bn (44%)	CNY20bn (43%)	CNY20.5bn (44%)	CNY11.5bn (47%)	CNY18bn (45%)	CNY12bn (40%)	CNY11.5bn (40%)
Total investment (exchange rate is as of announce date)	CNY46.5bn (roughly ¥745b)	CNY46.5bn (roughly ¥785b)	CNY46bn (roughly ¥760b)	CNY46.5bn (roughly ¥710b)	CNY24.5bn (roughly ¥420b)	CNY40bn (roughly ¥770b)	CNY30bn (roughly ¥580b)	CNY28.5bn



Source: Mizuho Securities Equity Research, from company materials

LCDs: History of shift in technology (outflows) overseas (to China/Taiwan)

Production capacity among Chinese players overtook Japanese firms in 2012. Chinese companies are also mounting a charge on the technical front for large panels. Still disparities in small and medium-sized panels.



Technical application	(Announced) Year	Original granter of the technology	Technology, etc., granted to	Remarks
	1998	Matsushita Electric	Taiwan → Unipac	G3 (granted technology/license)
	1998	Toshiba	Taiwan → Hannstar	G3 (granted technology)
	1998	IBM Japan	Taiwan → Acer Display	G3.5 (granted technology/license)
	1998	Toshiba/IBM	China → Jilin Sino-Micro	Agreement signed on production technology
	1999	Mitsubishi Electric (+ Asahi Glass)	Taiwan → CPT	G3 (granted technology)
	1999	Fujitsu	Taiwan → Acer Display	MVA technology
	1999	Fujitsu	Taiwan → CMO	MVA technology
	1999	Sharp	Taiwan → Quanta	Granted technology/license
	2001	IBM Japan	Taiwan → CMO	Business acquired by CMO
	2001	Hydis	China → BOE	Technological tie-up (Hydis was under the BOE umbrella until 2003, and subsequently broken up)
	2002	NEC	China → Shanghai Kohden	Set up a joint venture and constructed a 5G line in Shanghai (NEC: 25%)
	2003	Hitachi	Taiwan → Hannstar	Joint development of panels used in IPS technology, color filters, driver ICs, and TVs
	2003	Fujitsu	Taiwan → AUO	AUO made a small investment in Fujitsu's LCD subsidiary and the two collaborated on technology
	2006	Sharp	Taiwan → Innolux	Cross-licensing agreement, including for TFT forming technology
	2009	Sharp	China → CEC Panda	G6 (switched production to Sharp's Kameyama No. 1 plant)
	2011	Sharp	Taiwan → Innolux	Granted technology for UV2A photo-alignment
	2011	Sharp	China → CSOT	Granted technology for UV2A photo-alignment
	2011	NEC	China → Tianma	Roughly 70% of shares in NEC's display subsidiary were transferred to Tianma
	2013	Sharp	China → CEC Panda	Joint production of IGZO (Sharp around 8%), granted technology

Plant construction

LGD Guangzhou		
Generation	G8.5	
Joint venture participants	LGD	70%
	Local government	20%
	Skyworth	10%
Investment amount	US\$4b	

SDC Suzhou		
Generation	G8.5	
Joint venture participants	SDC	60%
	A local industrial park	30%
	TCL Group	10%
Investment amount	US\$3b	

Source: Mizuho Securities Equity Research, from company materials

China : Content provider's strategy for excursion into hardware (1): come to caught

LeEco Company Overview:

- Established in November 2004, headquartered in Beijing's Chaoyang District. The founder, Jia Yueting, is the CEO. Listed on the Shenzhen Stock Exchange in August 2010.
- A major player in online TV in China, the company is engaged in the creation and streaming of movies, TV programs, music, and other content, and runs an advertising business and other operations as well. Carries out content streaming under licenses obtained from TV stations and other entities.
- Content aside, the company also sells TVs (smart TVs) under the "Le" brand, and recently entered the smartphone business. The company sold a total of about 4.5m "Chao Ji(means super)" series smart TVs in 2015, and aims to sell another 6m in 2016. The company sold about 3m smartphones in 2015.
- Principal subsidiaries include Letv.com (online TV program distribution), Leshi Zhi Xin (consumer electronic product sales), Le Vision Pictures (a feature film studio), Le Mobile (mobile handset sales), Wangjiu.com (online wine sales), Letv Holding, Letv Investment Management, and others.

Investment in TCL Multimedia:

- The company announced in December 2015 that it is acquiring 20% of all shares outstanding in TCL Multimedia for US\$293m, through its Hong Kong subsidiary Letv Zhixin.
- TCL Multimedia is part of the TCL Group, and is the world no. 3 by TV shipment volume. In September 2013, TCL announced a 48" smart TV built in collaboration with the video content provider Iqiyi.

Major Product / Services:

- "Chao Ji(means super)" brand smart TVs and smartphones are sold bundled with content.
- The latest "Chao4" series smart TV in the 50" size sells with a one-month paid membership for CNY2,499 (about ¥41,000).
- A standard paid membership costs CNY490 annually (about ¥8,000). When a membership and a smartphone are purchased together, there is a discount of CNY300 x the duration of the contract in years. Since a Le2 smartphone normally sells for CNY1,099, buying a four-year membership at the same time yields a discount of CNY1,200, making the smartphone essentially free.

Source: Compiled by Mizuho Securities Equity Research from company data

Ownership Structure(as of the end of 2015)

Holder Name		(%)
YUETING JIA (贾跃亭)	Founder / CEO	36.79%
XINGEN (鑫根) FUND	Domestic / non state-owned	5.39%
HONG LIU (刘弘)	Domestic / personal	3.30%
YUEMIN JIA (贾跃民)	Domestic / personal	2.37%
CAO YONG (曹勇)	Domestic / personal	2.21%
Central Huijin (中央汇金) AM	Domestic / state-owned	1.51%
WU MINGXIAO (吴鸣霄)	Domestic / personal	0.76%
LETV HOLDING BJ CO LTD	Domestic / non state-owned	0.64%
LIAO JUN (廖俊)	Domestic / personal	0.61%
YONGQIANG YANG (杨永强)	Domestic / personal	0.59%
Others		45.83%

Market Cap



China : Content provider's strategy for excursion into hardware (2): come to caught

Transition of LeEco business model

Broadcast and streaming of contents in China

Acquire license to distribute IP from TV and movie companies

- Some free IP but subject to time limits and comes with advertisements.
- Domestic TV show repeats, overseas series, sports programs, movies etc
- By acquiring rights to Chinese TV series & movies, trying to set up position like a content provider. Some in-house production of films via subsidiary



Sale of Handset + IP package/ Enter overseas inc Hong Kong

Bundling high end handset (large screen/thin TV, high spec smartphones etc) with some IP content. Discounts on packages, increasing monetizing of services.

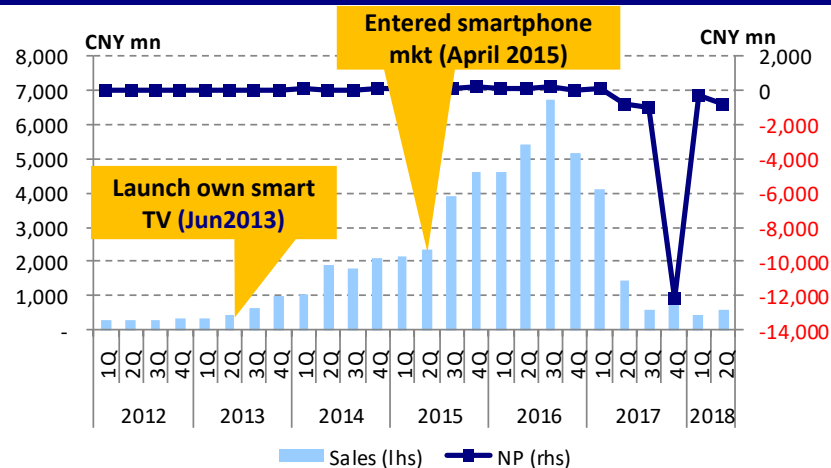
- Start selling own set top box in 2012. Needed to buy terminal and register for different paid services. Then connect to existing TV and watch LeEco.
- Began selling smart TVs in 2013, growth accelerated. No need to buy set top box but by bundling a package of hardware + annual usage fee, provided a sense that the TV itself
- Entered smartphone market in 2015. Bundling high end phone with streaming services. First ever global sale of Qualcomm's Snapdragon820 phone 'Le Max Pro'. Pre-installed app enables user to watch content
- Nearly 50% of sales in 2015 were hard wear.



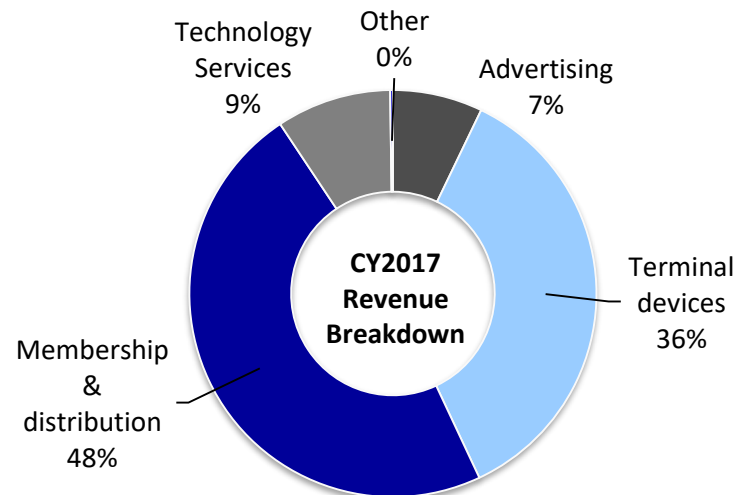
Diversification

Founder Jia Yueting placed No.17 on Forbes China rich list. Invested in Faraday Future, the 2nd largest pure play electric vehicle developer after Tesla

LeEco earnings (Sales/Net profit)

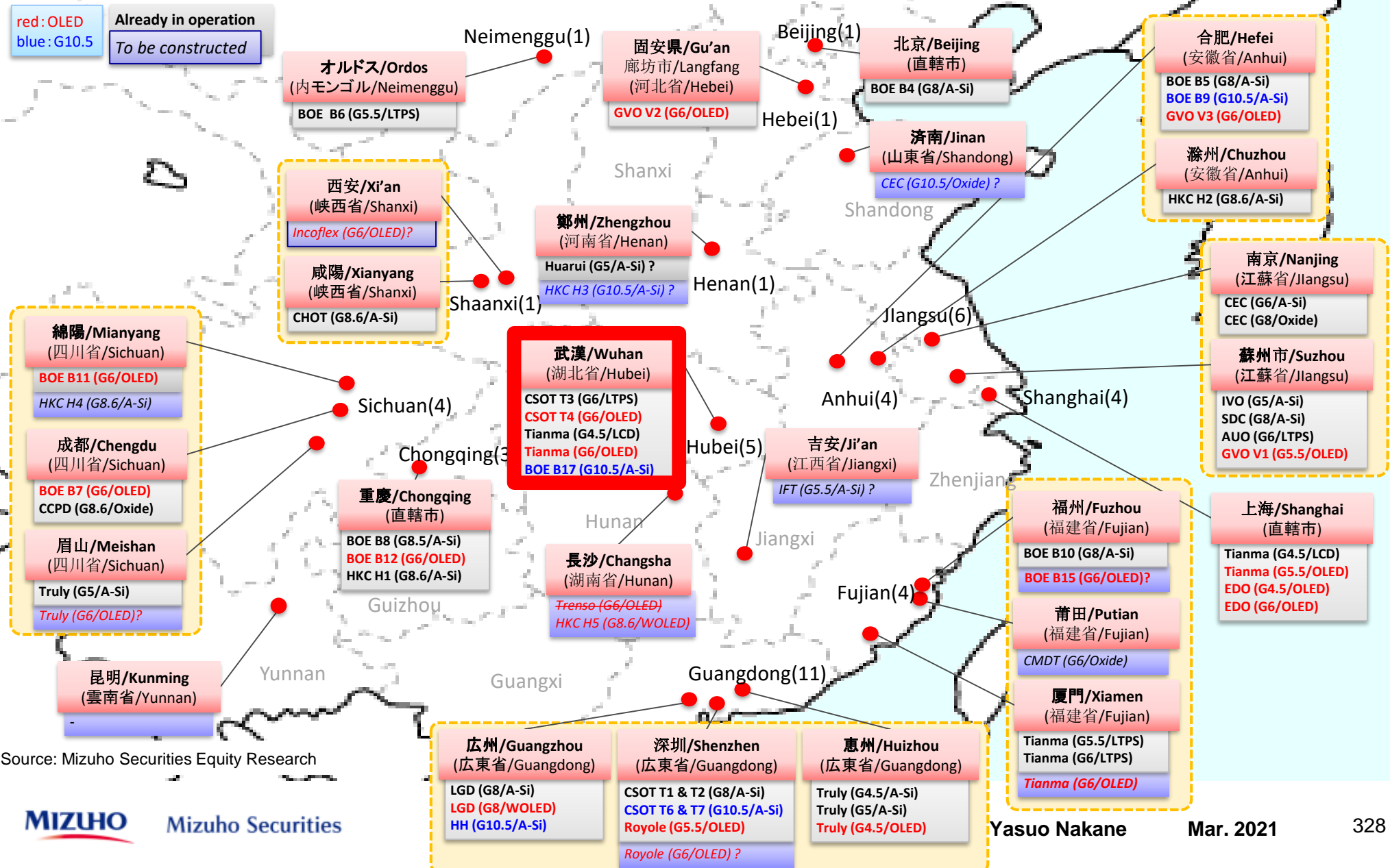


LeEco breakdown of sales (2017)



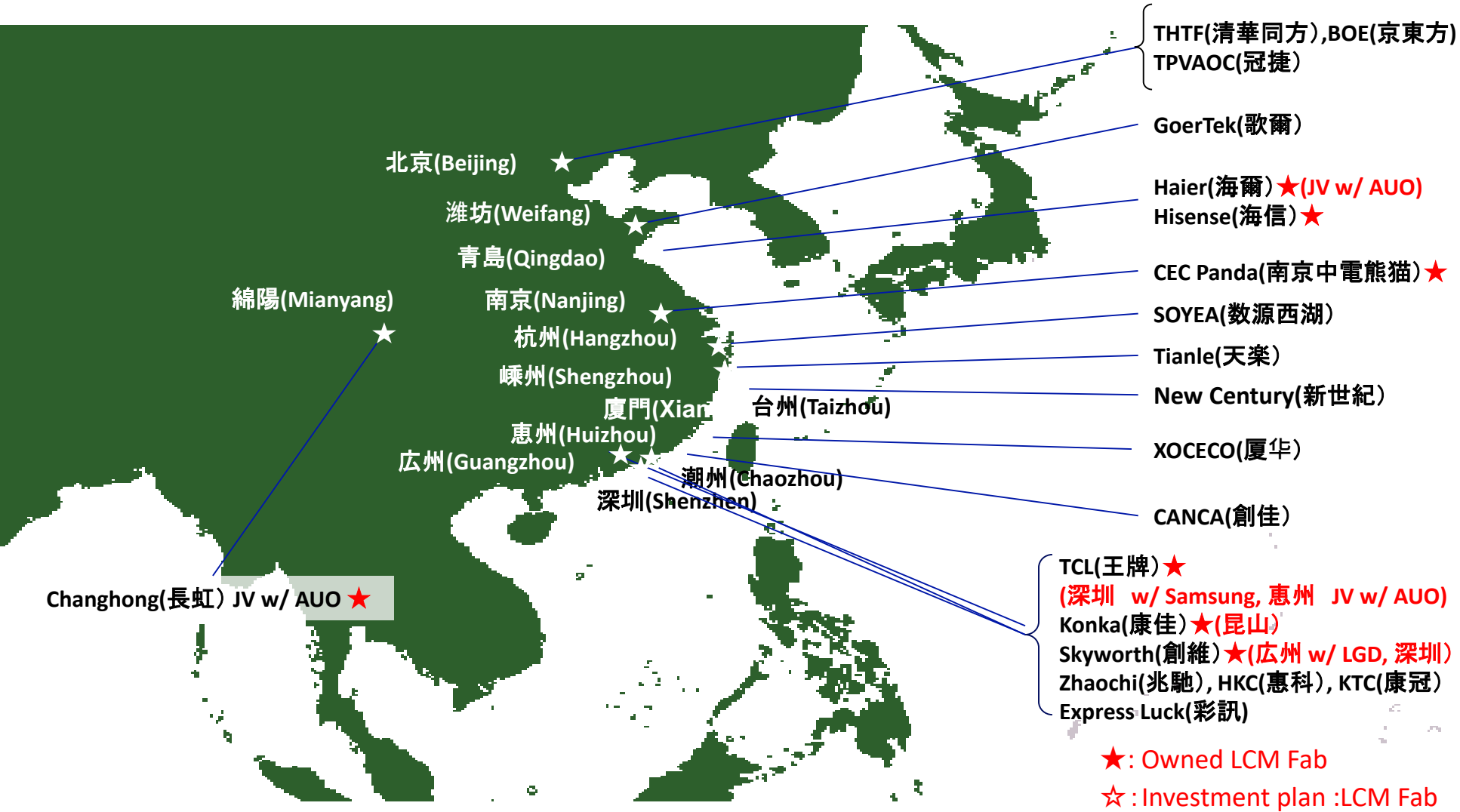
Source: Compiled by Mizuho Securities Equity Research from company data

List of Chinese FPD fab (G4.5 and above)



Source: Mizuho Securities Equity Research

Major Chinese TV Brands' HQ Location Map

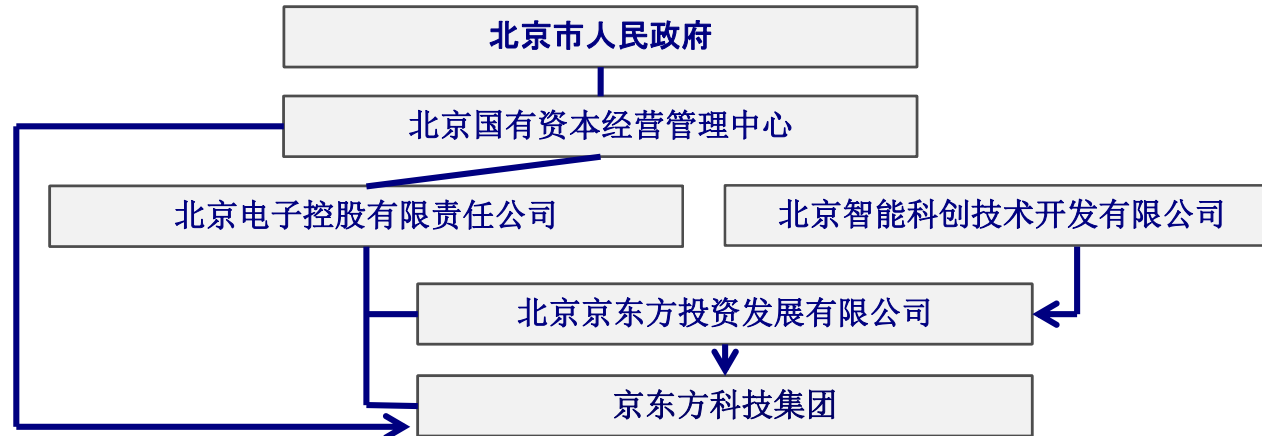


Source: Compiled by Mizuho Securities Equity Research from company data

BOE Technology Group(京東方)

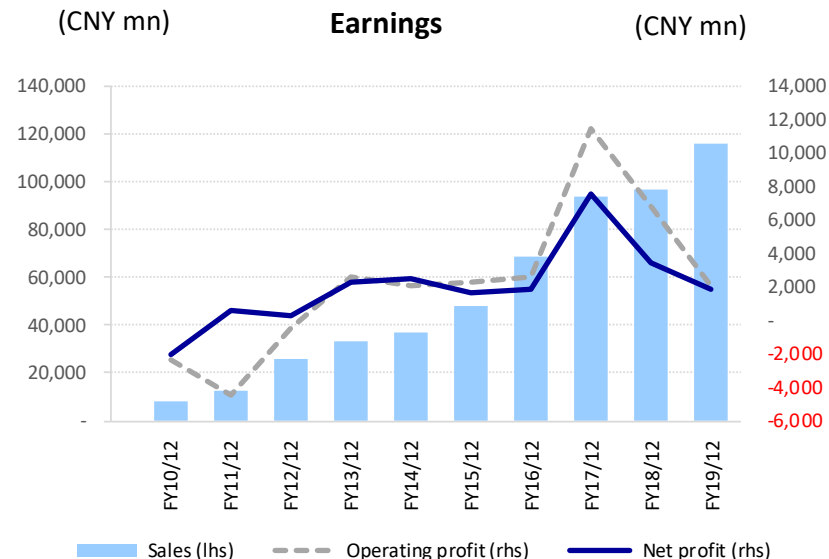
- Company outline:** China's largest flat panel display maker. Shenzhen Stock Exchange stock codes: A shares 000725, B shares 200725. About 80% of sales are in FPD. Company also operates in healthcare services. Invests in semiconductors through a subsidiary fund.
- Market shares:** Company is ranked No. 1 in terms of shipment volume for LCD panels with a 24.7% share. The company vaulted to the No. 1 slot in panels for TV, notebook computers, tablets, and monitors. In terms of area, company is ranked No. 3 share. Headed toward even larger market share with operation of G10.5 plants (Hefei + Wuhan).
- Strategies:** About 80% of sales are directed toward R&D, with the company securing over 40,000 patents. Management is targeting leadership in large and small to medium-sized panels through investment in two G6 OLED plants and a G10.5 plant. The company established a joint-venture firm when launching plant construction, with most of the funding for investment secured through local governments and banks. BOE also enacted a capital increase in 2014. For large panels, the company is expanding the ODM business, including for finished TVs, and is seeking to further boost value added.

Company	BOE Technology Group (京東方科技集团)
Headquarters	Beijing, China
Chairman	Chen Yan Shun
Employees	68,175 (as of 2018)
Established	April 1993
Listing	June 1997:(Shenzhen B) Jan 2001: (Shenzhen A))



Source: Compiled by Mizuho Securities Equity Research from company data

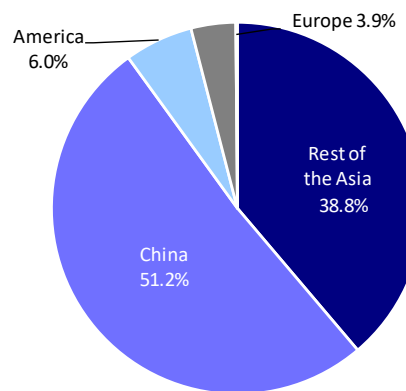
BOE Technology



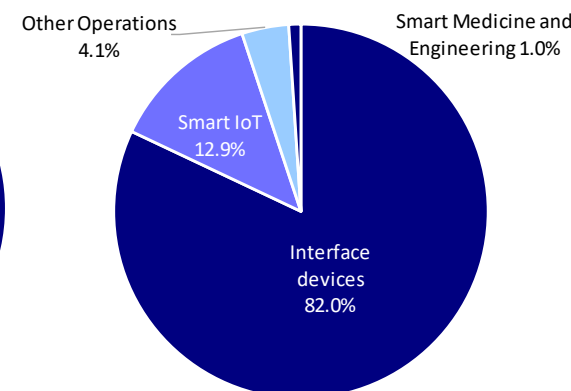
Stockholding Ratio

Holder Name	Type	%
BEIJING STATE-OWNED ASSET	Government	12.00
Hefei Jianxiang Investment Co Ltd	Sovereign Wealth Fund	7.41
Chongqing Yuzi Photoelectric Indus	Investment Advisor	5.97
Beijing Yizhuang Investment Holdin	Corporation	3.45
BEIJING E TWN INT INV&DEV CO LTD	Investment Advisor	2.43
Hong Kong Securities Clearing Co L	Corporation	1.41
Beijing Electronics Holding Co Ltd	Government	0.81
Central Huijin Asset Management Lt	Government	0.73
Hengxing Group Co Ltd	Unclassified	0.48
China Securities Finance Corp Ltd	Government	0.39

Revenue by Region in 2019

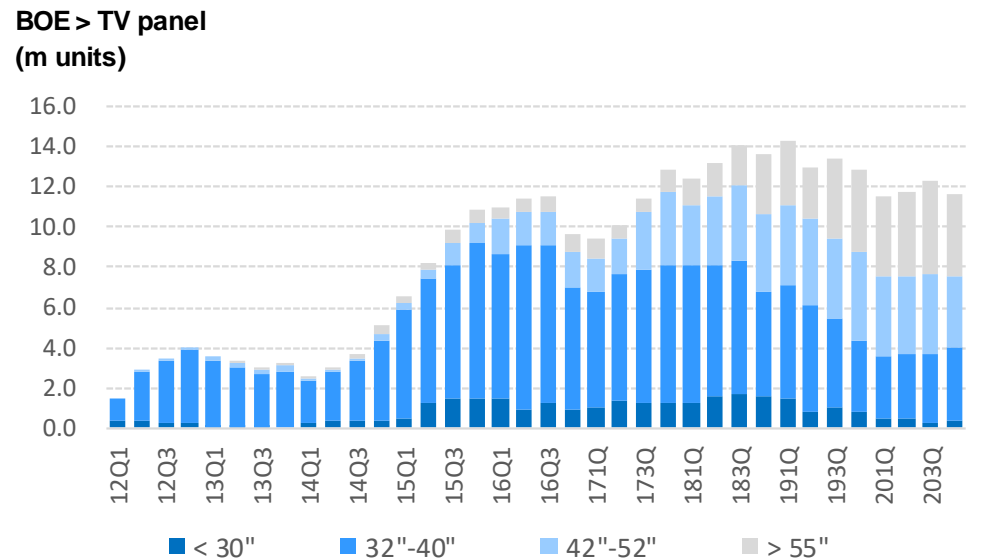
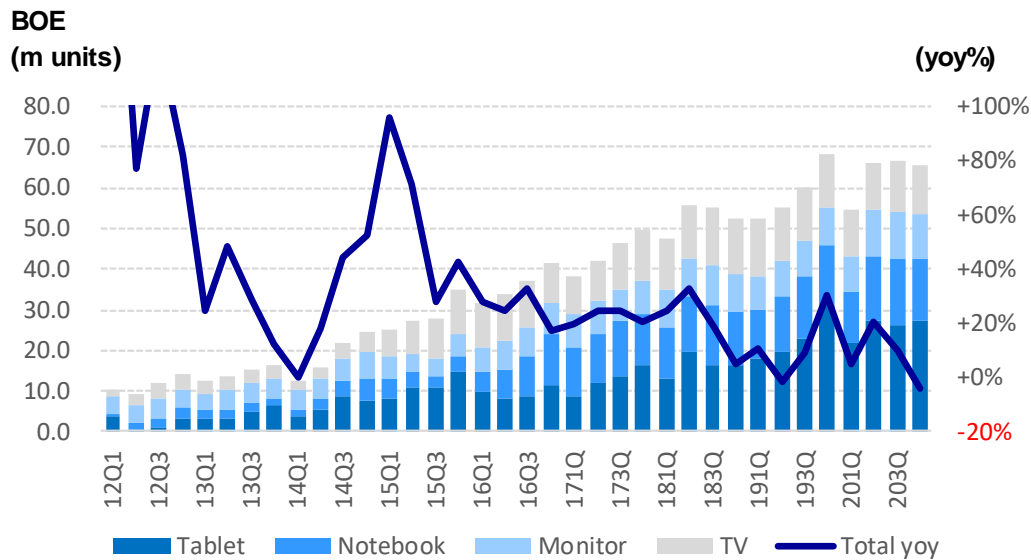
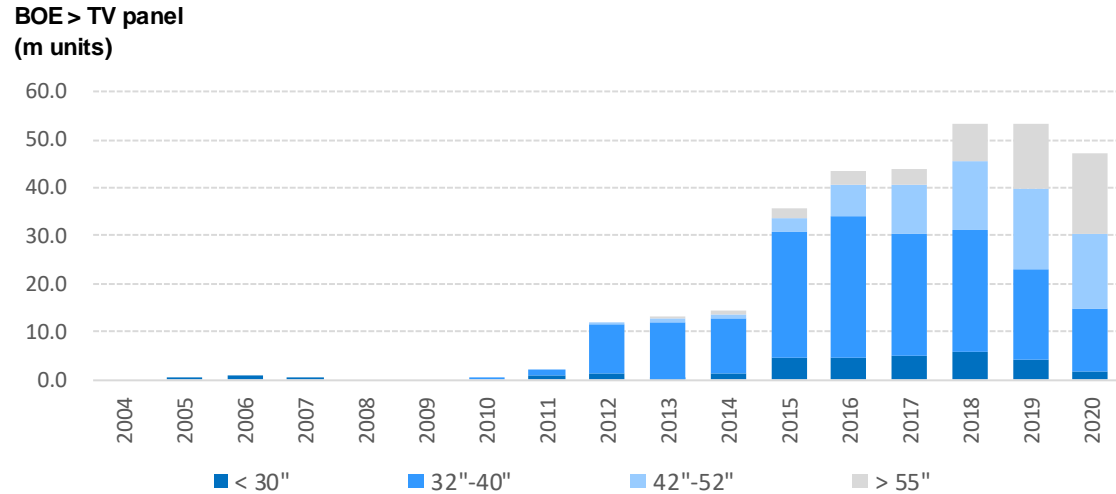
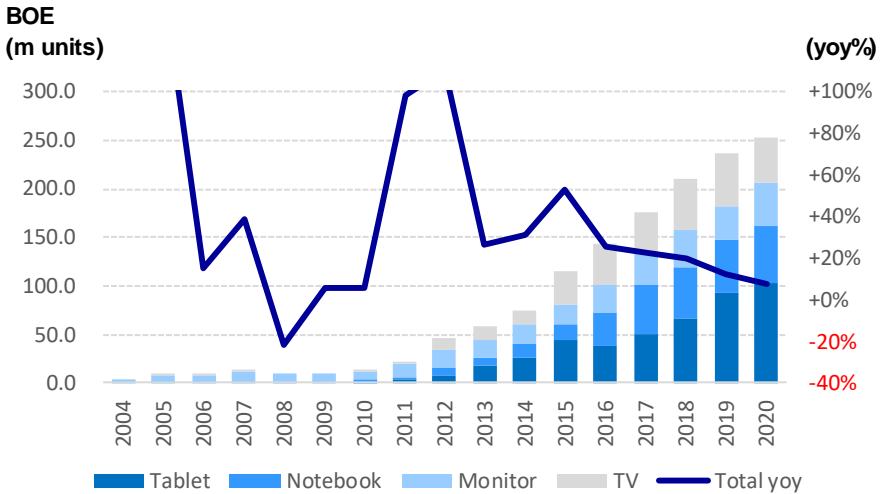


Revenue by Segment in 2019



Source: Compiled by Mizuho Securities Equity Research from Bloomberg

BOE Technology – Large-size panel shipment volume



Source: Compiled by Mizuho Securities Equity Research from company data

BOE Technology

(CNY mn)

BOE TECHNOLOGY-A

	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12
Sales	8,005	12,712	25,678	33,591	36,698	48,348	68,896	93,800	97,109	116,060
(Seq%)	+28%	+59%	+102%	+31%	+9%	+32%	+42%	+36%	+4%	+20%
Gross profit	-283	-729	2,887	7,887	8,193	9,593	12,310	23,518	19,803	17,613
(Gross margin)	-3.5%	-5.7%	11.2%	23.5%	22.3%	19.8%	17.9%	25.1%	20.4%	15.2%
Operating profit	-2,330	-4,418	-427	2,652	2,107	2,263	2,651	11,506	6,898	2,050
(Operating margin)	-29.1%	-34.8%	-1.7%	7.9%	5.7%	4.7%	3.8%	12.3%	7.1%	1.8%
Net profit	-2,004	561	258	2,353	2,562	1,636	1,883	7,568	3,435	1,919
ROE	-9.3%	2.2%	1.0%	8.7%	4.9%	2.1%	2.4%	9.3%	4.0%	2.0%
Oper_CF	-1,225	-1,230	2,337	7,592	6,532	9,453	8,309	24,035	21,964	20,494
Invest_CF	-13,141	-15,379	-2,179	-18,162	-23,770	-19,779	-24,644	-59,636	-47,420	-47,510
Fin_CF	18,233	10,471	439	13,488	37,267	10,004	29,507	34,160	20,893	33,935
FCF	-15,339	-19,562	-1,897	-10,734	-14,758	-9,154	-22,394	-23,707	-32,557	-28,922
EBITDA	-627	-1,574	3,425	7,225	7,832	10,302	12,958	23,372	20,673	20,913
(EBITDA margin)	-7.8%	-12.4%	13.3%	21.5%	21.3%	21.3%	18.8%	24.9%	21.3%	18.0%
Dep&Amot	1,703	2,844	3,852	4,573	5,726	8,039	10,307	11,866	13,775	18,863
R&D	-	-	1,781	1,904	2,477	3,319	4,139	6,972	7,238	8,748
Inventory	1,300	2,116	2,669	3,019	4,163	6,609	7,833	8,958	11,985	12,396
(days)	47	49	34	31	36	41	38	33	39	38
Net debt to equity ratio	-0.25	0.39	0.17	0.60	-0.01	0.10	0.27	0.65	0.87	0.91
Net assets	34,260	35,045	35,265	38,154	76,959	78,351	92,016	104,284	120,357	141,058
Liabilities	19,970	33,724	31,841	54,384	59,281	74,242	113,119	151,824	183,671	199,355
Assets	54,230	68,769	67,105	92,538	136,240	152,593	205,135	256,109	304,028	340,412

BOE TECHNOLOGY-A

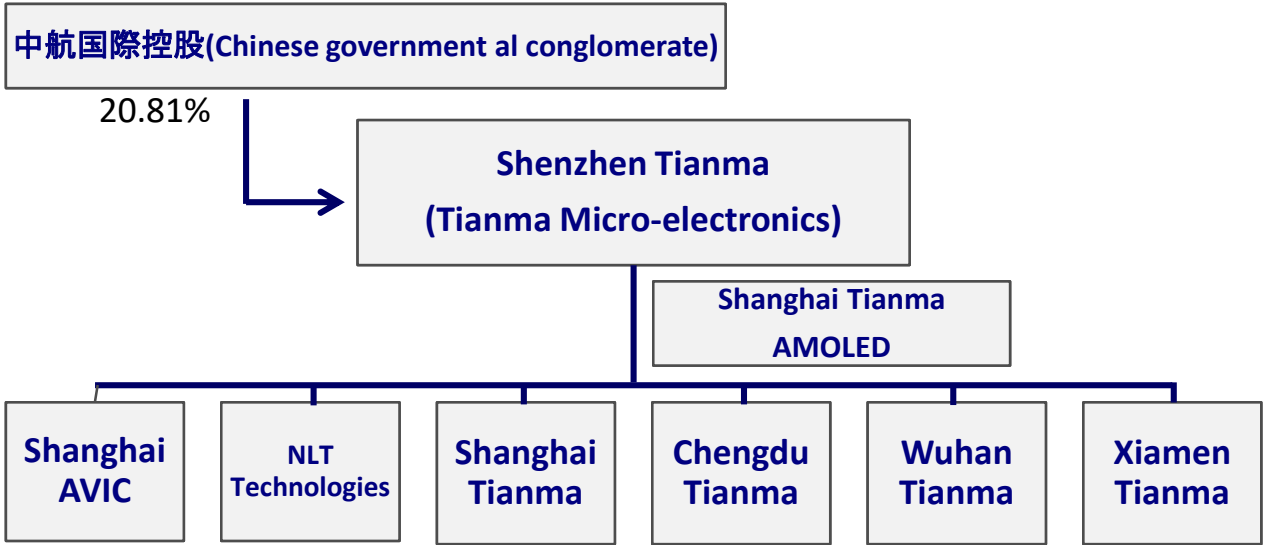
	18/3	18/6	18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9
Sales	21,567	21,907	25,991	27,644	26,454	28,585	30,683	30,338	25,880	34,987	40,821
(Seq%)	-12%	+2%	+19%	+6%	-4%	+8%	+7%	-1%	-15%	+35%	+17%
Gross profit	4,479	3,850	4,745	6,728	4,672	4,555	3,625	4,761	3,706	5,892	7,596
(Gross margin)	20.8%	17.6%	18.3%	24.3%	17.7%	15.9%	11.8%	15.7%	14.3%	16.8%	18.6%
Operating profit	2,650	1,784	1,364	1,100	1,833	1,038	-437	-384	575	1,212	2,406
(Operating margin)	12.3%	8.1%	5.2%	4.0%	6.9%	3.6%	-1.4%	-1.3%	2.2%	3.5%	5.9%
Net profit	2,019	957	404	56	1,052	617	184	66	567	569	1,340

Source: Compiled by Mizuho Securities Equity Research from Bloomberg

Tianma Microelectronics (天馬微電子)

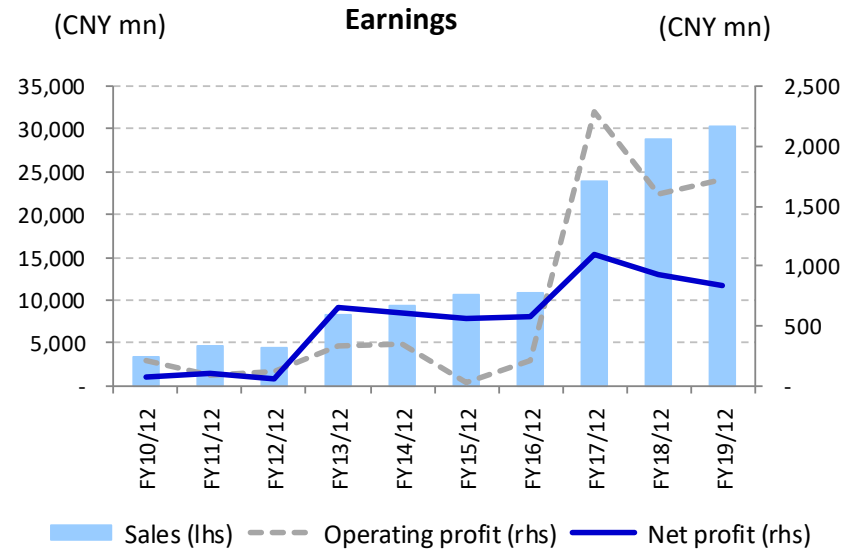
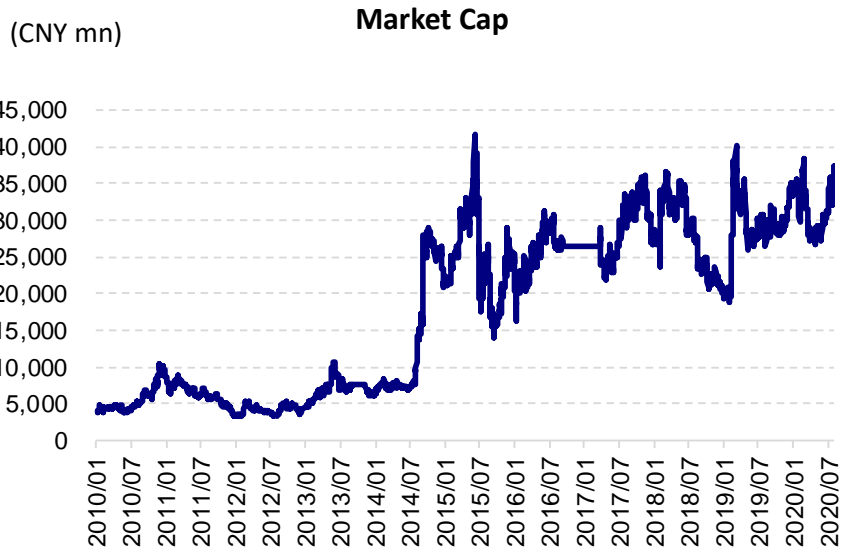
- Company outline:** manufacturer of small to medium-sized LCD panels. Shenzhen Stock Exchange stock code: A-shares: 000050. Company successfully launched mass production in LTPS-LCD at China’s first G5.5 plant. Promoting aggressive investment in OLED. Subsidiary NLT Technologies (formerly NEC) maintains plant in Akita, producing a wide variety of low-volume products, including for medical and industrial applications. Subsidiary also involved in advanced technologies, including in LTPS and photo-alignment, serving to support technological advancement in the group.
- Market shares:** development focused on smartphones, with market share at about 10%.
- Strategies:** company specializes in small to medium-sized panels, with aggressive expansion in sales in not just smartphones, but also B2B, including POS, as well as medical, industrial, and automotive applications.

Company	Tianma Microelectronics (天馬微電子)
Headquarters	Shenzhen, China
Director	You Lei
Employees	10,550(as of 2019)
Overseas subsidiaries	USA, Korea, Taiwan, Germany
Established	August 1983
Listed	March 1995 (Shenzhen A shares)



Source: Compiled by Mizuho Securities Equity Research from company data

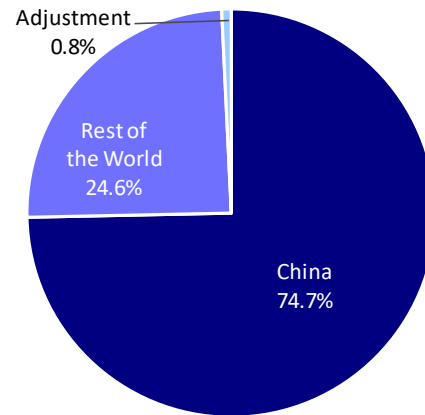
Tianma Microelectronics



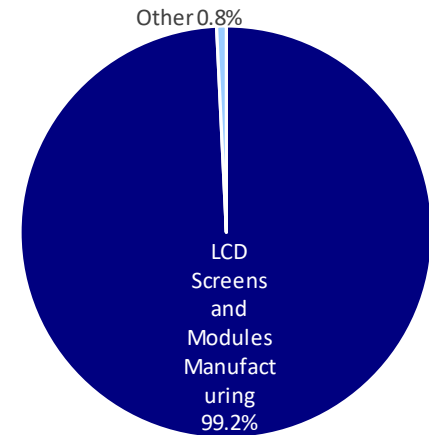
Stockholding Ratio

Holder Name	Type	%
XM FINAN INDUS DEVE CO	Unclassified	19.02
AVIC International Holding HK Ltd	Corporation	14.24
AVIC International Shenzhen Co Ltd	Government	8.76
AVIC International Holding Corp	Corporation	8.40
Hubei Science & Technology Investm	Unclassified	6.14
WH GUANGGU NEW TECH INDUS	Unclassified	2.14
AVIC INTERNATIONAL XM CO	Unclassified	1.78
Shenzhen Tongchan Group Co Ltd	Government	1.68
CHENGDU INDUSTRY INVESTMEN	Other	1.14
Shanghai Industrial Investment Gro	Holding Company	0.99

Revenue by Region in 2019



Revenue by Segment in 2019



Source: Compiled by Mizuho Securities Equity Research from Bloomberg

Tianma Microelectronics

(CNY mn)

TIANMA-A												
	FY08/12	FY09/12	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12
Sales	1,373	2,187	3,443	4,602	4,324	8,339	9,309	10,521	10,737	23,824	28,912	30,282
(Seq%)	-20%	+59%	+57%	+34%	-6%	+93%	+12%	+13%	+2%	+122%	+21%	+5%
Gross profit	145	83	539	534	613	1,573	1,725	1,711	2,167	4,811	4,392	5,102
(Gross margin)	10.6%	3.8%	15.7%	11.6%	14.2%	18.9%	18.5%	16.3%	20.2%	20.2%	15.2%	16.8%
Operating profit	-95	-233	205	84	112	335	351	20	207	2,282	1,597	1,729
(Operating margin)	-7.0%	-10.7%	5.9%	1.8%	2.6%	4.0%	3.8%	0.2%	1.9%	9.6%	5.5%	5.7%
Net profit	9	-206	70	101	54	658	613	555	569	1,091	926	829
ROE	0.6%	-16.5%	6.0%	8.0%	4.0%	33.6%	11.5%	5.2%	4.2%	6.9%	4.2%	3.1%
Oper_CF	73	295	182	346	635	2,052	1,131	4,363	950	2,783	2,584	3,815
Invest_CF	-808	-1,060	-1,380	-506	-433	-422	209	-1,631	-3,055	-10,998	-5,639	-9,295
Fin_CF	366	1,662	790	24	-344	-1,150	-1,759	3,792	-770	8,477	1,399	5,015
FCF	-823	-685	-975	-203	206	1,725	609	2,706	-2,084	-8,213	-3,123	-5,487
EBITDA	36	80	519	549	596	1,313	1,429	1,302	1,290	4,590	4,670	4,863
(EBITDA margin)	2.6%	3.7%	15.1%	11.9%	13.8%	15.7%	15.3%	12.4%	12.0%	19.3%	16.2%	16.1%
Dep&Amot	131	313	314	464	484	978	1,077	1,282	1,083	2,308	3,073	3,134
R&D	-	-	70	110	176	119	539	883	1,078	1,670	1,803	1,857
Inventory	335	278	497	442	512	1,110	1,508	1,387	1,082	2,586	3,125	3,339
(days)	87	51	41	37	40	36	51	50	42	28	36	39
Net debt to equity ratio	1.49	2.39	2.60	2.35	2.05	0.81	0.26	-0.30	-0.13	0.70	0.67	0.86
Net assets	1,997	2,099	2,491	2,919	3,056	4,340	8,561	13,248	13,759	24,486	26,005	26,707
Liabilities	3,027	4,377	5,481	5,400	4,747	7,459	7,131	8,380	7,920	30,265	34,032	38,744
Assets	5,023	6,476	7,972	8,319	7,803	11,799	15,692	21,629	21,679	54,751	60,037	65,451

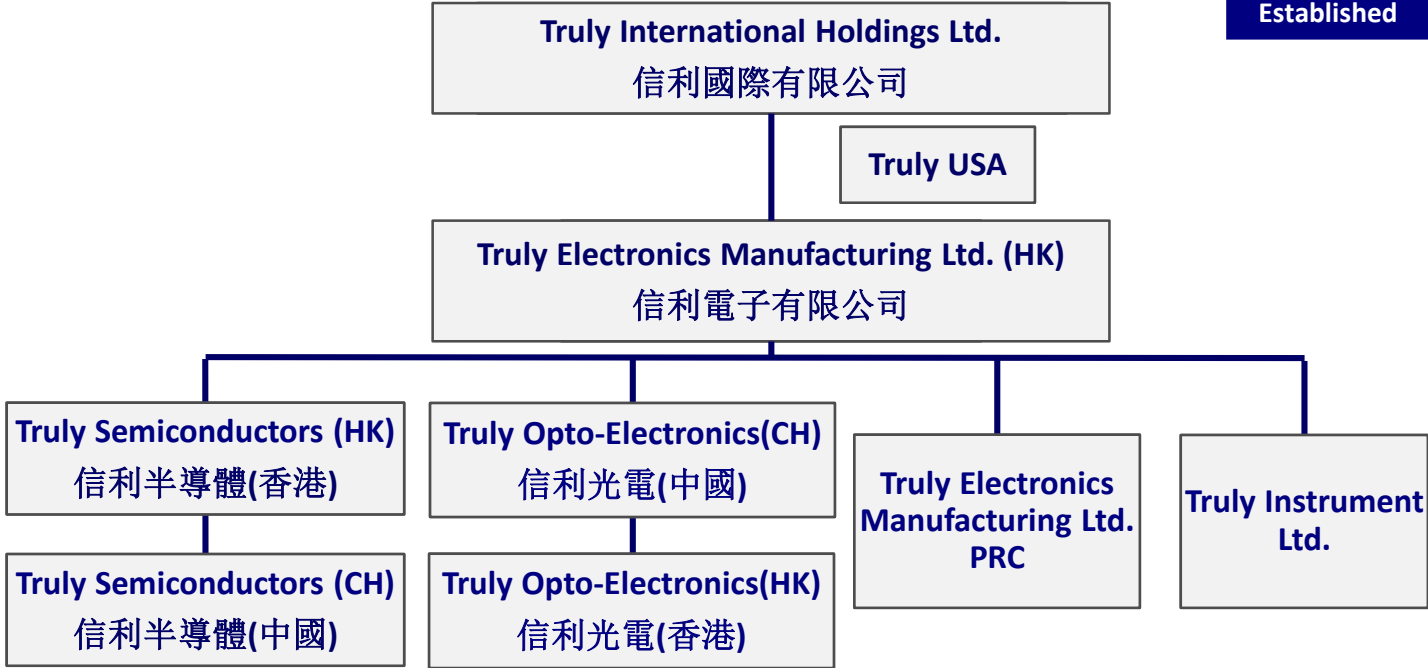
TIANMA-A												
	18/3	18/6	18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9	
Sales	6,568	7,408	7,764	7,172	6,927	7,668	8,826	6,860	6,562	7,495	8,626	
(Seq%)	-10%	+13%	+5%	-8%	-3%	+11%	+15%	-22%	-4%	+14%	+15%	
Gross profit	1,026	1,114	1,221	1,031	962	1,309	1,541	1,289	1,127	1,593	1,469	
(Gross margin)	15.6%	15.0%	15.7%	14.4%	13.9%	17.1%	17.5%	18.8%	17.2%	21.3%	17.0%	
Operating profit	675	494	596	-168	435	580	624	89	518	738	708	
(Operating margin)	10.3%	6.7%	7.7%	-2.3%	6.3%	7.6%	7.1%	1.3%	7.9%	9.8%	8.2%	
Net profit	448	334	435	-291	289	354	390	-204	301	443	486	

Source: Compiled by Mizuho Securities Equity Research from Bloomberg

Truly Semiconductors

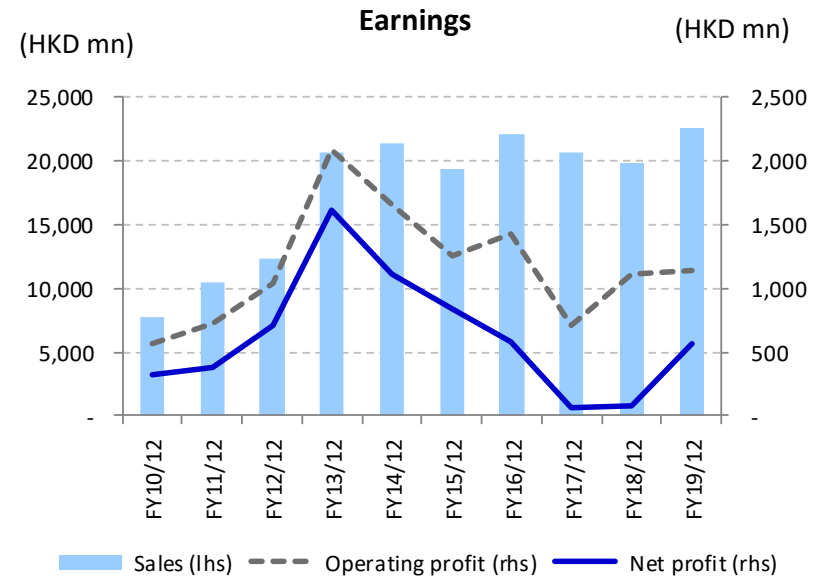
- Company outline:** Hong Kong manufacturer of small to medium-sized panels. Produces OLED and LCDs, mainly for medical equipment, automotive applications, and smartphones. Parent company Truly International Holdings listed on the Hong Kong Exchange (000732).
- Strategies:** The company started STN LCD production in China in 1995, invested in a 2.5G TFT-LCD plant in 2007, and thereafter invested in G4.5 OLED while purchasing G5 LCD plant equipment from Samsung. Development is currently focused on automotive applications and smartphones, but the company is moving from combining its modules with cells from other companies to constructing a vertically integrated structure by handling front-end processes in house.

Company	Truly Semiconductors (信利半导体)
Headquarters	Hong Kong, China
Director	林伟华
Employees	16,100 (as of 2018)
Areas of operation	Shanswei, Guangdong (production), Beijing, Shanghai, Shenzhen, Wuhan, Taipei, Europe, US, Asia
Established	1991



Source: Compiled by Mizuho Securities Equity Research from company data

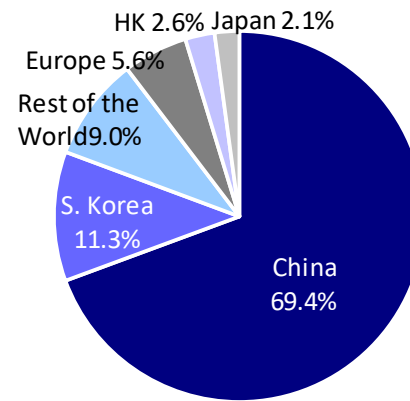
Truly International Holdings



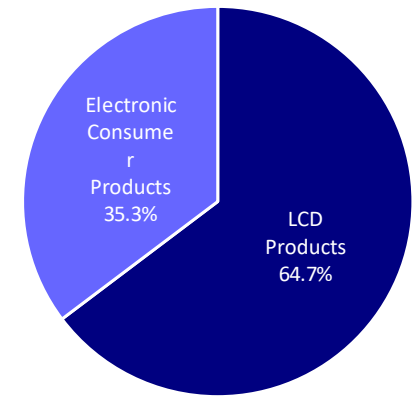
Stockholding Ratio

Holder Name	Type	%
Lam Wai Wah	Unclassified	46.11
Harvest Global Investments Ltd	Investment Advisor	4.73
UBS AG	Investment Advisor	4.24
Chan Kin Sun	Unclassified	2.99
CHENG KWAN YING JENNIFER	Unclassified	1.63
Vanguard Group Inc/The	Investment Advisor	1.25
BlackRock Inc	Investment Advisor	0.86
Dimensional Fund Advisors LP	Investment Advisor	0.61
Norges Bank	Sovereign Wealth Fund	0.58
Li Jian Hua	Unclassified	0.44

Revenue by Region in 2019



Revenue by Segment in 2019



Source: Compiled by Mizuho Securities Equity Research from Bloomberg

Truly International Holdings

(HKD mn)

TRULY INTL HLDGS												
	FY08/12	FY09/12	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12
Sales	5,669	5,804	7,736	10,504	12,374	20,681	21,416	19,427	22,072	20,733	19,762	22,532
(Seq%)	-13%	+2%	+33%	+36%	+18%	+67%	+4%	-9%	+14%	-6%	-5%	+14%
Gross profit	696	828	911	1,310	1,557	2,892	2,486	2,122	2,196	2,040	1,886	1,825
(Gross margin)	12.3%	14.3%	11.8%	12.5%	12.6%	14.0%	11.6%	10.9%	9.9%	9.8%	9.5%	8.1%
Operating profit	429	513	569	720	1,034	2,087	1,652	1,250	1,428	710	1,110	1,134
(Operating margin)	7.6%	8.8%	7.4%	6.9%	8.4%	10.1%	7.7%	6.4%	6.5%	3.4%	5.6%	5.0%
Net profit	261	307	315	381	710	1,620	1,118	845	582	63	74	562
ROE	8.3%	9.1%	8.5%	9.1%	15.2%	27.3%	16.0%	11.9%	8.4%	0.9%	1.0%	7.2%
Oper_CF	995	310	475	524	1,011	2,050	2,823	2,317	555	3,290	1,301	876
Invest_CF	-1,337	-334	-470	-1,165	-667	-1,291	-2,889	-2,902	-3,226	-3,999	-2,651	-1,074
Fin_CF	475	-159	344	657	119	717	888	-986	3,070	1,721	-1,025	-389
FCF	-322	-23	-53	-239	212	865	644	830	-2,403	607	-632	-403
EBITDA	858	888	1,030	1,235	1,600	2,711	2,416	2,179	2,362	1,831	2,268	2,266
(EBITDA margin)	15.1%	15.3%	13.3%	11.8%	12.9%	13.1%	11.3%	11.2%	10.7%	8.8%	11.5%	10.1%
Dep&Amot	429	375	461	515	566	624	764	929	935	1,121	1,158	1,132
R&D	1	-	-	377	481	782	803	755	760	812	666	809
Inventory	708	693	749	883	1,016	1,489	1,511	1,776	2,603	2,580	3,133	3,975
(days)	49	44	34	28	28	22	26	31	36	46	53	58
Net debt to equity ratio	0.44	0.44	0.36	0.49	0.37	0.16	0.25	0.39	0.82	0.73	0.89	0.70
Net assets	3,246	3,484	3,950	4,397	5,140	7,227	7,523	7,596	7,295	8,448	8,246	9,008
Liabilities	3,314	3,176	3,965	5,702	6,447	9,054	11,208	10,639	16,002	18,491	16,808	15,979
Assets	6,560	6,660	7,915	10,099	11,587	16,281	18,732	18,234	23,297	26,939	25,055	24,986

TRULY INTL HLDGS												
	18/3	18/6	18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9	
Sales	4,070	4,996	5,239	5,458	4,580	5,660	5,780	6,512	4,689	5,643	5,801	
(Seq%)	-13%	+23%	+5%	+4%	-16%	+24%	+2%	+13%	-28%	+20%	+3%	
Gross profit	475	470	492	448	444	533	-	337	429	514	-	
(Gross margin)	11.7%	9.4%	9.4%	8.2%	9.7%	9.4%	-	5.2%	9.2%	9.1%	-	
Operating profit	226	256	355	273	343	234	-	334	239	363	-	
(Operating margin)	5.5%	5.1%	6.8%	5.0%	7.5%	4.1%	-	5.1%	5.1%	6.4%	-	
Net profit	12	-7	10	58	102	39	28	393	95	205	109	

Source: Compiled by Mizuho Securities Equity Research from Bloomberg

CEC Panda

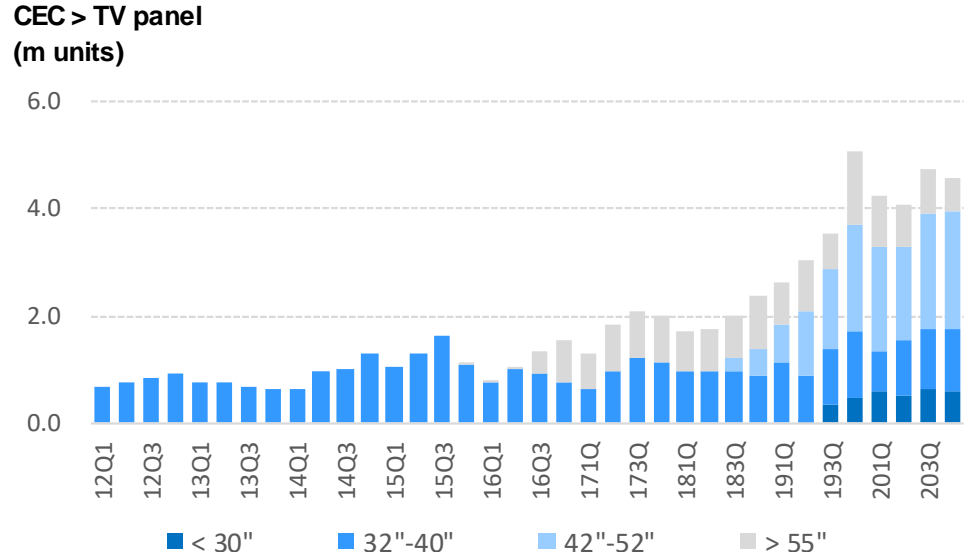
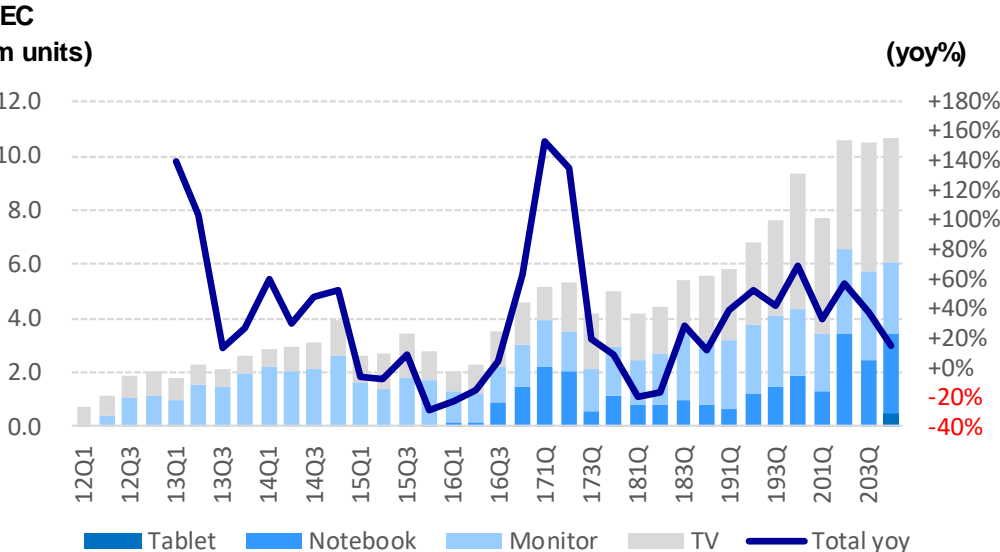
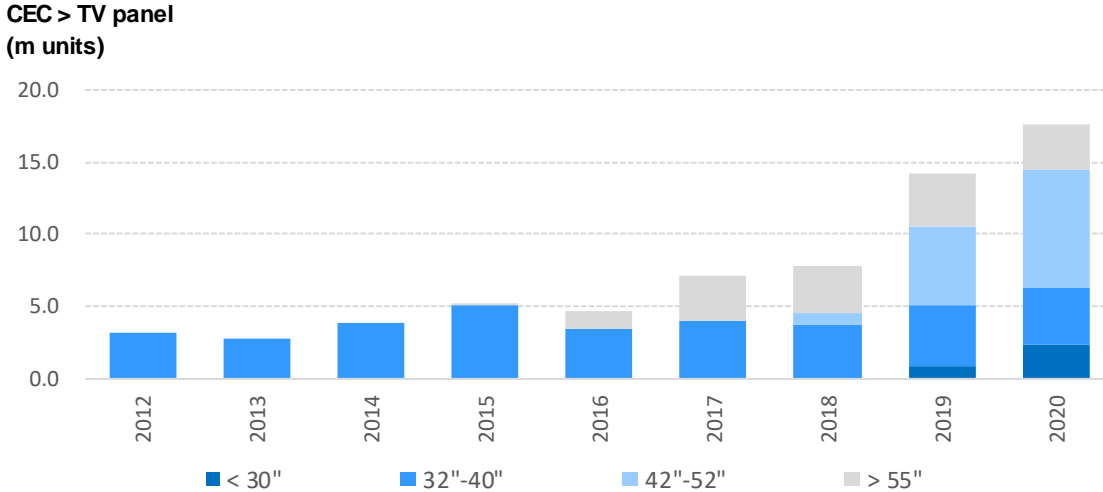
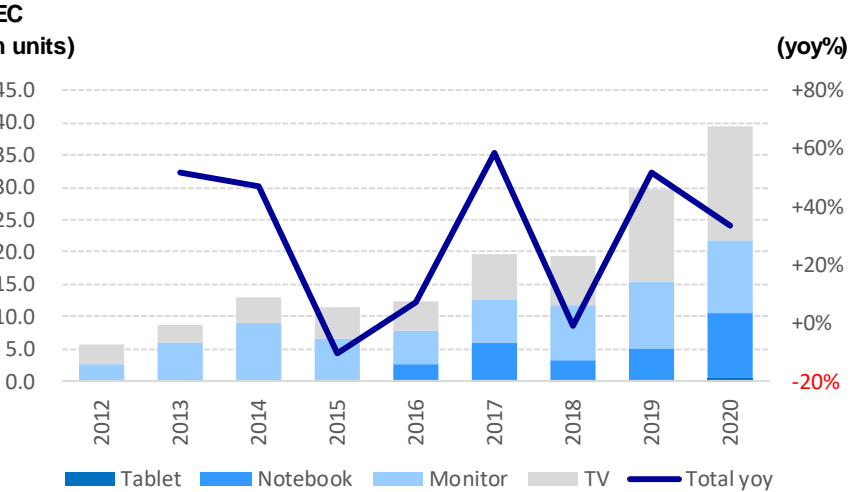
- Company outline:** State-owned manufacturer of LCD panels and an unlisted company. Subsidiary Nanjing CEC Panda owns the Nanjing City, Jiangsu Province G6 (A-Si) and G8 (Oxide) LCD panel production plants. The Chinese government places parent company CEC (China Electronics Corporation) as a core company within the country's IT strategy. The company received equipment and technology from Sharp.
- Market share:** The company at present has no more than a 5% share in TV panels.
- Strategies:** The company aims to expand capacity based on technologies received from Sharp. Besides two 8.6G plants, it had a G10.5 investment plan but this stalled. It ended up selling the Chengdu G8.6 plant and Nanjing G8 plants to BOE.

Company	CEC (南京中电熊猫信息产业)
Headquarters	Nanjing, China
Director	徐国飞
Employees	(CEC)about 110,000
Established	2007



Source: Compiled by Mizuho Securities Equity Research from company data

CEC Panda China Electronics – Large-size panel shipment volume



Source: Compiled by Mizuho Securities Equity Research from company data

Visionox Technology Inc. (維信諾科技有限公司):

Company's roots are in the OLED research department at Tsinghua University:

- Visionox was descendant to the OLED research department at Tsinghua University, which was formed in March 1996. Beijing Visionox Technology Co., Ltd. was founded in 2001 as a subsidiary. Kunshan Visionox Display Co., Ltd. was founded in 2006, while the Kunshan research and development center was established in 2009 and Kunshan Visionox Technology, producing PMOLED, was established in 2010.
- The company in November 2012 established GVO as a joint-venture through funding by sources such as the Kunshan government, with investment in China's first mass-production AMOLED line (4K/M, G5.5).
- On June 8, 2018, **Black Cattle Food Company** (Shenzhen Stock Exchange: 002387) announced to change its name for Visionox Technology Inc. with original stock ticker remaining the same.
- Two months later, Visionox split its PMOLED business and came into sight as a pure AMOLED player since then.

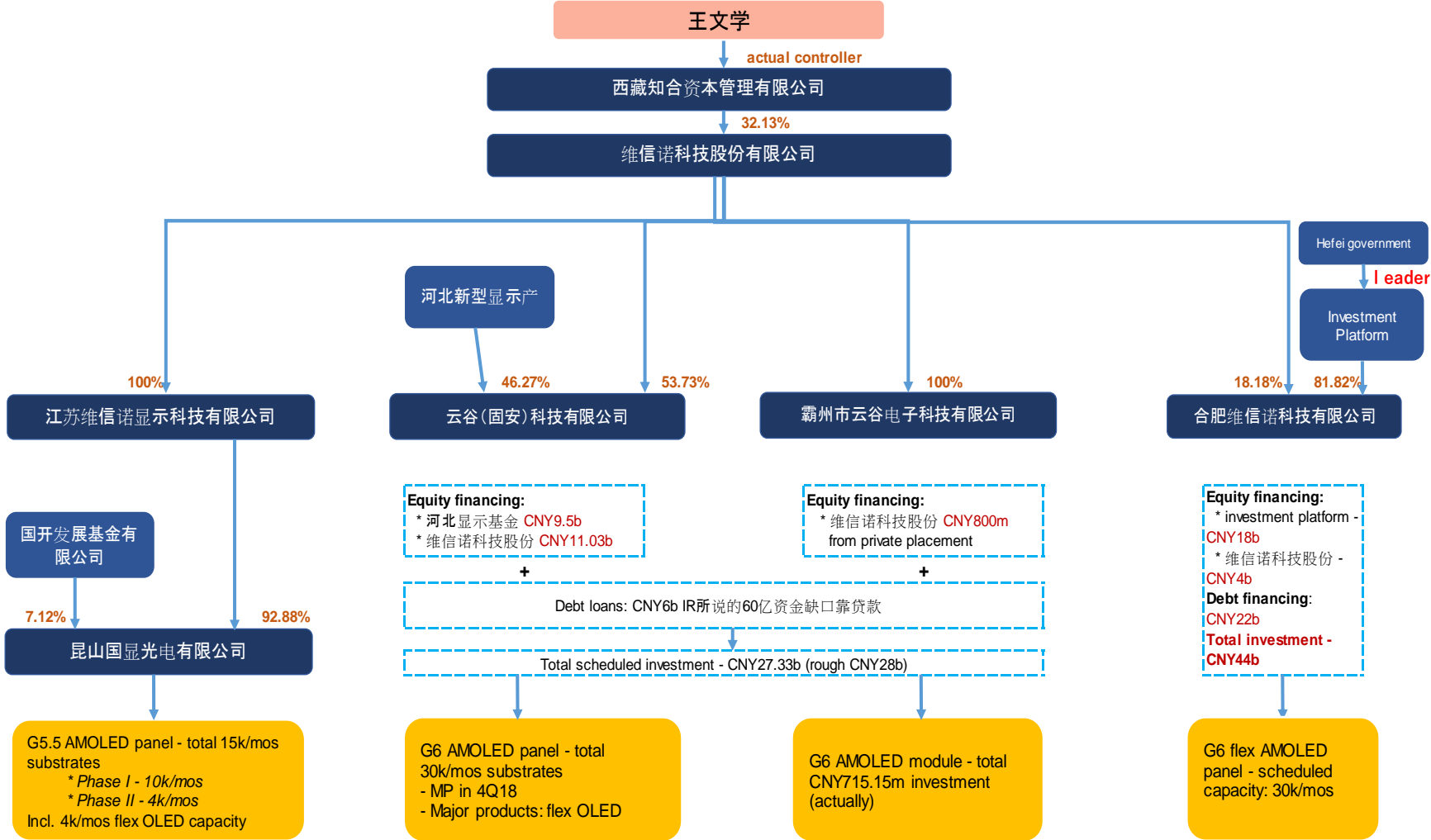
Company	Visionox Technology Inc. (維信諾科技有限公司)
Headquarters	Beijing, China
Director	程涛
Employees	7,214(as of 2018)
Established	December 2001
Listed	June 2018 (Shenzhen A shares)

Construction plans for the new G6 plant and the often revised second phase (expansion) for the G5.5 facility

- Investment and real estate development company **China Fortune Land Development** (SHA: 600340), alongside the regional Gu'an County (Hebei Province) government and GVO, on 29 June 2016 announced the signing of a memorandum of understanding to construct a G6 OLED plant in Gu'an. However, the suspension of the agreement was announced on 10 September, 2016.
- Almost immediately afterward, GVO, the Kunshan City Government, and **Black Cattle Food Company** (Shenzhen Stock Exchange: 002387) on 14 September announced an agreement to invest in a second-phase expansion for the G5.5 line. At the same time, Black Cattle Food Company announced it would invest through its subsidiary in a G6 flexible AMOLED line in Gu'an. Black Cattle Food Company also announced capital increases through third-party allocations (CNY3b and CNY5b, respectively) to the GVO parent and Tibet Capital, an investment fund held by Wang Wenxue, a current shareholder.
- Under the initial plan, the state-owned parent company of GVO and Black Cattle Food Company would establish a joint-venture firm for the construction of the plant, but that plan was revised so GVO would be the main party responsible for construction.
- Mr. Wang Wenxue, the effective owner of China Fortune Land Development and Black Cattle Food Company, is both a founder and quite wealthy, with assets of at least CNY40b.
- On November 17, 2018, Visionox along with Hefei government signed a memorandum of understanding to build another G6 OLED plant in Hefei. The initial investment structure of total CNY44b is based on equity financing (CNY22b) plus bank loans (CNY22b). Visionox planned to inject CNY4b for registered capital with rest CNY18b coming from local investment forum led by Hefei government.
- The new G6 line will focus on flex OLED panels and construction is set to complete in 4Q19 with equipment installation starting next spring.

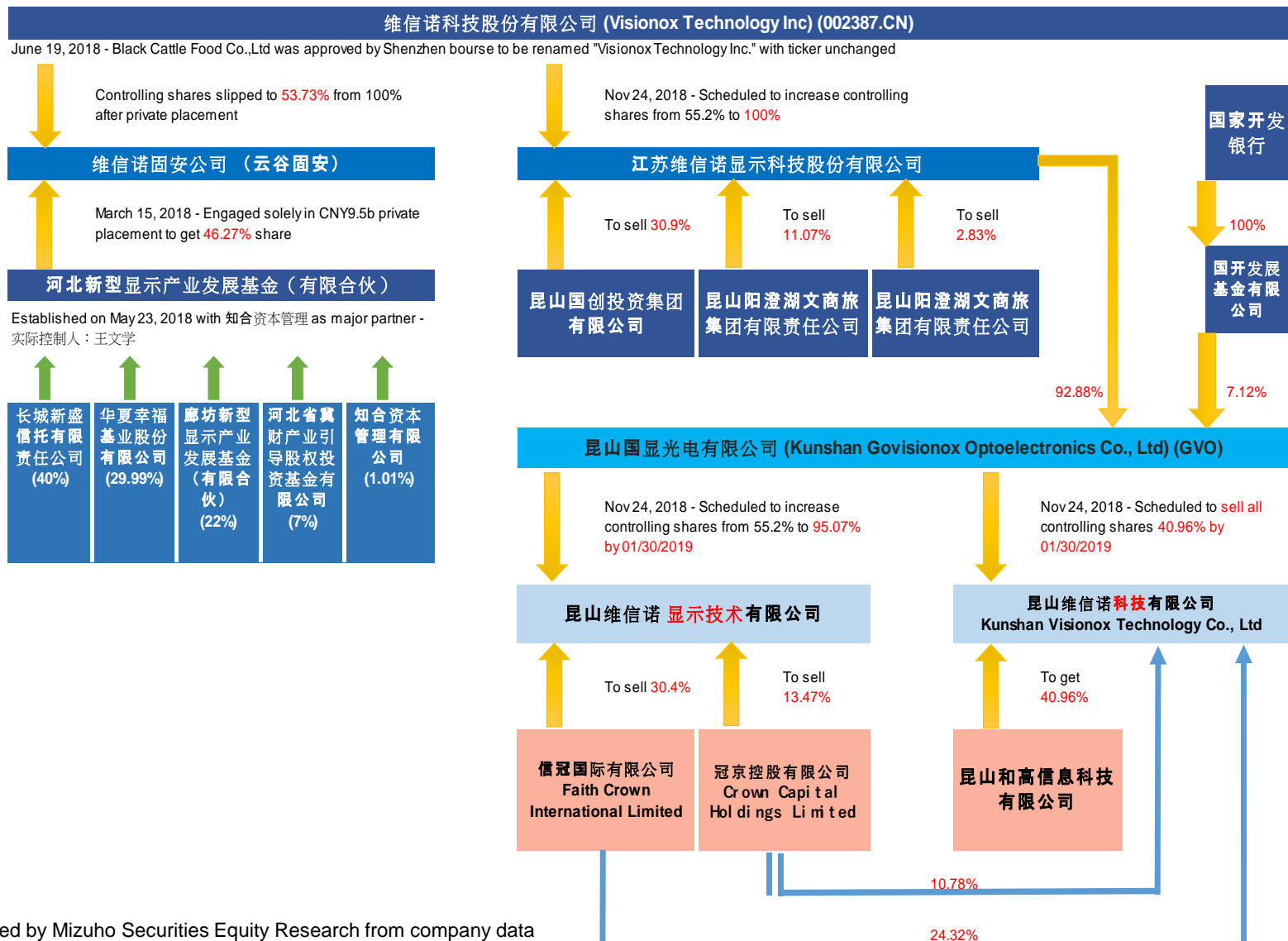
Source: Compiled by Mizuho Securities Equity Research from company data

Capital structure surrounding Visionox group 1



Source: Compiled by Mizuho Securities Equity Research from company data

Capital structure surrounding Visionox group 2



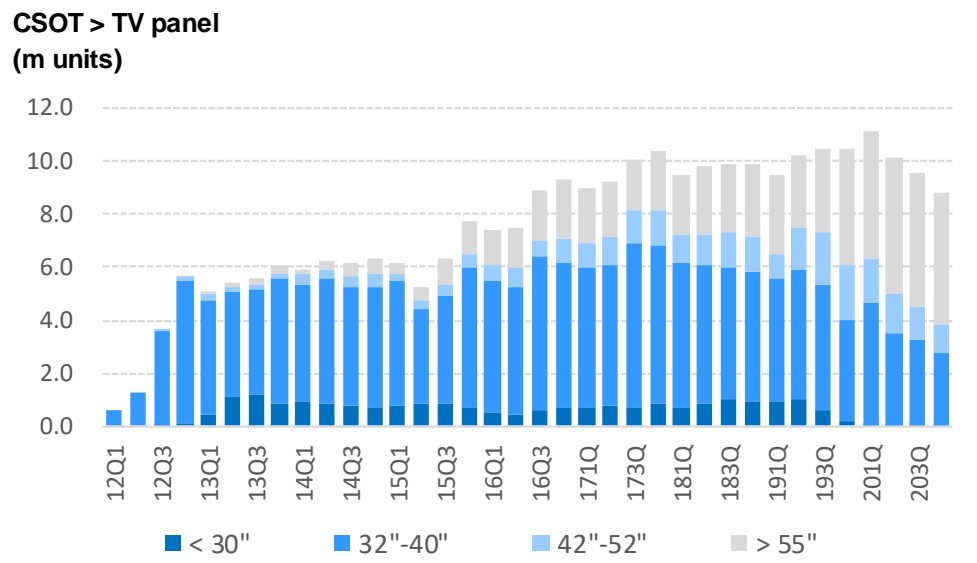
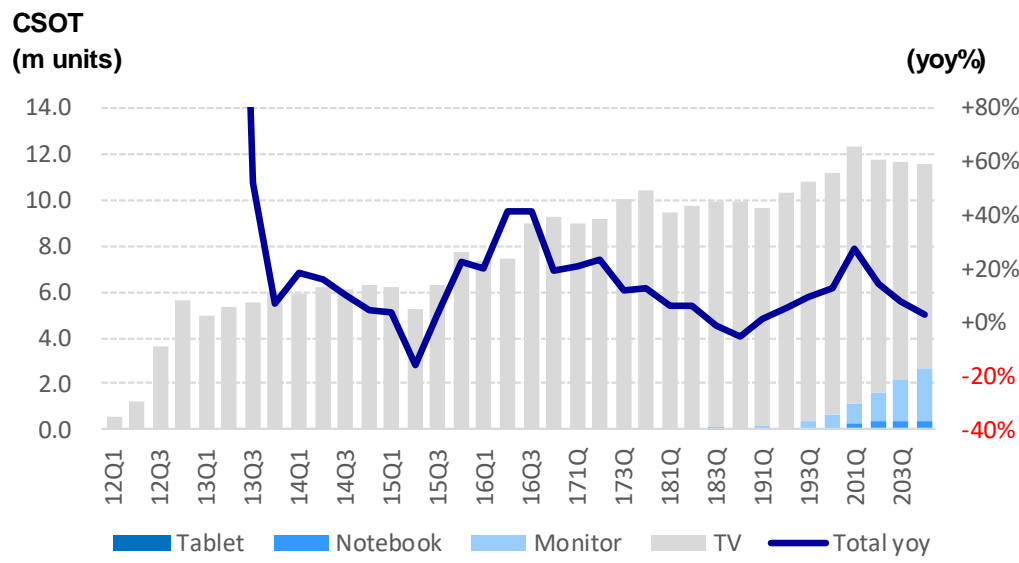
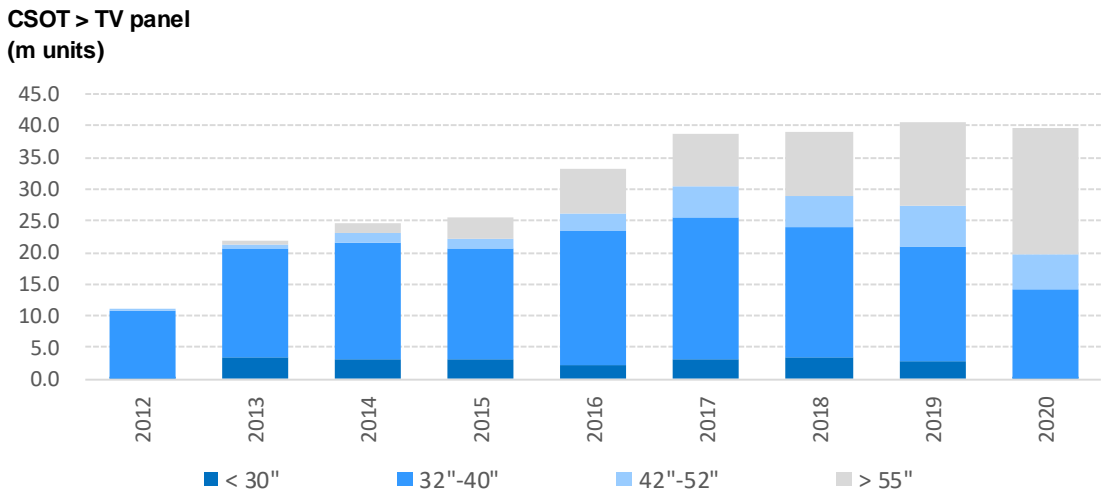
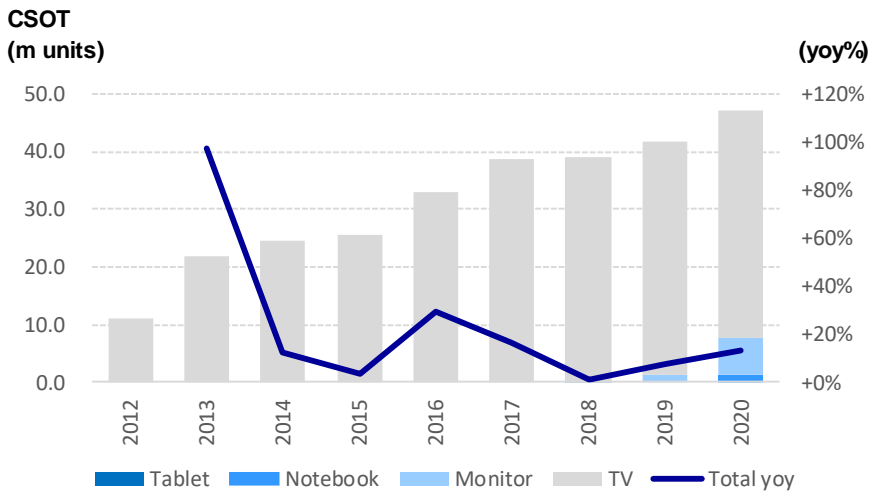
Source: Compiled by Mizuho Securities Equity Research from company data

VISIONOX TECHN-A												
	FY08/12	FY09/12	FY10/12	FY11/12	FY12/12	FY13/12	FY14/12	FY15/12	FY16/12	FY17/12	FY18/12	FY19/12
Sales	498	582	635	852	758	692	577	427	159	32	1,778	2,690
(Seq%)	+47%	+17%	+9%	+34%	-11%	-9%	-17%	-26%	-63%	-80%	+5,504%	+51%
Gross profit	155	186	207	292	258	241	221	38	39	6	-43	702
(Gross margin)	31.2%	31.9%	32.7%	34.3%	34.0%	34.8%	38.4%	9.0%	24.6%	18.3%	-2.4%	26.1%
Operating profit	74	91	93	116	63	24	12	-221	-65	286	702	692
(Operating margin)	14.8%	15.6%	14.6%	13.6%	8.4%	3.5%	2.0%	-51.8%	-41.1%	900.6%	39.5%	25.7%
Net profit	56	67	81	103	55	15	12	-642	26	15	35	64
ROE	30.3%	27.1%	10.7%	8.1%	4.1%	1.1%	0.9%	-61.1%	3.5%	2.0%	0.4%	0.4%
Oper_CF	93	138	23	52	14	110	-25	35	-65	117	25	441
Invest_CF	-109	-35	-100	-302	-245	-314	-475	353	-343	-3,929	-11,251	-4,438
Fin_CF	56	-10	741	-13	88	150	240	-205	190	4,121	18,201	12
FCF	-21	103	-79	-253	-239	-205	-756	-4	-936	-4,010	-13,701	-3,049
EBITDA	86	-	111	137	96	66	60	-159	-40	309	1,185	1,388
(EBITDA margin)	17.3%	-	17.4%	16.1%	12.7%	9.6%	10.3%	-37.3%	-25.1%	972.7%	66.7%	51.6%
Dep&Amot	12	-	18	22	33	42	48	62	25	23	484	696
R&D	-	1	2	2	3	4	4	4	1	24	569	723
Inventory	59	49	78	132	174	155	132	48	-	1	459	845
(days)	46	34	37	45	73	87	91	77	55	4	47	89
Net debt to equity ratio	0.10	-0.30	-0.71	-0.46	-0.27	-0.11	0.26	-0.02	0.05	5.78	-0.03	0.23
Net assets	214	282	1,226	1,316	1,363	1,363	1,372	727	753	769	19,149	19,212
Liabilities	254	283	131	145	217	437	804	500	603	8,429	17,724	17,939
Assets	468	564	1,357	1,461	1,580	1,799	2,176	1,227	1,357	9,197	36,873	37,151

VISIONOX TECHN-A												
	18/3	18/6	18/9	18/12	19/3	19/6	19/9	19/12	20/3	20/6	20/9	
Sales	11	465	455	848	207	909	768	806	412	753	844	
(Seq%)	-4%	+4,172%	-2%	+86%	-76%	+340%	-15%	+5%	-49%	+83%	+12%	
Gross profit	2	60	61	-166	-50	434	178	139	176	97	136	
(Gross margin)	22.6%	12.9%	13.4%	-19.6%	-24.1%	47.7%	23.2%	17.3%	42.8%	12.8%	16.2%	
Operating profit	-84	492	-166	459	-407	886	-85	299	-121	730	-53	
(Operating margin)	-769.2%	105.9%	-36.4%	54.1%	-197.2%	97.4%	-11.0%	37.1%	-29.3%	97.0%	-6.3%	
Net profit	-192	208	-168	187	-388	563	-236	124	-257	350	-119	

Source: Compiled by Mizuho Securities Equity Research from Bloomberg

China star optoelectronics technology Technology – Large-size panel shipment volume



Source: Compiled by Mizuho Securities Equity Research from company HP

TCL Electronics

① Summary

- ❑ TCL Electronics Holdings Limited is China's largest TV manufacturer and a subsidiary of the Chinese electrical equipment manufacturer TCL Corporation.
- ❑ The shareholders are the TCL Group (48.0%) and the firm's chairman Li Dongsheng (3.0%). (as of 10 January 2019)
- ❑ The company was founded in 1981, listed in January 1999 (HKSE ticker: 01070), and market cap was HK\$7,263m as of 10 January 2019.

Strategies

China

Overseas

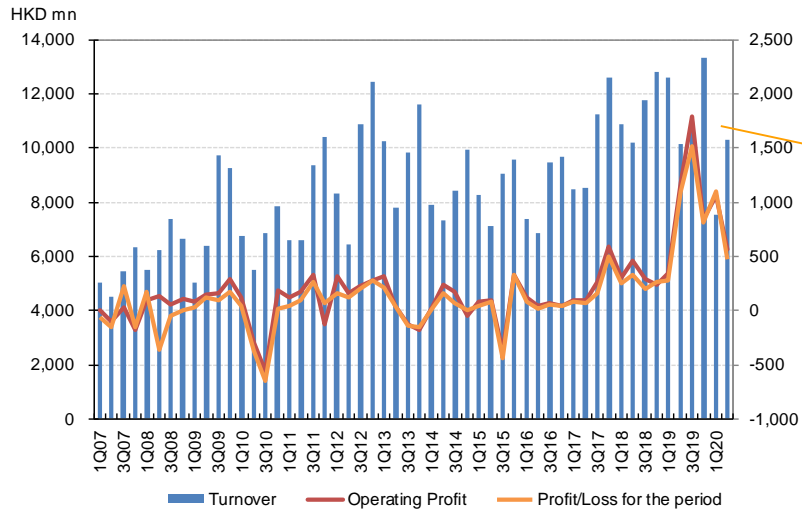
- ❑ Product strategy: Based on a "full-cloud strategy", increasing weighting of high end TVs (e.g., Smart TVs)
- ❑ Brand and promotions strategy: Utilize highly distinct sales promotion methods. Plans to strengthen its brand image.
- ❑ Channel strategy: Increase directly-managed stores at the same time as introducing a POS system to boost efficiency/strengthen management system at outlets
- ❑ Business operations: Decrease costs, plans to improve supply chain efficiency/vertically integrate to reduce lead times.
- ❑ North America: Increase advertising budget, participate in large trade fairs to foster a young brand image globally.
- ❑ Europe: Improve operating efficiency, product mix, and inventory management
- ❑ Emerging markets: Rising sales share for high-end products (e.g., smart TVs)
- ❑ Strategic OEM business: Supply completed products to other firms, utilize supply chain, reduce unit costs via economies of scale.

③ Earnings results and future outlook

- ❑ FY12/19 results: While sales volumes in China was 7.18m (+2.1% YoY), 13.46m(+26.1% YoY) in overseas.
- ❑ Sales volume for LCD TVs: 32m units (+11.9% YoY) in 2019 achieved the company's target (32m)
- ❑ Share of global LCD TV market (excl. ODM) : 5.4% in 2014 (4th), 5.6% in 2015 (4th), 5.9% in 2016 (4th), 7.1% in 2017 (3rd), 8.1% in 2018 (3rd), 9.3% in 2019 (3rd).
- ❑ Share of China LCD TV market (excl. ODM) : 16.0% in 2014 (3rd), 14.9% in 2015 (3rd), 13.0% in 2016 (3rd), 13.3% in 2017 (2nd), 13.0% in 2018 (3rd), 13.3% in 2019 (3rd).

Source: Compiled by Mizuho Securities Equity Research from company data, DisplaySearch

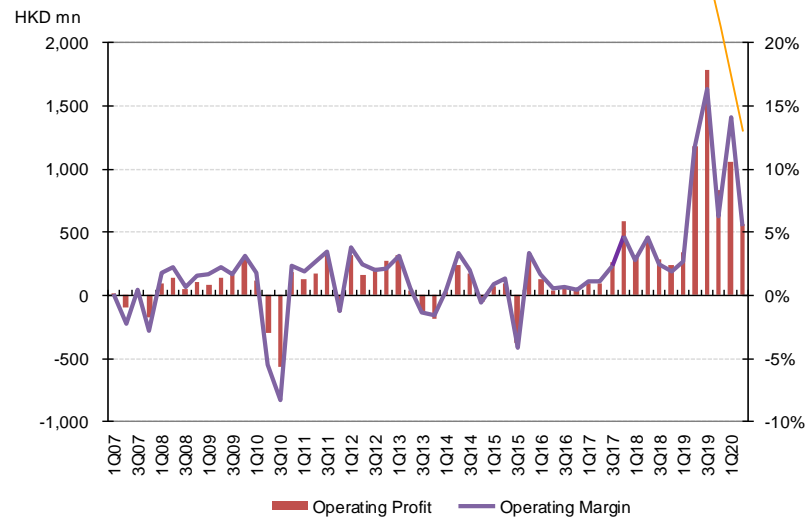
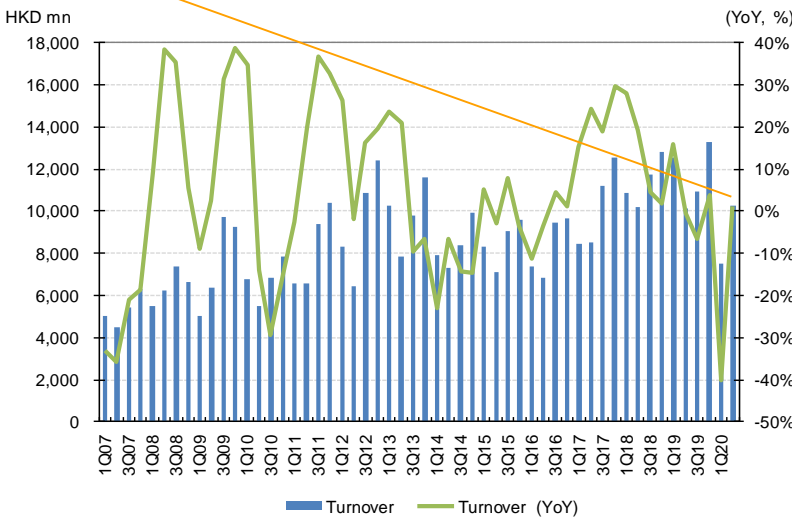
TCL Electronics : Earnings trends



<2Q20>
 Turnover: 10,277M HK\$ (YoY +1.2%)
 OP: 566M HK\$ (YoY -51.9%)
 NP: 477M HK\$ (YoY -56.6%)

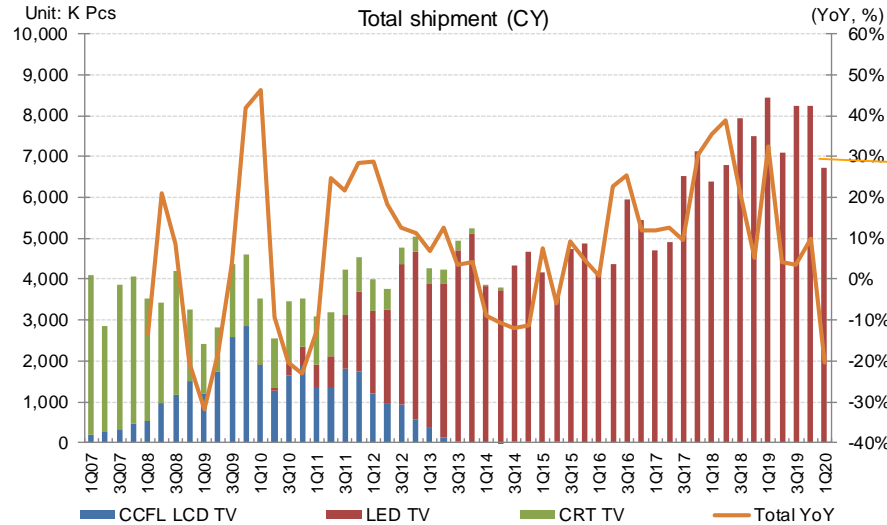
<2Q20>
 Turnover: 10,277M HK\$ (YoY +1.2%)

<2Q20>
 OP: 566M HK\$ (YoY -51.9%)



Source: Compiled by Mizuho Securities Equity Research from company data

TCL Electronics : Unit shipments by model

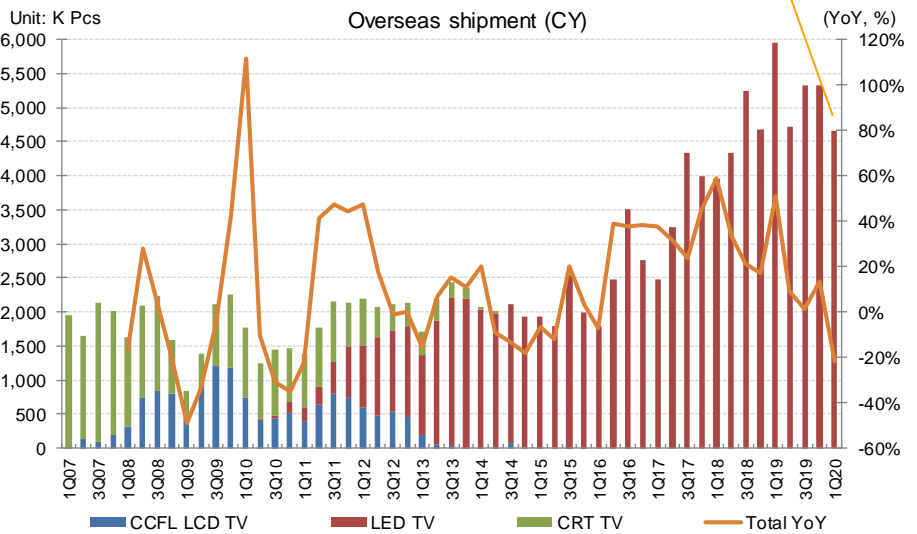
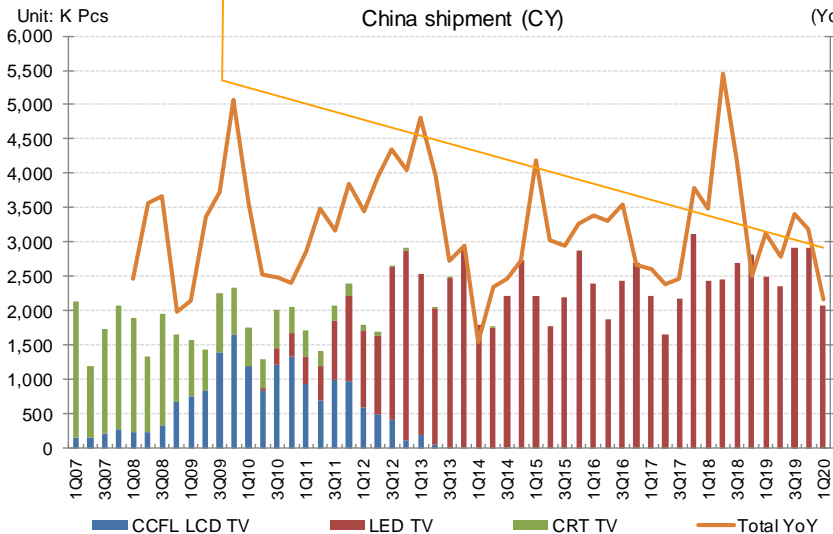


<1Q20>
PRC(China 30.8%):
2.075K Unit (YoY -16.8%)

<1Q20>
LED Backlight: 6,735K Unit (YoY -20.2%)

- Weight of LED Backlight TV is almost 100%
- CCFL LCD and CRT converting

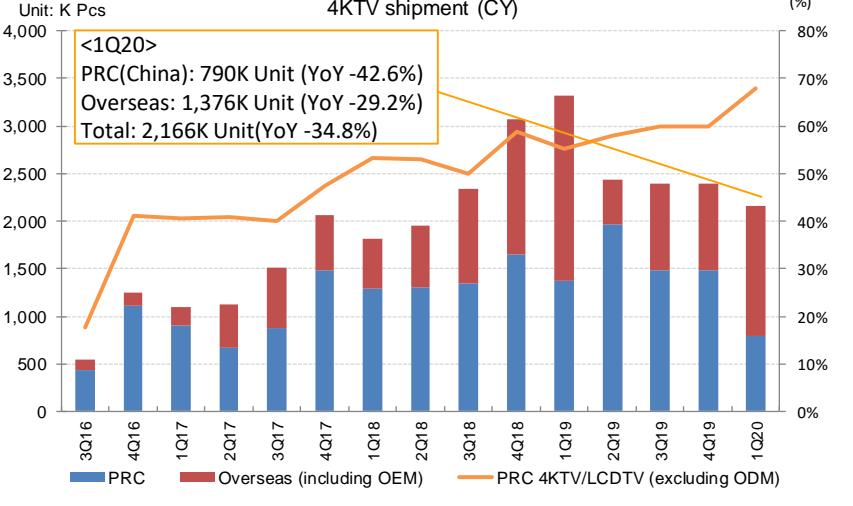
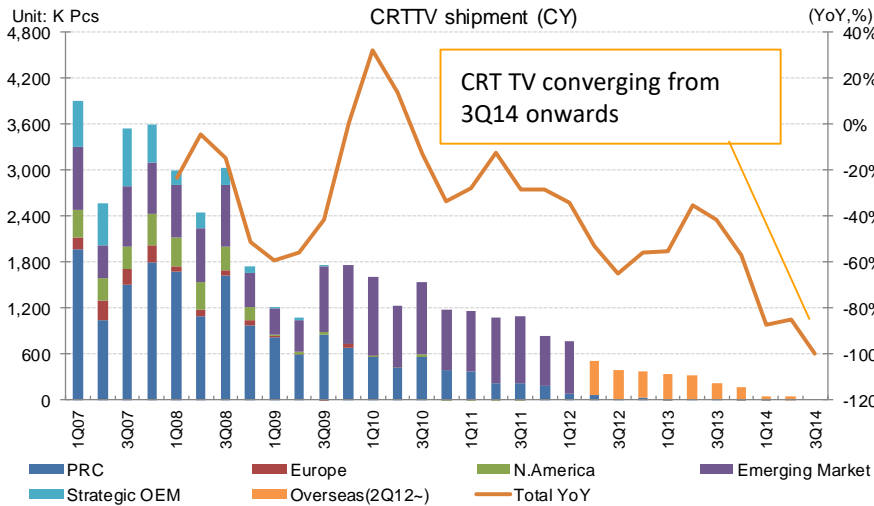
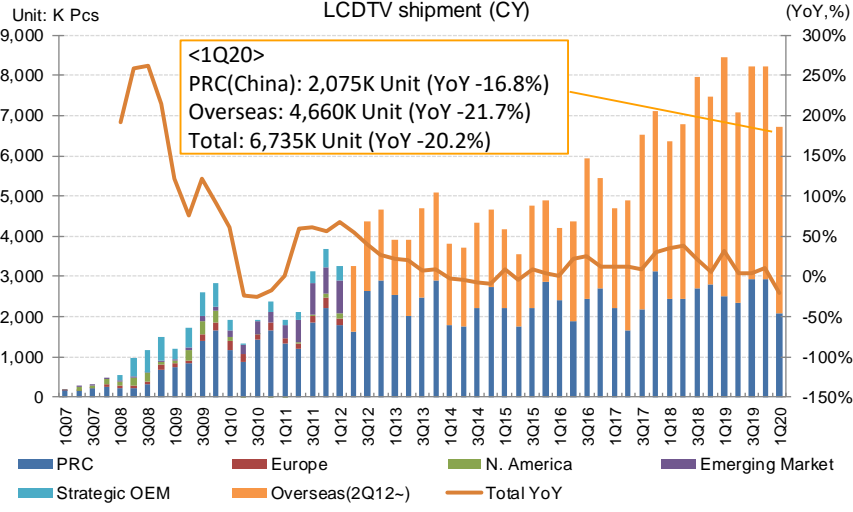
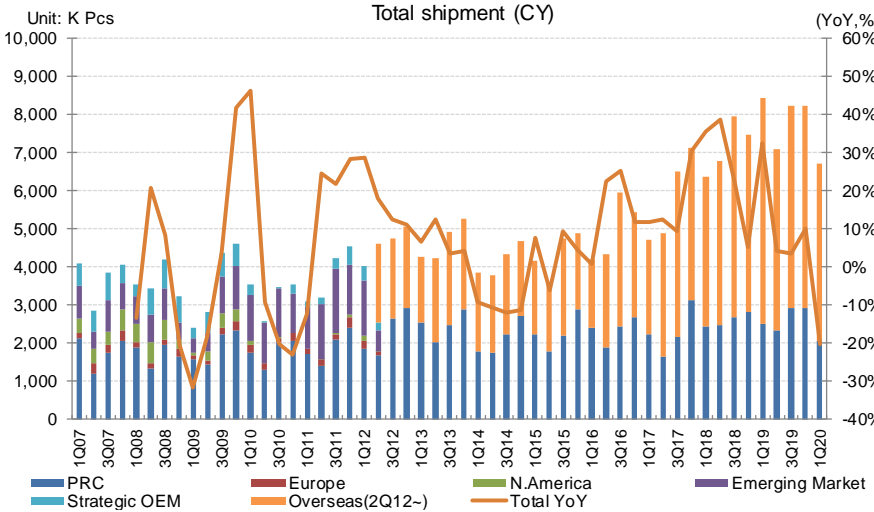
<1Q20>
Overseas (69.2%):
4,660K Unit (YoY -21.7%)



※The data in 1Q-4Q19 = ODM in 2018 divided by ratio of China:overseas. The data in 3Q-4Q19 = half of 2H19.

Source: Compiled by Mizuho Securities Equity Research from company data

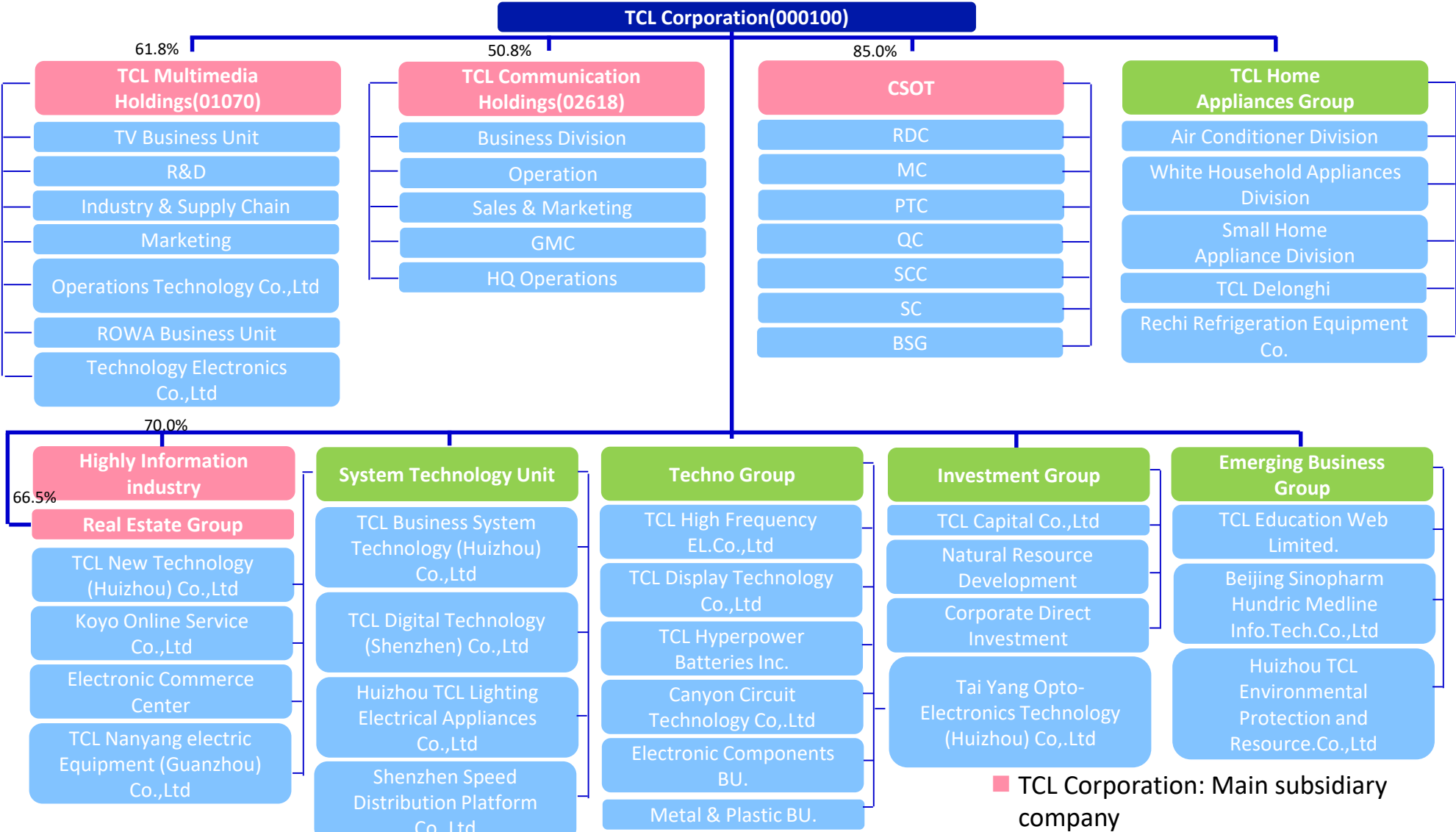
TCL Electronics : Unit shipments by region



※ The data in 1Q-4Q19 = ODM in 2018 divided by ratio of China:overseas. The data in 3Q-4Q19 = half of 2H19.

Source: Compiled by Mizuho Securities Equity Research from company data

TCL Corporation group



Source: Compiled by Mizuho Securities Equity Research from company data

① Summary

- Skyworth Digital Holdings Ltd is a large TV manufacturer in China.
- Major businesses are manufacturing and sales of digital home appliances and related products.
- The company was founded in 1988, listed in April 2000.
- The major shareholder is Lin Wei Ping (林衛平)(35.64%), Wong Wang Sang, Stephen (黃宏生)(35.64%).

② Strategy

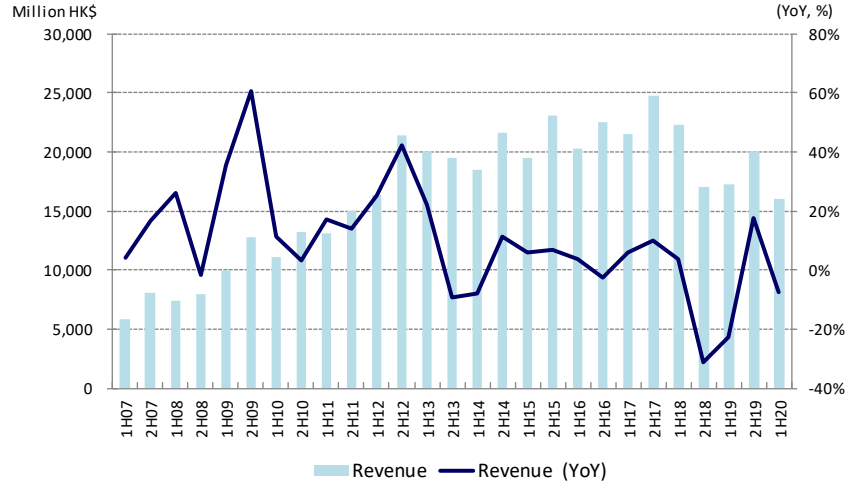
- The company operates in six segments: 1) China TV segment, 2) overseas TV segment, 3) digital set-top box segment, 4) LCD module segment, 5) other electronic products segment, and 6) property investment segment.
- The two TV-related segments target China and overseas markets, respectively, and both design, produce, and sell TVs.
- The digital set-top box segment, LCD module segments, and other electronic products segments respectively design, manufacture, and sell digital set-top boxes, LCD modules, and other electronic product peripherals.

③ Earnings results

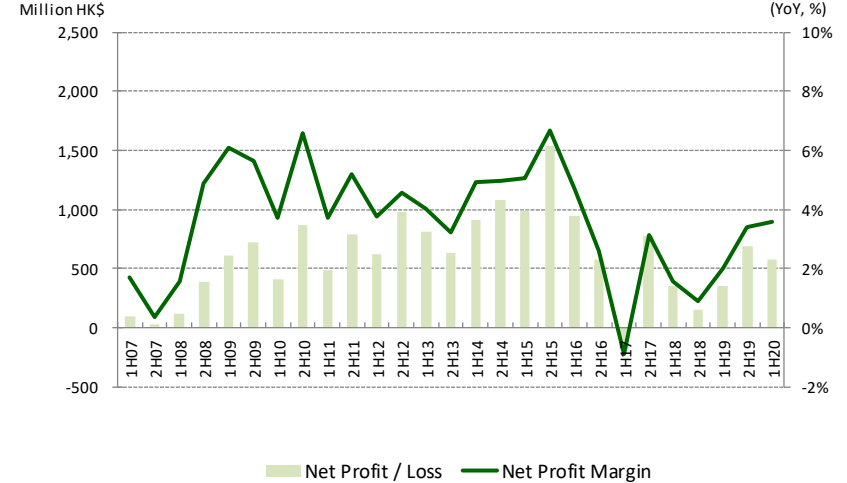
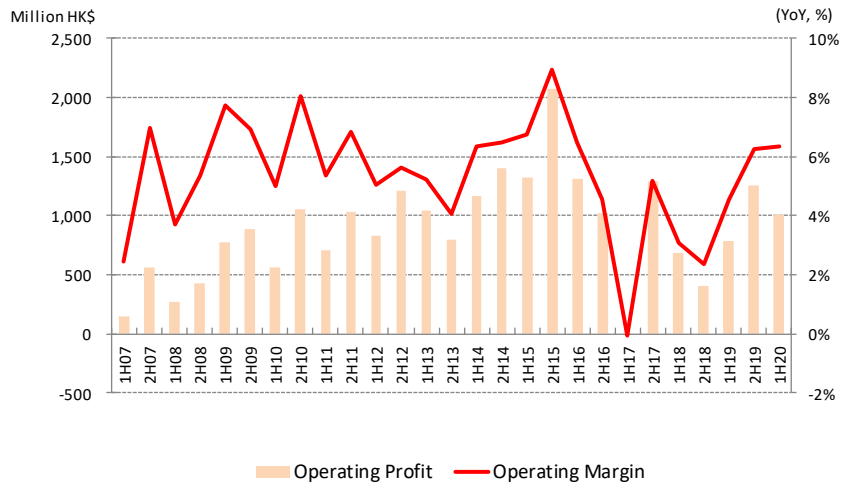
- FY19 results(HK\$): sales 37,277M(YoY-5.1%), OP 2,037M(YoY +88.1%)
- FY19 sales composition : Smart TV systems(PRC):19,865 M(53.3%), Home access systems:6,268 M(16.8%), Smart white appliances:4,118M(11.0%), Intelligent manufacturing:1,728M(4.6%), Internet valued-added services of Coocaa system:826M(2.2%), Sales of properties:528M(1.4%), Automotive electronic systems :55M(0.1%), Others:3,889M(10.4%)
- Share of China TV market(Unit Shipments)
 - ✓ LCD TV (CY19 ;IHS Markit):1st Xiaomi(20.3%), **2nd Skyworth(16.5%)**, 3rd Hisense(15.5%), 4th TCL(13.3%)
 - ✓ 4K UHD TV (CY19) : 1st Xiaomi(18.9%), 2nd Hisense(16.7%), **3rd Skyworth(15.9%)**, 4th TCL(12.6%)

Source: Compiled by Mizuho Securities Equity Research from company data and IHS Markit.

SKYWORTH: Earnings trends

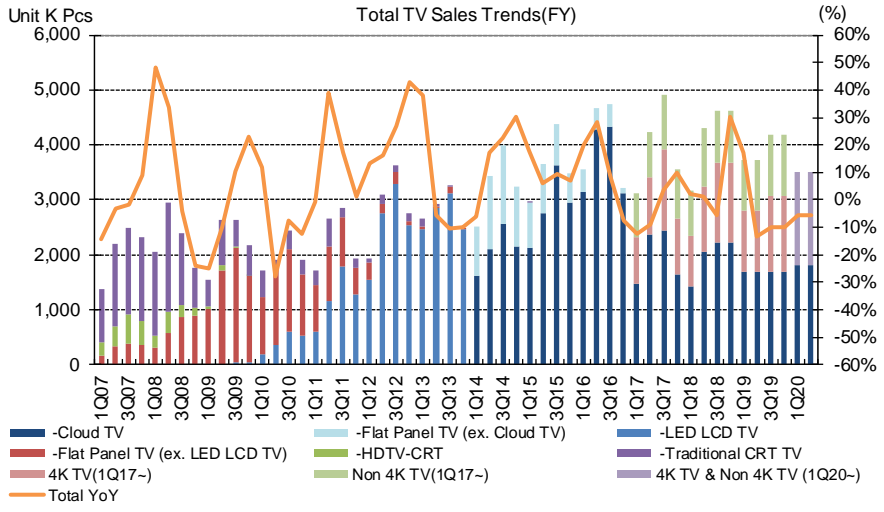


<1H20>
 Revenue: 15,979 (YoY ▲ 7.3%)
 OP: 1010 (YoY 28.7%)
 NP: 573 (YoY 64.7%)

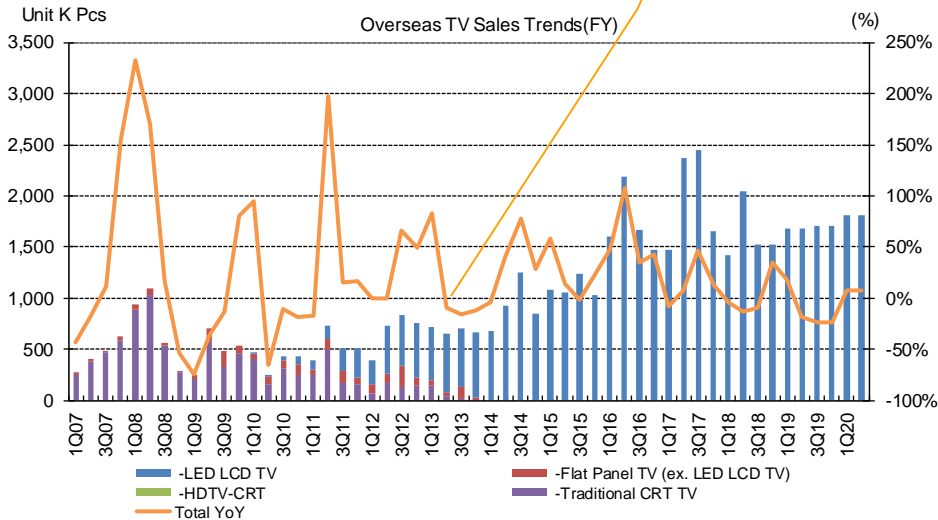
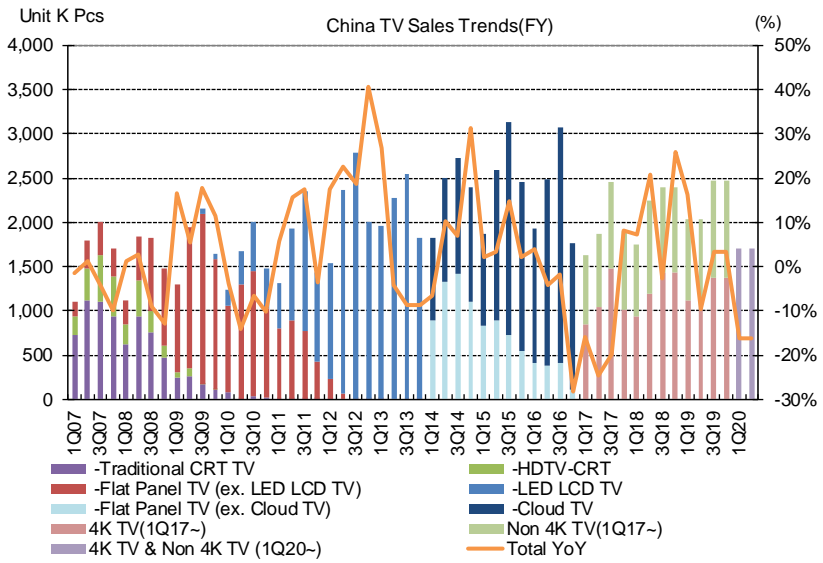


Note: The fiscal year is ending in March till 4Q18 and ending in June subsequently.
 Source: Compiled by Mizuho Securities Equity Research from company data.

SKYWORTH: Unit shipments by model

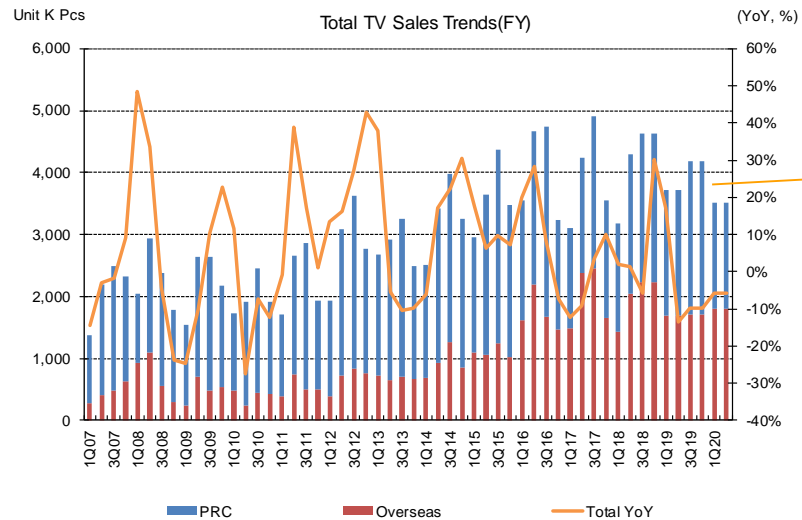


<1Q14~>
 For overseas, weighting of LED LCD TVs is nearly 100%



Note: The fiscal year is ending in March till 4Q18 and ending in June subsequently. Quarterly data for 2Q18 and later is not disclosed, so the 1H/2H value divided into two is used for each quarter.
 Source: Compiled by Mizuho Securities Equity Research from company data.

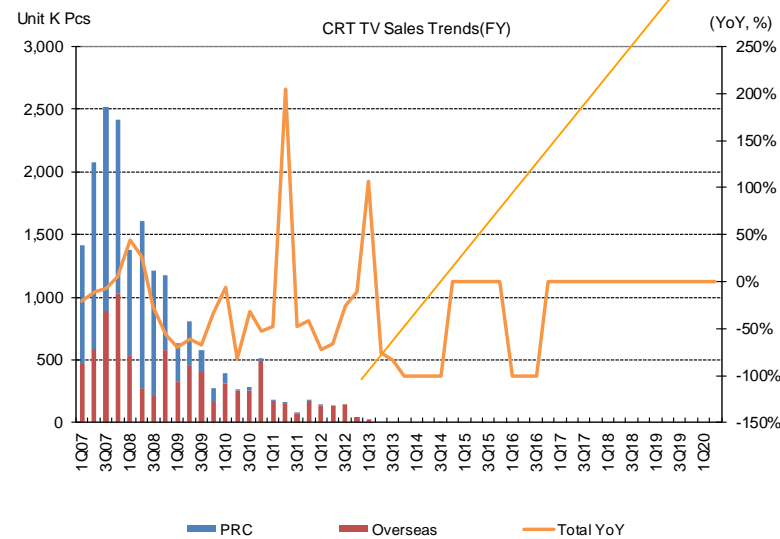
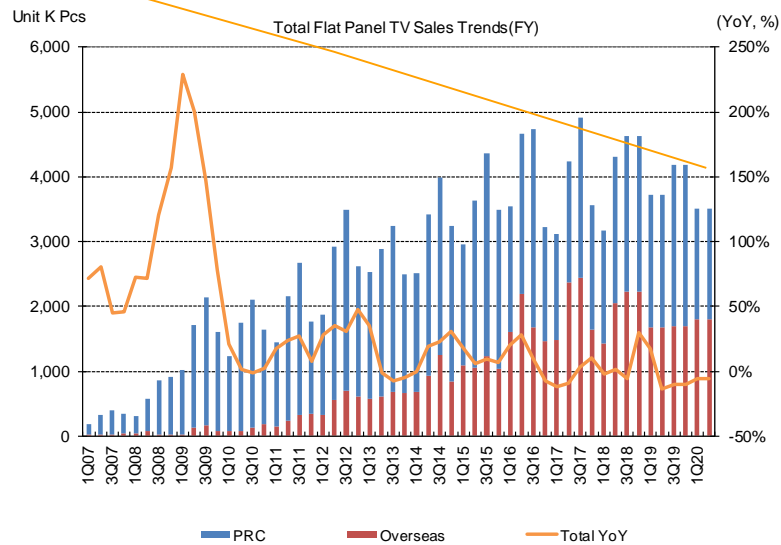
SKYWORTH: Unit shipments by region



<1H20>
 PRC(China): 3,415 (YoY ▲16.2%)
 Overseas: 3,613 (YoY +7.1%)
 Total: 7,028 (YoY ▲5.7%)

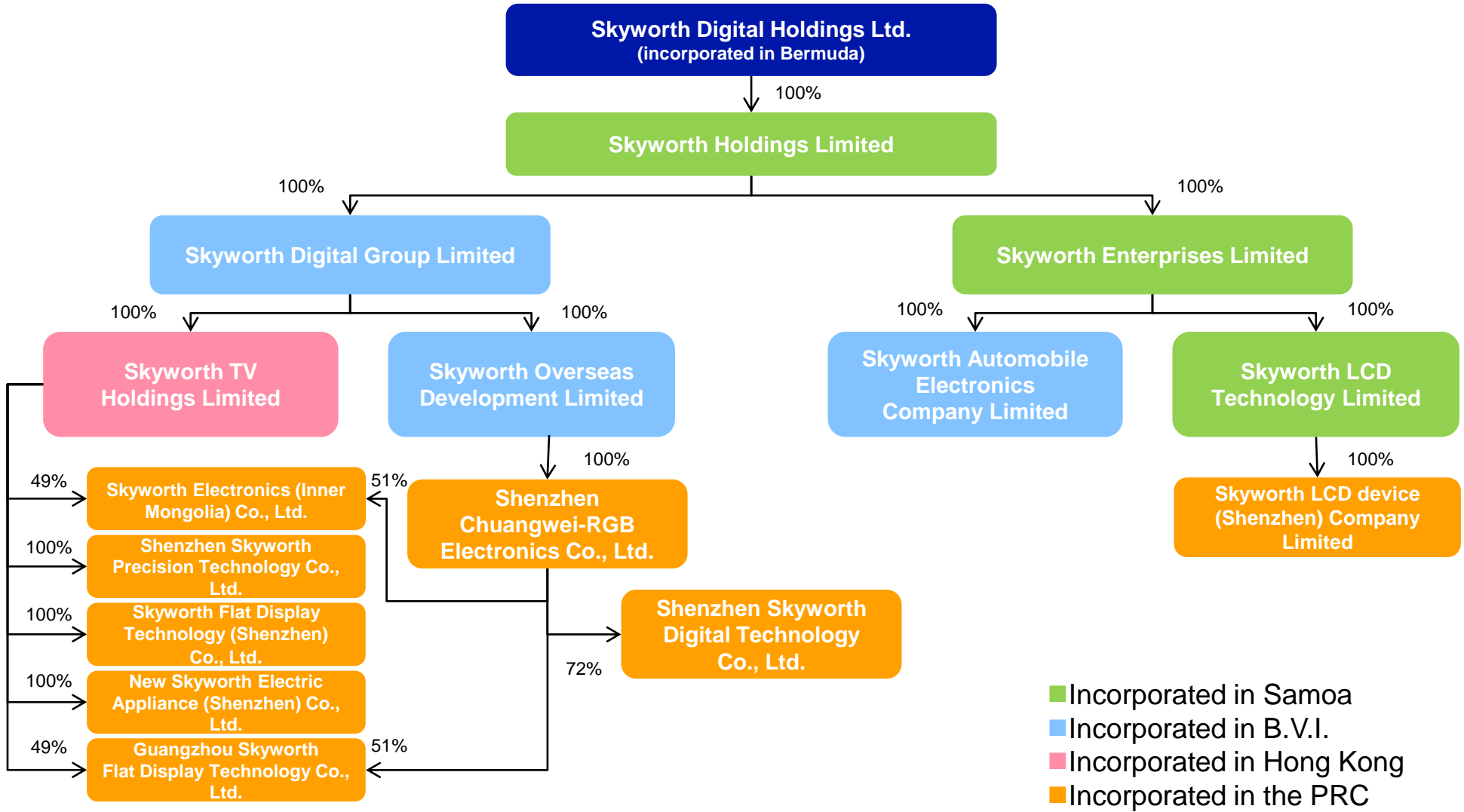
<1H20>
 PRC(China): 3,415 (49%)
 Overseas: 3,613 (51%)
 Total: 7,028 (100%)

<4Q13~>
 CRT TV business converging



Note: The fiscal year is ending in March till 4Q18 and ending in June subsequently. Quarterly data for 2Q18 and later is not disclosed, so the 1H/2H value divided into two is used for each quarter. Source: Compiled by Mizuho Securities Equity Research from company data.

SKYWORTH Corporation group

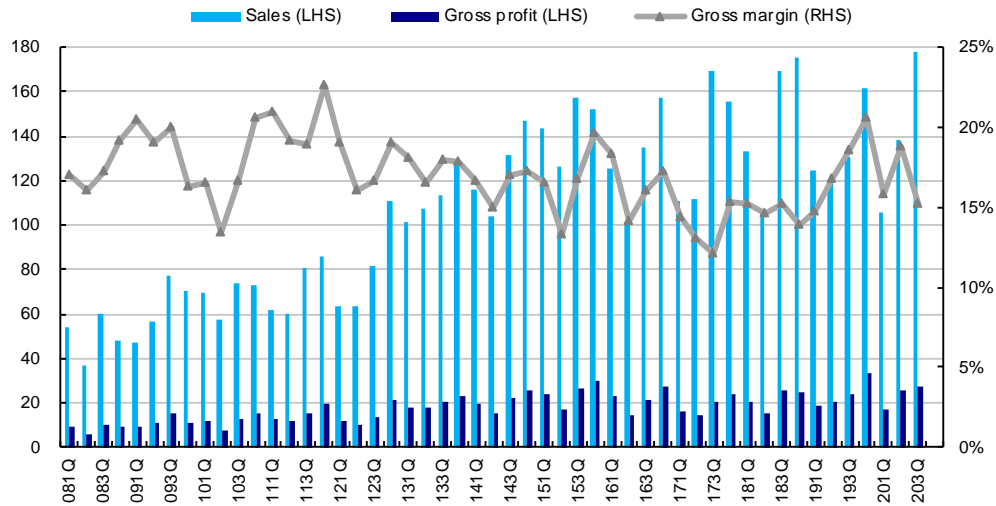


- Incorporated in Samoa
- Incorporated in B.V.I.
- Incorporated in Hong Kong
- Incorporated in the PRC

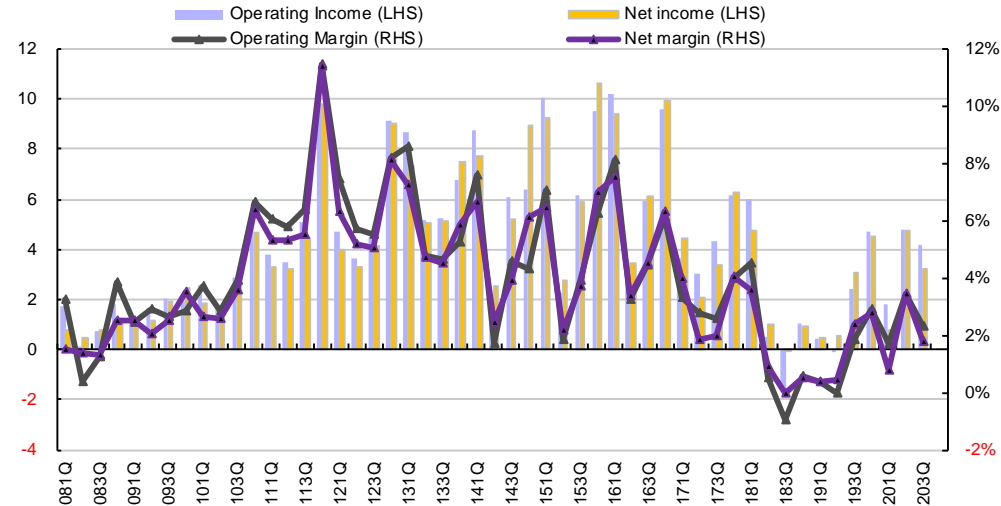
Source: Compiled by Mizuho Securities Equity Research from company data

Funai / Hisense Quarterly trend

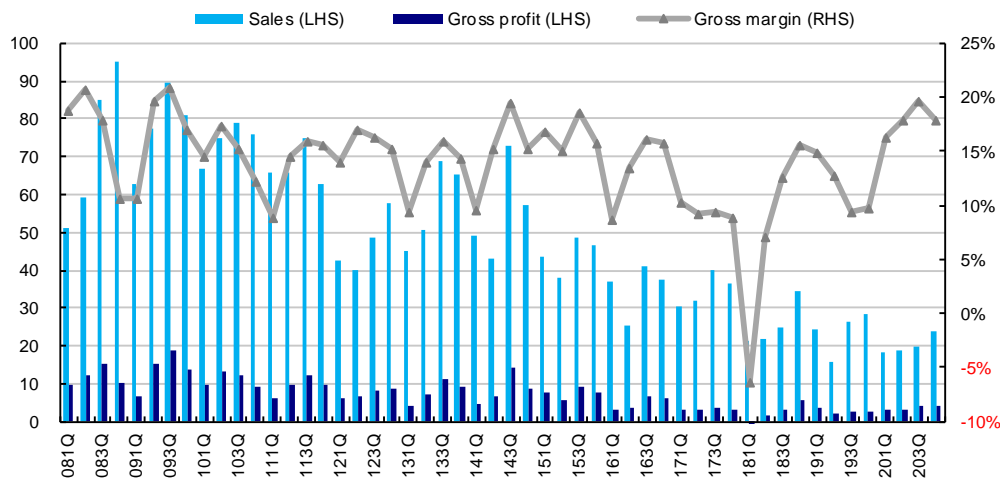
Hisense Sales/Gross profit trend (bn yen) JPY base



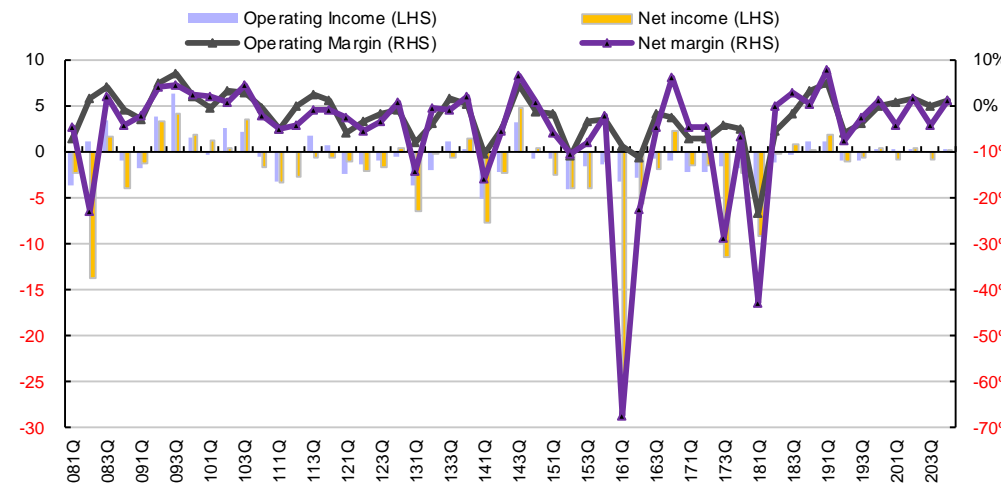
Hisense OP/Net profit trend (bn yen) JPY base



Funai Sales/Gross profit trend (bn yen) JPY base



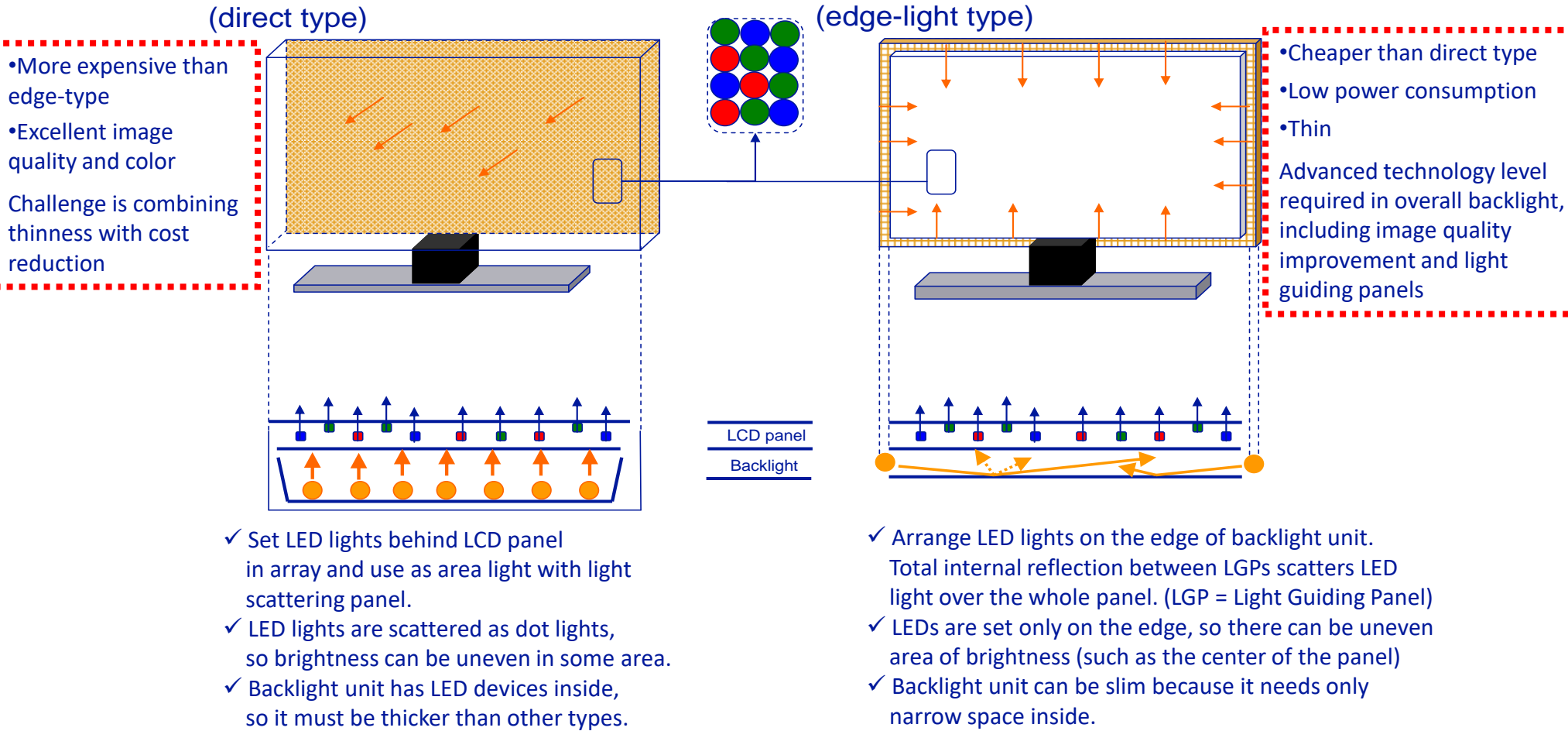
Funai OP/Net profit trend (bn yen) JPY base



Source: Compiled by Mizuho Securities Equity Research from company data, Bloomberg

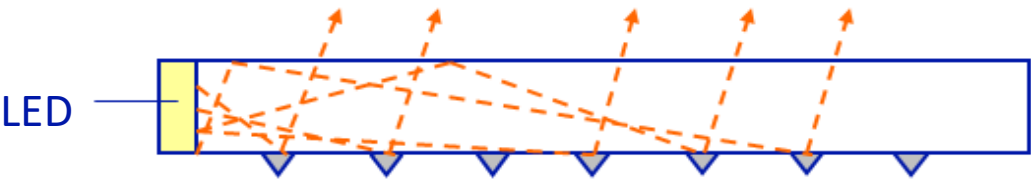
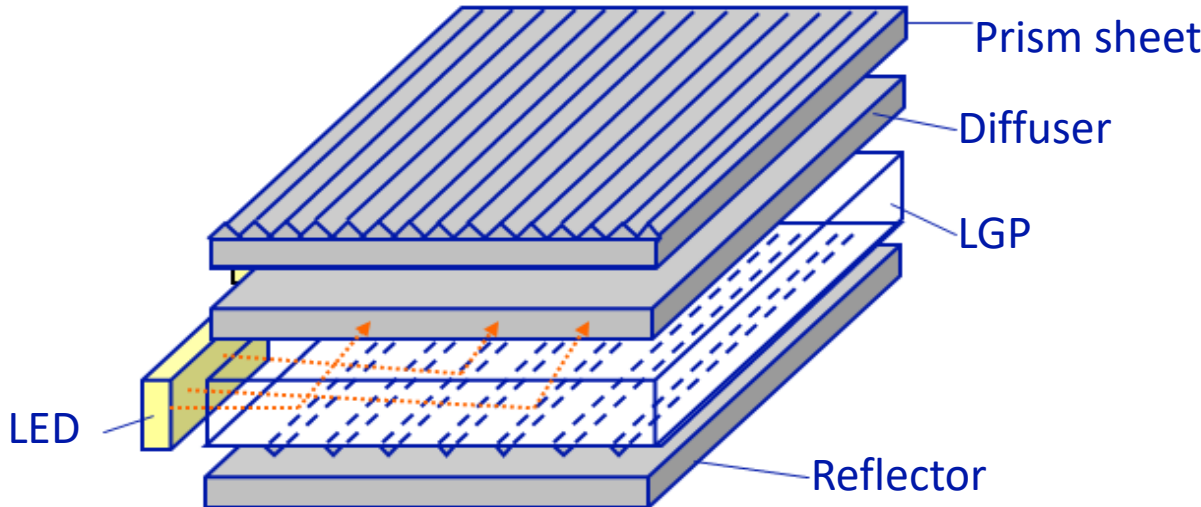
8. LED and film industry

TV use LED Backlight : Direct type and Edge type



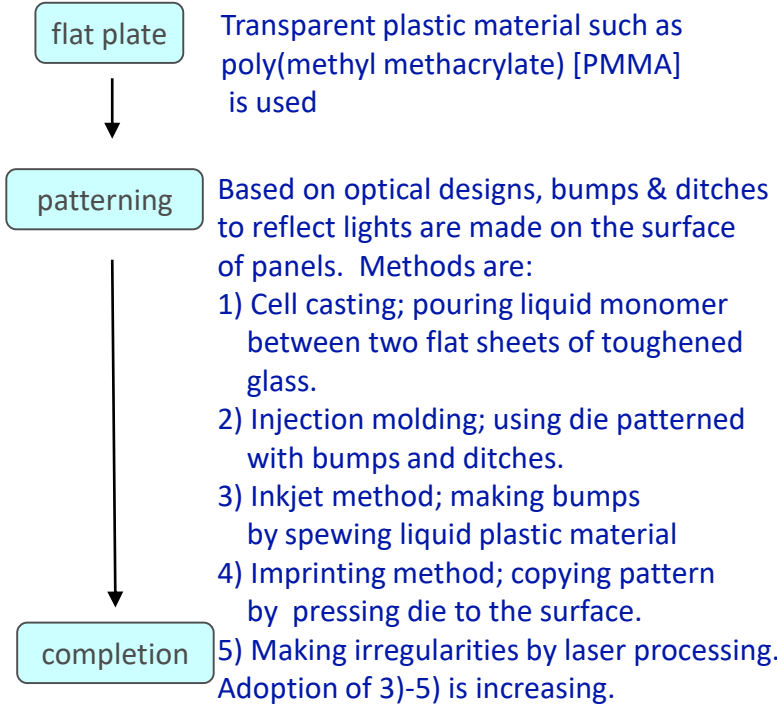
Source: Mizuho Securities Equity Research

Light Guide Plate (LGP) –Mechanism and Production Method-

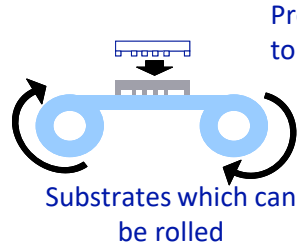


※Surface lighting is achieved by reflecting lights in the LGP which contains micro-V ditches and dot-shaped bumps.

Production of LGP



Imprinting method

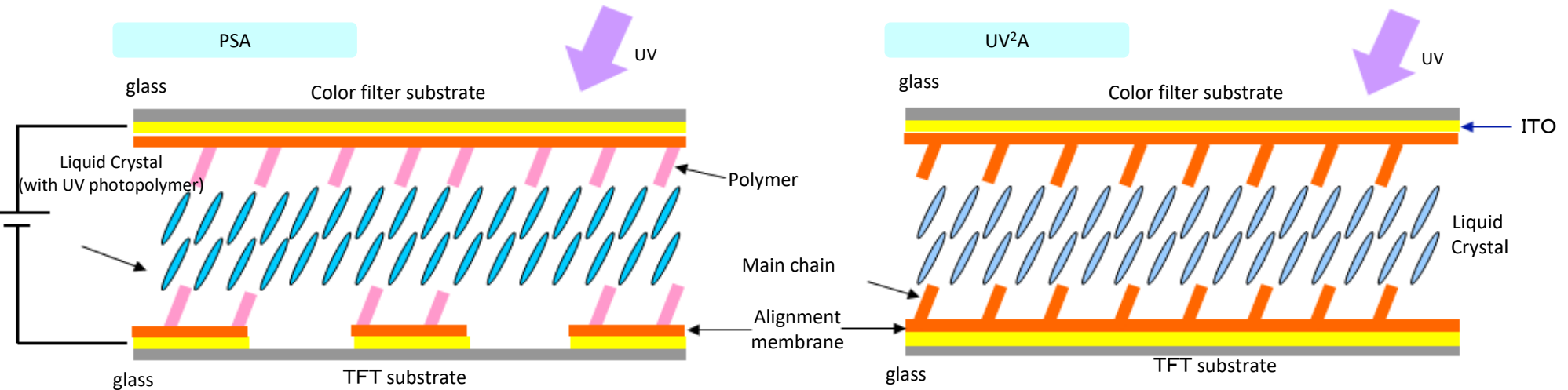


Inkjet method



Source: Mizuho Securities Equity Research

PSA vs UV2A(optical alignment)



- When liquid crystal with UV photopolymer is sealed, exposed to UV with electric field, the photopolymer get solid along the shape of ITO electrode. Alignment membrane is deposited along the ITO electrode on both TFT and CF side.
- "Advance sloping angle" is set at the boundary between liquid crystal and substrate making the monomer in liquid crystal transition into polymer film. It controls LC molecule's inclination.
- Square-shaped unevenness at UV photopolymer transition had been a technical problem. But AUO has solved it and launched mass production. Samsung announced its launch of production in 9/09.

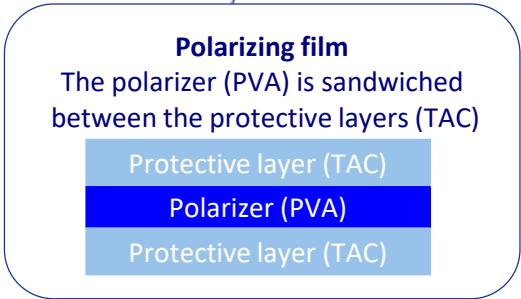
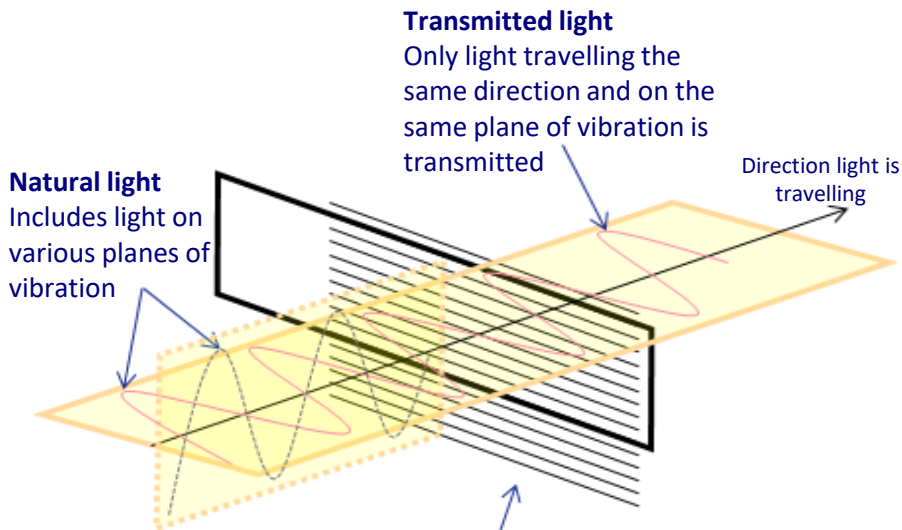
- It's similar to PSA at the point that it controls liquid crystal's alignment by exposing to UV light. For UV²A, the polymer membrane whose main chain leans along the UV light direction.
- Furthermore, it has no unevenness such as limbs and hollows, which makes homogenous alignment, improvement in response speed and high penetration rate.
- Sharp has developed and announced in 9/09.

Source: Mizuho Securities Equity Research

Polarizing film

Polarizing film takes in light that is oscillating in different directions and only allows those waves oscillating in a particular direction to pass through it by blocking the other waves. In optics, this is one type of polarizer.

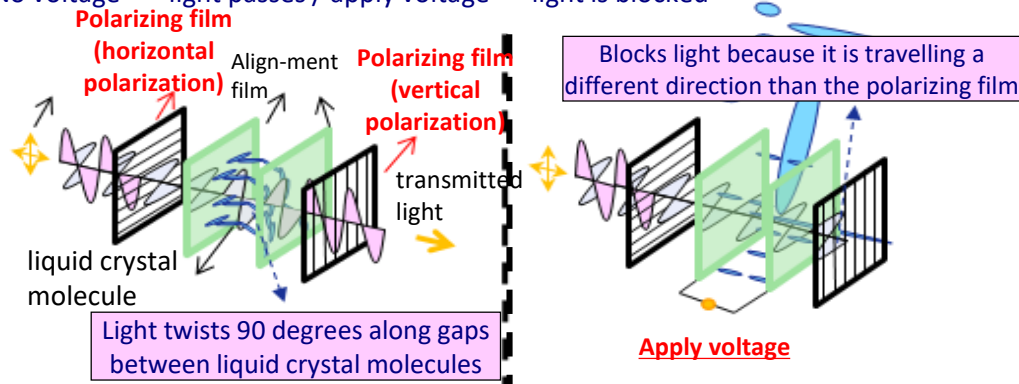
How polarizing film works



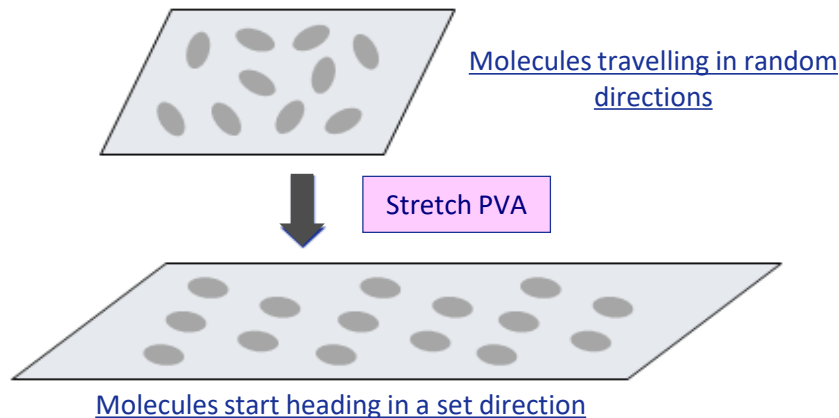
Polarizing film application: LCDs

<Basis of TN LCDs>

No voltage \Rightarrow light passes / apply voltage \Rightarrow light is blocked



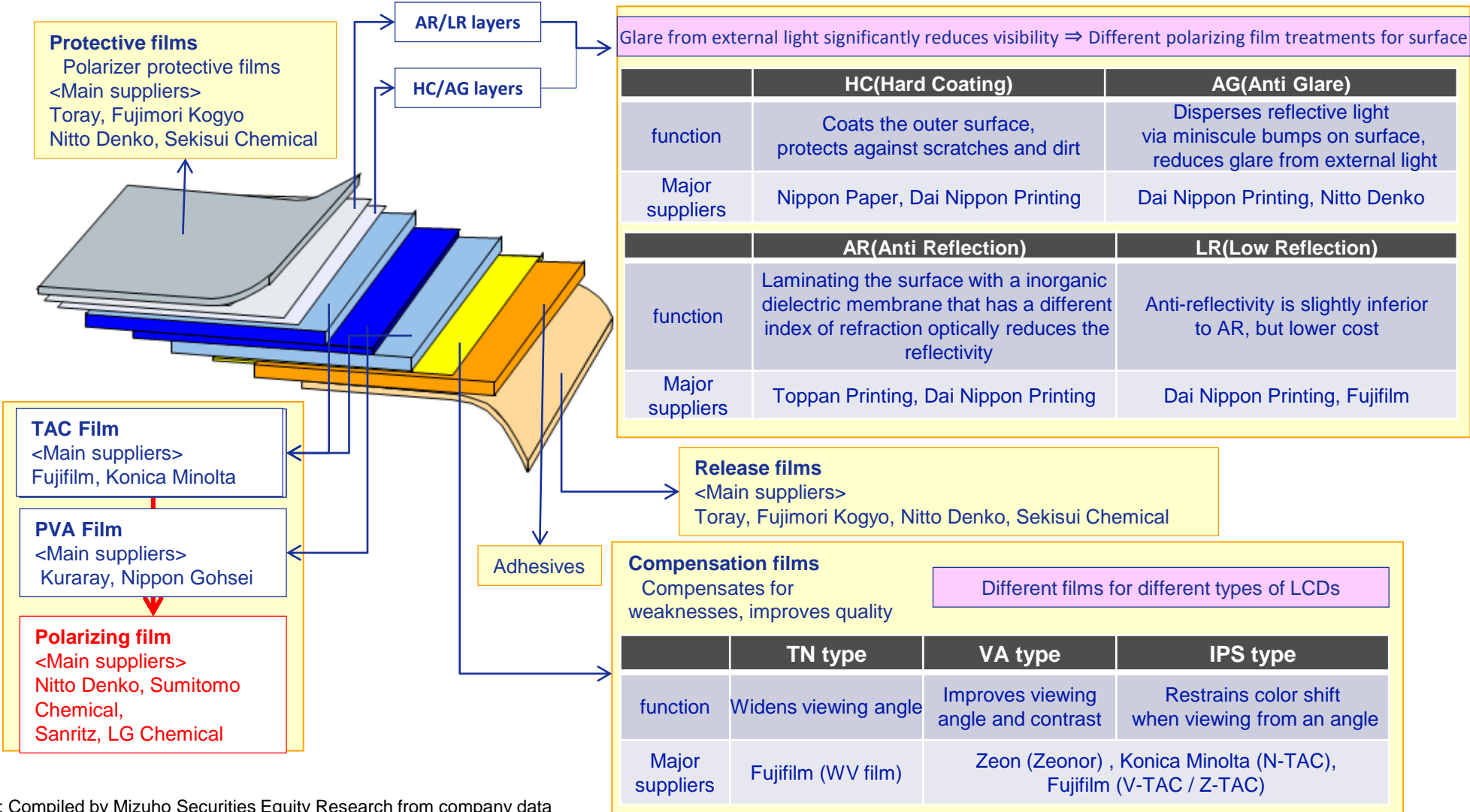
Making polarizing film: Stretch PVA



Source: Compiled by Mizuho Securities Equity Research from company data

Composition of LCD polarizing film

Composition of LCD-use optical functional films and main materials suppliers



Source: Compiled by Mizuho Securities Equity Research from company data

Organic EL lighting: Developing a new market while competing with LED

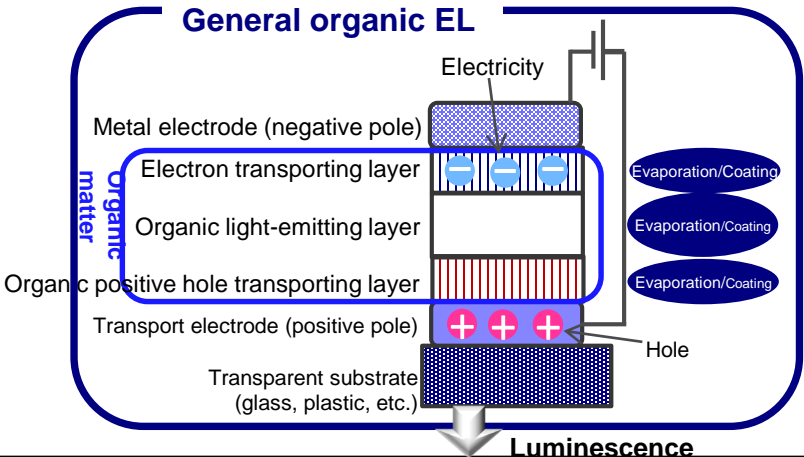
Principle
Lighting in which luminescent material excited by voltage application emits light when subsequently returning to their original state. This is the same principle as OLED displays, but whereas the electric current to each OLED panel pixel (subpixel) needs to be controlled, the electric current for organic EL lighting only needs to be controlled for a single cell, and the luminescent material can be produced in a single color, making for a simpler configuration.

Features
Organic OLED lighting is surface light emitting, making it a more natural light (shadows, etc.) than traditional LED. Merits include high color rendering, slim surfaces (EL layer of less than 1µm), and high efficiency. Another merit is that it doesn't emit blue light or ultraviolet rays. Organic OLED lighting is flexible and transparent, and will likely be integrated with printed electronics in the future.

Applications
Hospital lighting, vehicles (interior lighting, tail lamp) etc. With current technology, lack of luminance and directional projection means it is not expected to be used in vehicle headlights. It costs around 10x more than LED lights, meaning the price would have to fall for widespread general household usage.

Production method
No need for back plane array process or RGB evaporation is needed as in OLED displays. Mass production using the roll to roll method has also started.

- Players**
- Konica Minolta (phosphor materials, coating type roll to roll, ¥10b plant investment in Kofu)
 - Toshiba (coating type, as well as transmission type prototypes)
 - Lumiotec (JV between Mitsubishi Heavy Industries+Rohm+Toppan Printing+Mitsui and others. In-line film deposition apparatus with linear evaporation sources developed by Mitsubishi Heavy Industries)
 - Sumitomo Chemical (luminous layer generated using printing and single coating, considering roll to roll?)
 - Mitsubishi Chemical+Pioneer (coating type mass production, roll to roll for white only)
 - Kaneka (vapor deposition method mass production)
 - Overseas players include Phillips, LG Chemical
 - Panasonic Electric Works + Idemitsu → liquidation / withdrawal in March 2014
 - Showa Denko (withdrew in Jan 2014)



	Organic EL light	Light bulb	Fluorescent bulb	LED
Principle	Voltage application to luminescent material generates light	Electric current to filament (metal) generates light	Ultraviolet ray created by electric current collides with fluorescent material to generate light	Voltage application to inorganic semiconductor generates light
Features	<ul style="list-style-type: none"> ○Wide illumination area ○Surface light source (diffusion light) ○Energy saving ○Low heat generation ○Slim, light ○Flexible (plastic substrate) ○Environmentally friendly 	<ul style="list-style-type: none"> •Narrow illumination area Point light source × High electricity consumption × High heat generation ○Close to natural light 	<ul style="list-style-type: none"> •Lighting area lies between point light source and surface light source Line light source ○Energy saving × Uses toxic substance (mercury) 	<ul style="list-style-type: none"> •Narrow illumination area Point light source ○Energy saving ○Long life span ○Easy to miniaturize ○Environmentally friendly
Usage	Expected usage in living space, decorative lighting, vehicle cabin lighting, living room and POP lighting.	Filming lighting, living space lighting such as bedroom	Living space, office, commercial facilities, etc.	Indirect lighting, foot lamp, store spotlights, etc.

Source: Compiled by Mizuho Securities Equity Research from company data

Micro-LED : High-resolution, wide-viewing angle display crammed with roughly 1-10 μ m ultra-fine LEDs

Major Production Technology

Manufacturing types	Chip bonding	Wafer bonding	Thin film transfer
Display resolution type	Micro LED chip	Micro LED thin film	Micro LED thin film
Display substrate size	No size limits	Small sizes	No size limits
Adjustable transfer distance	Yes	No	Yes
Mass transfer capacity	No	Yes	Yes
Epitaxy usage rate	mid	low	high
Epitaxy reuse rate	none	mid	high
Costs	high	mid	low
Manufacturers	Sony	Leti	LuxVue(Apple)
		ITRI	Mikro Mesa

Issues

- ✓ **Low yields means high costs**
 - Large, high-resolution displays particularly difficult to achieve
- ✓ **Trade-off between resolution and LED size**
 - High-resolution + low yield = higher costs for small LEDs (Apple)
- ✓ **In wafer production, different materials are needed for each RGB color element**
 - Acts as brake on miniaturization and higher resolutions

Source: Mizuho Securities Equity Research, based on various media sources

Micro LED (μ LED): Next-gen display technology

- New display tech based on existing inorganic LEDs
- Excl. the organic/inorganic difference, structured just like an OLED. Active TFT required (LCD: voltage-drive; OLED/ μ LED: current driven)
- Like OLED, no backlight or color filter necessary
- Similar advantages to OLED (fast refresh, low power consumption, flexible). In addition, inorganic tech means longer life/improved stability; widely expected to beat out OLED (sealing not as difficult as with OLED). Overall, a bright, long-lasting display technology. Also compatible with existing LED supply chains
- **Biggest barrier** to greater proliferation: Immature manufacturing & mass production processes
- Interest originally in Taiwan (and other areas which were slower to pursue OLED) but recently interest in Korea and China is increasing
- Some suggesting embedding IR chips in the screen for additional communication functions

- Micro LED: Display types and production methods

✓ Individually produced RGB wafers followed by chip transfer; mainly used for large displays; commercialization imminent

- Semiconductor materials different depending on LED color; crystal substrate also differs as it uses very similar lattice constant

R (AlInGaP, GaAsP, GaP)

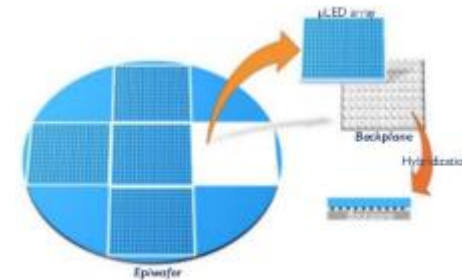
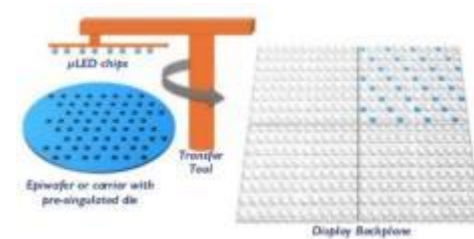
G (GaP, InGaN, AlGaIn, GaN, ZnSe)

B (GaN, ZnSe, InGaIn, AlGaIn)

- FHD (1920x1080x3RGB) = 6.22m pixels. Time/cost barriers (chip alignment and connection) significant
- Differences among LEDs lead to variable quality; correction necessary
- Shrinking the technology is difficult
- One-time elastomer-based printing; R2R and other techniques also being researched
- Commercialization: Sony CLEDIS (chip area: 0.003mm²; likely 50-60 μ m per square)

✓ Forming RGB pixels on a single wafer (monolithic array)→applicable for small displays, but do not see it leaving the R&D stage

- How to create RGB pixels on a single-material substrate (challenges with chromatic purity)
- Is crystal growth on GaAs/GaN substrate a possibility?
- Yield issues (fixing pixel issues reasonable? Laser-repair of faults?)
- Correcting differences among LEDs
- Finer processing possible



Source: Mizuho Securities Equity Research from company data

9. Individual companies

Yasuo Nakane's coverage list 1

6752	Panasonic	Term	Sales (¥m)	YoY (%)	OP (¥m)	YoY (%)	Pretax (¥m)	YoY (%)	NP (¥m)	YoY (%)	EPS (¥)	PER (x)	EV/ EBITDA (x)
Rating	Neutral	FY3/19 A	8,002,733	0	411,498	8	416,456	10	284,149	20	122	-	-
PO	¥880	FY3/20 A	7,490,601	-6.4	293,751	-28.6	291,050	-30.1	225,707	-20.6	96.8	-	-
Current Price	¥1,424	FY3/21 CE	6,600,000	-11.9	230,000	-21.7	230,000	-21.0	150,000	-33.5	64.3	22.1	-
(% to PO)	-38%	FY3/21 E	6,378,790	-14.8	135,880	-53.7	135,191	-53.6	83,986	-62.8	36.0	39.6	9.2
		FY3/21 IFIS	6,645,046	-11.3	234,199	-20.3	231,986	-20.3	149,681	-33.7	64.2		
52 week high	¥1,520	FY3/22 E	6,663,060	4.5	252,166	85.6	251,166	85.8	166,328	98.0	71.3	20.0	6.8
52 week low	¥692	FY3/22 IFIS	7,031,224	10.2	331,191	143.7	327,571	142.3	220,972	163.1	94.7		
	2021/3/8	FY3/23 E	6,772,386	1.6	314,034	24.5	313,034	24.6	210,254	26	90	16	6

6753	Sharp	Term	Sales (¥m)	YoY (%)	OP (¥m)	YoY (%)	Pretax (¥m)	YoY (%)	NP (¥m)	YoY (%)	EPS (¥)	PER (x)	EV/ EBITDA (x)
Rating	Neutral		-	-	-	-	-	-	-	-	-	-	-
PO	¥2,300	FY3/20 A	2,271,248	-5.4	52,773	-37.3	55,541	-19.5	20,958	-71.8	33.0	-	-
Current Price	¥1,958	FY3/21 CE	2,350,000	3.5	82,000	55.4	70,000	26.0	50,000	138.6	81.9	23.9	-
(% to PO)	17%	FY3/21 E	2,443,276	7.6	81,899	55.2	71,899	29.5	54,961	162.2	90.0	21.8	10.6
		FY3/21 IFIS	2,345,228	3.3	70,770	34.1	66,722	20.1	51,348	145.0	93.2		
52 week high	¥2,410	FY3/22 E	2,747,003	12.4	111,045	35.6	111,045	54.4	89,737	63.3	146.9	13.3	8.3
52 week low	¥896	FY3/22 IFIS	2,413,990	-1.2	78,214	-4.5	73,927	2.8	56,284	2.4	101.5		
	2021/3/8	FY3/23 E	2,769,644	0.8	128,445	15.7	128,445	15.7	104,005	15.9	170.3	11.5	7.2

6758	Sony	Term	Sales (¥m)	YoY (%)	OP (¥m)	YoY (%)	Pretax (¥m)	YoY (%)	NP (¥m)	YoY (%)	EPS (¥)	PER (x)	EV/ EBITDA (x)
Rating	Buy	FY3/19 A	8,665,687	1.4	894,235	21.7	1,011,648	44.7	916,271	86.7	707.7	-	-
PO	¥13,500	FY3/20 A	8,259,885	-4.7	845,459	-5.5	799,450	-21.0	582,191	-36.5	461.2	-	-
Current Price	¥11,020	FY3/21 CE	8,800,000	6.5	940,000	11.2	1,120,000	40.1	1,085,000	86.4	867.7	12.7	-
(% to PO)	23%	FY3/21 E	8,611,201	4.3	780,745	-7.7	848,745	6.2	881,531	51.4	705.0	15.6	9.7
		FY3/21 IFIS	8,758,413	6.0	899,991	6.4	1,042,440	30.4	1,003,888	72.4	816.0		
52 week high	¥12,545	FY3/22 E	9,128,311	6.0	933,351	19.5	913,351	7.6	707,240	-19.8	565.6	19.5	8.2
52 week low	¥5,297	FY3/22 IFIS	9,253,451	7.5	913,197	17.0	913,684	7.7	694,416	-21.2	580.5		
	2021/3/8	FY3/23 E	9,646,957	5.7	1,101,103	18.0	1,081,103	18.4	835,304	18.1	668.0	16.5	6.7

Source: Mizuho Securities Equity Research

Yasuo Nakane's coverage list 2

6875	MegaChips	Term	Sales	YoY	OP	YoY	Pretax	YoY	NP	YoY	EPS	PER	EV/ EBITDA
			(¥m)	(%)	(¥m)	(%)	(¥m)	(%)	(¥m)	(%)	(¥)	(x)	(x)
Rating	Neutral	FY3/19 A	95,145	6.9	574	-78.8	503	-77.2	-1,727	-	-79.4	-	-
PO	¥2,750	FY3/20 A	65,765	-30.9	972	69.5	639	27.1	-1,792	-	-82.3	-	-
Current Price	¥3,225	FY3/21 CE	75,000	14.0	4,200	331.9	2,700	322.5	2,700	-	124.1	26.0	-
(% to PO)	-15%	FY3/21 E	83,550	27.0	4,298	342.0	3,156	393.9	3,207	-	147.3	21.9	11.1
		FY3/21 IFIS	82,000	24.7	4,800	393.8	-	-	20,000	-1,216.1	919.6		
52 week high	¥3,735	FY3/22 E	68,245	-18.3	4,045	-5.9	3,701	17.3	2,517	-21.5	115.7	27.9	13.0
52 week low	¥1,045	FY3/22 IFIS	75,400	-9.8	4,800	11.7	-	-	2,500	-22.0	115.8		
	2021/3/8	FY3/23 E	64,511	-5.5	3,492	-13.7	3,899	5.4	2,881	14.5	132.4	24.4	11.8

7731	Nikon	Term	Sales	YoY	OP	YoY	Pretax	YoY	NP	YoY	EPS	PER	EV/ EBITDA
			(¥m)	(%)	(¥m)	(%)	(¥m)	(%)	(¥m)	(%)	(¥)	(x)	(x)
Rating	Underperform	FY3/19 A	708,660	-1.2	82,653	47.0	87,915	56.3	66,513	91.3	167.3	-	-
PO	¥800	FY3/20 A	591,012	-16.6	6,751	-91.8	11,864	-86.5	7,693	-88.4	19.9	-	-
Current Price	¥933	FY3/21 CE	450,000	-23.9	-65,000	-	-60,000	-	-42,000	-	-113.9	-	-
(% to PO)	-14%	FY3/21 E	458,358	-22.4	-48,762	-	-39,131	-	-28,100	-	-76.2	-	-
		FY3/21 IFIS	444,709	-24.8	-56,137	-931.5	-50,500	-525.7	-36,600	-575.8	-96.0		
52 week high	¥1,089	FY3/22 E	498,900	8.8	20,800	-	23,800	-	17,800	-	48.3	19.3	3.3
52 week low	¥620	FY3/22 IFIS	502,020	9.5	21,111	-143.3	24,478	-162.6	19,150	-168.1	54.0		
	2021/3/8	FY3/23 E	473,900	-5.0	18,700	-10.1	21,700	-8.8	16,400	-7.9	44.5	21.0	3.4

7951	Yamaha	Term	Sales	YoY	OP	YoY	Pretax	YoY	NP	YoY	EPS	PER	EV/ EBITDA
			(¥m)	(%)	(¥m)	(%)	(¥m)	(%)	(¥m)	(%)	(¥)	(x)	(x)
Rating	Buy	FY3/19 A	434,373	-	52,815	-	56,471	-	40,337	-	222.1	-	-
PO	¥7,100	FY3/20 A	414,227	-4.6	43,333	-18.0	47,225	-16.4	34,621	-14.2	194.7	-	-
Current Price	¥6,130	FY3/21 CE	370,000	-10.7	33,000	-23.8	33,500	-29.1	24,000	-30.7	136.5	44.9	-
(% to PO)	16%	FY3/21 E	368,803	-11.0	33,016	-23.8	33,467	-29.1	24,521	-29.2	139.5	44.0	20.0
		FY3/21 IFIS	368,741	-11.0	32,043	-26.1	32,393	-31.4	23,504	-32.1	133.7		
52 week high	¥6,560	FY3/22 E	427,900	16.0	54,300	64.5	57,300	71.2	42,100	71.7	239.4	25.6	13.7
52 week low	¥3,520	FY3/22 IFIS	421,220	14.2	51,060	54.7	53,280	59.2	38,540	57.2	219.5		
	2021/3/8	FY3/23 E	445,400	4.1	63,800	17.5	67,800	18.3	49,800	18.3	283.2	21.6	11.6

Source: Mizuho Securities Equity Research

Impact of forex on OP and YoY change based on forex assumptions

Panasonic(6752) impact of forex on FY3/21 IFRS OP OP (LHS, ¥b) and YoY change (RHS, %)

USD/JPY		¥95	¥100	¥105	¥110	¥115	USD/JPY		¥95	¥100	¥105	¥110	¥115
EUR/JPY	¥110	114.9	122.4	129.9	137.4	144.9	EUR/JPY	¥110	-61%	-58%	-56%	-53%	-51%
	¥115	117.9	125.4	132.9	140.4	147.9	EUR/JPY	¥115	-60%	-57%	-55%	-52%	-50%
	¥120	120.9	128.4	135.9	143.4	150.9	EUR/JPY	¥120	-59%	-56%	-54%	-51%	-49%
	¥125	123.9	131.4	138.9	146.4	153.9	EUR/JPY	¥125	-58%	-55%	-53%	-50%	-48%
	¥130	126.9	134.4	141.9	149.4	156.9	EUR/JPY	¥130	-57%	-54%	-52%	-49%	-47%

Note: Simple calculation using company's forex sensitivity analysis for FY3/21 (each single yen depreciation against the dollar and euro bolsters annual OP by ¥1.5b and ¥600m, respectively). Our forex assumptions are ¥105/\$ and ¥120/€. (as of Aug 18, 2020)

Sharp (6753) : Forecasts as of Feb. 2020 (before announcement of 3Q earnings results)

(JPY mn)	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Sales	2,461,589	2,050,639	2,427,271	2,400,072	2,271,248	2,443,276	2,747,003	2,769,644
OP	-161,967	62,454	90,125	84,140	52,773	81,899	111,045	128,445
NP attributable to ordinary sharehol	-261,450	-30,146	64,795	71,349	20,958	54,961	89,737	104,005
EBITDA	-85,243	130,689	166,241	162,989	127,485	161,008	196,463	211,310
EPS	-1,546.4	-68.4	106.1	116.8	34.3	90.0	146.9	170.3
DPS	-	-	10.0	20.0	18.0	20.0	20.0	20.0
Own capital	-43,050	294,155	378,342	350,632	275,310	322,139	399,659	491,448
P/E	-	-	30.0	10.4	33.1	25.6	15.7	13.5
P/B	-	-	20.18	3.75	2.94	4.36	3.52	2.86
EV/EBITDA	-	25.8	15.0	8.5	10.2	12.4	9.7	8.5

Note: Valuation based on Price Objective.

Investment Rating..... Neutral
 Price Objective..... ¥2,300
 Valuation method FY3/22 PER of 16x

Share Price Drivers

- Clarify its position/role within the Hon Hai Group
- Fully assembled products: expand sales in Asia, quality products
- Components: Boost sales using Hon Hai Group foundation
- Structural reform: Consequence of domestic factories such as G4
- Demand for finished products (iPhone, iPad, NBPC, Monitor)
- Price trends in small and medium-sized panels, inventory, production trends
- Investment into IGZO/OLED

- **Investment rating: Price objective based on PER of roughly 16x our FY3/22 EPS estimate. Our fair value multiple is based on an industry average of roughly 18.2x and the removal of the profit boosting effect from the company's low tax rate.**
- **OP forecast: ¥81.9b (up 55% YoY) in FY3/21, ¥111.0b (up 36%) in FY3/22, and ¥128.4b (up 16%) in FY3/23. Forecast return to ¥10b next year.**
- **Gap between our expectations and the IFIS consensus (OP of ¥77.3b in FY3/22): Display (iPhone11/SE2, PC, automotive) and camera modules (iPhone market share).**
- **LCD: Small risk of operating loss given depreciation of only ¥22b. Hakusan plant for iPhone, K1 (LTPS) for autos, K2 (Oxide) for PC/MNT. G4/G4.5 plants will start to close.**
- **OLED: Sakai G4.5 (15k) for smartphones → currently a burden with annual loss of over ¥8b. From FY3/22, earnings to improve on large increase in production for the company's own smartphones.**
- **Camera modules: High share for iPhone rear side and dual lens; expect strong trends at present. May enter triple-camera market by FY3/23.**
- **End products business: On track with specific products, Hon Hai utilization (purchasing, distribution, production). Keys: brand, product power, asset-light strategy, Asia expansion.**
- **Parts business: Needs to penetrate Hon Hai Group clients for camera modules, electronic components and displays. Strategy of maintaining at least 51%; possibility of external capital injection.**
- **Risks: Revived plans to make SDP a subsidiary, a sharp decline in Apple orders, and a market selloff of class-C shares.**

Source: Mizuho Securities Equity Research

Our views on Sharp

- **Conclusion:** Should be able to generate OP of ¥100b - ¥120b, but still no driver for the medium/long term.
- **Earnings:** Posted record high profits in FY3/08. After that faced a financial crisis due to built-up inventories and failed investment in SDP. Then get bailed out by Hon Hai Group.
- **Hon Hai Group management participation:** Effectively holds control, but technically a non-consolidated group affiliate. What does the future hold?
- **Medium-term plan:** Failed to hit previous MTP goals. After one-year break, focus on next MTP (FY3/22 – FY3/24).
- **Sharp from Hon Hai's perspective:** A treasure trove in terms of brand power, component technology, patents, etc.
- **Sharp's business and earnings structure:** Sharp-branded products (e.g., smartphones, TVs, major appliances, copiers) are main focus, components (e.g., displays, camera modules, semiconductors) are secondary. However, both are crucial for Sharp.

Conclusion: Should be able to generate OP of ¥100b-¥120b; long-term growth hereafter

- **Share price:** Change rating from Buy to Neutral on Feb.18, 2021; price objective of ¥2,300 (FY3/22 PER of 16x)
 - Short term: Share price doubles in one month; short covering, higher LCD prices, inclusion in Nikkei 225, other tailwinds largely priced in.
 - Medium/long term: Focus on details of next MTP. Share price could be likely to rise if OP looks on track to hit around ¥150b.
 - Valuation: Considering low tax rate and other factors, slightly lower than sector peers, but trending upward.
- **Earnings forecasts:** Expecting Sharp to be able to generate OP of ¥100b-¥120b. Needs to reconsider growth strategy.
 - OP: We forecast OP will be ¥81.9b in FY3/21, ¥111.0b in FY3/22, and ¥1028.4b in FY3/23.
 - NP: We forecast NP of ¥55.0b in FY3/21, ¥89.7b in FY3/22, and ¥104.0b in FY3/23. An effective tax rate of 20% or less thanks to almost ¥1t in losses carried forward.
 - Cash flow: We forecast FCF of ¥48.2b in FY3/21, ¥94.7b in FY3/22, and ¥124.9b in FY3/23. May be slightly less due to investment/lending.
 - Sources of income: Should be able to generate ¥80b-¥90b from finished products (e.g., major appliances, smartphones, and copy machines). Components (e.g., CCM and displays) income likely to be highly volatile.
 - Keys to growth: Expand finished products overseas (especially ASEAN, China) with Japan as cash cow.
 - For components, concerns include a lack of capex and OLED technology. Focus investments on finished products (brands), turn components business into subsidiary and look for ways to collaborate with other firms.
- **Working with the Hon Hai Group:** Could be good and bad. Would like to see a little more room for independent management
 - Finished products and B2B: Sharp creates a strategy and then uses Hon Hai's procurement, production, and logistics functions. Working to increase sales in ASEAN. Ideally Hon Hai Group would not interfere with Sharp's brand management or sales. Needs to invest in improving product power and brand power.
 - Components: Sharp is focused on technology research and development, production technology, working with and vertically integrating with Hon Hai, and increasing sales to EMS customers. Making solid progress so far. Should clarify its role within the group a bit more.
 - Investing 1: Sharp is able to invest a maximum of ¥100b per year. R&D for products/components, focus on brand investment is desirable.
 - Investing 2: Assuming a strategy in line with Hon Hai, but more freedom than before. Upbeat on CEO Jeng-Wu Tai stepping down as chairman.
 - Upside: Technological cooperation revenue from components segment (semiconductors, etc.). Pseudo fabless production after partial transfer of production to Hon Hai group.
 - Downside: Sharp buys unnecessary assets from Hon Hai, supports investment deals, shares more of its technology than necessary

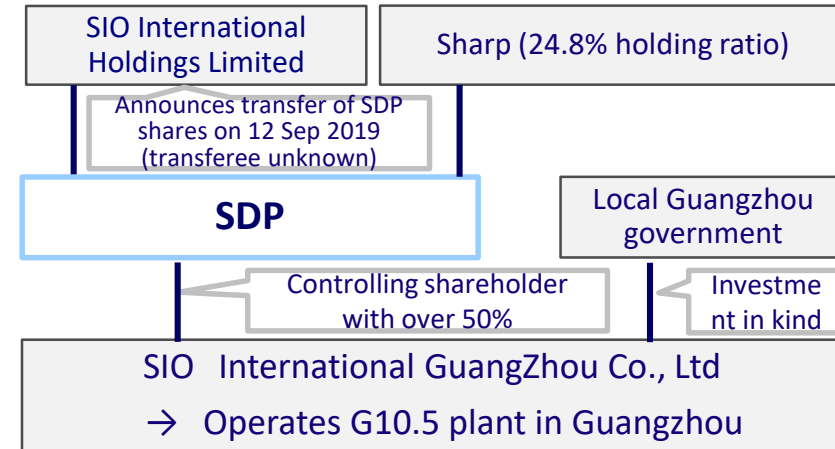
SDP (Sakai Display Products): issues and key points for becoming a Sharp subsidiary again

Current state and background

- President JW Tai positive on acquisition of SDP which was effectively owned by Terry Gou → withdrew
- SDP is a G10 LCD plant built by Sharp in 2008. 80,000/month capacity at present.
- Mr. Gou took a majority stake in 2015/2016, but revenue deteriorated again after failure of “Sky Tiger” plan: parent operating loss of ¥17.7b (down ¥29.4b YoY) in FY12/18, OP loss of ¥19.6b in FY12/19.

SDP's earnings (¥m)

FY3/20 consolidated		FY12/19 non-consolidated	
P/L statement		P/L statement	
Sales	101,458	Sales	99,920
Pre-tax income	-20,817	Pre-tax income	-19,609
Net profit	-20,941	Net profit	-19,642
Balance sheet		Balance sheet	
Current assets	296,480	Current assets	81,661
Fixed assets	505,031	Fixed assets	266,633
Total assets	801,511	Total assets	348,294
Current liabilities	209,683	Current liabilities	190,722
Fixed liabilities	371,276	Fixed liabilities	41,682
Total liabilities	580,959	Total liabilities	232,404
Total net assets	220,550	Total net assets	115,890



Near-term scenarios

- G10.5 plant in Guangzhou(SIO International Guangzhou)
 - SDP invests \$9.0b, plans 90,000/month. 63K for Array as of Feb. 2020. Aims to reach 90,000/month during 2Q 2021. Also targets 150,000/month with addition of 4-layer mask, lithography equipment.
 - Large order from Samsung Electronics (VD). Could potentially ship 4m or more in 2021.
- SDP inventory issue
 - SDP, Hon Hai Group carry excessive inventories since 2017, but have continued to produce at high levels.
 - Inventory accounted for at least half of total current assets of ¥87.1b in FY12/19 (¥54.1b in FY12/18); inventories considerably high, particularly of 70”.
 - However, from 2020, inventories are trending downward thanks to shipments outpacing production.
- Sharp’s utilization of SDP after turning it into a subsidiary
 - Can use IGZO technology jointly developed with Semiconductor Energy Laboratory (SEL), but to make what? (TVs/monitors?)
 - Shift to large OLEDs: Substantial risk, but converting to OLED line or supplying only TFT backplanes to OLED makers are also options.
- Sharp’s display business is in phase of investment shortage; clear and feasible strategy needed for SDP/SIO acquisition

Source: Mizuho Securities Equity Research, from company materials, media reports

How to fill capacity at Kameyama G6 (LTPS) and G8 (IGZO/A-Si)

Conclusion: How does G6 work around a rapid drop in demand from Apple in 2020 onward? Shift to IGZO for G8; key is developing demand for medium-sized product.

1. Kameyama Plant No. 1 (G6: LTPS): 22k/M. Continuing LTPS and leaning into auto products

- G6: 22k/M. 4.7" x 360 panels for capacity of around 8m/M. Used Apple advance to fund investment; outside supply constraints resolved; pathway to automotive going forward
- Apple: Company makes 4.7"/6.06" panels for the iPhone. Acquisition of JDI Hakusan lifts market share over 70%. Hakusan is main production center, Kameyama needs to be backfilled with non-iPhone demand.
- Non-iPhone demand: automotive, games, industrial are viable options; likely to take at least one more year to completely backfill.

2. Hakusan Plant (G6:LTPS): 25k/month; exclusively iPhone for the time being.

- Production for the iPhone only, starting with 6.06" but eventually 4.7" as well.
- Best-case scenario is collaboration with Apple on next-generation displays (e.g., μ LED, μ OLED) and expand capacity.

3. Kameyama Plant No.2 G8:IGZO/A-Si): Will depend on the combination of IGZO and A-Si; output of about 50k/M is expected. Focus on midsize.

- G8: Assuming mainly IGZO (tablet, NB, MNT, automotive, etc.), some A-Si (TV); around 50k/month.
- Currently: A-Si for TVs: Input of 15k/month or less. Shift from 32" to 85/90". 15k-20k IGZO per month for the iPad Pro (all versions) and iPad (9.7"/10.2"). Additionally NB, monitors for brands other than Apple (including company's own Dynabook).
- Ideal format: Best solution is transfer to IGZO, where substrate prices are high (6 masks , around 50k/M). Plant can be used for making large-scale OLED substrates.
- IGZO current situation: Supplying for iPad, iPad Mini , iPad Pro and Macbook. More models. Can it get the iMac 27"?

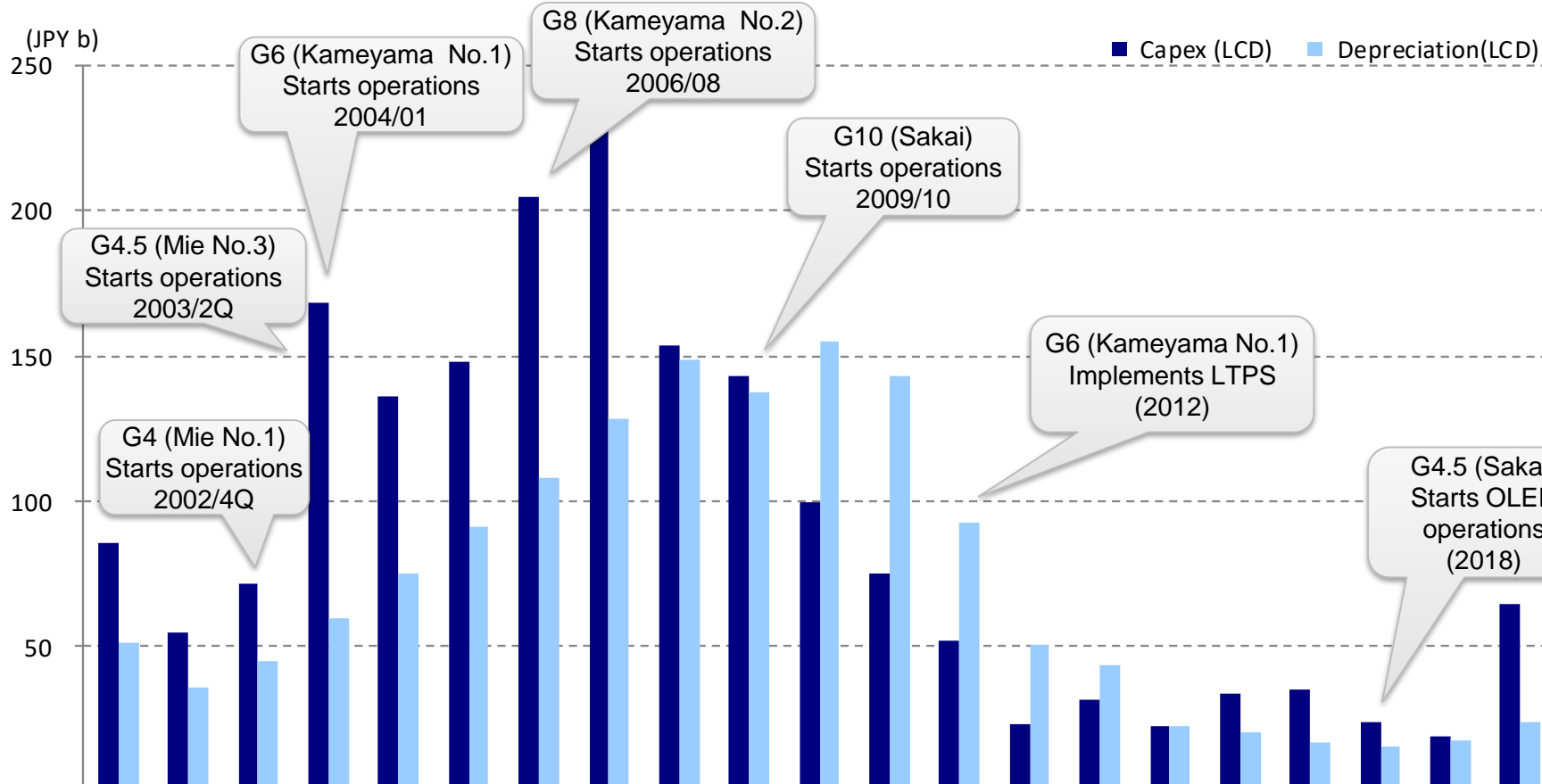
4. Sakai OLED Plant (G4.5): 15k/month small-scale factory; plans to boost capacity utilization by expanding production for internal use.

- OLED: Struggling with roughly ¥8b/year loss. Eyes improvement in earnings via rapid increase in supply for AQUOS Phone from FY21.

Sharp FPD businesses: TVs and smartphones

- **TVs:** Gradual volume expansion in Japan, China, and Southeast Asia is desirable. Expecting to reincrease product appeal.
 - We forecast FY3/22 sales of ¥200.0b, OP of ¥4.1b, on volume of 6.0m units. Focus on domestic/Asian markets.
 - Licensing: Retrieve licenses in Europe (UMC); developing own brand and expanding reach. North America (Hisense) is withheld.
 - Domestic ops: Market share bottoming out; making up lost grounds by going on offense, including OLED launch.
 - China: Hon Hai's Skytiger plan sours and stature-based strategy.
 - Southeast Asia, India: continued focus as strategic markets, particularly for white goods. Sharp excels in ASEAN markets.
 - Med/long-term: around 6m (actual basis) at present thanks to focus on Japan, China, ASEAN, India. Will 7m–8m in five years enough?.
- **Smartphone :** Concentration on development of proprietary products, where company has been trailing domestically. Overseas considering license supply. Should contribute to improvement in design potential at Hon Hai group.
 - We forecast FY3/22 sales of ¥164.5b, OP of ¥13.3b, on domestic sales of 4.5m units (around 15% domestic market share).
 - Supplying Docomo, au and Softbank (closest relationship with Softbank). Developing highly differentiated devices using LCD/OLED and camera-related technology. Production contracted out.
 - Launch of OLED devices: Adoption of OLED panels manufactured at G4.5. Will dramatically speed up the rate of increase in model count.
 - Japanese market peaking at around 35m units. Apple overwhelmingly strongest competitor, followed by Sharp and Sony. Limited upside.
 - Possibility of overseas licence production: Considering region by region licensing of Sharp brand to EMS/ODM customers within Hon Hai group.
 - Possibility of leveraging technology: Possibility of technology transfer to design teams within Hon Hai Group (at parent, FIH and parts-related companies).

Sharp's LCD business: capex and depreciation



	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09	FY10	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20 E
Capex (LCD)	86	55	72	168	136	148	205	229	154	143	100	75	52	24	32	23	34	36	24	19	65
Depreciation(LCD)	52	36	45	60	75	91	108	128	149	138	155	143	92	50	44	23	21	17	16	18	24

Note: We estimate ¥41.0b capex in FY20 is to acquire JDI Hakusan plant.
 Source: Mizuho Securities Equity Research from company data

Sharp FPD businesses: Large- and S/M-sized FPDs

■ **Large panels:** The initiatives of TV panels taken by Gou family(Hon Hai). Surplus capacity in SDP/SIO, so will again provide supply to Samsung Electronics.

- Organizational management: Hon Hai provides most of the management, while business is conducted by individual companies; INX, SDP(+SIO Guangzhou) and Sharp.
- Sharp: Kameyama 2 plant(G8) provides a small production of 32"/80"/90" only for TVs. Sharp to be the OEM producer for module. **Focus on finished products such as TV and PID. Manufacture of finished products (excl. Malaysia plant) could be conducted by Hon Hai. For Sharp FPD business(G8), focus on mid-sized panel(IT/Tablet/automotive)**
- LCD plant for TV: :INX(39.5/43/50/58/82/100 for A-Si/IT+TV), SDP(40/45/60/70/80/120), SIO Guhangzhou(32/55/65/75)
- SDP+SIO: Terry Gou sells SEP equity to investment firm but still manages on actual terms. Sharp's Jeng-Wu Tai essentially managing under consignment. SDP is former SH personnel, SIO is former INX personnel.
- Technology: Developing copper wiring, photo alignment (VA/IPS), curved panel technology and TP technology already used by Sharp at INX. Outlook for Oxide and LTPS unclear given relationship with SEL.
- TV panel clients/sales: In-house for INX, via SH, INX, HH and others for SDP/SIO. Reunites with Samsung Electronics, resuming supply from 2H 2020.

■ **S/M-sized panels:** Sharp in driving seat. Great synergies for LCD. Will company be able to develop OLED alone?

- Organizational management: Since INX is weak in medium-sized panels, operations is at Hon Hai itself (in Taiwan and at Century in China). Sharp leads technology/IP.
- Factories (production): G6: from AAPL to non-AAPL customers(especially automotive); in future, OLED substrates as well. The G8 plant will be used for medium-sized Oxide product. The G4 plant (A-Si) and G4.5 plant (LTPS) could be used for automotive, pachinko and FA applications, but since there would still be excess production capacity **it moves to closure toward 2022 gradually.**
- Applications: smartphone product will be made at Sharp's Kameyama 1 plant + Hakusan plant + INX Gaoxiong G6 plant + Century G5. High-end product for automotive and IT applications will be made at the Kameyama No 2. IT product will be made at Kameyama2 and INX.
- Sales: Expansion to include Hon Hai's EMS and ODM clients. Broad range of customers including Apple (SP/Tablets and MacBooks), Dell and HP. However, sales of these custom products will require a major expansion in technical, marketing and support personnel. It is highly likely that Sharp will supply front-end cells only.
- Back-end processing: Moving toward the fusion of SH (Wuxi, Dongguan), HH and GIS plants. Basically, work split among SH (front-end), GIS (LCM+TP), and HH (product assembly)
- OLED development: R&D→prototype line→G4.5 mass production (2018). Yields are lower than before; not really a success. Aims to resolve situation by boosting production for its own smartphones.
- Acquiring

Sharp: Capital increase using classified shares (buys back Class A shares; converts Class C shares into common shares)

- At the time of the FY3/15 earnings announcement (in May, 2015) the company announced a ¥225.0b capital increase through the issue of preferred stock (Class A and Class B shares). Underlying DES; aiming to repay debt to two main banks.
- Maximum dilution was 139%. The issue of preferred shares resulted in a recovery in the consolidated equity ratio to 12.3% in 1Q FY3/16.
- On 25 February the company decided to issue Class C shares to Hon Hai. The same conditions as the ordinary shares allocated to Hon Hai (¥88 per share, the dividend will be at the same level).
- It was initially announced that Hon Hai would acquire half of the Class A preference shares held by each bank for a total of ¥100b (face value) and the Class B preference shares held by JIS (with the conditions of sale undecided), but the revised agreement as of 30 March omitted these provisions. Sharp to buy back & Class B shares after Hon Hai investment.
- **Retracted 5 June 2018 announcement, saying it would issue shares in order to acquire Class A shares. On 30 Oct, announced it will acquire/retire 92k out of 200k shares. Acquire the rest in FY19.**
- All remaining Class C shares will be converted to common shares in February 2021, thus eliminating all classified shares.

Capital increases excluding ordinary shares	Mizuho Bank	Bank of Tokyo-Mitsubishi UFJ	Hon Hai Precision etc.	JIS (industrial reconstruction fund) transfer to Hon Hai Precision etc.	Hon Hai Group
Share classification	Class A shares (non-voting, restricted assignment)			Class B shares (non-voting, restricted assignment)	Class C shares (non-voting, restricted assignment)
Amount before Hon Hai funds	¥100b	¥100b	-	¥25b	-
Amount after Hon Hai funds	¥50b →undecided	¥50b →undecided	¥100b →undecided	¥0 →Shares canceled after repurchase	¥101.7b(Sharp announcement 25 Feb) →¥100b (announcement 30 Mar)
Number of shares	50,000 →undecided	50,000 →undecided	100,000 →undecided	25,000 → 0	11.36m → 0
Uses	Debt repayment		(Transfer from two banks)	Growth investment	Growth investment, bond redemption
Dividend	¥TIBOR+2.5% (Cumulative, non-participating, in preferences to ordinary shares)			7.0% until FY3/18, 8.0% from FY3/19 onwards (Cumulative, non-participating, in preferences to ordinary shares)	100x DPS for ordinary shares (same level as for ordinary shares)
Consideration for exercise of call option	Ordinary shares or cash			Ordinary shares	Ordinary shares (ratio 1:100)
Exercise period	Ordinary shares: from July 2019 Cash: from July 2021			Basically from July 2018 (From July 2015 in issue plan)	1 July 2017
Maximum increase in ordinary shares on exercise of call option (dilution rate @ announcement)	2b shares (118.7%)			350m shares (20.8%)	0
Acquisition conditions (at Sharp)	From July 2016 onwards (Possible if there are no B class preferred shares outstanding)			From July 2016	From July 2017

Source: Mizuho Securities Equity Research from company data

Sharp:PL (half year / full year)

Sales	FY3/20		FY3/21		FY3/22		FY3/23		FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	(JPY bn)
	1H	2H	1H	2HE	1HE	2HE	1HE	2HE						
Consolidated sales	1,120.7	1,150.6	1,142.2	1,301.1	1,327.5	1,419.5	1,335.6	1,434.0	2,271.2	2,443.3	2,747.0	2,769.6	2,350.0	
yoy	-1%	-9%	+2%	+13%	+16%	+9%	+1%	+1%	-5%	+8%	+12%	+1%	+3%	
Smart Life	414.9	441.1	410.4	474.8	442.6	494.1	453.6	508.8	856.0	885.2	936.7	962.4	n/a	
Health and Environment Systems	175.5	164.5	174.0	184.5	192.2	191.1	196.9	195.9	340.0	358.5	383.2	392.8	n/a	
Camera modules+Electronics Compor	194.5	235.5	192.0	241.6	198.4	256.4	206.0	266.2	430.0	433.6	454.7	472.2	n/a	
Energy Solutions	45.5	41.5	37.5	49.1	45.2	47.1	43.8	47.1	87.0	86.6	92.3	91.0	n/a	
8K Ecosystem	574.3	582.7	611.7	705.0	758.1	809.1	759.6	815.4	1,157.0	1,316.7	1,567.1	1,575.0	n/a	
Digital information equipment (LCDTVs)	90.5	99.5	91.0	103.0	100.7	111.6	97.3	104.6	190.0	194.0	212.3	202.0	n/a	
Smart Business Solutions	167.0	160.0	130.5	187.5	194.6	206.0	199.6	212.2	327.0	318.0	400.6	411.7	n/a	
Display	334.0	345.0	403.0	408.3	475.5	485.3	475.5	492.4	679.0	811.3	960.8	968.0	n/a	
Large size	36.2	28.0	46.0	75.2	107.7	124.8	99.1	124.8	64.2	121.2	232.5	223.9	n/a	
Small & mid size	297.8	317.0	357.0	333.1	367.9	360.5	376.4	367.6	614.8	690.1	728.3	744.0	n/a	
ICT	179.3	178.1	170.4	183.0	187.3	190.2	195.0	198.2	357.4	353.4	377.5	393.2	n/a	
IoT communications	71.0	82.0	74.0	91.4	90.4	97.7	95.6	102.8	153.0	165.4	188.1	198.4	n/a	
Dynabook	98.4	85.0	88.0	93.0	98.6	93.9	101.0	96.7	183.4	181.0	192.5	197.8	n/a	
Eliminations & adjustments	-48.1	-51.5	-50.6	-61.7	-60.6	-73.8	-72.6	-88.4	-99.6	-112.3	-134.4	-161.0	n/a	
Operating income	FY3/20	FY3/21	FY3/22	FY3/23	FY3/20	FY3/21	FY3/22	FY3/23	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	
	1H	2H	1H	2HE	1HE	2HE	1HE	2HE	E	E	E	E	CoE	
Consolidated operating income	37.0	15.8	27.6	54.3	51.9	59.1	59.4	69.1	52.8	81.9	111.0	128.4	82.0	
yoy	-21%	-57%	-25%	+243%	+88%	+9%	+14%	+17%	-37%	+55%	+36%	+16%	+55%	
Smart Life	18.7	20.7	29.5	35.6	33.7	35.7	32.8	34.9	39.4	65.1	69.4	67.7	n/a	
Health and Environment Systems	13.7	10.8	22.0	20.5	22.5	19.0	21.6	18.3	24.5	42.5	41.5	39.8	n/a	
Camera modules+Electronics Compor	3.5	8.0	4.6	12.5	8.0	14.0	7.8	13.7	11.5	17.1	22.0	21.5	n/a	
Energy Solutions	1.3	1.8	1.5	2.6	1.8	2.6	2.1	2.9	3.1	4.1	4.4	4.9	n/a	
8K Ecosystem	17.5	-2.7	0.1	17.2	18.6	21.2	26.7	31.7	14.8	17.3	39.8	58.3	n/a	
Digital information equipment (LCDTVs)	-0.4	-5.3	2.1	1.9	2.6	1.5	2.3	0.7	-5.7	4.0	4.1	3.0	n/a	
Smart Business Solutions	9.9	6.5	2.6	9.4	7.2	9.6	7.6	9.9	16.4	12.0	16.8	17.5	n/a	
Display	8.1	-3.8	-4.7	6.1	8.7	10.3	16.7	21.2	4.3	1.4	19.0	37.9	n/a	
ICT	10.8	9.3	7.6	11.2	9.4	11.6	9.8	11.9	20.1	18.8	21.0	21.7	n/a	
IoT communications	7.6	5.3	3.8	6.7	6.0	7.2	6.6	7.7	12.9	10.5	13.3	14.2	n/a	
Dynabook	2.8	3.0	2.5	3.5	3.0	3.3	2.9	3.2	5.8	6.0	6.3	6.1	n/a	
Eliminations & adjustments	-10.3	-11.6	-9.7	-9.7	-9.8	-9.3	-9.9	-9.5	-21.9	-19.4	-19.1	-19.4	n/a	
Recurring profit	33.1	22.4	24.2	47.7	51.9	59.1	59.4	69.1	55.5	71.9	111.0	128.4	70.0	
Net income attributable to shareholders	27.4	-6.4	22.5	32.4	41.3	48.4	47.3	56.7	21.0	55.0	89.7	104.0	50.0	
Capex (tangibles)	29.2	31.0	21.8	63.8	29.7	40.3	27.5	42.5	60.2	100.0	70.0	70.0	100.0	
Depreciation (tangibles)	30.8	36.3	30.3	38.4	35.1	41.9	34.0	41.0	67.1	70.0	77.0	75.0	70.0	
R&D expenditure	49.9	50.6	42.9	60.2	46.2	53.8	44.4	55.6	100.5	105.0	100.0	100.0	105.0	

Source: Mizuho Securities Equity Research

Sharp:PL (quarter)

(JPY bn)

Sales	FY3/20				FY3/21				FY3/22				FY3/23			
	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE
Consolidated sales	515.0	605.7	634.9	515.7	517.3	624.9	675.3	625.8	626.1	701.4	754.9	664.6	631.4	704.2	763.3	670.7
yoy	-4%	+2%	-1%	-18%	+0%	+3%	+6%	+21%	+21%	+12%	+12%	+6%	+1%	+0%	+1%	+1%
Smart Life	181.0	233.9	247.5	193.6	184.5	225.9	251.8	223.0	207.6	235.1	270.0	224.1	211.7	241.9	278.6	230.2
Health and Environment Systems	88.5	87.0	82.0	82.5	79.0	95.0	89.4	95.1	90.3	101.9	92.8	98.2	92.6	104.3	95.3	100.6
Camera modules+Electronics Components	74.0	120.5	146.5	89.0	87.0	105.0	144.4	97.1	92.2	106.2	157.7	98.7	95.1	110.9	163.8	102.4
Energy Solutions	18.5	27.0	19.5	22.0	16.0	21.5	18.4	30.7	22.6	22.6	19.9	27.1	21.5	22.3	20.0	27.1
8K Ecosystem	262.5	311.8	324.3	258.4	267.1	344.6	366.1	338.9	343.9	414.1	429.0	380.1	347.0	412.6	431.7	383.8
Digital information equipment (LCDTVs)	43.5	47.0	61.0	38.5	42.0	49.0	58.4	44.6	44.4	56.3	65.7	45.9	44.4	52.9	61.9	42.7
Smart Business Solutions	80.0	87.0	80.0	80.0	56.5	74.0	92.0	95.5	90.4	104.2	104.1	101.9	92.1	107.4	107.5	104.7
Display	151.0	183.0	198.0	147.0	174.0	229.0	212.4	195.9	214.6	261.0	255.9	229.4	215.8	259.7	259.0	233.4
Large size	20.2	16.0	18.0	10.0	16.0	30.0	32.1	43.1	50.4	57.2	64.8	60.0	46.1	53.1	65.0	59.8
Small & mid size	130.8	167.0	180.0	137.0	158.0	199.0	180.3	152.8	164.1	203.7	191.1	169.4	169.8	206.6	194.0	173.6
ICT	96.2	83.1	88.4	89.7	88.3	82.1	87.8	95.2	101.7	85.6	92.3	97.9	105.3	89.7	96.6	101.6
IoT communications	45.0	26.0	36.5	45.5	40.0	34.0	43.4	48.0	51.8	38.5	47.5	50.2	54.3	41.2	50.4	52.4
Dynabook	46.4	52.0	46.5	38.5	44.0	44.0	45.0	48.0	50.6	48.0	45.5	48.5	51.6	49.4	46.8	49.9
Eliminations & adjustments	-24.8	-23.3	-25.4	-26.1	-22.7	-27.9	-30.4	-31.3	-27.2	-33.4	-36.4	-37.4	-32.5	-40.0	-43.6	-44.8
Operating income	FY3/20	FY3/21	FY3/22	FY3/23												
	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE
Consolidated operating income	14.6	22.3	29.4	-13.6	9.1	18.5	30.0	24.3	24.0	27.9	34.4	24.8	26.6	32.8	40.3	28.8
yoy	-41%	+1%	+38%	-	-38%	-17%	+2%	-	+164%	+51%	+15%	+2%	+11%	+18%	+17%	+16%
Smart Life	6.2	12.5	16.2	4.5	13.4	16.1	19.7	15.9	15.3	18.4	21.2	14.5	14.6	18.2	21.5	13.4
Health and Environment Systems	9.0	4.7	6.0	4.8	10.0	12.0	10.1	10.4	10.8	11.6	9.4	9.6	10.2	11.4	9.7	8.6
Camera modules+Electronics Components	-3.0	6.5	9.0	-1.0	2.5	2.1	8.4	4.1	3.3	4.7	10.5	3.5	3.2	4.6	10.3	3.4
Energy Solutions	-0.3	1.6	1.1	0.7	0.5	1.0	1.1	1.5	0.8	1.1	1.2	1.4	0.8	1.2	1.4	1.5
8K Ecosystem	6.5	11.0	11.7	-14.4	-4.9	5.0	8.8	8.4	7.6	11.0	11.4	9.8	10.7	16.0	16.8	14.8
Digital information equipment (LCDTVs)	-0.4	0.0	0.0	-5.3	1.0	1.1	1.2	0.7	1.1	1.5	1.3	0.2	1.0	1.3	0.6	0.1
Smart Business Solutions	5.2	4.7	3.5	3.0	-2.0	4.6	4.2	5.2	2.6	4.6	4.9	4.7	2.7	4.9	5.2	4.7
Display	1.8	6.3	8.2	-12.0	-4.0	-0.7	3.4	2.7	3.8	4.9	5.2	5.0	6.9	9.7	11.1	10.1
ICT	7.3	3.5	4.7	4.6	4.4	3.2	5.3	5.8	4.9	4.5	5.7	5.9	5.1	4.7	5.9	6.0
IoT communications	6.3	1.3	2.5	2.8	2.5	1.3	3.1	3.6	3.3	2.8	3.5	3.8	3.5	3.1	3.7	3.9
Dynabook	0.7	2.1	1.6	1.4	1.0	1.5	1.7	1.8	1.3	1.7	1.6	1.7	1.2	1.7	1.5	1.7
Eliminations & adjustments	-5.5	-4.8	-3.2	-8.4	-3.8	-5.9	-3.8	-5.9	-3.8	-6.0	-3.9	-5.5	-3.9	-6.0	-3.9	-5.5
Recurring profit	13.9	19.2	31.0	-8.6	7.8	16.4	27.5	20.2	24.0	27.9	34.4	24.8	26.6	32.8	40.3	28.8
Net income attributable to shareholders	12.5	14.9	25.0	-31.5	8.0	14.6	23.8	8.7	18.7	22.6	29.1	19.3	20.5	26.8	34.2	22.5

Source: Mizuho Securities Equity Research

Sharp: Earnings estimates (display device sales/TV sales volume breakdowns)

(JPY bn)

LCD (Display Devices)	FY3/19				FY3/20				FY3/21				FY3/22				FY3/23				FY3/19	FY3/20	FY3/21	FY3/22	FY3/23
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE					
Sales	164.0	199.0	205.0	183.0	151.0	183.0	198.0	147.0	174.0	229.0	212.4	195.9	214.6	261.0	255.9	229.4	215.8	259.7	259.0	233.4	751	679	811.3	961	968
Large size	21.8	40.0	19.0	7.2	20.2	16.0	18.0	10.0	16.0	30.0	32.1	43.1	50.4	57.2	64.8	60.0	46.1	53.1	65.0	59.8	88.0	64.2	121.2	232.5	223.9
yoy	-33%	+92%	+81%	-77%	-7%	-60%	-5%	+39%	-21%	+88%	+79%	+331%	+215%	+91%	+102%	+39%	-9%	-7%	+0%	-0%	-7%	-27%	+89%	+92%	-4%
% sales	13%	20%	9%	4%	13%	9%	9%	7%	9%	13%	15%	22%	24%	22%	25%	26%	21%	20%	25%	26%	12%	9%	15%	24%	23%
Small & mid size	142.2	159.0	186.0	175.8	130.8	167.0	180.0	137.0	158.0	199.0	180.3	152.8	164.1	203.7	191.1	169.4	169.8	206.6	194.0	173.6	663.0	614.8	690.1	728.3	744.0
yoy	+6%	-1%	+16%	+24%	-8%	+5%	-3%	-22%	+21%	+19%	+0%	+12%	+4%	+2%	+6%	+11%	+3%	+1%	+2%	+2%	+11%	-7%	+12%	+6%	+2%
% sales	87%	80%	91%	96%	87%	91%	91%	93%	91%	87%	85%	78%	76%	78%	75%	74%	79%	80%	75%	74%	88%	91%	85%	76%	77%
(By application)																									
Smartphone	68.7	79.1	84.8	69.6	43.5	52.3	90.7	68.8	60.0	81.4	80.0	69.6	57.0	77.4	76.0	69.5	49.8	67.6	66.4	60.7	302.2	255.3	291.1	279.8	244.6
Non-smartphone	73.5	79.9	101.2	106.2	87.3	114.7	89.3	68.2	98.0	117.6	100.2	83.2	107.2	126.4	115.1	99.9	120.0	139.0	127.6	112.9	360.8	359.5	399.0	448.5	499.5
Operating profit	8.3	8.0	5.3	3.8	1.8	6.3	8.2	4.0	-4.0	-0.7	3.4	2.7	3.8	4.9	5.2	5.0	6.9	9.7	11.1	10.1	25.4	20.3	1.3	19.0	37.9
yoy	+66%	-7%	-49%	-32%	-78%	-22%	+55%	+8%	-	-	-59%	-33%	-	-	+56%	+87%	+80%	+100%	+112%	+101%	-14%	-20%	-93%	+1,308%	+100%

(000's)

LCD-TV sales volume	FY3/19				FY3/20				FY3/21				FY3/22				FY3/23				FY3/19	FY3/20	FY3/21	FY3/22	FY3/23
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE					
LCD-TV total	1,650	1,800	1,890	1,650	1,280	1,370	1,640	1,330	1,290	1,480	1,820	1,440	1,370	1,590	1,940	1,470	1,370	1,530	1,890	1,480	6,990	5,620	6,030	6,370	6,270
yoy	-9%	-10%	-39%	-27%	-22%	-24%	-13%	-19%	+1%	+8%	+11%	+8%	+6%	+7%	+7%	+2%	-	-4%	-3%	+1%	-24%	-20%	+7%	+6%	-2%
Domestic	350	420	390	390	310	380	350	330	310	370	400	370	350	410	420	380	340	370	390	350	1,550	1,370	1,450	1,560	1,450
yoy	+9%	-7%	-7%	-7%	-11%	-7%	-7%	-7%	-	-3%	+15%	+12%	+12%	+10%	+6%	+3%	-2%	-9%	-7%	-7%	+2%	-12%	+6%	+8%	-7%
Overseas	1,300	1,380	1,500	1,260	970	990	1,290	1,000	980	1,110	1,420	1,070	1,020	1,180	1,520	1,090	1,030	1,160	1,500	1,130	5,440	4,250	4,580	4,810	4,820
yoy	-13%	-16%	-45%	-30%	-25%	-28%	-14%	-21%	+1%	+12%	+10%	+7%	+4%	+6%	+7%	+2%	+1%	-2%	-1%	+4%	-29%	-22%	+8%	+5%	+0%

Source: Mizuho Securities Equity Research

Sharp: Balance Sheet

(JPY bn)

Consolidated balance sheet	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Cash and deposits	195.3	191.9	379.6	258.5	275.4	482.1	422.3	266.6	225.0	322	393	510
Notes and accounts receivable	375.4	424.2	432.7	414.0	287.3	375.6	471.6	539.9	429.1	462	519	523
Inventory	527.5	310.7	295.1	338.3	184.3	217.9	219.7	243.8	294.8	263	284	286
Current assets	1,421.1	1,221.8	1,374.2	1,299.2	966.0	1,193.7	1,217.2	1,141.4	1,088.6	1,196	1,364	1,489
Tangible fixed assets	872.4	563.7	519.7	400.6	351.2	349.6	428.6	405.0	410.8	441	434	429
Intangible fixed assets	76.0	59.2	46.0	42.5	41.6	42.4	44.8	39.7	45.5	42	39	37
Investments and other assets	242.4	242.4	241.6	219.6	211.8	188.0	217.9	280.2	287.4	309	309	309
Fixed assets	1,190.9	865.3	807.3	662.6	604.7	579.9	691.2	725.0	743.7	792	782	775
Total assets	2,614.1	2,087.8	2,181.7	1,961.9	1,570.7	1,773.7	1,908.5	1,866.3	1,832.3	1,988	2,147	2,264
Notes and accounts payable	334.1	293.0	292.5	334.5	212.6	306.0	385.0	372.2	312.9	343	393	404
Short-term debt	585.5	910.3	781.9	840.0	632.6	113.5	91.3	111.4	237.7	221	157	121
Current liabilities	1,391.1	1,667.5	1,551.6	1,687.0	1,374.9	801.6	833.5	813.1	861.0	896	924	909
Long-term debt	509.0	233.1	289.5	113.5	80.3	530.3	537.0	538.2	538.7	612	665	705
Fixed liabilities	577.9	285.4	422.9	230.4	227.0	664.2	673.3	680.7	676.2	750	802	843
Total liabilities	1,969.0	1,952.9	1,974.5	1,917.4	1,601.9	1,465.9	1,506.7	1,493.9	1,537.2	1,646	1,726	1,751
Capital stock	204.7	212.3	121.9	121.9	0.5	5.0	5.0	5.0	5.0	5	5	5
Capital surplus	268.5	276.2	96.0	95.9	222.5	576.8	295.3	208.7	108.9	109	109	109
Retained earnings	259.9	-290.9	135.1	-87.4	-123.6	-148.6	204.9	258.0	264.7	312	389	481
Treasury stock	-13.9	-13.9	-13.9	-13.9	-13.9	-13.9	-13.9	-14.0	-14.0	-14	-14	-14
Shareholders' equity	719.3	183.7	339.0	116.5	85.4	419.3	491.3	457.8	364.6	411	489	581
Class A Shares (cumulative, non-participating)					200.0	200.0	200.0	200.0	-	-	-	-
Class B Shares (cumulative, non-participating)					25.0	-	-	-	-	-	-	-
Class C Shares (non-cumulative, pari passu to ordinary shares)					-	100.0	100.0	100.0	70.0	-	-	-
Accumulated pref. dividend					5.5	9.4	-	-	-	-	-	-
Accumulated other comprehensive income	-93.4	-59.1	-143.9	-86.3	-128.5	-125.1	-113.0	-107.1	-89.3	-89	-89	-89
Non-controlling interests	19.2	10.2	12.0	14.3	11.8	13.6	23.3	21.6	19.5	20	21	21
Total net assets	645.1	134.8	207.2	44.5	-31.2	307.8	401.7	372.5	295.1	342	420	513
Total liabilities and net assets	2,614.1	2,087.8	2,181.7	1,961.9	1,570.7	1,773.7	1,908.5	1,866.3	1,832.3	1,988	2,147	2,264
(Interest-bearing debt)	1,094.5	1,143.4	1,071.4	953.5	712.8	643.9	628.3	649.7	776.5	834	822	826
(Net debt)	900.7	955.5	720.7	721.3	563.3	190.4	224.3	420.9	606.1	566	484	371
(Owned capital)	625.9	124.7	195.2	30.2	-43.1	294.2	378.3	350.6	275.3	322	400	491
(Owned capital ratio)	23.9%	6.0%	8.9%	1.5%	-2.7%	16.6%	19.8%	18.8%	15.0%	16.2%	18.6%	21.7%
(Owned capital attributable to ordinary shares)	-1,788.2				-273.5	-15.3	78.3	50.6	205.3	322	400	491

Source: Mizuho Securities Equity Research

Sharp: Cash Flow

(JPY bn)

Consolidated cash flow statement	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Net income before minority interests	-238.4	-466.2	46.0	-188.8	-231.1	-0.6	89.4	75.6	38.3	69	110	127
Depreciation / amortization	248.4	177.8	123.8	109.3	76.7	68.2	76.1	78.8	74.7	79	85	83
Cash flow from operating activities	-143.3	-81.1	199.0	17.3	-18.9	127.2	105.3	79.0	68.1	176	170	201
Acquisition of tangible fixed assets	-118.2	-61.5	-45.7	-49.7	-46.4	-77.4	-102.1	-126.3	-73.1	-100	-70	-70
Cash flow from investing activities	-159.6	7.1	-84.9	-16.0	-40.5	-90.7	-126.0	-167.6	-127.9	-128	-76	-76
Issuance of ordinary shares	-	15.0	142.5	-	-	287.5	-	-	-	-	-	-
Issuance of preferred shares	-	-	-	-	224.6	99.6	-	-	-	-	-	-
Purchase of treasury stock (class shares)	-	-	-	-	-0.0	-30.0	-0.0	-85.2	-97.1	-	-	-
Cash flow from financial activities	256.4	51.6	32.8	-136.1	-15.4	272.2	-29.1	-88.5	4.6	49	-24	-8
Cash and cash equivalents	193.8	187.9	350.6	232.2	149.5	453.5	404.0	228.8	170.3	268	339	455
(Free cash flow)	-302.9	-74.0	114.0	1.3	-59.4	36.6	-20.7	-88.5	-59.8	48	95	125

Source: Mizuho Securities Equity Research

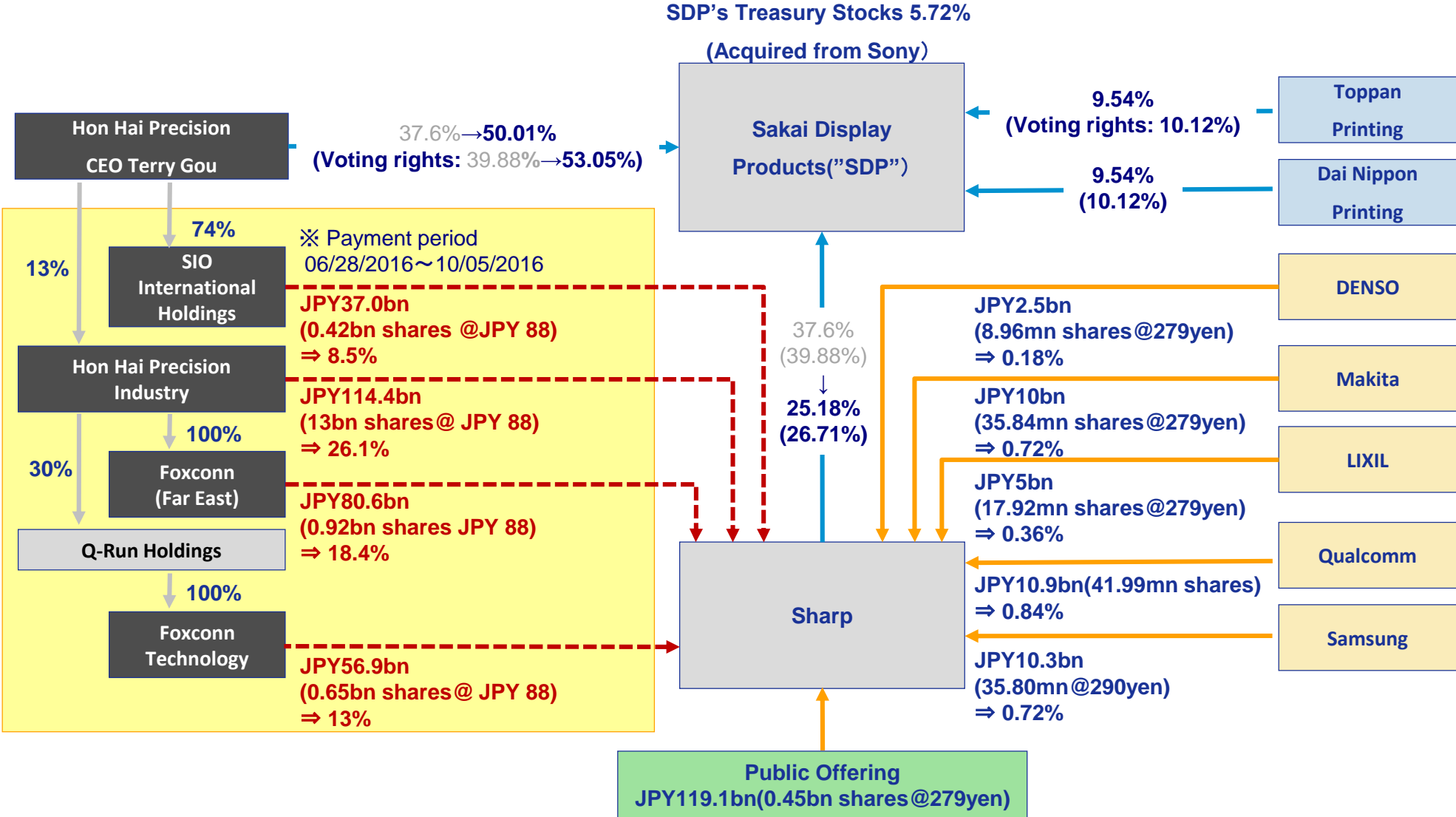
Sharp's Ownership Structure (Hon Hai owns a 61% stake, which would decline to about 50% if class C shares are converted)

As of Sep, 2015		
Name	Share Owned(in 000's)	Ownership
Nippon Life Insurance	47,317	2.80%
Meiji Yasuda Life Insurance	45,781	2.71%
Qualcomm	41,988	2.48%
Mizuho Bank	41,910	2.48%
Bank of Tokyo Mitsubishi UFJ	41,678	2.46%
Makita	35,842	2.12%
Samsung Electronics Japan	35,804	2.12%
Employee' Stockholding	28,966	1.71%
The Master Trust Bank of Japan	27,148	1.61%
Mitsui Sumitomo Insurance	24,658	1.46%
Others	1,319,760	78.05%
Total Share O/S Share (Excluding treasuryshare)	1,690,852	100.00%

As of the end of March 2020			(in the event the remain 70% of class C shares are converted)	
Name	Share Owned (million)	Ownership(%)	Share Owned (mil)	Ownership(%)
HON HAI PRECISION INDUSTRY CO.,LTD.	130.0	24.47%	130.0	21.28%
FOXCONN (FAR EAST) LIMITED	91.6	17.23%	91.6	14.99%
FOXCONN TECHNOLOGY PTE.LTD.	64.6	12.17%	64.6	10.58%
SIO INTERNATIONAL HOLDINGS LIMITED	36.6	6.89%	36.6	5.99%
ES Platform LP	0.0	0.00%	79.5	13.02%
The Master Trust Bank of Japan,Ltd.	10.2	1.92%	10.2	1.67%
Nippon Life Insurance	4.7	0.89%	4.7	0.77%
Japan Trustee Services Bank,Ltd.(Trust Account 5)	4.7	0.89%	4.7	0.77%
Meiji Yasuda Life Insurance Company	4.6	0.86%	4.6	0.75%
Japan Trustee Services Bank,Ltd.(Trust Account)	4.6	0.86%	4.6	0.75%
Mizuho Bank,Ltd.	4.2	0.79%	4.2	0.69%
Others	175.5	33.04%	175.5	28.74%
Total	531.3	100.00%	610.9	100.00%
Hon Hai Group Holding Ratio		60.75%		65.86%

Source: Mizuho Securities Equity Research, from company documents Note: Under its articles of incorporation, Sharp is limited to issuing 1billion shares (as of Jun. 2018).

Sharp and SDP: Ownership After the Transaction (SDP to become Terry Gou's private company)



Source: Mizuho Securities Equity Research

SDP(Sakai Display Product) results: FY12/18 Sales of just under ¥100b and operating loss of about ¥7.2b

An equity method affiliate of Sharp. Transferred part of stock owned by Sharp to SIO at the end of December 2016.

Sakai Display Products	(12m)	(9m)	(12m)	(12m)	(12m)	(12m)	(12m)	(12m)	(12m)	(12m)
Income Statement (JPY m)	FY3/12	FY12/12	FY12/13	FY12/14	FY12/15	FY12/16	FY12/17	FY12/18	FY12/19	
Sales	240,031	108,607	210,869	220,392	205,645	161,357	200,226	111,442	99,920	
CoGS	210,141	110,528	191,961	201,261	191,720	206,548	185,109	126,464	105,466	
Gross profit	29,889	-1,920	18,908	19,131	13,924	45,190	15,117	-15,022	-5,546	
SG&A	3,923	1,399	3,840	3,990	2,367	4,049	3,525	2,736	1,629	
Operating profit	25,965	-3,319	15,069	15,141	11,558	-49,240	11,592	-17,759	-7,175	
Non-operating income/expenses	814	115	-5,973	-3,645	-4,728	-5,634	-3,715	-10,785	-12,458	
Recurring profit	26,780	-3,204	9,096	11,496	6,830	-54,874	7,877	-28,543	-19,633	
Extraordinary income/losses	-22,693	-8,697	-232	-166	-259	-634	-1,684	258	24	
Pre-tax profit	4,086	-11,901	8,864	11,330	6,570	-55,507	6,193	-28,286	-19,609	
Taxiation	896	-4,452	2,831	4,115	2,234	3,785	1,894	184	34	
Corporate Taxes	4	1,102	3,485	5,711	6,533	-87	1,909	-207	2	
Tax Adjustment	892	-5,554	-654	-1,596	-4,299	3,872	-15	391	32	
Net profit	3,189	-7,449	6,032	7,215	4,336	-59,292	4,300	-28,470	-19,642	
(株数修正EPS、千円/株)	1.0	-2.3	1.8	2.2	1.3	-17.9	1.3	-8.6	-5.9	

Balance sheet (JPY m)	FY3/12	FY12/12	FY12/13	FY12/14	FY12/15	FY12/16	FY12/17	FY12/18	FY12/19
Current assets	58,212	67,123	81,785	90,329	100,153	43,156	68,161	54,072	81,661
Fixed assets	187,685	282,495	265,891	254,739	243,166	212,393	222,143	258,677	266,633
Deferred assets	655	459	197	-	-	-	-	-	-
Total assets	246,553	350,077	347,872	345,068	343,320	255,549	290,305	312,749	348,295
Allowance for bonus	401	421	421	-	-	-	-	-	-
Others	83,042	99,661	97,948	-	-	-	-	-	-
Current liabilities	83,444	100,082	98,369	98,864	109,886	98,197	95,447	129,343	190,722
Fixed liabilities	9,115	80,590	74,066	64,543	48,432	32,894	30,861	47,903	41,682
Total Liabilities	92,559	180,672	172,435	163,407	158,318	131,081	126,309	177,246	232,404
Shareholders' equity	153,993	169,405	175,437	181,659	185,001	124,716	163,986	135,516	115,874
Capital	15,000	15,000	15,000	15,000	15,000	15,000	32,485	32,485	32,485
Capital surplus	127,000	160,500	160,500	160,500	160,500	160,500	177,985	177,985	177,985
Capital Reserve	127,000	127,000	127,000	127,000	127,000	127,000	144,485	144,485	144,485
Other Capital Surplus	-	33,500	33,500	33,500	33,500	33,500	33,500	33,500	33,500
Retained earnings	11,993	3,905	9,937	16,159	19,501	-40,784	-36,484	-64,954	-84,596
Earnings Reserve	78	78	78	78	78	78	78	78	78
Other Retained Earnings	11,915	3,827	9,859	16,081	19,423	-40,862	-36,562	-65,032	-84,674
Treasury stock	-	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000
Accum. OCI	-	-	-	1	-	-248	10	-14	17
Deferred gains/losses on hedges	-	-	-	1	-	-248	10	-14	17
Net assets	153,993	169,405	175,437	181,661	185,001	124,468	163,996	135,503	115,891
Total liabilities and net assets	246,553	350,077	347,872	345,068	343,320	255,549	290,305	312,749	348,295

Source: Mizuho Securities Equity Research, from company documents

Panasonic (6752)

(JPY mn / IFRS)	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Sales	7,626,306	7,982,164	8,002,733	7,490,601	6,378,790	6,663,060	6,772,386
Adjusted OP	413,246	401,202	327,032	286,663	205,880	282,166	344,034
OP	230,299	380,539	411,498	293,751	135,880	252,166	314,034
NP	165,212	236,040	284,149	225,707	83,986	166,328	210,254
EPS	64.3	101.2	121.8	96.8	36.0	71.3	90.1
BPS	673.9	732.1	820.4	856.6	872.6	918.9	979.0
DPS	25.0	30.0	30.0	30.0	15.0	30.0	35.0
P/E	19.6	15.0	7.8	8.5	24.4	12.3	9.8
P/B	1.87	2.08	1.16	0.96	1.01	0.96	0.90
EV/EBITDA	5.4	5.8	3.7	3.8	6.4	4.6	3.8

Note: Valuation based on Price Objective.

Investment Rating.....	Neutral
Price Objective.....	¥880
Valuation method	FY3/22 PER 12.3x

■ Share Price Drivers

- FCF improvement
- Profit improvement/withdrawal from the revitalization businesses;
- Car production volume recovery
- Additional measures of fixed-cost cuts

• Neutral rating. Key tests in FY3/21–FY3/22. The first step is internal-company optimization. Valuations show no signs of picking up.

- Price objective ¥880: based on a PER of 12.3x our EPS forecast for FY3/22. PER taken as average of 61 companies used for comparison (from energy, auto parts sectors. etc.).
- FY3/21 OP forecasts: ¥135.9b (down ¥54% YoY), which is just below guidance of ¥150b. Expect OP to improve gradually to ¥252.2b in FY3/22 and ¥314.0b in FY3/23.
- Ceiling of OP: 1) reduced losses due to exiting/selling businesses; 2) already announced fixed-cost cutting measures (¥60b); 3) OP would be ¥300b–¥350b at most by the recovery of cyclical business.
- What is required?: 1) a swing to profitability or withdrawal from the revitalization businesses; 2) increased profits in the AP and LS segments overseas and in the China geographical segment; 3) business expansion by M&A; 4) additional measures of fixed-cost cuts.
- Revitalization businesses future: We cannot expect at present that company achieves OPM of at least 5% in its automotive and 10% in batteries businesses. We think it is time to decide whether to quit or continue these operations.
- Upbeat on CNS: The earnings outlook seems bleak due to deterioration in avionics, but Panasonic seems to be focusing on “frontline process innovation”, as evidenced by its 20% stake in Blue Yonder.

Source: Mizuho Securities Equity Research

Panasonic: Earnings estimates by segment (IFRS: Sales)

(JPY bn)

	FY3/20				FY3/21				FY3/22				FY3/23				FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	
	1Q	2Q	3Q	4Q	1Q	2QE	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	E	E	E	CoE		
Sales Revenue(IFRS)	1,891.1	1,953.3	1,911.2	1,735.0	1,391.9	1,622.0	1,680.3	1,684.5	1,512.9	1,711.2	1,730.1	1,708.8	1,548.8	1,740.1	1,751.7	1,731.8	7,490.6	6,378.8	6,663.1	6,772.4	6,500.0	
	yoy	-5.9%	-2.3%	-7.9%	-9.6%	-26.4%	-17.0%	-12.1%	-2.9%	+8.7%	+5.5%	+3.0%	+1.4%	+2.4%	+1.7%	+1.2%	+1.3%	-6.4%	-14.8%	+4.5%	+1.6%	-13.2%
AP(Appliances)	688.4	686.2	682.6	533.1	554.7	619.0	655.5	560.1	600.3	656.6	666.6	561.7	611.2	662.8	668.8	566.5	2,590.3	2,389.2	2,485.3	2,509.3	2,370.0	
Heating and Cooling Solutions	166.4	123.6	100.0	102.2	144.4	117.4	99.0	106.3	157.4	128.0	101.0	107.9	162.1	131.8	104.0	110.0	492.2	467.1	494.2	508.0		
Home Appliances	224.2	240.4	243.6	169.7	197.8	228.4	241.2	183.3	213.6	237.5	241.2	180.0	220.0	242.3	246.0	183.6	877.9	850.6	872.3	891.9		
Smart Life Network	134.4	144.5	170.1	112.9	72.3	118.5	161.6	117.4	81.0	128.0	166.4	118.6	80.2	124.1	158.1	116.2	561.9	469.8	494.0	478.6		
Commercial Refrigeration & Food Equipr	70.3	77.8	70.5	65.8	55.0	63.8	64.2	66.5	58.9	69.5	66.7	67.8	59.4	70.9	69.4	69.1	284.4	249.4	262.9	268.9		
Other	93.1	99.9	98.4	82.5	85.2	90.9	89.5	86.6	89.5	93.6	91.3	87.5	89.5	93.6	91.3	87.5	373.9	352.3	361.9	361.9		
LS(Life Solutions)	462.7	531.7	514.3	409.9	325.1	397.1	399.9	402.4	331.6	392.8	394.1	396.4	329.4	389.6	392.6	394.7	1,918.6	1,524.5	1,514.9	1,506.3	1,480.0	
Lighting	66.8	75.2	82.6	72.1	53.7	64.7	71.9	67.1	56.9	63.4	69.0	65.7	57.5	64.6	70.4	66.4	296.7	257.3	255.0	258.9		
Energy Systems	83.0	89.0	87.0	82.2	66.2	74.8	80.9	88.0	73.5	79.2	84.1	90.6	75.0	80.8	86.7	94.2	341.2	309.8	327.5	336.7		
Panasonic Ecology Systems	43.3	44.1	47.7	42.4	38.9	43.2	48.7	44.5	41.2	44.5	49.6	45.0	40.8	43.6	49.1	44.1	177.5	175.3	180.3	177.6		
Housing Systems	87.4	95.4	91.7	81.7	99.5	97.3	92.6	79.2	96.5	94.4	90.8	77.7	94.6	92.5	88.9	76.1	356.2	368.7	359.3	352.1		
Panasonic Homes	79.7	102.0	91.5	-	-	-	-	-	-	-	-	-	-	-	-	-	273.2	-	-	-		
Other	102.5	126.0	113.8	131.5	66.8	117.2	105.8	123.6	63.5	111.3	100.5	117.4	61.6	108.0	97.5	113.9	473.8	413.4	392.8	381.0		
CNS(Connected Solutions)	255.2	263.4	251.3	264.8	185.3	206.6	209.4	231.3	192.7	216.2	214.6	236.0	198.3	225.2	221.9	244.0	1,034.7	832.6	859.5	889.5	900.0	
Avionics	58.6	60.8	62.1	62.7	27.3	30.4	34.8	37.6	36.0	37.4	38.9	41.4	37.8	40.0	40.9	42.6	244.2	130.1	153.8	161.4		
Process Automation	48.5	44.0	39.0	37.8	43.3	44.4	42.5	42.3	48.5	51.1	46.3	44.9	50.9	53.7	49.1	48.0	169.3	172.6	190.8	201.7		
Media Entertainment	27.9	29.3	27.5	25.6	17.9	19.9	20.9	21.0	17.4	19.5	20.1	19.9	16.8	19.3	20.3	20.5	110.3	79.7	76.9	77.0		
Mobile Solutions	61.2	60.4	60.1	50.3	49.3	50.1	52.3	46.3	46.8	48.6	51.8	46.7	48.2	50.6	52.8	47.7	232.0	198.0	194.0	199.3		
PSSJ	66.9	79.8	74.0	106.9	59.5	72.6	70.3	102.6	55.9	70.4	68.9	101.6	56.5	72.6	70.3	103.6	327.6	305.0	296.9	302.9		
Other	-7.9	-10.9	-11.4	-18.5	-12.0	-10.9	-11.4	-18.5	-12.0	-10.9	-11.4	-18.5	-12.0	-10.9	-11.4	-18.5	-48.7	-52.8	-52.8	-52.8		
AM(Automotive)	377.4	369.8	366.2	369.0	210.8	327.4	339.1	364.8	286.5	352.7	365.8	379.7	298.5	362.1	372.8	384.9	1,482.4	1,242.1	1,384.6	1,418.3	1,250.0	
Automotive Solutions	239.8	225.0	210.4	218.2	119.1	180.0	176.7	205.1	145.3	190.8	188.6	209.2	149.7	194.6	192.3	211.3	893.4	680.9	733.9	747.9		
Automotive Batteries	109.2	115.9	125.8	122.6	75.9	118.2	132.1	131.2	125.2	132.4	146.6	141.7	132.7	137.7	149.6	144.5	473.5	457.4	545.9	564.5		
Other	28.4	28.9	30.0	28.2	15.8	29.2	30.3	28.5	16.0	29.5	30.6	28.8	16.1	29.8	30.9	29.1	115.5	103.8	104.8	105.9		
IS(Industrial Solutions)	327.1	330.8	326.2	298.6	288.6	303.6	309.0	269.7	277.0	327.7	324.7	282.0	289.0	338.5	334.3	292.1	1,282.7	1,170.9	1,211.4	1,253.9	1,200.0	
Systems	132.8	134.0	124.0	116.9	113.7	123.3	120.3	119.2	127.3	141.8	132.3	128.8	133.7	148.2	137.6	133.9	507.7	476.5	530.2	553.4		
Devices	115.2	118.8	120.3	110.3	105.4	114.0	119.1	114.7	112.8	124.3	126.2	119.3	119.5	130.5	132.6	125.3	464.6	453.3	482.6	507.9		
Other	79.1	78.0	81.9	71.4	69.5	66.3	69.6	35.7	36.8	61.7	66.1	33.9	35.7	59.8	64.2	32.9	310.4	241.1	198.5	192.6		
Other	58.5	57.1	54.7	125.1	52.3	56.8	54.4	124.5	52.0	56.5	54.2	123.9	51.8	56.2	53.9	123.2	295.4	288.0	286.6	285.1	-	
Adjustment/Elimination	-278.2	-285.7	-284.1	-265.5	-224.9	-288.6	-286.9	-268.2	-227.1	-291.4	-289.8	-270.8	-229.4	-294.4	-292.7	-273.5	-1,113.5	-1,068.6	-1,079.2	-1,090.0	-700.0	

Source: Mizuho Securities Equity Research

Panasonic: Earnings estimates by segment (IFRS: OP)

(JPY bn)

	FY3/20				FY3/21				FY3/22				FY3/23				FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	
	1Q	2Q	3Q	4Q	1Q	2QE	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	E	E	E	CoE		
OP(IFRS)	56.4	83.9	100.4	53.1	3.8	32.3	56.2	43.6	58.6	60.8	75.8	57.0	73.5	76.0	87.2	77.3	293.8	135.9	252.2	314.0	150.0	
	yoy	-44%	-12%	+3%	-55%	-93%	-61%	-44%	-18%	+1,458%	+88%	+35%	+31%	+26%	+25%	+15%	+36%	-28.6%	-54%	+85.6%	+24.5%	-49%
AP(Appliances)	30.0	22.9	29.7	-26.9	15.2	17.3	18.3	-2.0	26.6	17.4	21.4	2.9	32.5	24.9	24.9	15.2	55.7	48.8	68.3	97.6	55.0	
Heating and Cooling Solutions	17.3	5.0	1.6	1.1	13.7	5.6	1.4	1.6	16.4	5.2	1.7	1.3	16.4	5.7	2.0	1.5	25.0	22.3	24.6	25.6		
Home Appliances	12.1	15.0	20.0	2.9	17.2	16.4	16.4	9.3	14.5	16.4	16.9	13.1	16.1	17.9	18.4	14.3	50.0	59.4	60.9	66.8		
Smart Life Network	-2.0	-2.0	4.0	-15.0	-8.7	-2.7	0.3	-9.4	-4.9	-5.1	1.8	-9.5	-0.8	-	3.2	1.2	-15.0	-20.5	-17.6	3.5		
Commercial Refrigeration & Food Equipr	2.1	3.5	0.9	-0.0	-2.2	-1.6	0.6	-2.7	0.6	1.0	1.0	-2.0	0.9	1.3	1.3	-1.8	6.5	-5.8	0.6	1.7		
Other	0.5	1.4	3.2	-15.9	-4.8	-0.5	-0.4	-0.9	-0.0	-0.0	-0.0	-0.0	0.0	0.0	0.0	0.0	-10.8	-6.6	-0.2	0.1		
LS(Life Solutions)	12.7	28.5	29.9	109.0	5.6	12.8	14.3	6.8	10.1	13.3	15.2	13.1	11.8	14.6	16.6	14.8	180.1	39.6	51.7	57.8	45.0	
Lighting	2.0	3.0	3.0	-1.0	2.0	2.3	2.4	-5.4	1.8	2.0	2.1	2.0	1.8	2.1	2.3	2.1	7.0	1.4	7.9	8.3		
Energy Systems	5.8	6.0	5.2	4.0	-0.7	3.1	3.5	4.1	3.5	3.6	3.9	4.5	5.0	5.3	5.7	6.6	21.0	10.1	15.4	22.6		
Panasonic Ecology Systems	2.1	4.0	5.2	3.7	2.7	3.8	4.1	3.7	1.9	3.9	5.3	3.4	1.8	3.8	5.2	3.2	15.0	14.2	14.5	14.0		
Housing Systems	2.7	4.5	4.5	0.8	0.4	3.0	3.8	4.0	2.7	3.2	3.4	3.0	2.8	2.9	3.0	2.7	12.5	11.3	12.2	11.4		
Panasonic Homes	0.1	3.0	5.0	-	-	-	-	-	-	-	-	-	-	-	-	-	8.1	-	-	-		
Other	0.0	8.0	7.0	101.5	0.3	0.6	0.5	0.4	0.3	0.6	0.5	0.2	0.3	0.5	0.5	0.2	116.5	1.8	1.6	1.6		
CNS(Connected Solutions)	13.7	22.6	40.3	15.4	-16.0	-2.2	9.3	12.5	7.0	10.6	13.3	15.3	9.9	13.5	16.0	18.1	92.0	3.6	46.3	57.6	13.0	
Avionics	5.9	9.0	9.0	7.1	-14.2	-8.2	-0.7	0.4	0.4	0.7	0.8	2.1	2.6	2.8	2.7	3.3	31.0	-22.7	4.0	11.4		
Process Automation	3.9	3.5	2.0	1.6	3.0	3.3	3.7	4.0	4.8	5.1	4.8	4.2	5.0	5.5	5.1	5.0	11.0	14.0	18.9	20.6		
Media Entertainment	0.9	2.0	1.6	0.5	-2.7	-1.8	-1.3	-0.4	0.6	1.0	1.0	0.7	0.7	1.0	1.0	0.8	5.0	-6.2	3.3	3.6		
Mobile Solutions	3.7	4.5	5.0	-0.2	2.4	2.5	3.7	3.6	2.3	2.5	3.5	3.5	2.5	2.7	3.7	3.7	13.0	12.2	11.9	12.6		
PSSJ	-0.7	3.1	23.0	-5.4	-1.8	2.0	3.8	4.9	-1.1	1.3	3.2	4.9	-1.0	1.5	3.5	5.3	20.0	9.0	8.3	9.4		
Other	0.0	0.5	-0.3	11.8	-2.7	-	-	-	-	-	-	-	-	-	-	-	12.0	-2.7	-	-		
AM(Automotive)	-10.0	-12.7	-6.5	-17.4	-9.5	-13.6	-8.9	1.7	-0.2	2.2	5.8	5.0	2.9	4.4	8.0	7.2	-46.6	-30.2	12.8	22.5	-34.0	
Automotive Solutions	-3.0	-10.8	-1.7	7.5	-20.8	-7.2	-3.5	4.1	0.4	1.5	4.1	3.1	0.9	2.1	4.8	3.8	-8.0	-27.5	9.2	11.7		
Automotive Batteries	-7.0	-1.9	-5.0	-8.1	-9.1	-2.4	-1.3	1.6	3.4	3.7	4.7	4.8	4.0	4.3	5.2	5.3	-22.0	-11.2	16.6	18.8		
Other	-	-	0.2	-16.8	20.5	-4.0	-4.0	-4.0	-4.0	-3.0	-3.0	-3.0	-2.0	-2.0	-2.0	-2.0	-16.6	8.5	-13.0	-8.0		
IS(Industrial Solutions)	5.2	11.2	-6.6	-5.2	9.2	9.4	12.6	13.3	10.4	12.6	15.6	15.5	11.9	14.0	17.0	16.8	4.6	44.5	54.1	59.7	43.0	
Systems	2.7	3.5	2.0	0.3	2.3	2.5	4.6	4.7	2.8	3.1	5.3	5.3	3.1	3.4	5.6	5.6	8.5	14.0	16.5	17.7		
Devices	8.1	9.0	9.5	-18.1	6.7	8.2	9.4	9.4	8.0	9.8	10.6	10.4	8.8	10.7	11.5	11.3	8.5	33.8	38.8	42.4		
Other	-5.5	-1.3	-18.1	12.5	0.2	-1.3	-1.4	-0.7	-0.4	-0.3	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-12.4	-3.3	-1.2	-0.4		
Other	1.5	1.0	0.9	4.2	0.3	0.6	0.5	1.2	0.5	0.6	0.5	1.2	0.5	0.6	0.5	1.2	7.6	2.7	2.9	2.9		
Adjustment/Elimination	3.3	10.4	12.7	-26.0	-1.0	8.0	10.0	10.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	0.4	27.0	16.0	16.0	28.0	
PTP	56.2	81.7	100.2	53.0	3.1	32.3	56.2	43.6	58.3	60.6	75.6	56.7	73.3	75.7	87.0	77.1	291.1	135.2	251.2	313.0	150.0	
NP	49.8	51.1	77.2	47.6	-9.8	19.5	43.4	30.9	37.1	39.4	54.4	35.5	47.6	50.0	61.3	51.4	225.7	84.0	166.3	210.3	100.0	

Note: Sub-segment breakdown for reported OP is as estimated by Mizuho Securities
Source: Mizuho Securities Equity Research

Panasonic: B/S C/F estimates (IFRS)

	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21 E	FY3/22 E	FY3/23 E
(Balance sheet)							
Current assets	3,204,819	3,485,958	3,274,093	3,435,835	3,165,070	3,267,083	3,307,463
Cash and cash equivalents	1,270,787	1,089,585	772,264	1,016,504	1,048,568	1,095,297	1,113,269
Trade receivables	847,003	1,038,984	1,190,620	1,051,203	908,759	949,258	964,833
Inventories	806,309	988,609	1,016,437	793,516	722,540	715,702	714,219
Non-current assets	2,778,142	2,805,190	2,739,838	2,782,683	2,723,683	2,725,683	2,740,683
Investments accounted for using the equity method	155,987	147,959	136,486	306,864	404,864	391,864	386,864
Other financial assets	161,986	166,466	216,225	215,293	215,293	215,293	215,293
Property, plant and equipment	1,323,282	1,374,066	1,324,374	1,034,632	887,632	912,632	942,632
Other non-current assets	1,136,887	1,116,699	1,062,753	1,225,894	1,215,894	1,205,894	1,195,894
Total assets	5,982,961	6,291,148	6,013,931	6,218,518	5,888,753	5,992,766	6,048,146
Current liabilities	2,712,063	3,097,935	2,989,450	2,616,108	2,068,795	2,082,701	2,108,043
Short-term debt, including current portion of long-term debt	177,038	375,392	389,955	314,995	109,271	35,851	27,608
Non-current liabilities	1,510,963	1,310,928	939,866	1,446,542	1,629,429	1,614,185	1,506,612
Long-term debt	946,966	864,052	608,766	1,156,316	1,251,203	1,235,959	1,128,386
Total liabilities	4,223,026	4,408,863	3,929,316	4,062,650	3,698,224	3,696,887	3,614,655
Common stock	258,740	258,740	258,740	258,867	258,867	258,867	258,867
Capital surplus	636,905	527,408	528,880	531,048	531,048	531,048	531,048
Retained earnings	1,051,445	1,300,336	1,500,870	1,646,403	1,683,729	1,791,733	1,931,999
Other components of equity	(164,632)	(168,259)	(164,417)	(227,957)	(227,957)	(227,957)	(227,957)
Treasury stock	(210,569)	(210,674)	(210,560)	(210,012)	(210,012)	(210,012)	(210,012)
Non-controlling interests	188,046	174,734	171,102	157,519	154,865	152,211	149,557
Total equity	1,759,935	1,882,285	2,084,615	2,155,868	2,190,529	2,295,879	2,433,490
Total liabilities and equity	5,982,961	6,291,148	6,013,931	6,218,518	5,888,753	5,992,766	6,048,146
(Cash Flow Statement)							
Net profit	172,442	252,027	302,737	240,038	95,986	178,328	222,254
Depreciation and amortization	270,767	287,754	296,041	372,975	260,000	265,000	270,000
Net cash provided by operating activities	385,410	423,182	203,677	430,303	368,724	430,296	486,096
Purchase of property, plant and equipment	(278,594)	(394,485)	(316,083)	(273,920)	(253,000)	(280,000)	(290,000)
Net cash used in investing activities	(420,156)	(458,828)	(193,387)	(206,096)	(252,509)	(221,926)	(267,665)
Increase (decrease) in short-term debt	6,261	239,990	(132,417)	105,119	(233,332)	(73,420)	(8,243)
Increase (decrease) in long-term debt	349,649	(159,908)	(108,586)	31,911	122,495	(15,243)	(107,573)
Dividends paid to Panasonic Corporation stockholders	(58,025)	(58,310)	(81,633)	(69,979)	(46,659)	(58,324)	(69,989)
Dividends paid to non-controlling interests	(17,648)	(20,053)	(18,185)	(14,654)	(14,654)	(14,654)	(14,654)
(Increase) decrease in treasury stock	(97)	(108)	9	(33)	-	-	-
Net cash provided by (used in) financing activities	294,598	(128,763)	(341,761)	48,222	(84,150)	(161,581)	(200,389)
Cash and cash equivalents at beginning of period	1,012,666	1,270,787	1,089,585	772,264	1,016,504	1,048,568	1,095,358
Cash and cash equivalents at the end of the period	1,270,787	1,089,585	772,264	1,016,504	1,048,568	1,095,358	1,113,400
(Free cash flow)	(34,746)	(35,646)	10,290	224,207	116,215	208,370	218,431

(JPY mn)

Source: Mizuho Securities Equity Research, from company documents

Panasonic: CEO change (Jun 2021) and switch to holding company structure (Apr 2022)

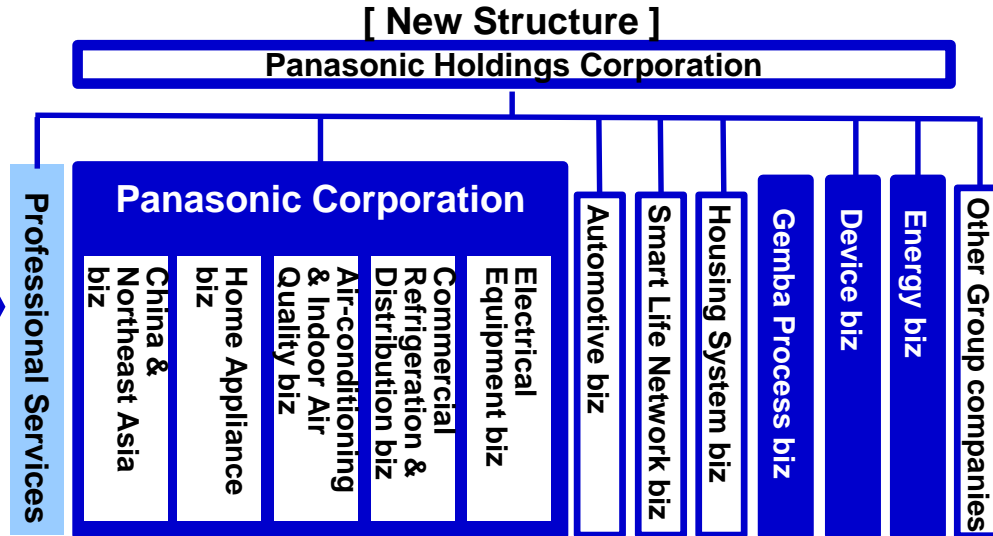
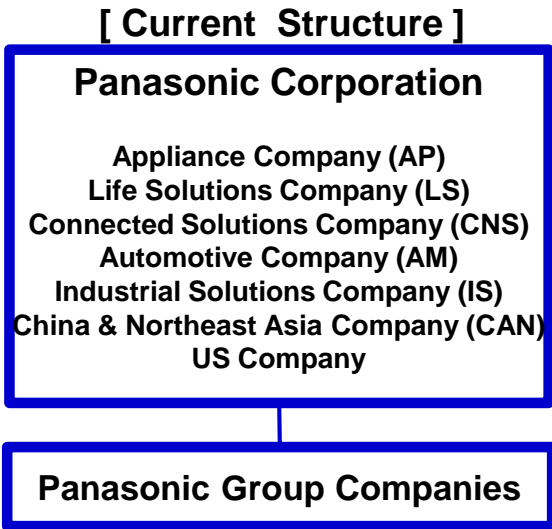
Objectives of change in CEO and change in organizational structure

- Yuki Kusumi will take over as CEO on 1 April 2021, and pending approval at the general meeting of shareholders on 24 June, he will be appointed president and representative director. Current president Kazuhiro Tsuga will become chairman without representative authority.
- Panasonic will switch to a holding company structure in April 2022. The current Company System will be abolished at end-September 2021.
- Objectives of new structure: “Specialization” and “Sharpening” of business units
 - ✓ Swifter and more specialized decision-making (transfer of authority, rewards and accountability)
 - ✓ Enhance the competitiveness of each business unit (make them essentially specialized companies)
 - ✓ Streamline indirect departments so that they contribute to stronger competitiveness

Incoming CEO Yuki Kusumi

- After, graduating from the Kyoto University Graduate School of Engineering in March 1989, joined Matsushita Electric Industrial
 - ✓ Worked as a software developer, and participated in the development of the “d Button” and the second-generation “DIGA” hard disk recorder
- After heading up Panasonic’s corporate R&D and TV business operations, Kusumi was appointed President of the Automotive Company (automotive equipment and batteries) in April 2019
 - ✓ CEO Kazuhiro Tsuga praised him for his ability to see the essence of problems and fix them, and for his expertise in both theory and the factory floor.

New Structure



- Four main business
 - ✓ Panasonic Corporation (AP/LS/CAN)
 - ✓ Gemba Process (CNS)
 - ✓ Device (IS)
 - ✓ Energy (AM)
- Others
 - ✓ Smart Life (AP : black goods incl. AV)
 - ✓ Housing (LS)
 - ✓ Automotive (AM : automotive equipment)
 - ✓ Many other group companies
- Support all business (indirect Dept.)
 - ✓ Professional Services

Source: Mizuho Securities Equity Research from company data

Panasonic: IR Day Summary / Appliances

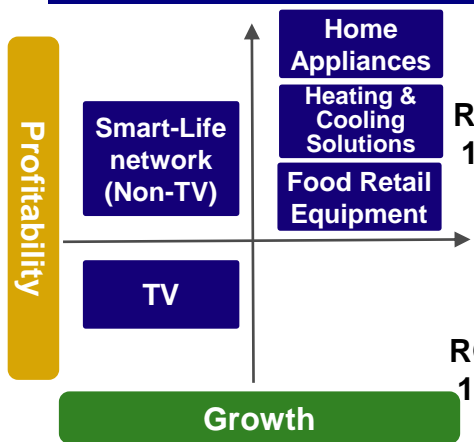
FY3/20 1H Results and FY3/20 2H Forecast

- While the sales of overseas TVs remain slow, increased profit is expected owing to steady consumer electronics in Japan and overseas air conditioning.

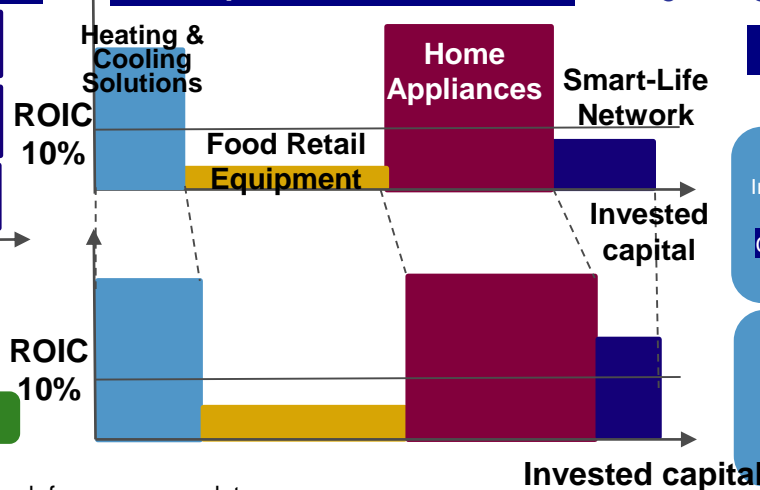
Issues/Strategy for this mid-term (FY20 to FT22)

- Issues
- Concentrate on **air-conditioning, food retail equipment, and home appliances** to achieve highly profitable biz entities
- Concentrate resources on key areas, **set direction for unprofitable (non-investing) biz** to form a robust profit-oriented makeup
- Business Portfolio Strategy
- Regarding the “Lifestyle Infrastructure” biz as an area for further investments, pursue profit increase through growth
- Pursue the conversion of the “Lifestyle Appliances” biz to a more profitable structure through reforming the structure

Business Environment



Profit portfolio for mid-term



Strategy and target for mid-to long-term

- Heating & Cooling Solutions
- Focus on design/install/construction as well as manufacturing and sales of products
- CAC : Stronger coordination with the LS Company in Japan, China and Asia. Expand through total solution of air-conditioning, chiller, ventilation and cloud in Europe
- A2W : Aim to grow beyond markets implementing proactive investments
- Home Appliances(ROIC improvement target: +3.2pt in FY3/22, +10.4pt for long-term)
- Provide satisfying UX with stronger IoT/software centering on divers product lineup
- Smart-Life network (TCs, audio equipment, cameras, etc.)
- Set direction for unprofitable biz(TV) (Aim to eliminate loss of TV biz in FY3/22) → Select models to be internally developed/collaborative development with other companies
- Target fir mid-to long term
- FY3/19: OPM2.9%, ROIC7..3% → FY3/22: OPM4~5%, ROIC at least 10%
- Long-term goal: OPM7.5%, ROIC over 15%

Mid-term Business Portfolio Strategy

Business	Strategy	Key indicators
Lifestyle Infrastructure Core Growth Business	Heating & Cooling Solutions Food Retail Equipment	<ul style="list-style-type: none"> New revenue model incl. install/construction and maintenance/service Focus on CAC and A2W EBITDA growth rate
Lifestyle Appliances Co-creation Business	Home Appliance Smart-Life network	<ul style="list-style-type: none"> Expand to Asia/India from China/Japan wWith stronger IoT/software Structural reform by sales, development and manufacturing ROIC Improvement

Source: Mizuho Securities Equity Research from company data

Panasonic: IR Day Summary / Life Solutions

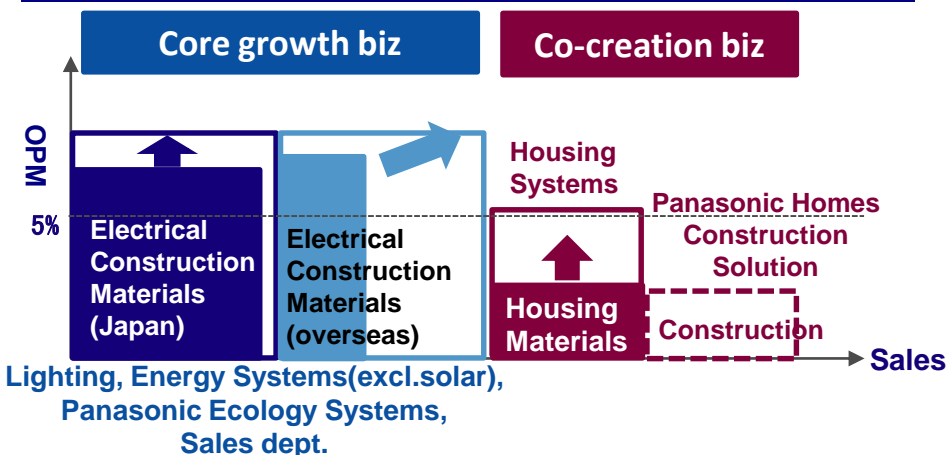
FY3/20 1H Results and FY3/20 2H Forecast

- In 2H there will be impacts of consumption tax hike and market deterioration, but strengthening the constitution and annual adjusted OP is expected to increase

Mid-term Strategy : Portfolio Management

- Core Growth biz (lights)
- Japan: Improve profitability in the growing renovation market of non-residential domain. Shift from one-time selling of a single product to proposing a set of equipment and designing space.
- Overseas: Improve profitability by sales in 3 priority regions(China, Southeast Asia and ISAMEA(focus on India and Turkey) / Southeast Asia, Oceania)
- Co-creation biz
- Strengthen competitiveness through co-creation
- Construction: Set up a new company with TOYOTA Motor Corporation
- Solar: Increase the competitiveness of solar panels through collaboration with GS Solar

Profit pool (FY3/19→FY3/31)

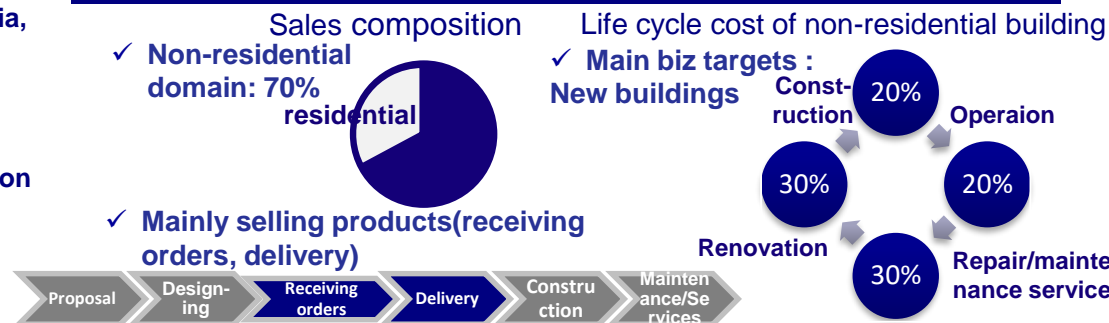


Source: Mizuho Securities Equity Research from company data

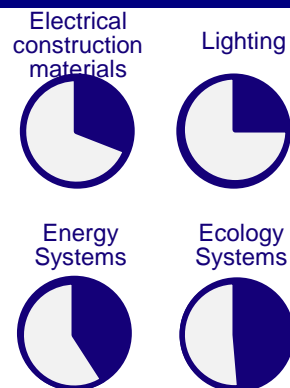
Target for mid-term

- LS: FY3/20 Sales ¥1,700b, Adjusted OP 5.7%
→ FY3/22 Sales ¥1,700b, Adjusted OP 7.0%
- Core growth biz(Electrical construction materials):
FY3/20 Sales ¥963b, Adjusted OP 7.9%
→ FY3/22 Sales ¥1,600b, Adjusted OP 10%
(Grow mainly overseas) (Improve profitability in Japan)

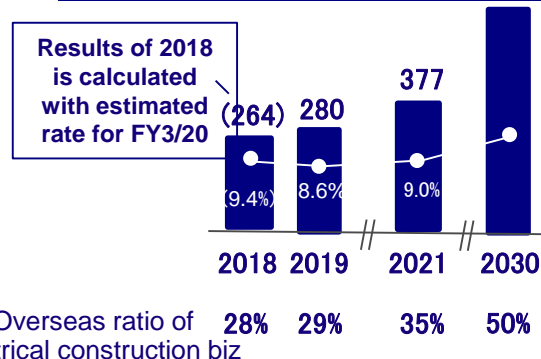
Electrical construction materials (Japan) -Present-



% of overseas sales



Sales target for electrical construction materials (overseas) (¥b)



Panasonic: IR Day Summary / Connected Solutions

Mid-term strategy (FY3/20-FY3/22)

- Portfolio management
- Focus on Gemba process biz in good business positioning
- Gemba process biz
- Fine process (exquisite and precise processing)
- ✓ Expand hardware biz domain: Expanded from mounting field to semiconductor manufacturing process. In the thermal processing field (welding / cutting), expand the biz area with new laser technology.
- ✓ Making manufacturing processes smarter with AI and data analysis: Aims to stabilize the manufacturing quality of semiconductor manufacturing and improve the capacity utilization rate through collaboration with IBM Japan.
- Supply chain (Manufacture, transport and sell) (Joint corporation with JDA Software Group, Inc. will be established on Nov.29)
- ✓ Expand biz domain to upstream process: Expanding the useful range of upstream processes incl. consulting and requirement definition in order to solve on-site issues in the supply chain (ex. Shipping sorting system)
- ✓ Create customer value through a combination of hardware and software: cooperate with external partners to enhance software and consulting capability, and combine them with hardware to develop new solution business. (ex. Solutions to visualize inventories)

Business Portfolio

Good Biz positioning Bad	Category	Concept	Main biz	FY3/20 sales composition ratio
		Core biz	A biz that can provide comprehensive solutions by combining hardware and software. A biz incl. ancillary biz such as maintenance service, etc. that can be expected to be highly profitable.	Gemba process biz
	Sharpening hardware biz	A biz that has the most advanced features and continues to be a leading company in the industry by improving advantages to maintain its competitiveness.	IFEC* Projector, etc.	42%
	Strategic capital alliance biz	A biz that introduces external capital and combines its advantages with partner's advantages to increase competitiveness.	Securities system, etc.	
	Downsizing/terminating biz	Biz that are difficult to continue to generate profits due to poor positioning.	Assess as required	

*IFEC : In-Flight Entertainment + Connectivity

Source: Mizuho Securities Equity Research from company data

Target for mid-term

- CNS
- FY3/20: OPM 7.4%, sales of Gemba process 58%
- FY3/26: OPM over 10%, sales of Gemba process over 75%
- ✓ Accelerate to shift to a new solution
- ✓ Achieve high profits with software and maintenance
- ✓ Increase recurring sales ratio

Connected Solutions

Avionics	In-flight entertainment & connectivity system, etc.
Process Automation	Lasers, integrated line control systems, welding-related systems, etc.
Media Entertainment	Professional displays, audio equipment, etc.
Mobile Solutions	PCs, tablets, supply chain solutions, etc.
PSSJ	Development of system solutions, installation, operation, maintenance, etc.

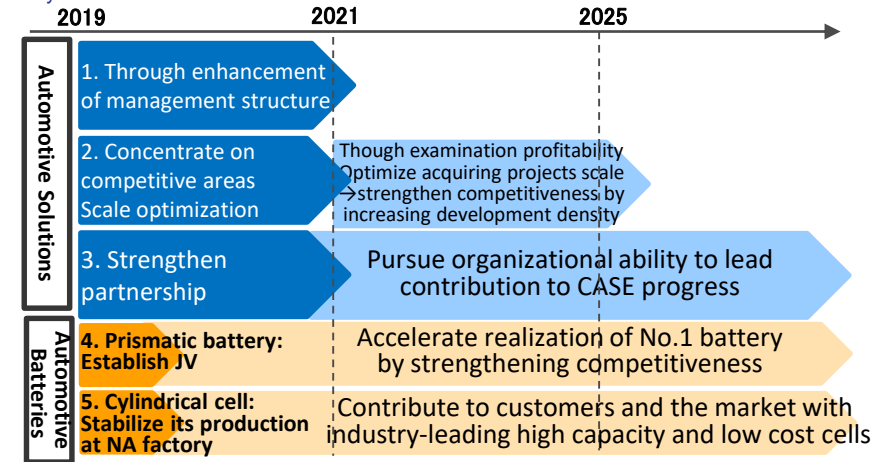
Panasonic: IR Day Summary / Automotive

Summary of growth strategy and mid-term initiatives(FY3/20-FY3/22)

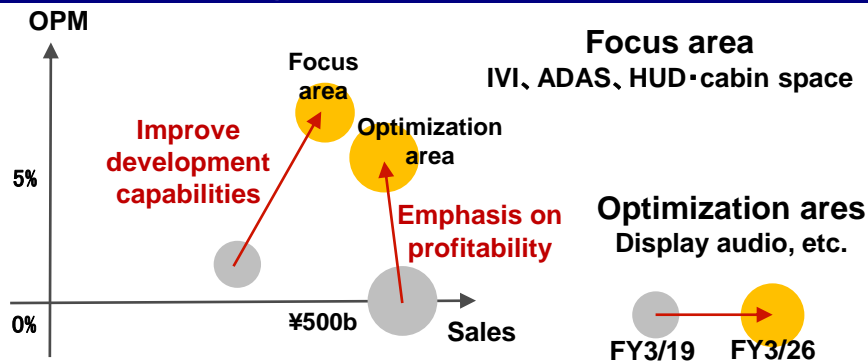
- ◆ Achievement
- Expanded biz scale to position themselves to become one of the top 10 automotive solutions suppliers (Target of sales ¥2t of automotive biz almost achieved in FY3/19(sales of ¥1.9t))
- Created new biz such as ADAS, Established global development/production/sales system
- Automotive Solutions
- Exceeded the appropriate order volume due to rapid sales expansion
- In response to rapid expansion, the organization's ability to respond to changes haven't been able to catch up and losses have occurred (charging systems for European customers)
- ✓ Issues: Insufficient management of received orders and projects, individually optimized global supply chain, poor development management and efficiency loss
- ✓ Mid-term initiatives: Through enhancement of management structure, concentrate on competitive areas/scale optimization, and strengthen partnership. Aim for OPM of over 5% in FY3/22.
- Automotive Batteries
- Prismatic cell: Large-scale investment was concentrated in a short period due to the rapid increase in demand for electric vehicles
- Cylindrical cell: Struggled in conducting rapid start-up of world-largest factory due to lack of experience
- ✓ Issues: [Prismatic cell] Deficient resources for response to expanding demand.
[Cylindrical cell] Delay in productivity improvement as NA factory.
- ✓ Mid-term initiatives: [Prismatic cell] JV with Toyota Motor Corporation.
[Cylindrical cell] Stabilizing productivity of NA factory

Mid-term business plan

[Automotive Solutions]Carry out management reforms by FY3/22 and promote the preparation in areas where competitiveness can be utilized, enhance partnership as a foundation for future.
[Automotive Batteries]Move to recovery phase due to steady start-up, improved operation and battery evolution

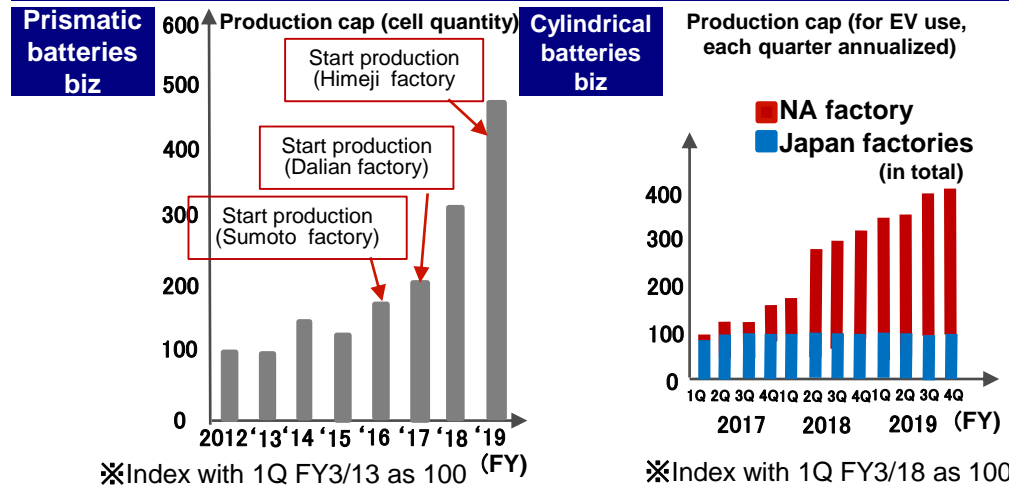


Portfolio Management of Automotive Solutions



※IVI : In-Vehicle Infotainment, ADAS : Advanced Driver Assistance System
HUD : Head-Up Display, the size of circle represents sales.

Production capacity trend of automotive batteries



※Index with 1Q FY3/13 as 100 (FY)

※Index with 1Q FY3/18 as 100

Panasonic: IR Day Summary / Industrial Solutions

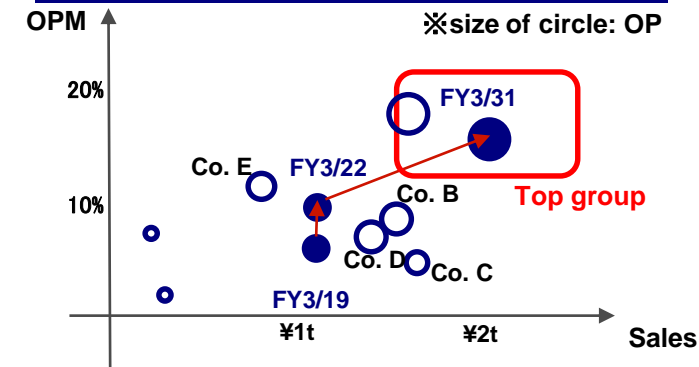
Initiatives for 2H FY3/20

- Core growth biz: Systems (Automotive power supplies, etc.) Devices (Capacitors, etc.)
- ✓ Key measures: Fixed-cost reduction, quality loss reduction, raw material rationalization
- Under-performing biz: LCD. Semiconductors
- ✓ LCD: End production around CY2021
- ✓ Semicon: Set the direction through taking various approaches→After IR Day. They announced on Nov.28 the biz transfer to Nuvoten Technology (Taiwan) .

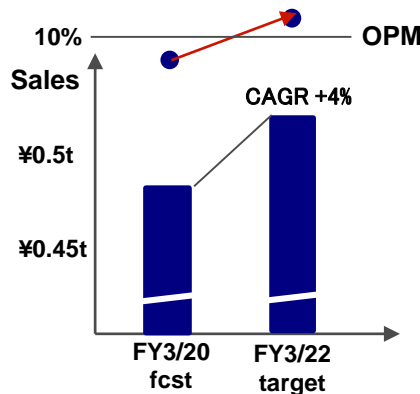
Long-term vision of core growth business

- Transition of mid-term strategy
- ✓ Shift to automotive/industrial areas, selection and concentration(FY3/13-FY3/19)
- ✓ Further growth in new areas (FY3/20-FY3/22)
- ✓ Sales composition of automotive/industrial areas: 38%(FY3/13)→83%(FY3/22 target)
- Long-term goal
- ✓ Focused areas: Automotive CASE, Information/communication infrastructure, and Factory labor-saving
- Mid-term target
- ✓ Sales:¥1t for FY3/20 fcst→FY3/22 target ¥1.1t(+¥130b in focused areas)
- ✓ OPM: +4pt in FY3/22 (YoY)

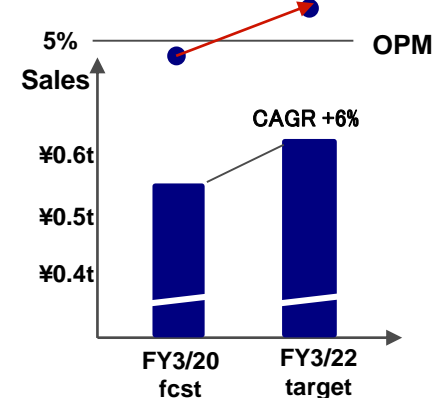
Positioning



Sales/profit targets for Devices biz



Sales/profit targets for Systems biz



Strategy

- Devices biz
- Basic strategy: Increase topo-share-product ratio in industry → Build a solid foundation for sales and profit
- ✓ Automotive inductor(market share No.1) (CAGR30%: FY3/20→FY3/22)
- ✓ Film capacitor (market share No.1) (CAGR31% : FY3/20→FY3/22)
- ✓ Circuit board materials (market share No.1) (CAGR22% : FY3/20→FY3/22)
- Approach: Strengthen material/process technologies, sources of differentiation
- ✓ Continuous investment from a long-term perspective
- ✓ Innovation of development approaches (Materials informatics, AI)
- Systems biz
- Basic strategy: Maximize value to offer by being close to customers, Focus on modules/packages based on competitive devices
- ✓ Automotive power module (Core device: EV relay)
- ✓ Backup power module (Core device: LiB cell)
- ✓ Motion control (Core device: Servo motor)
- Cumulative sales: ¥90b(FY3/20-FY3/22)→ ¥300b (FY3/20-FY3/25)
- Approach: Strengthen/improve customer contacts and proposal capabilities
- ✓ Localize management in the strategic regions (Europe: Strengthen a collaboration with OEMs utilizing local management , China: Built a new biz operational organization for FA area (FY3/20)
- ✓ Obtain technologies/know-hows (Aggressively promote biz collaboration inside and outside the company)

Panasonic: IR Day Summary / China & Northeast Asia

Scope and Business area of CNA

- CAN: Established CAN mainly based on AP China biz and LS biz
- Responsibilities and Authority
- ✓ Full responsibility for R&D, manufacturing and sales of products manufactured and sold in the region (the decision authority on HR, products and financial resources)
- ✓ Product planning for products that will be exported outside the region is determined by the destination Divisional Companies.

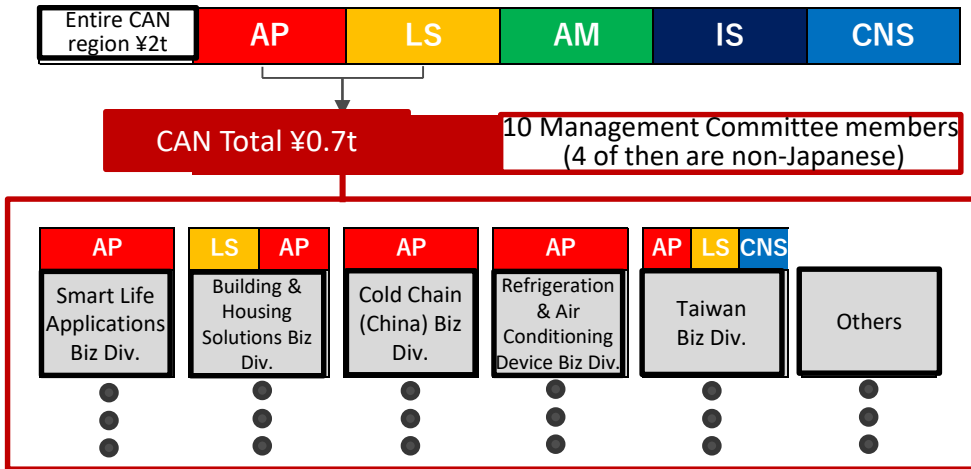
Mid-term target (FY3/22)

- Sales: ¥672b (FY3/19)→¥940b (FY3/22)
- OPM: 4.5% (FY3/19)→6.2% (FY3/22) (ROIC over 15%)
- ✓ Deploy successful CAN's initiatives in Asia and Japan
- ✓ Aiming to reach ¥940b sales in FY3/22 and contribute to sales expansion of AP and LS segments

Priority business strategies

- Priority biz: Co-create with partners to expand biz in China with 2 updates growing in China
- ✓ Life Spaces (Smart Life Appliances BD X Building and Housing Solutions CE X Housing Equipment): Developing housing, nursing care, entertainment and educational facilities on 4m² of land at Health/Nursing care "Panasonic Block Development". Besides, Introducing full specifications to 90,000 m² area 800 units by collaborating with Yada International (Investment/Developer)..
- ✓ Fresh Food Supply Chain (Cold Chain BD Equipment + Engineering): Establish an optimal partner for each supply chain and establish a refrigeration solution. Ware-house: From equipment sales to reinforcing engineering biz. (into a recurring biz such as remote monitoring etc.), Transportation: Collaboration with local automobile manufacturers. Launch demonstration tests with a focus on EV refrigeration truck biz.
- Foundation Reform: Realizing the speed, style and cost to win in China
- ✓ China Speed, China Cost and China Style → Transferring to China for business that have a foundation in place in China for mid-and long-term.
- ✓ Japan's Superiority: Long-term Reliability, Elemental Technology, Wide range of products and Brand Power

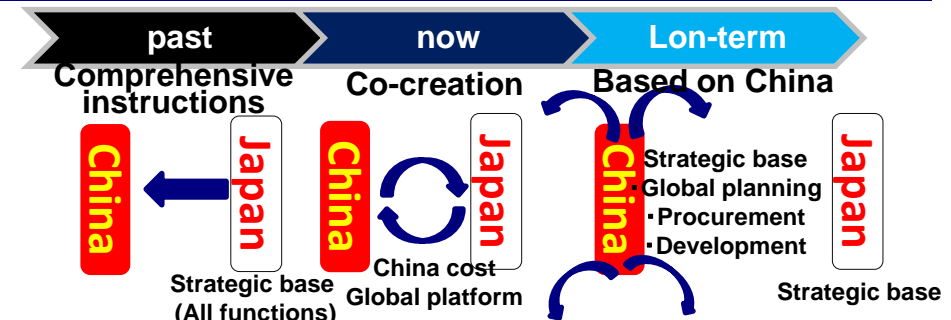
CAN's organization



Responsibility for gaining profits

Responsibility for gaining profits	Production	Sales
Within region (consolidated production & sales)	CNA	CNA
Export (production & sales unconsolidated)	CNA	AP/LS

Toward China-led production



Source: Mizuho Securities Equity Research from company data

Panasonic FPD Business: No more LCD subsequently to PDP, TV for domestic +α

■ TVs: Restructuring and the strategy of domestic +α sales due to deterioration in earnings again

- Business unit: Handling development and production. Our FY20 estimates: volume of 5M, operating loss of over ¥10b (Consolidation of manufacturing and sales).
- Presence: Generating profit in Japan, struggling overseas. Marginal profit low due to fewer large-scale products after withdrawal from China/US.
- TV production: In-house production (Malaysia, etc.) and outsource to ODMs. LCD panels largely from LG Display and Innolux.
- Prudent strategy: Aggressively target Japan, Asia, Europe, and emerging markets as a single appliances (AP) business unit. High-end models mainly OLED.
- Actual strategy of domestic +α sales due to deterioration in earnings, likely to outsource production + license supply for other region
- Channels: Collaborate with Life Solutions (LS) unit to cultivate BtoB sales channels besides volume retailers.

■ PDP panels: 2M/year or withdraw; were 2013 models the last? → Ultimate decision to withdraw

- Withdraw and sell off manufacturing plants. Cause was not excessive capex, but rather pricing strategy for Panasonic branded TVs (low pricing), posture in PDP industry (did not work with Korean brands), failure of panel marketing strategy (did not focus on outside sales).

■ LCD panels: Focus on 4K and small panels to survive, or withdraw from the market? → to end at the end pf FY3/22

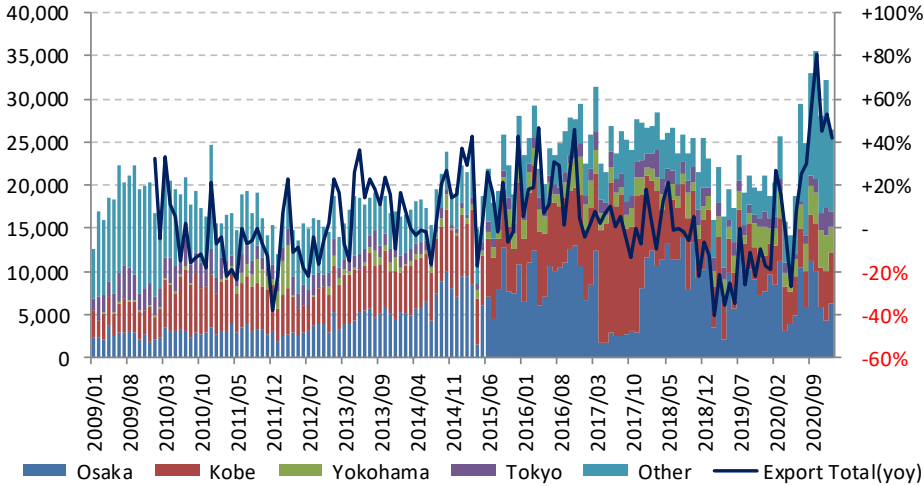
- Production capacity: Himeji G8 (25K/month) w/o LCM: equipment ¥1.5b as of the end of Mar. 2019, buildings ¥38.7b and 554 employees. OP in PLD is -¥8.2b in FY18.
- Capacity utilization: Less than 10K for mainstay mid to small-size size panels (used in tablets, in-vehicle electronics, industrial/medical equipment, etc). Finally discontinued supplying Pure Cell in the 32" range.
- Survival: Hope for large-scale products for internal, IT, and B2B use
- IPS patents & new photo-alignment technology: JV with Japan Display should limit risk of outflows overseas.
- Transition to oxide? Production and supply of substrate for OLED is also an option.

■ OLED panels: Technology is strong, but no timetable for mass production → Transfer entire business to J-OLED

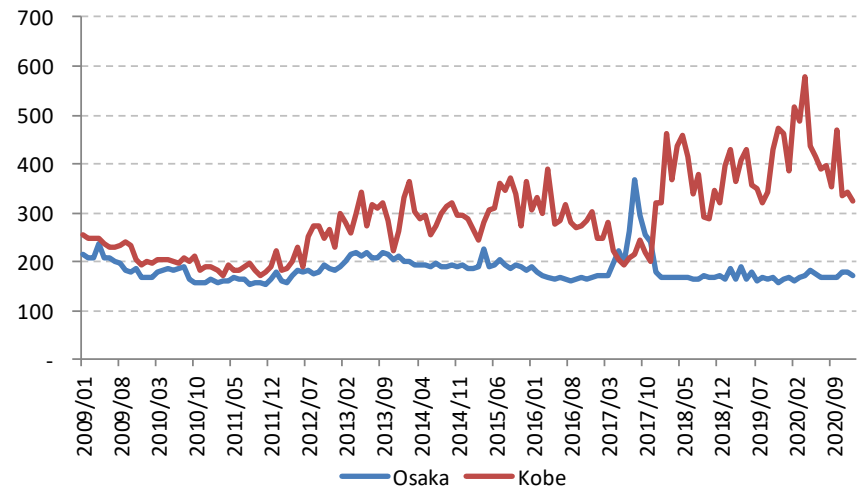
- Trial production line: Use oxide for substrate, inkjet (IJ) process on G5 (1100x1300) for OLED (polymer) process ⇒ already eliminated
- Kyoto R&D center personnel, IP, and equipment to JOLED. IJ process for both low-molecular and high polymer.

Panasonic: LIB (Export statistics)

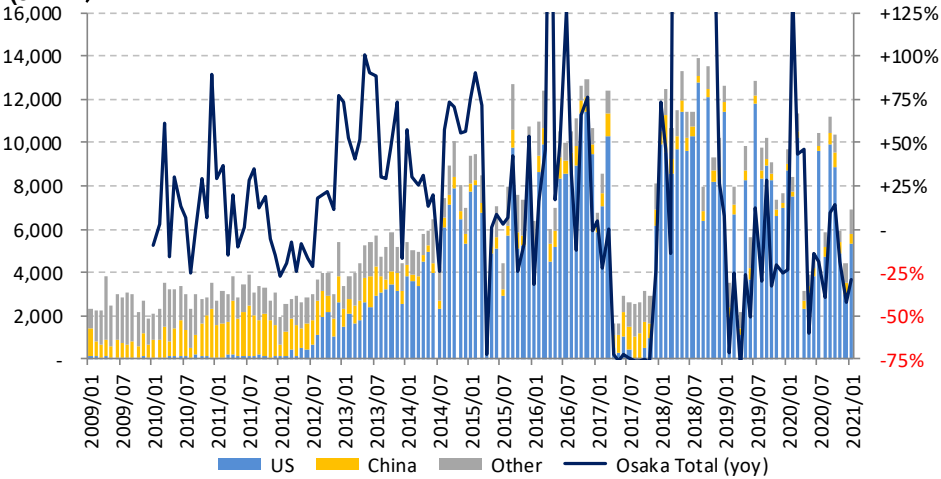
Value of Li-ion exports by port (JPYm)



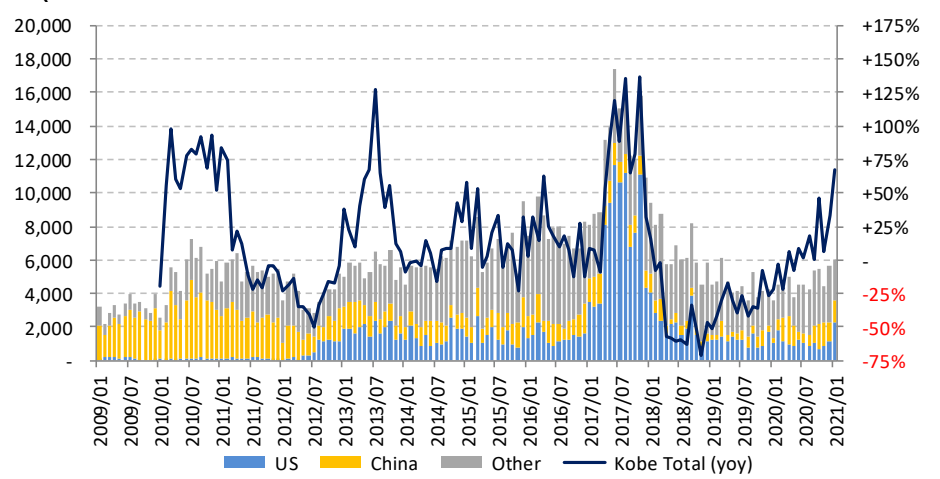
ASP for Li-ion batteries clearing the Port of Osaka and Kobe (JPY/unit)



Value of Li-ion battery exports cleared at the Port of Osaka by destination (JPYm)



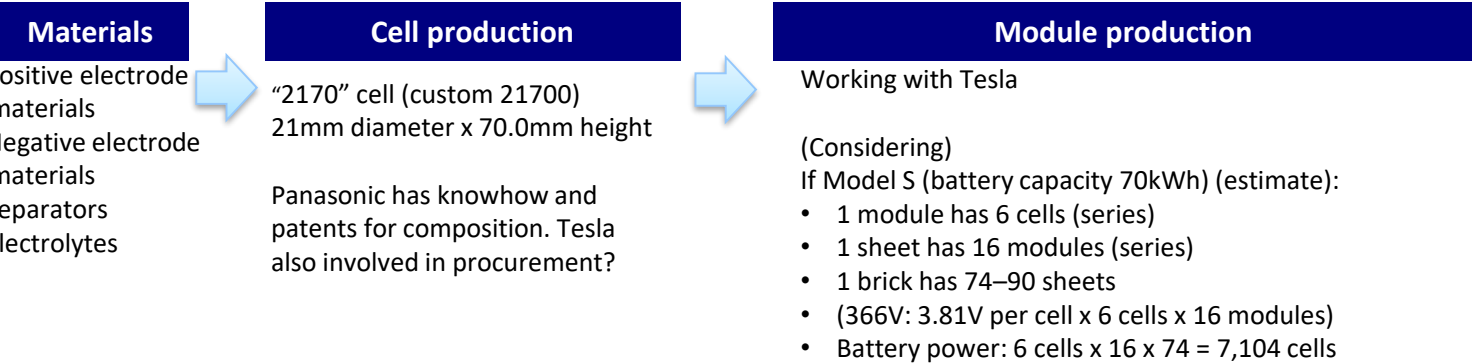
Value of Li-ion battery exports cleared at the Port of Kobe by destination (JPYm)



Source: Ministry of Finance

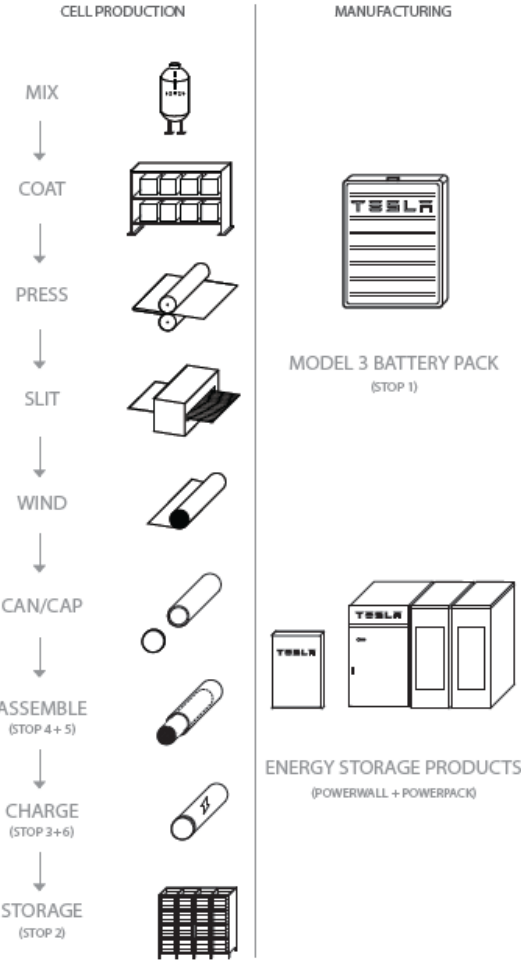
Tesla motors: Gigafactory

- Panasonic handling cell production, modules (battery packs)/control software for Tesla.
- All Panasonic cell production is for Tesla, so if sales slump (for vehicles and storage batteries), company can sell elsewhere.
- Production of Model 3 started for Q2 CY2017 in Nevada after factory construction began in June 2014, and production of Power Wall 2 and Power Pack 2 storage batteries began in January 2017.
- Production capacity: 35 GWh/year of battery cells (roughly 500,000 vehicles). Gigafactory 2 to produce an extra 21 GWh.
- Capital investment: invested slightly less than ¥200b till FY3/18. . 7 year depreciation.
- Tesla: Model 3 production at 20k/month.



Location (left) and image (right) of factory after full completion

Production method (from company materials)



Source: Mizuho Securities Equity Research, from company materials, Google Maps etc.

Tesla – Earnings Trend

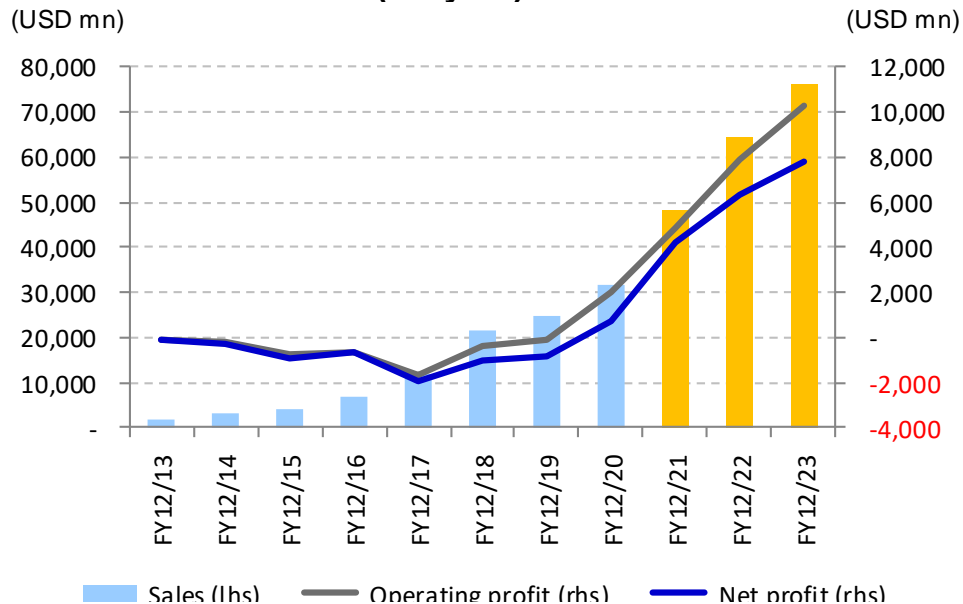
TESLA INC										Consensus As of 2021/2/1		
	(USD mn)	FY12/13	FY12/14	FY12/15	FY12/16	FY12/17	FY12/18	FY12/19	FY12/20	FY12/21	FY12/22	FY12/23
Sales		2,013	3,198	4,046	7,000	11,759	21,461	24,578	31,536	48,374	64,428	76,343
	(Seq%)	+387%	+59%	+27%	+73%	+68%	+83%	+15%	+28%	+53%	+33%	+18%
Gross profit		456	882	924	1,599	2,222	4,042	4,069	6,630	10,826	14,661	17,783
	(Gross margin)	22.7%	27.6%	22.8%	22.8%	18.9%	18.8%	16.6%	21.0%	22.4%	22.8%	23.3%
Operating profit		-61	-187	-717	-667	-1,632	-388	-69	1,994	4,835	7,908	10,257
	(Operating margin)	-3.0%	-5.8%	-17.7%	-9.5%	-13.9%	-1.8%	-0.3%	6.3%	10.0%	12.3%	13.4%
Net profit		-74	-294	-889	-675	-1,961	-976	-862	721	4,232	6,326	7,770
ROE		-18.7%	-37.2%	-87.0%	-22.9%	-43.6%	-21.3%	-14.9%	5.0%	18.6%	21.7%	19.9%
Oper_CF		265	-57	-524	-124	-61	2,098	2,405	5,943	-	-	-
Invest_CF		-249	-990	-1,674	-1,416	-4,419	-2,337	-1,436	-3,132	-	-	-
Fin_CF		629	2,108	1,489	3,737	4,454	551	1,537	10,307	-	-	-
FCF		1	-1,027	-2,159	-1,405	-3,475	-3	1,078	2,786	2,522	4,715	6,699
EBITDA		45	45	-294	280	4	1,513	2,511	4,316	8,294	11,461	14,159
	(EBITDA margin)	2.2%	1.4%	-7.3%	4.0%	0.0%	7.0%	10.2%	13.7%	17.1%	17.8%	18.5%
Dep&Amot		106	232	423	947	1,636	1,901	2,154	2,322	2,691	3,249	3,199
R&D		232	465	718	834	1,378	1,460	1,343	1,491	-	-	-
Net debt to equity ratio		-0.36	0.64	1.28	0.73	1.62	1.68	1.26	-0.35	-	-	-
EPS_basic		-0.12	-0.47	-1.39	-0.94	-2.37	-1.14	-0.98	0.64	3.95	5.97	7.47
EPS_diluted		-0.12	-0.47	-1.39	-0.94	-2.37	-1.14	-0.98	0.64	-	-	-
BPS		1.08	1.45	1.72	5.89	5.02	5.70	7.31	23.50	23.33	29.32	39.72

	(USD mn)	6/18	9/18	12/18	3/19	6/19	9/19	12/19	3/20	6/20	9/20	12/20
Sales		4,002	6,824	7,226	4,541	6,350	6,303	7,384	5,985	6,036	8,771	10,744
	(Seq%)	+17%	+71%	+6%	-37%	+40%	-1%	+17%	-19%	+1%	+45%	+22%
Gross profit		619	1,524	1,443	566	921	1,191	1,391	1,234	1,267	2,063	2,066
	(Gross margin)	15.5%	22.3%	20.0%	12.5%	14.5%	18.9%	18.8%	20.6%	21.0%	23.5%	19.2%
Operating profit		-621	417	414	-522	-167	261	359	283	327	809	575
	(Operating margin)	-15.5%	6.1%	5.7%	-11.5%	-2.6%	4.1%	4.9%	4.7%	5.4%	9.2%	5.4%
Net profit		-718	312	139	-702	-408	143	105	16	104	331	270

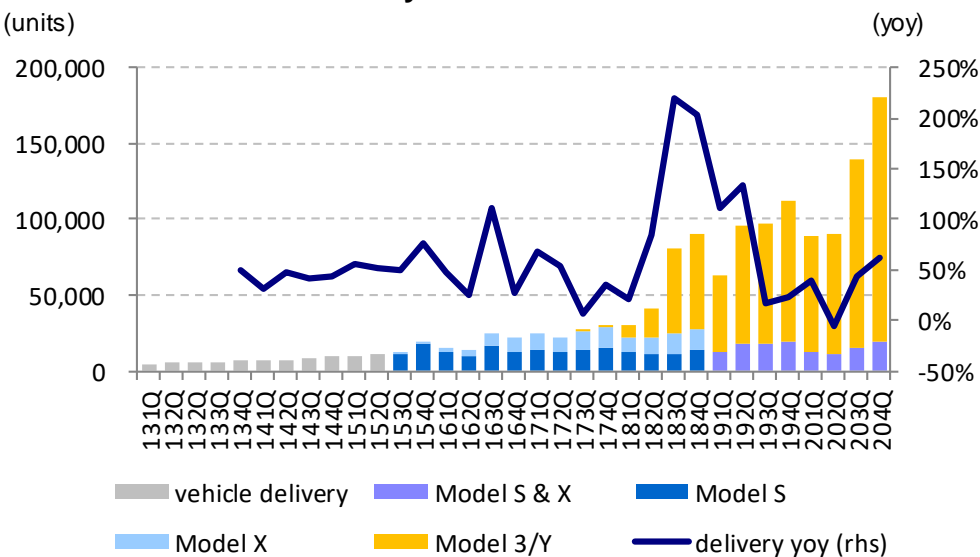
Note: Consensus from Bloomberg, Source: Mizuho Securities Equity Research from Bloomberg

Tesla – Sales volume

Financials / consensus (full-year)



Tesla - total vehicle delivery



Model S



Model X



Note: Consensus from Bloomberg
 Source: Mizuho Securities Equity Research from Bloomberg and company data, Pictures from Tesla Web site

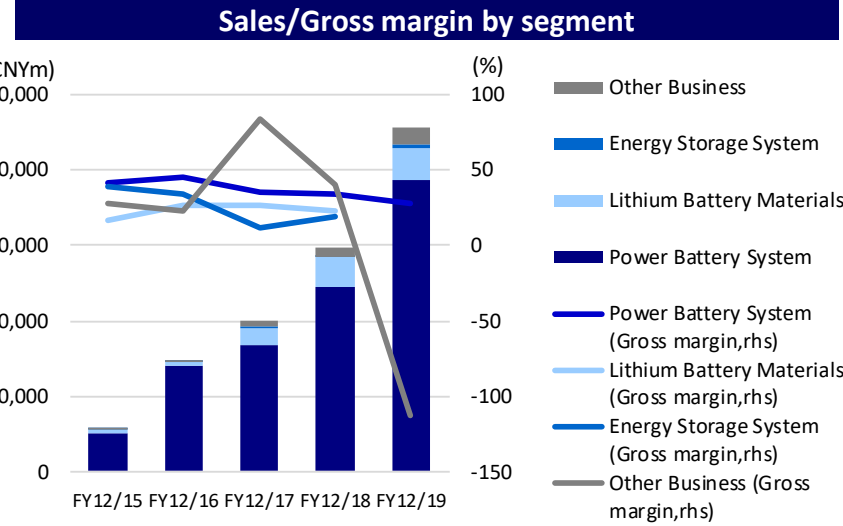
Contemporary Amperex Technology (CATL) : Outlook

(CNY mn)

- Headquartered in Ningde, Fujian, China. Established in December 2011 as a spinoff of Amperex, a Hong Kong battery maker acquired by Japan's TDK
- Major Chinese automotive battery company. Primary operations deal with R&D, production, and sales of automotive batteries, battery cells, battery modules, and battery management system.
- Listing on the Shenzhen Stock Exchange was approved in April 2018. Originally aimed to raise RMB13.1b (about ¥220b) by listing 10% stocks, but reduced the amount to RMB 8.5b in May 2018.
- Plans to build a new factory after Market share to rapidly grow after the Chinese government implements New Energy Vehicle regulations in 2019
- Three business segments: 1) Power Battery System; 2) Lithium Battery Materials; and 3) Energy Storage System
 - Power Battery System: Had largest share of the global automotive lithium ion battery market in volume terms in FY2017,2018 ⇒ expecting 50GWh by 2020 on rapid YoY growth

CONTEMPORARY A-A					
	(CNY mn)	FY12/16	FY12/17	FY12/18	FY12/19
Sales		14,879	19,997	29,611	45,788
	(Seq%)	+163%	+34%	+48%	+55%
Gross profit		6,502	7,257	9,709	13,305
	(Gross margin)	43.7%	36.3%	32.8%	29.1%
Operating profit		3,216	3,530	3,704	5,057
	(Operating margin)	21.6%	17.7%	12.5%	11.0%
Net profit		2,852	3,878	3,387	4,560
ROE		34.1%	19.3%	11.8%	12.8%
Oper_CF		2,055	2,370	11,104	13,210
Invest_CF		-12,428	-7,747	-19,491	1,854
Fin_CF		11,023	9,001	7,286	4,448
FCF		-745	-4,810	4,475	3,583
EBITDA		3,996	4,885	5,925	9,309
	(EBITDA margin)	26.9%	24.4%	20.0%	20.3%
Dep&Amot		779	1,355	2,221	4,252
R&D		1,134	1,632	1,991	2,992

Global sales of lithium-ion battery (GWh)						
	2016		2017		2018	
	Company(Country)	GWh	Company(Country)	GWh	Company(Country)	GWh
1	Panasonic(Japan)	7.2	CATL(China)	12	CATL(China)	23.5
2	BYD(China)	7.1	Panasonic(Japan)	10	Panasonic(Japan)	23.3
3	CATL(China)	6.8	BYD(China)	7.2	BYD(China)	11.6
4	Optimum Nano Energy (China)	3.2	Optimum Nano Energy (China)	5.5	LG Chemical	7.5
5	LG Chemical	2.5	LG Chemical	4.5	AESC(Japan)	3.7



Source: Compiled by Mizuho Securities Equity Research from company data/Bloomberg

Sony (6758)

(JPY mn)	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Sales	7,603,250	8,543,982	8,665,687	8,259,885	8,611,201	9,128,311	9,646,957
Operating profit	288,702	734,860	894,235	845,459	780,745	933,351	1,101,103
Net profit	73,289	490,794	916,271	582,191	881,531	707,240	835,304
EBITDA	615,750	1,096,304	1,268,261	1,262,101	1,195,710	1,358,346	1,561,959
EPS	119.4	58.1	723.4	471.6	722.5	579.6	684.6
EPS_diluted			707.7	461.2	705.0	565.6	668.0
BPS	1,977.7	2,345.0	2,995.3	3,381.0	4,264.8	4,785.0	5,405.0
DPS	20.0	20.0	35.0	45.0	55.0	60.0	65.0
PER	31.5	88.6	6.4	13.6	18.7	23.3	19.7
PER_diluted			6.6	13.9	19.1	23.9	20.2
PBR	1.90	2.19	1.55	1.90	3.17	2.82	2.50
EV/EBITDA	7.4	5.3	4.0	5.2	12.3	10.4	8.7

Investment Rating.....Buy
 Price Objective.....**¥13,500**
 Valuation method FY3/22 SOTP (diluted)

Share Price Drivers

- COVID-19 impact (finished product demand; content production)
- AAPL/Samsung/OVX smartphone production(CMOS sensors)
- PS5 hardware/software demand, PS Plus/Now membership
- Progress in pictures, mobile structural reforms
- US-China relations, and impact on Sony's related businesses
- Share prices and valuations of Sony's competitors
- Forex (dollar depreciation a plus, euro/emerging market currency depreciation a minus)

Note: Valuation based on Price Objective.

Medium-to long-term perspective: Earnings growth and higher valuation multiples likely to lift the share price. Price objective: ¥13,500.

- Price objective SOTP on FY3/22 (EV/EBITDA, PER for Financial Services only): The current share price is around 10x of EV/EBITDA.
- Key point of COVID-19: (1) Sustainability of stay-at-home demand (for games and consumer electronics), (2) Impact on pictures (production/release) and electronics supply-chain
- OP: Expect ¥1.1t in FY3/23. Game/Music/ Sensor are drivers. Pictures to undershoot underlying the segment's OP capacity till FY3/23 due to COVID-19.
- US-China trade relations: Keep an eye on the impact on sensor and entertainment (Pictures/Music/Game).
- Expectations for next MTP (higher valuations): Will it define roadmap for synergies and earnings growth through collaboration among different businesses?
- Scope for share buybacks: Capacity to generate stable OP cash flow. Capacity for at least ¥100b/year consistently.

Conclusion: ¥1t OP in FY3/23; further growth hinges on synergies and B-to-B

- **Stock:** Buy investment rating, ¥13,500 price objective (SOTP based on FY3/22 estimates)
 - Bull in short term: CMOS sensor risk has been factored in. OP likely to exceed guidance this year.
 - Optimistic over the medium to long term: earnings growth + higher valuation multiples (conglomerate premium). 1H 2021 OP likely to decline YoY. Share price fluctuation could present opportunity.
 - I&SS: Covid-19+ Huawei restrictions to result in demand undershoots through 1H FY3/21. Capex, R&D, Foundry utilization may all slow down.
 - Unique business portfolio structure: electronics and entertainment (capacitor-side) businesses have no rivals.
 - Management team: Strongest team to date with Kenichiro Yoshida, Hiroki Totoki, and top managers from different divisions. Quick action when it comes to partnership with MS and aggressive share buybacks.
 - Valuation: EV/EBITDA multiple is low relative to those of competitors. Release from conglomerate discount (shift to conglomerate premium) is key.
 - Risks: Currency movements (weaker EUR, EM currencies), game streaming capabilities, failure to shore up EP&S and pictures, depressed valuation.
- **Earnings:** OP to exceed ¥1t in FY3/23. Company to grow OP CF, allowing for better shareholder returns, while investing in growth opportunities
 - OP estimate: ¥780.7b in FY3/21, ¥933.4b in FY3/22, and ¥1,101.1b in FY3/23. Possible protraction of COVID-19 impact on movies etc.
 - NP estimate: ¥881.52b in FY3/21, ¥707.2b in FY3/22, and ¥835.3b in FY3/23. Further upside possible depending on tax rate, deferred taxes, and asset sales.
 - Cash flow: FCF estimate (excluding financial business) is ¥356.3b in FY3/20, ¥554.0b in FY3/21 and ¥650.8b in FY3/22.
 - Growth investments, shareholder returns: Will likely continue to establish targets for annual share buybacks and continue gradual hiking DPS (dividend payout ratio is currently less than 10%).
- **Market expectations vs management team:** Market wants company's value to quickly increase, whereas management team is operating under a more medium/long-term perspective
 - Investors' expectations: Exit mobile, merge or publicly list entertainment business (majority stake), cut out hardware business (minority stake). Boost company's value.
 - President Yoshida's strategy: Believes in synergies between businesses. Focuses on grip on division management. In other words, the above is unlikely to happen.
 - Conversion of SFH into wholly owned subsidiary: Should be positive for Sony's enterprise value, but some investors have concerns from a valuation perspective. Needs to deliver results.
 - How to unlock value?: Boost EPS + increased dividend via aggressive share buybacks, dialog with market, and better disclosures for entertainment business
 - Currently does not present plans to deal with missing targets, timetable, strategy, or ROIC target. We think disclosure is important.
 - Upside: Synergies among entertainment businesses, profitability in new businesses such as medical devices, collaboration between entertainment and electronics businesses; stronger BtoB; expectations regarding next MTP (FY3/22 – FY3/24).

Sony: Business content

Segment	Sub Segment	FY3/20					Main Products / Services
		Sales		OP		OPM	
		JPYb	Composition ratio	JPYb	Composition ratio		
Game & Network Services(G&NS)	Hardware	371.9	4.5%			5-15%(GPM)	PS4 hardware
	Software	1,126.8	13.6%			30-35%(GPM)	1st/3rd party titles, in Game Sales
	Network	337.3	4.1%			55-60%(GPM)	PS plus (monthly subscription), PS Now(monthly subscription), image/video contents sales
	Others	141.6	1.7%				Peripherals, PS VR
		1,977.6	23.9%	238.4	28.2%	12.1%	
Music	Recorded Music	467.2	5.7%	approx 90-			Music(Sound Source) sales(Streaming, CD, Download)
	Music Publishing	157.5	1.9%	approx 30			Music Charge(Copyright)
	Visual Media & Platform	214.0	2.6%	approx 25			Aniplex(smartpphone app Fate), Management of live music clu
		849.9	10.3%	142.3	16.8%	16.7%	
Pictures	Motion Pictures	475.1	5.8%	approx 40+			Columbia/Tristar/Screen Gems/Funnimation/AXN etc
	Television Productions	301.2	3.6%	approx 23+			Jeopardy!/The Young and the Restless etc.
	Media Networks	234.4	2.8%	approx 5+			Programs distribution, Game Show Network
		1,011.9	12.3%	68.2	8.1%	6.7%	
Electronics Products & Solutions (EP&S)	TV	646.5	7.8%	17.8	2.1%	2.8%	LCD TV, OLED TV
	Audio & Video	346.1	4.2%	33.2	3.9%	9.6%	Audio-related device
	Still and Video Cameras	384.1	4.7%	63.8	7.5%	16.6%	Mirrorless camera, comcorder
	Mobile Communications(MC	362.1	4.4%	-21.1	-2.5%	-5.8%	
	Smartphone	192.1	2.3%	-39.1	-4.6%	-20.4%	smarphone(Xperia series)
	Other MC	170.0	2.1%	18.1	2.1%	10.6%	So-net(ISP), etc.
Other	231.0	2.8%	-21.1	-2.5%	-9.1%	PSG(professional camera and projector, etc.)	
		1,991.3	24.1%	87.3	10.3%	4.4%	
Imaging and Sensing Solutions(I&SS)	Image Sensors	930.2	11.3%	237.8	28.1%	25.6%	CMOS Image Sensor (for smartphones, Auto etc)
	Others	140.4	1.7%	-2.2	-0.3%	-1.6%	Display device, Logic, Discrete
		1,070.6	13.0%	235.6	27.9%	22.0%	
Financial Services		1,307.7	15.8%	129.6	15.3%	9.9%	Life insurance, nonlife insurance, Bank
All Other		251.4	3.0%	16.3	1.9%	6.5%	disc production, storage
Corporate and elimination		-200.4	-2.4%	-72.2	-8.5%	36.0%	
Consolidated Total		8,259.9	100%	845.5	100%	10.2%	

Note: Italic figures are estimated by Mizuho Securities. Source: Mizuho Securities Equity Research from company data

Sony: FY3/21 OP by segment, comparison of new and old forecasts

Segment	FY3/21	FY3/21	FY3/21	FY3/21	FY3/21
	New E	(Sep.11,2020)	(Jun.24,2020)	(Apr.7,2020)	change from the last time
Consolidated	780.7	627.6	667.6	638.9	+153.1
yoy	-8%	-26%	-21%	-25%	
G&NS	314.9	281.1	228.8	226.6	+33.8
Music	162.2	134.4	117.8	108.0	+27.8
Pictures	55.1	46.2	33.7	21.5	+8.9
EP&S	78.3	68.8	43.2	17.9	+9.5
TV	27.5	23.4	9.5	1.8	+4.0
Audio & Video	22.7	25.0	22.4	6.6	-2.3
Still and Video Cameras	28.9	16.3	19.2	15.4	+12.6
Mobile Communications(MC)	24.0	27.1	5.6	1.1	-3.1
Other	-24.7	-23.0	-13.4	-7.1	-1.7
I&SS	118.4	63.0	165.8	183.8	+55.4
Financial Services	158.2	150.7	153.0	169.0	+7.5
All Other	0.4	-4.0	-1.5	-12.5	+4.4
Corporate & Elimination	-106.9	-112.7	-73.2	-75.4	+5.8
(Total restructuring costs / included in the above)	-27.9	-25.0	-24.0	-30.0	-2.9

(JPY b)

Source: Mizuho Securities Equity Research

Sony: Earnings estimates by segment (half year, full year)

Sales revenue	FY3/20		FY3/21		FY3/22		FY3/23		FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	FY3/21
	1H	2H	1H	2HE	1HE	2HE	1HE	2HE						
Consolidated	4,048.0	4,211.9	4,082.4	4,528.8	4,258.0	4,870.3	4,503.5	5,143.5	8,259.9	8,611.2	9,128.3	9,647.0	8,500.0	8,800.0
	yoy	-2%	-7%	+1%	+8%	+4%	+8%	+6%	-5%	+4%	+6%	+6%	+3%	+7%
Game & Network Services(G&NS)	911.9	1,065.7	1,112.7	1,509.2	1,283.4	1,589.8	1,350.5	1,711.7	1,977.6	2,621.9	2,873.2	3,062.2	2,600.0	2,630.0
Music	421.5	428.4	408.0	468.1	463.3	495.4	492.7	522.0	849.9	876.0	958.7	1,014.7	850.0	900.0
Pictures	446.7	565.2	367.4	410.2	416.9	481.3	456.2	519.2	1,011.9	777.7	898.2	975.5	760.0	750.0
Electronics Products & Solutions(EP&S)	977.4	1,013.9	836.5	1,061.9	930.8	1,087.2	939.4	1,101.8	1,991.3	1,898.4	2,018.0	2,041.2	1,870.0	1,890.0
TV	314.2	332.3	311.2	376.1	340.7	377.4	343.9	376.7	646.5	687.3	718.1	720.6	n/a	n/a
Audio & Video	162.5	183.6	131.0	193.8	148.3	198.9	154.3	205.9	346.1	324.8	347.3	360.2	n/a	n/a
Still and Video Cameras	199.9	184.3	136.6	177.9	149.8	184.0	149.6	187.0	384.1	314.5	333.8	336.6	n/a	n/a
Mobile Communications(MC)	178.3	183.9	173.4	191.4	185.7	201.6	186.1	207.9	362.1	364.7	387.4	394.0	n/a	n/a
Other	122.6	129.9	84.3	122.8	106.3	125.2	105.5	124.3	252.4	207.2	231.6	229.8	n/a	n/a
Imaging & Sensing Solution(I&SS)	541.4	529.2	513.3	461.6	513.5	582.7	600.6	640.0	1,070.6	974.9	1,096.2	1,240.7	960.0	1,010.0
Financial Services	714.1	593.6	820.7	613.1	624.1	634.7	646.3	657.6	1,307.7	1,433.8	1,258.8	1,303.9	1,460.0	1,600.0
All Other	138.5	112.9	103.3	101.6	100.2	98.6	97.2	95.6	251.4	204.9	198.8	192.8	0.0	20.0
Corporate and elimination	-103.5	-96.9	-79.5	-97.0	-74.1	-99.4	-79.5	-104.4	-200.4	-176.5	-173.6	-183.9		
Operating profit	FY3/20	FY3/21	FY3/21	FY3/22	FY3/22	FY3/23	FY3/23	FY3/23	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	FY3/21
	1H	2H	1H	2HE	1HE	2HE	1HE	2HE	E	E	E	E	CoE as of 2Q	CoE as of 3Q
Consolidated	509.9	335.6	546.2	234.6	454.6	478.8	547.3	553.8	845.5	780.7	933.4	1,101.1	700.0	940.0
	yoy	+17%	-27%	+7%	-30%	-17%	+104%	+20%	-5%	-8%	+20%	+18%	-17%	+11%
Game & Network Services(G&NS)	138.8	99.6	229.0	85.9	184.0	181.7	225.9	209.0	238.4	314.9	365.7	434.9	300.0	340.0
Music	75.8	66.6	87.7	74.5	83.6	86.9	91.9	94.8	142.3	162.2	170.5	186.7	152.0	180.0
Pictures	39.7	28.5	56.5	-1.4	0.6	52.1	14.3	49.4	68.2	55.1	52.7	63.6	48.0	72.0
Electronics Products & Solutions(EP&S)	66.5	20.8	44.9	33.5	68.7	62.3	77.1	69.6	87.3	78.3	131.0	146.7	67.0	125.0
TV	13.5	4.3	23.5	4.0	24.2	6.0	27.6	4.7	17.8	27.5	30.2	32.3	n/a	n/a
Audio & Video	14.5	18.7	5.0	17.7	10.9	21.1	13.1	22.7	33.2	22.7	32.0	35.8	n/a	n/a
Still and Video Cameras	38.3	25.4	6.0	22.9	14.8	32.0	15.7	33.5	63.8	28.9	46.8	49.2	n/a	n/a
Mobile Communications(MC)	1.7	-22.7	20.5	3.5	18.6	8.5	19.4	10.9	-21.1	24.0	27.1	30.3	n/a	n/a
Other	-1.6	-4.9	-10.1	-14.6	0.3	-5.4	1.3	-2.3	-6.4	-24.7	-5.1	-1.0	n/a	n/a
Imaging & Sensing Solution(I&SS)	125.9	109.7	75.3	43.1	76.7	84.6	91.5	112.3	235.6	118.4	161.3	203.8	81.0	136.0
Financial Services	84.9	44.7	90.9	67.3	80.1	78.7	83.8	82.3	129.6	158.2	158.8	166.1	155.0	170.0
All Other	-0.2	16.5	6.7	-6.3	-1.0	-8.5	-1.0	-7.5	16.3	0.4	-9.5	-8.5	-103.0	-83.0
Corporate & Elimination	-21.4	-50.8	-44.8	-62.1	-38.1	-59.0	-36.2	-56.0	-72.2	-106.9	-97.1	-92.2		
(Total restructuring costs / included in the above)	-9.9	-15.1	-4.4	-23.5	-2.0	-18.0	-2.0	-14.0	-25.0	-27.9	-20.0	-16.0	-25.0	-27.0
Non-operating income/losses	-16.8	-29.2	73.4	-13.4	-10.0	-10.0	-10.0	-10.0	-46.0	68.0	-20.0	-20.0	65.0	180.0
Pretax profit	493.1	306.3	619.5	221.2	444.6	468.8	537.3	543.8	799.5	848.7	913.4	1,081.1	765.0	1,120.0
Net income attributable to Sony's stockholders	340.0	242.2	692.9	119.1	281.2	304.2	351.8	357.1	582.2	881.5	707.2	835.3	800.0	1,085.0
Capital expenditures (consolidated)									513.1	480.0	500.0	500.0	480.0	460.0
Capital expenditures (Sony without Financial Services)									491.4	460.0	481.3	481.3	460.0	440.0
Depreciation & amortization (consolidated)									416.6	415.0	425.0	460.9	415.0	400.0
Depreciation & amortization (Sony without Financial Services)									310.0	335.0	343.7	376.9	335.0	330.0
R&D expenses (incl. fin)									499.3	515.0	510.0	510.0	530.0	530.0

Note: Actual sales figures are adjusted to reflect new segments, subsegment breakdown of actual operating profit are Mizuho Securities estimates

Source: Mizuho Securities Equity Research

Sony: Earnings estimates by segment (quarter)

(JPY bn)

Sales revenue	FY3/20				FY3/21				FY3/22				FY3/23				
	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	
Consolidated	1,925.7	2,122.3	2,463.2	1,748.7	1,968.9	2,113.5	2,487.6	2,041.2	2,068.3	2,189.7	2,676.5	2,193.8	2,191.2	2,312.3	2,840.6	2,302.9	
	yoy	-1%	-3%	+3%	-18%	+2%	-0%	+1%	+17%	+5%	+4%	+8%	+7%	+6%	+6%	+5%	
Game & Network Services(G&NS)	457.5	454.4	632.1	433.6	606.1	506.6	832.7	676.4	660.8	622.6	883.5	706.4	705.8	644.7	970.9	740.8	
Music	202.3	219.3	216.9	211.4	177.1	230.9	235.8	232.3	216.2	247.1	249.1	246.3	230.7	262.0	262.5	259.5	
Pictures	186.1	260.6	236.0	329.1	175.1	192.3	186.4	223.8	203.5	213.4	220.4	260.9	223.1	233.1	238.9	280.3	
Electronics Products & Solutions(EP&S)	483.9	493.5	650.4	363.4	331.8	504.7	638.6	423.4	426.2	504.6	673.6	413.6	427.7	511.8	682.5	419.3	
TV	147.8	166.5	235.9	96.4	106.6	204.6	227.4	148.6	149.1	191.6	245.2	132.2	152.2	191.7	245.0	131.7	
Audio & Video	78.7	83.8	121.7	61.8	47.1	83.9	127.7	66.1	59.9	88.4	131.5	67.4	62.3	91.9	136.1	69.8	
Still and Video Cameras	100.3	99.6	122.0	62.3	46.4	90.2	113.2	64.6	63.6	86.2	117.7	66.4	62.6	87.0	118.5	68.5	
Mobile Communications(MC)	100.6	77.7	113.5	70.4	94.2	79.1	118.1	73.3	102.8	82.9	124.1	77.5	100.0	86.1	128.2	79.6	
Other	56.6	65.9	57.3	72.6	37.6	46.8	52.1	70.7	50.9	55.4	55.1	70.2	50.5	55.0	54.7	69.7	
Imaging & Sensing Solution(I&SS)	230.7	310.7	298.0	231.2	206.2	307.1	274.6	187.0	224.6	288.9	320.7	262.0	258.7	341.9	349.8	290.2	
Financial Services	336.9	377.2	407.2	186.4	446.8	373.9	305.3	307.8	310.7	313.3	316.0	318.7	321.8	324.5	327.4	330.2	
All Other	69.6	68.9	72.3	40.7	54.1	49.2	65.0	36.6	52.5	47.7	63.1	35.5	50.9	46.3	61.2	34.4	
Corporate and elimination	-41.2	-62.3	-49.9	-47.1	-28.3	-51.2	-51.0	-46.0	-26.2	-48.0	-49.9	-49.5	-27.6	-52.0	-52.5	-51.9	
Operating profit	FY3/20	FY3/20	FY3/20	FY3/20	FY3/21	FY3/21	FY3/21	FY3/21	FY3/22	FY3/22	FY3/22	FY3/22	FY3/23	FY3/23	FY3/23	FY3/23	
	1Q	2Q	3Q	4Q	1Q	2Q	3QE	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	
Consolidated	230.9	279.0	300.1	35.4	228.4	317.8	208.4	26.2	214.3	240.3	296.4	182.4	250.9	296.4	336.3	217.5	
	yoy	+18%	+16%	-20%	-57%	-1%	+14%	-31%	-26%	-6%	-24%	+42%	+598%	+17%	+23%	+13%	+19%
Game & Network Services(G&NS)	73.8	65.0	53.5	46.2	124.0	104.9	52.4	33.5	96.5	87.5	87.4	94.3	114.6	111.3	104.7	104.3	
Music	38.3	37.5	36.3	30.3	34.9	52.9	39.0	35.4	39.3	44.3	44.9	42.0	43.3	48.6	48.9	45.9	
Pictures	0.4	39.3	5.4	23.0	24.7	31.8	6.0	-7.3	-1.8	2.4	16.4	35.7	1.8	12.5	17.8	31.6	
Electronics Products & Solutions(EP&S)	25.1	41.4	80.3	-59.5	-9.1	54.0	54.2	-20.7	24.3	44.4	62.7	-0.5	30.0	47.1	65.3	4.3	
TV	1.0	12.5	23.6	-19.3	-2.0	25.5	8.8	-4.8	7.7	16.5	10.2	-4.3	10.9	16.7	8.5	-3.7	
Audio & Video	5.0	9.5	19.4	-0.7	-3.0	8.0	16.2	1.5	2.2	8.7	18.2	2.9	3.7	9.4	19.4	3.3	
Still and Video Cameras	18.5	19.9	29.2	-3.8	-8.0	14.0	21.7	1.2	3.6	11.2	25.6	6.4	3.9	11.8	26.5	7.0	
Mobile Communications(MC)	1.0	0.6	7.0	-29.7	11.0	9.5	6.5	-3.0	10.8	7.8	7.1	1.3	11.0	8.4	9.0	1.9	
Other	-0.4	-1.1	1.1	-6.0	-7.2	-3.0	0.9	-15.6	0.0	0.3	1.5	-6.9	0.5	0.8	2.0	-4.3	
Imaging & Sensing Solution(I&SS)	49.5	76.4	75.2	34.5	25.4	49.8	30.6	12.6	34.7	42.0	51.6	33.1	37.0	54.4	66.2	46.2	
Financial Services	46.1	38.8	32.6	12.1	47.2	43.7	34.3	33.0	40.7	39.4	40.0	38.7	42.6	41.2	41.8	40.5	
All Other	-2.6	2.4	20.7	-4.2	3.5	3.2	-0.8	-5.5	-0.5	-0.5	-0.5	-8.0	-0.5	-0.5	-2.5	-5.0	
Corporate and elimination	0.4	-21.8	-3.8	-46.9	-22.3	-22.5	-7.2	-54.8	-19.0	-19.1	-6.2	-52.8	-18.0	-18.2	-5.9	-50.2	
(Total restructuring costs / included in the above)	-3.6	-6.3	-4.2	-10.9	-0.5	-3.9	-1.0	-22.5	-1.0	-1.0	-3.0	-15.0	-1.0	-1.0	-4.0	-10.0	
Non-operating income/losses	0.1	-16.9	10.2	-39.4	91.5	-18.2	-6.5	-6.9	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	-5.0	
Pretax profit	231.0	262.1	310.3	-4.0	319.9	299.6	201.9	19.3	209.3	235.3	291.4	177.4	245.9	291.4	331.3	212.5	
Net income attributable to Sony's stockholders	152.1	187.9	229.5	12.6	233.3	459.6	129.2	-10.1	127.7	153.5	209.2	95.0	153.3	198.5	238.1	119.0	

Note: Actual sales figures are adjusted to reflect new segments, subsegment breakdown of actual operating profit are Mizuho Securities estimates

Source: Mizuho Securities Equity Research

Sony: B/S estimates

(JPY bn)

Consolidated balance sheet	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Cash and cash equivalents	894.6	826.4	1,046.5	949.4	983.6	960.1	1,586.3	1,470.1	1,512.4	2,569.5	2,858.0	3,017.1
Marketable securities	680.9	697.6	832.6	936.7	946.4	1,051.4	1,176.6	1,324.5	1,847.8	2,025.9	1,778.6	1,842.3
Notes and accounts receivable, trade	840.9	844.1	946.6	986.5	926.4	1,007.0	1,061.4	1,091.2	1,028.8	1,140.5	1,185.8	1,257.2
Inventories	707.1	710.1	733.9	665.4	683.1	640.8	692.9	653.3	590.0	751.4	765.0	779.8
Total current assets	3,755.0	3,646.5	4,204.9	4,197.9	4,196.7	4,355.7	5,176.1	5,246.6	5,735.1	7,313.3	7,438.9	7,796.3
Film costs	270.0	270.1	275.8	305.2	301.2	336.9	327.6	409.0	427.3	446.7	493.4	486.2
Investments and advances	6,319.5	7,317.1	7,919.0	8,531.4	9,234.1	10,111.8	10,756.1	11,724.7	12,734.1	13,560.5	14,305.1	15,175.5
Property, plant and equipment	931.0	861.6	750.0	739.3	820.8	758.2	739.5	777.1	908.6	1,043.6	1,198.4	1,318.3
Intangibles	503.7	694.6	675.7	642.4	615.8	584.2	527.2	918.0	906.3	908.3	901.6	895.8
Goodwill	576.8	643.2	691.8	561.3	606.3	522.5	530.5	768.6	783.9	783.9	783.9	783.9
Total assets	13,295.7	14,211.0	15,333.7	15,834.3	16,673.4	17,660.6	19,065.5	20,981.6	23,039.3	25,607.4	26,684.6	28,038.0
Short-term debt	410.4	244.2	377.8	221.5	336.9	518.1	721.6	791.1	840.0	1,489.3	1,002.3	610.2
Notes and accounts payable, trade	758.7	572.1	712.8	622.2	551.0	539.9	468.6	492.1	380.8	392.4	430.2	456.1
Total current liabilities	4,530.0	4,315.1	4,783.6	4,745.6	4,830.8	5,221.7	5,620.5	6,079.8	6,240.4	6,991.1	6,763.4	6,567.5
Long-term debt	762.2	938.4	916.6	712.1	556.6	681.5	623.5	568.4	635.0	1,273.2	1,273.2	1,273.2
Fixed liabilities	6,255.6	7,220.9	7,762.9	8,155.0	8,710.8	9,291.3	9,788.6	10,456.3	12,001.6	13,392.0	14,053.7	14,838.0
Total liabilities	10,785.5	11,536.0	12,546.5	12,900.6	13,541.5	14,513.1	15,409.2	16,536.1	18,242.0	20,383.1	20,817.1	21,405.5
Redeemable noncontrolling interest	20.0	3.0	4.1	5.2	7.5	12.1	9.2	8.8	7.8	7.8	7.8	7.8
Common stock	630.9	630.9	646.7	707.0	858.9	860.6	865.7	874.3	880.2	880.2	880.2	880.2
Additional paid-in capital	1,160.2	1,110.5	1,127.1	1,185.8	1,325.7	1,275.3	1,282.6	1,266.9	1,289.7	1,289.7	1,289.7	1,289.7
Retained earnings	1,084.5	1,094.8	940.3	813.8	936.3	984.4	1,440.4	2,320.6	2,768.9	3,847.3	4,482.1	5,238.6
Accumulated other comprehensive income	-842.1	-639.5	-451.6	-385.3	-653.3	-618.8	-616.7	-610.7	-581.0	-581.0	-581.0	-581.0
Treasury stock, at cost	-4.6	-4.5	-4.3	-4.2	-4.3	-4.3	-4.5	-104.7	-232.5	-232.5	-232.5	-232.5
Total Sony Corporation's stockholders' equity	2,028.9	2,192.3	2,258.1	2,317.1	2,463.3	2,497.2	2,967.4	3,746.4	4,125.3	5,203.8	5,838.5	6,595.0
Noncontrolling interests	461.2	479.7	525.0	611.4	661.1	638.2	679.8	690.3	664.2	12.7	21.2	29.7
Total equity	2,490.1	2,672.0	2,783.1	2,928.5	3,124.4	3,135.4	3,647.2	4,436.7	4,789.5	5,216.5	5,859.7	6,624.7
Total liabilities and equity	13,295.7	14,211.0	15,333.7	15,834.3	16,673.4	17,660.6	19,065.5	20,981.6	23,039.3	25,607.4	26,684.6	28,038.0

Source: Mizuho Securities Equity Research

Sony: C/F Financial indicator estimates

(JPY bn)

Consolidated Cash Flow Statement	FY3/12	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Net income	-398.4	101.7	-68.8	-49.0	209.7	127.6	547.3	966.6	622.3	890.0	715.7	843.8
Depreciation & amortization	319.6	376.7	376.7	354.6	397.1	327.0	361.4	374.0	416.6	415.0	425.0	460.9
Cash flows from operating activities	519.5	476.2	664.1	754.6	749.1	809.3	1,254.0	1,258.7	1,349.7	1,459.8	2,005.2	1,909.2
Payments for purchases of fixed assets	-382.5	-326.5	-283.5	-215.9	-375.4	-333.5	-263.0	-312.6	-439.8	-480.0	-500.0	-500.0
Cash flows from investing activities	-882.9	-705.3	-710.5	-639.6	-1,030.4	-1,254.0	-823.1	-1,307.4	-1,352.3	-1,227.2	-1,157.3	-1,279.1
Issuance of shares					301.7							
Cash flows from financing activities	257.3	88.5	207.9	-263.2	380.1	452.3	246.5	-122.9	65.7	1,224.5	-559.5	-471.0
Cash and cash equivalents at end of the fiscal year	894.6	826.4	1,046.5	949.4	983.6	960.1	1,586.3	1,470.1	1,512.4	2,969.5	3,258.0	3,417.1
Consolidated												
(Own capital)	2,028.9	2,192.3	2,258.1	2,317.1	2,463.3	2,497.2	2,967.4	3,746.4	4,125.3	5,203.8	5,838.5	6,595.0
(Equity ratio)	15.3%	15.4%	14.7%	14.6%	14.8%	14.1%	15.6%	17.9%	17.9%	0.2	0.2	0.2
(Interest-bearing debt)	1,172.6	1,182.6	1,294.4	933.6	893.5	1,199.5	1,345.1	1,359.5	1,474.9	2,762.5	2,275.6	1,883.4
(Net debt)	278.0	356.2	247.9	-15.8	-90.1	239.4	-241.3	-110.6	-37.4	-207.0	-982.4	-1,533.6
(Free cash flow)	-363.3	-229.1	-46.4	115.0	-281.3	-444.7	430.9	-48.7	-2.5	232.6	847.9	630.1
Sony without financial services												
(Own capital)	1,651.9	1,722.3	1,722.7	1,733.2	1,796.9	1,770.6	2,173.1	2,850.4	3,159.1			
(Equity ratio)	28.6%	29.7%	28.1%	29.2%	30.2%	30.4%	34.7%	40.3%	42.8%			
(Interest-bearing debt)	1,148.6	1,148.9	1,247.0	886.3	769.1	716.1	710.3	562.8	480.0	1,190.9	1,071.5	639.6
(Net debt)	429.1	524.1	440.9	144.4	19.1	24.4	-482.9	-397.7	-482.3	-775.5	-1,257.0	-1,829.0
Cash flows from operating activities	176.1	38.5	257.2	303.7	262.8	445.8	770.6	753.4	762.9	831.3	1,049.6	1,145.6
Cash flows from investing activities	-321.5	-49.8	-94.3	-103.6	-334.9	-299.4	-164.0	-520.4	-363.1	-475.1	-495.6	-494.8
(Free cash flow)	-145.4	-11.3	162.9	200.0	-72.1	146.3	606.7	233.1	399.8	356.3	554.0	650.8

Source: Mizuho Securities Equity Research

Sony: Estimates of sales and sales volumes for key electronics products

		FY3/17	FY3/18	FY3/19	FY3/20	FY3/21 E	FY3/22 E	FY3/23 E	FY3/20 CoE
MC									
Smartphone	(000s)	14,600	13,500	6,500	3,200	2,960	3,230	3,260	n/a
IP&S (DI)									
Camcorder	(000s)	712	699	540	377	250	250	250	n/a
DSC (compact)	(000s)	2,626	2,635	1,781	1,342	980	850	830	n/a
DSLR	(000s)	1,574	1,765	1,819	1,458	1,270	1,350	1,280	
HE&S									
TV	(000s)	12,100	12,400	11,300	9,300	9,415	9,729	9,626	n/a
G&NS									
PS4	(000s)	20,000	19,000	17,800	13,400	5,550	833	125	n/a
(accum. unit sales since launch)	(000s)	60,000	79,000	96,800	110,200	115,750	116,583	116,707	n/a
PS5	(000s)	-	-	-	-	7,900	16,613	19,823	at least
(accum. unit sales since launch)	(000s)	-	-	-	-	7,900	24,513	44,336	7,500
Number of PS Plus subscribers (End of FY)	(m)	26.4	34.2	36.4	41.5	46.4	49.4	51.0	
Number of PS Now subscribers (End of FY)	(m)					3.7	5.3	6.4	
Hardware Sales	(JPY bn)	598.4	590.6	527.7	371.9	503.4	766.0	861.2	n/a
Software Sales	(JPY bn)	711.0	920.1	1,293.7	1,126.8	1,634.1	1,622.8	1,680.0	n/a
Network sales (net)	(JPY bn)	189.2	271.0	326.5	337.3	389.3	434.4	469.1	n/a
I&SS									
(image sensor)	(JPY bn)	548.6	649.4	711.4	930.2	848.3	968.0	1,110.8	820.0
MC									
Smartphone	(yoy)	-41%	-8%	-52%	-51%	-8%	+9%	+1%	n/a
IP&S (DI)									
Camcorder	(yoy)	-45%	-2%	-23%	-30%	-34%	+0%	+0%	n/a
DSC (compact)	(yoy)	-33%	+0%	-32%	-25%	-27%	-13%	-2%	n/a
DSLR	(yoy)	-28%	+12%	+3%	-20%	-13%	+6%	-5%	
HE&S									
TV	(yoy)	-1%	+2%	-9%	-18%	+1%	+3%	-1%	n/a
G&NS									
PS4	(yoy)	+13%	-5%	-6%	-25%	-59%	-85%	-85%	n/a
(accum. unit sales since launch)	(yoy)	+50%	+32%	+23%	+14%	+5%	+1%	+0%	n/a
PS5	(yoy)	-	-	-	-	-	+110%	+19%	-
(accum. unit sales since launch)	(yoy)	-	-	-	-	-	+210%	+81%	-
Hardware Sales	(yoy)	-17%	-1%	-11%	-30%	+35%	+52%	+12%	n/a
Software Sales	(yoy)	+27%	+29%	+41%	-13%	+45%	-1%	+4%	n/a
Network sales (net)	(yoy)	+47%	+43%	+21%	+3%	+15%	+12%	+8%	n/a
I&SS									
(image sensor)	(yoy)	+15%	+18%	+10%	+31%	-9%	+14%	+15%	-12%

Notes: Certain figures for prior years are Mizuho Securities estimates.
Source: Mizuho Securities Equity Research

Sony: SOTP Valuations by business

Price objective uses median value from sum-of-the-parts analysis

						(JPY b)	
FY3/21E	EBITDA	EV/EBITDA multiple			Estimated business value		
Game & Network Services (G&NS)	403.5 ×	13.0	~	14.0	=	5,245.4 ~	5,648.9
Entertainment(Music+Pictures)	278.3 ×	14.0	~	15.0	=	3,896.0 ~	4,174.3
Electronics Products & Solutions(EP&S)	150.5 ×	8.5	~	9.5	=	1,279.6 ~	1,430.2
Imaging & Sensing Solution (I&SS)	309.1 ×	14.0	~	15.0	=	4,327.3 ~	4,636.4
Other/Corporate/Elimination	-23.2 ×	12.4	~	13.4	=	-286.9 ~	-310.1
Net debt (Sony without Financial Services / convertible bonds)						-1,377.0 ~	-1,377.0
Estimated SFH equity value						454.2 ~	454.2
Total estimated EV attributable to shareholders						16,292.7 ~	17,410.9
# of shares fully diluted (m)						1,250 ~	1,250
Per share (diluted/¥)						13,029 ~	13,924
Median							13,477

Note: Number of companies used for EV/EBITDA multiple comparisons in each segment is as follows: Five for the G&NS segment (including Nintendo and Activision Blizzard), five for Entertainment (music & pictures) (including The Walt Disney Company), fourteen for EP&S (including JVCKENWOOD), five for I&SS (including Murata Mfg.). The weighted average of all segments is used for the others segment and corporate & elimination. EV/EBITDA multiples for peer companies reference Bloomberg consensus estimates. Estimated SFH equity value is calculated by applying a multiple of 10x to forecast FY3/22 NP. Source: Mizuho Securities Equity Research

Sony CMOS sensor business

■ Present (estimates for FY3/20): Sales around ¥930.2b, 80% for mobile and 20% for DSC and others

- Plants: Nagasaki (mobile + laminating), Kumamoto (non-mobile + laminating), Yamagata (mobile), Oita (mobile).
- Foundry: Fujitsu (sensors), TSMC (logic). Production capacity is 138K/M including the foundry. Shipment of around 1.6b/year.
- Sales: 80% from mobile. 1) Apple's iPhone/iPad, 2) Huawei, 3) Oppo, Xiaomi and Vivo, 4) Samsung and others. 20% from DSC (e.g., Sony and Nikon), surveillance cameras, FA, and cameras for automobiles. Shipments to Huawei temporarily halted on 14 Sep. Partially resumed after approval from US government. Steadily resuming shipments for Honor.
- Demand drivers: smartphones up until FY23. Shift to multilens cameras (2-4 lenses), ToF, larger chips (emphasizing sensitivity).
- Profitability: Economies of scale and improved mix (higher ASPs) to result in OPM of over 25% at full utilization.
- Rivals: Samsung LSI (production capacity is 63K, specialized in mobile, Samsung/Vivo are main customers), On Semi, Omnivision (Will semi), Hynix, etc.
- Competitive strengths: production capacity, process, layered structure (Sensor/DRAM/Logic) related technology, energy efficient, labor saving, dominating rivals and their customer bases.

■ Future: Sales exceeding ¥2t and OP exceeding ¥400b. Positive expectations for secondary drivers such as automotive/industrial applications in addition to mobile.

- Capacity expansion outlook: to 120k/M in FY3/20 and 138k/M in FY3/21 (using existing space); startup of new plant in Nagasaki from April 2021 → assume half-year delay to October 2021
- CMOS sensors: Trend toward larger format smartphone cameras, more lenses, likely to continue through 2023 mainly for Apple/Huawei/Samsung. Some Chinese firms such as Xiaomi focusing on high pixels.
- Client strategy: Now focusing on Apple/Huawei. Aims to gain custom of Oppo/Vivo/Xiaomi/Samsung. Clients increasing with revival of Honor, Shanghai (P/Mate).
- Technology strategy: Revises strategy from focusing on large format and 0.8 μm or above, to 1) miniaturization to 0.7 μm and 0.6 μm ; 2) investment in high-definition sensors of 100 Mp or more.
- ToF sensors: Beacon of hope. One of the new drivers. First for smartphones (HW/SS in 2019 → AAPL in 2020) and then for automobiles. Smartphone products slightly sluggish on APP shortage.
- CMOS sensors for automobiles: growth driver from FY22. Likely to be adopted for viewing cameras for Level-3 and higher self-driving technology. OEM (e.g., Toyota and Tesla), Tier1 (Denso and Bosch) and collaborations with Mobileye. Large size, high unit prices, but small quantities. Likely to achieve sales of ¥100b in around FY23-FY24.
- Intelligent Vision Sensor: AI DSP/Memory layering. Offline image analysis (low latency, safety, LP). Compatibility with various applications, including writing AI models to memory, smartphones/smart speakers, and surveillance cameras.
- Capex: over ¥150b per year, will exceed ¥200b when investing in new plants. However, level may be lower in FY3/22 due to delayed startup of mass production at the new plant in Nagasaki.
- Challenges: increasing number of developers (seems to be a shortage), reducing lead times (pre-production and mass production), development of applications besides smartphones. Growth in OPCF (+ improved FCF) via higher profitability (better margins).

Sony CMOS sensors sales: estimated breakdown (assumes zero shipments to Huawei from 2H)

- Huawei sanctions→around ¥130b in 1H (up to 14 Sep). Receives US approval; assume a small sales booking in 2H also. Estimate around ¥45.0b for Honor and Shanghai (P/Mate).
- OP: We forecast ¥118.4b in FY3/21(company guidance is ¥81b), ¥161.3b in FY3/22 and ¥203.8b in FY3/23.
- Who will step in? → Limits to growth in AAPL/Samsung demand, increased sales to OVX. Some earnings impact unavoidable.
- FY3/22: Lift from growth in AAPL/SS demand, increased sales to OVX expected. Sales toward former Huawei depends on revival/timing/re-launch speed of Honor and Shanghai (P/Mate).

(JPYb)

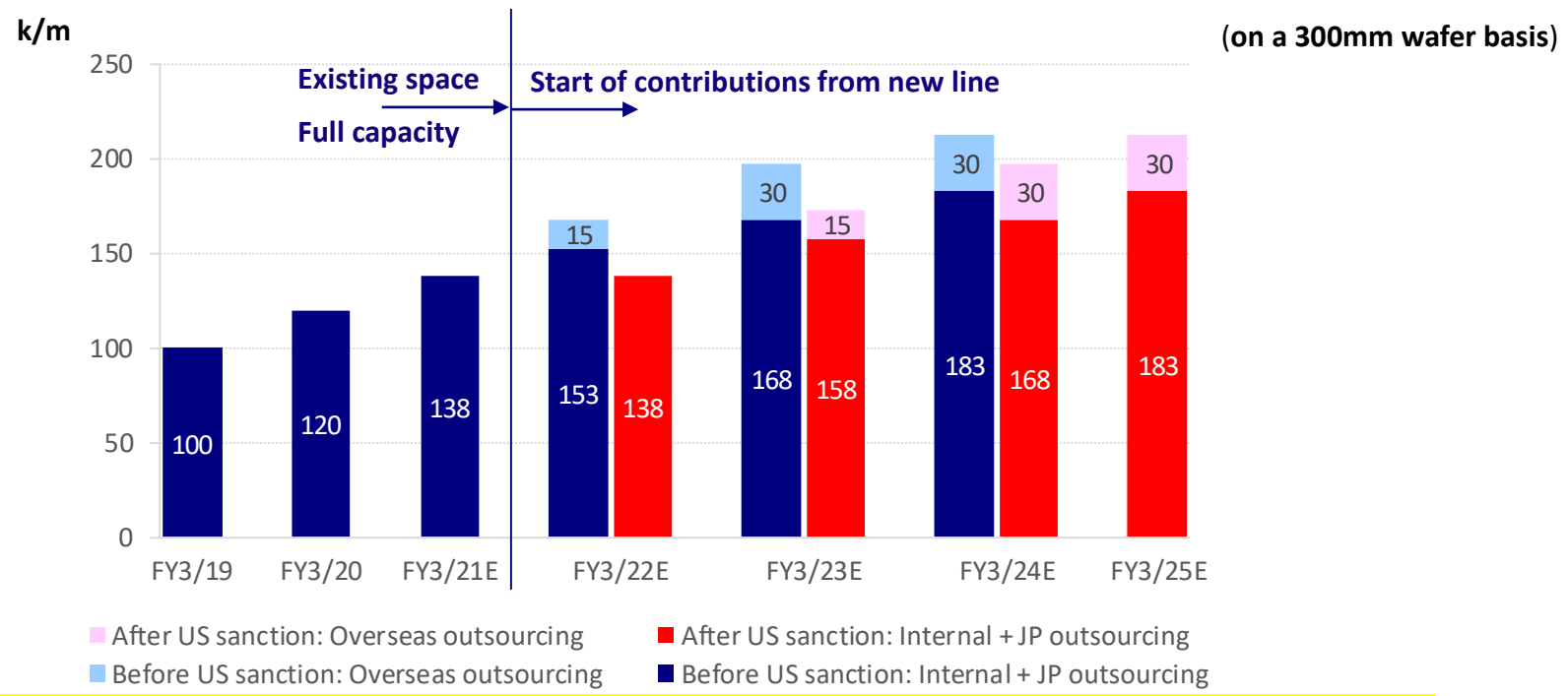
	FY3/19	FY3/20	FY3/21F					FY3/22			M/S (Vol)
			as of Nov. (Before COVID-19)	as of Apr. (After COVID-19)	as of Jun.	as of Sep.	as of Dec. (Latest)	as of Jun.	as of Sep.	as of Dec. (Latest)	
Apple	270	310	380	355	355	355	365	390	410	430	100%
Huawei	150	290	360	320	280	130	135	260	0	0	45~50%
P + Mate										30	
Honor										15	
Oppo	40	55	80	40	40	50	60	50	95	95	30~35% ↑
Vivo	5	10	40	10	20	20	20	25	40	40	5~10% ↑
Xiaomi	50	40	50	40	50	40	45	60	65	65	25~30%
Samsung	55	90	90	100	95	105	100	115	140	150	20%
Others	5	5	0	5	10	10	15	15	30	30	
Non Mobile	135	130	140	115	109	101	108	119	129	113	
Total Sales	710	930	1,140	985	959	811	848	1,034	909	968	
I&SS segment OP	144	236	257	184	166	63	118	201	142	161	

Source: Mizuho Securities Equity Research

Huawei Technologies: Impact on Sony CMOS sensor business

- **How to read the impact:** Revised targets assume no sales from 2H. Potential upside if circumstances change
 - Huawei output volume : 2020: 180m. 2021: 40m at Huawei (however, sensors are in stock). Honor: 30m–40m (ODM+30m), P/Mate (assuming a spinout): 20m
 - **Impact by decreased sales to Huawei:** Previous forecast ¥280b→¥130b in FY3/21. Previous ¥260b → looking at zero in FY3/22. Now we expect an increase in these values of ¥135b in FY3/21 and of ¥45b in FY3/22.
 - **Approval from the US? Downward pattern. No prospects for 5G-related semiconductor procurement at Huawei, so full-scale revival under current circumstances appears difficult.**
 - **FY20: Company target after revision of ¥820b (I&SS overall at roughly ¥960b); I&SS OP: Upside potential to ¥81b. Our sales forecasts for CMOS sensor :¥848.3b and OP for I&SS segment: ¥118.4b. Slight increase in sales to Huawei, 4Q increase in utilization rate; background factor is a reversal from inventory write-downs in 2Q.**
 - **FY21: We revised our sales estimate for CMOS sensor from ¥909.7b to ¥ 968.0b and revise I&SS OP from ¥142.1b to ¥161.3b.**
 - **FY22: Our estimate for CMOS sales: ¥1.11t, I&SS OP: ¥203.8b.**
- **Sony's potential response:** Entering difficult phase where strategy must be formed despite high uncertainty
 - **Increase shipments to AAPL/Samsung:** More volume to Apple likely. For M/S, passive since 100%. Likely to increase sales for work with Samsung on increase in volume + marketing
 - **Higher sales to China-based OVX:** Sony's share is small. Chances for Vivo, Xiaomi and Oppo which is focused on high-end devices. However, price support and low-pixel support are also needed.
 - **What if we see Honor response or P/Mate revival?:** Need to reallocate development resources and production capacity. Need for strategic planning while gauging the outcome of competition among customer companies.
 - **Capex plan changes (1):** Existing building investment 138,000/month (March 2021) slated for completion in March 2021. Delayed equipment installation at the Nagasaki new building (Phase 1: 15,000 wafers). Mass production moved slightly forward: 2Q 2021→2Q 2022 →4Q 2021?
 - **Capital plan changes (2) and foundry utilization outlook:** Delaying new building Phase 2 and 3 in accordance with Phase 1, also **assume trial operation of sensor process foundry at TSMC at minimum scale**
 - **Depreciation costs and R&D expenses:** Amortization costs depend on investment target; development costs continue to increase as number of customers and products in development rise.
 - **Increase non-mobile sales:** Aims to expand sales and accelerate deal acquisition in automotive, industrial, and medical areas
 - **Conclusions: Still expecting longer-term growth in demand and profit expansion at Sony.**

Forecast of Sony CMOS sensor capacity expansion(Nagasaki: postponement shortened from one year to six months)



- ★ **Depends on trends at Huawei: Construction of new wing in Nagasaki in FY3/21, +15K investment; mass production was expected to be postponed from spring 2021 to spring 2022 (roughly one year) due to delivery delays, etc., but could be brought forward slightly to autumn 2021**
- ★ **Nagasaki new building Phase 2 and 3: Likely to implement with an interval of a year or longer after conducting Phase 1**
- ★ **Foundry: First sensor (Master) outsourcing is expected to be a small-scale operation after April 2022**
- ★ **Longer-term demand outlook unchanged, but . . . : difficult to decide because in the best case investment would have to be sped up, while in the worst case you may have excess capacity.**

Note: Overseas outsourcing shows the maximum production capacity that can be captured by foundries
 Source: Mizuho Securities Equity Research

Onboard cameras in cars with driverless technologies

Front: 2 – 4 units



Single-lens camera + millimeter waver radar OR stereo cameras: use in lane detection, bicyclist/pedestrian detection, sign identification, signal detection

Night vision camera: detects bicyclists, pedestrians at night

Rear: 6 units



Electric interior rear-view mirror camera

Rear and diagonal rear sensors: necessary for lane changes *radar also possible

Rear view camera: mandatory in the US from May 2018

Side sensor: *radar also possible

Side: 2 – 4 units



Electric side mirror camera

Interior: 1 unit



Camera for monitoring the driver: checks line of sight, direction driver's face is pointed

- Sensing camera
- Viewing camera

Source: Compiled by Mizuho Securities Equity Research from company HP and compmany data

Samsung Semiconductor: CMOS Image Sensor

SEC's CIS capacity expansion outlook

SEC's CIS capacity forecast

SEC's CIS capacity trend (K WPM, Quarter-end basis)

		1Q19	2Q19	3Q19	4Q19	1Q20	2Q20	3Q20	4Q20	1Q21E	2Q21E	3Q21E	4Q21E
S1+ S2	CIS	38	38	38	38	38	38	38	38	36	36	36	36
Line 11 (S4)	DRAM	0	0	0	0	0	0	0	0	0	0	0	0
	CIS	13	15	15	15	20	20	25	25	25	25	25	25
Line 13	DRAM	100	100	100	100	80	55	55	55	55	55	55	55
	CIS									5	10	14	14
U1 + M1	CIS												
Total		51	53	53	53	58	58	63	63	66	71	75	75

SEC's CIS capacity trend (K WPM, Year-end basis)

		2015	2016	2017	2018	2019	2020	2021E	2022E	2023E	2024E	2025E
S1+ S2	CIS	30	34	38	38	38	38	36	36	36	36	36
Line 11 (S4)	DRAM	50	50	20	0	0	0	0	0	0	0	0
	CIS	0	0	0	10	15	25	25	25	30	30	30
Line 13	DRAM	100	100	100	100	100	55	55	55	55	55	55
	CIS							14	14	14	14	14
U1 + M1	CIS								10	22	38	43
Total		30	34	38	48	53	63	75	85	102	118	123

Source: Mizuho Securities Equity Research from company data

SONY EV-VISION-S

What is VISION-S?

- The Vision-S is a prototype EV that Sony unveiled at CES 2020. Sony has no plan of mass production. Development is led by Sony's AI robotics biz team (the team that developed "aibo"), and Sony will partner with Magna Steyr on production (with Sony in charge of design).
- It features an advanced audio/infotainment system and interior/exterior sensors for passenger comfort and safety.
- Sony announced collaboration with Almotive at CES2021. This ensures that Vision-S will satisfy high safety standards with the use of Almotive's automatic driving technology.
- Vision-S prototype has already been tested on public roads in Austria.

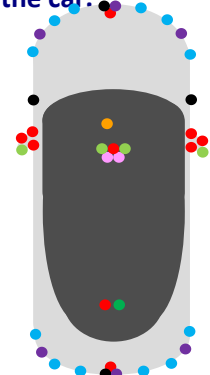
Spec

- Length X Width X Height : 4,895mm X 1,900mm X 1,450mm
- Wheelbase : 3,030mm
- Weight : 2,350kg
- Motor : 200kW X 2 (front x rear)
- Passengers : 4 seats with individual speaker
- Suspension : Double wishbone front and rear
- Drive : All-Wheel Drive
- Ground Clearance : 120~135mm
- Tire size : F : 245/40R21, R : 275/35R21
- Vmax : 240km/h(4.8 s 0-62 mph, 0-100km/h)



Sensor

- There are a total of 40 automotive grade sensors (including Sony CMOS sensors) installed both inside and outside the car.
 - IMX390 X 10 (resolution : 1,937 X 1,217)
 - IMX456 X 2 (resolution : 640 X 480)
 - IMX490 X 4 (resolution : 2,880 X 1,860)
 - Inner Electronic Mirror Camera X 1
 - Driver Monitoring Camera X 1
 - Ultrasonic X 12
 - Rader X 6
 - Solid State LiDAR X 4
- Autonomous driving: Level 2+ (targets eventual upgrade to Level 4 via software updates)
- Mirrors: A central driver-side monitor displays high-resolution images of the sides of the vehicle. Brightness level can be adjusted if there is glare.
- Safety: Over half of the sensors are used to create a 'safety cocoon' that monitors the vehicle's surroundings. Sensors inside the car detect and measure the driver's concentration and alertness levels.
- Comfort: The car can detect the driver's conditions and automatically adjust the interior temperature and/or seat recline.



Entertainment

- 360 REALITY AUDIO: The immersive, spatial audio technology unveiled by Sony at CES 2019. Speakers are installed in each seat and throughout the car's interior. Separate content can be enjoyed from each individual passenger seat.
- Panoramic display: Music, games, and videos can be accessed via a screen that covers the entire dashboard.

Source: Mizuho Securities Equity Research from company data and media reports

Automotive LiDAR using SONY SPAD pixels

Outline

Industry's first SPAD pixel-using stacked direct dToF distance sensor announced at ISSCC (International Solid-State Circuits Conference) in February 2021

Characteristics

- SPAD pixels can measure distances up to 300m at 15cm intervals
- Real-time recognition of surrounding conditions with high-speed ranging processing
- Cost reduction and miniaturization of LiDAR achieved by integrating SPAD pixels and distance measurement processing circuit into one chip
- Achieves stable photon detection efficiency and response speed even under harsh conditions of -40 to 125 Celsius due to the unique SPAD pixel structure.

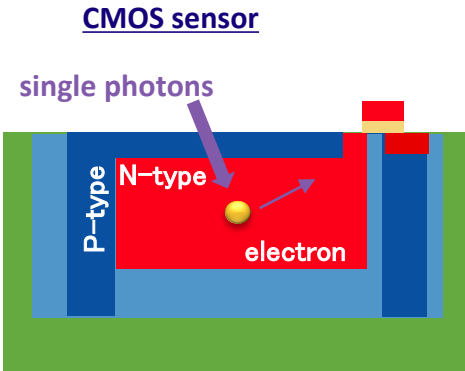
Specs

- Total number of SPAD pixels : 189 x 600 pixels (H x V), approx. 110,000 pixels
- Distance precision at 300 m :
 - ✓ 3 x 3 pixels (H x V) additive mode: 30 cm
 - ✓ 6 x 6 pixels (H x V) additive mode: 15 cm
- Max. detection distance : 300m
- Recommended light source wavelength : 905nm (wavelength used in general automotive LiDAR)
- Photon detection efficiency: 22%, Response speed: 6ns
- Power consumption: 1,192mW, Image size : Diagonal 6.25 mm (1/2.9-type)

What is SPAD Pixels?

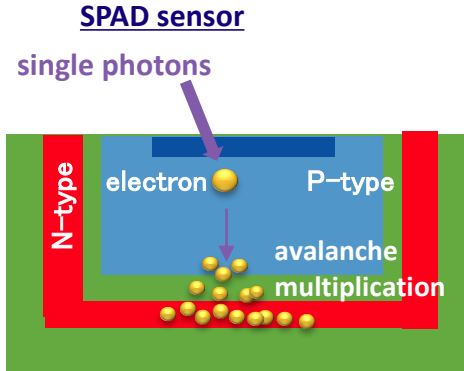
- SPAD(Single Photon Avalanche Diode) :
 - ✓ When one incident photon in a pixel triggers multiplication like an avalanche, even weak light can be detected.
 - ✓ A sensor with a structure in which electronic elements that output large electric pulse signals are arranged for each pixel.

Pixel Structure of CMOS / SPAD sensor



Multiplication rate ~1x

Due to the influence of noise, it may not be possible to correctly recognize that one photon has entered and the accuracy may decrease.



Multiplication rate ~1m x

Correctly recognizes that one photon has entered; increases information accuracy by multiplying.

※P-type (semiconductor): Intrinsic semiconductor with boron (B) etc. added as an impurity
 N-type (semiconductor): Intrinsic semiconductor with phosphorus (P) and arsenic (As) added as impurities

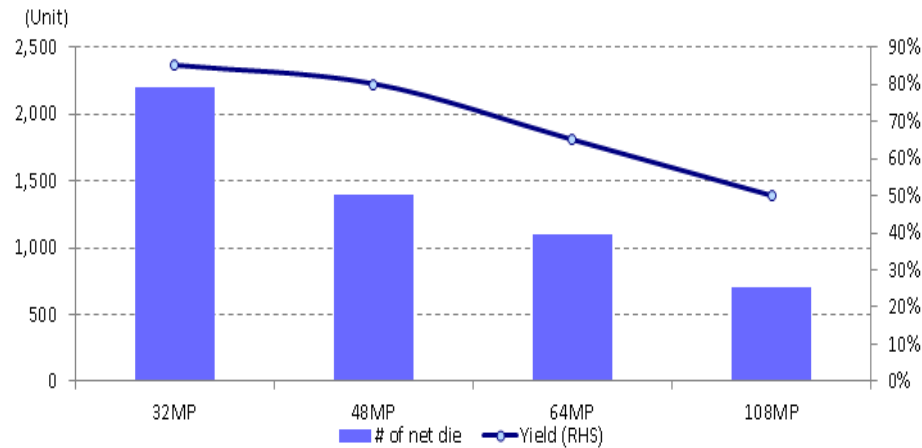
Source: Mizuho Securities Equity Research from company data and Canon HP

Samsung Semiconductor: CMOS Image Sensor

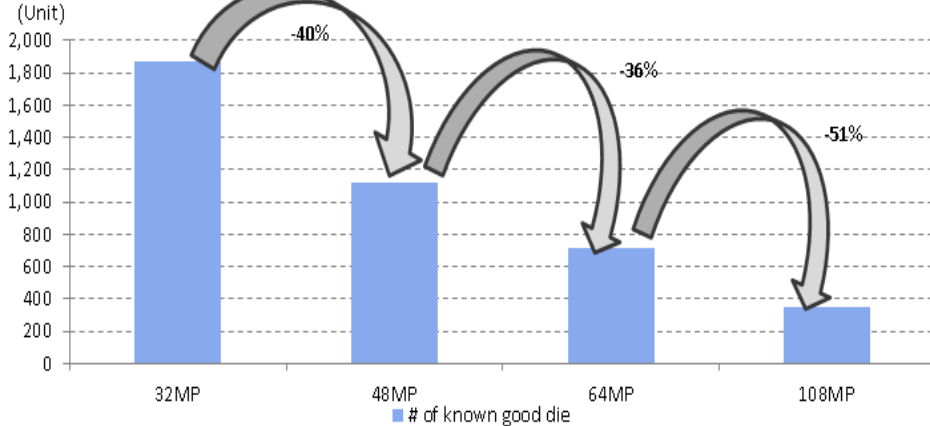
Three major reasons for Samsung's aggressive CIS capacity expansion plan

- (1) In the near term, Samsung continues to see strong CIS demand growth from rapid growth in multiple camera adoptions. On the flip side, supply for high-end CIS continues to remain tight given limited capacity expansion for high-end CIS. Accordingly, Samsung wants to add CIS capacity to meet surging demand from smartphone in the near term. In addition, ongoing oversupply in the DRAM market has provides Samsung with more motivation to convert DRAM capacity to CIS.
- (2) In the mid/long-term, Samsung forecasts that CIS demand will show structural and sustainable growth, largely in light of ongoing enhancement in average camera resolution in consumer IT products together with expanding CIS adoptions in new applications such as automotive.
- (3) Last but not least, known good die of Samsung CIS is estimated to decrease exponentially, primarily due to sharply decreasing both net die and production yields for high-resolution CIS products on account of substantial increase in CIS chip size.

SEC's CIS net die and yield by products



SEC's CIS known good die by products



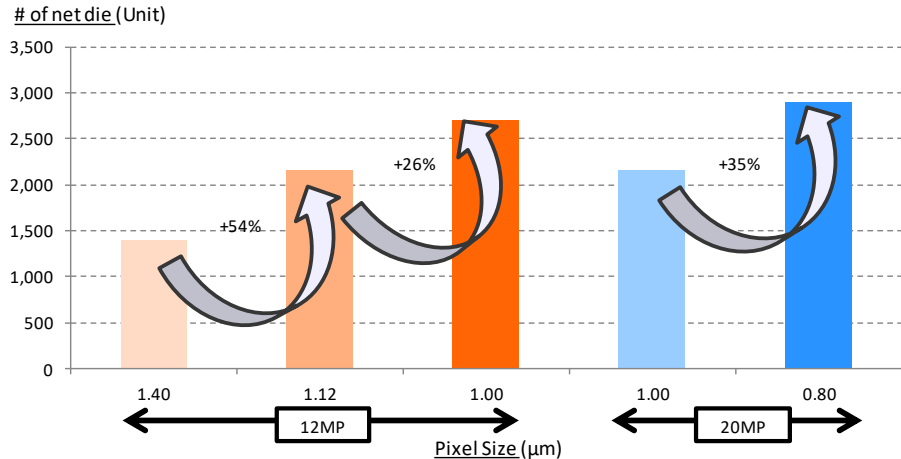
Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

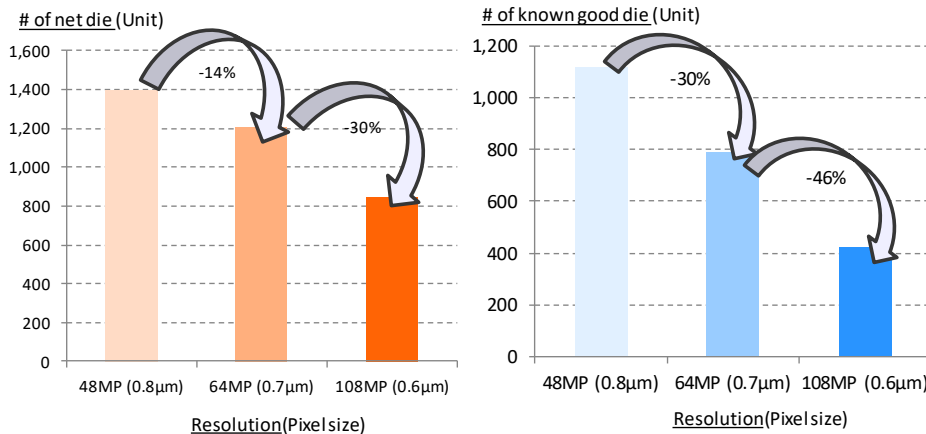
Analysis on net die growth impacts from pixel size shrink

- SEC's two major directions for mobile CIS roadmaps
 - ✓ (1) **Higher resolution:** SEC strategically focuses on developing high resolution CIS to expand customer base more effectively as SEC views that Chinese smartphone makers prefers to leverage higher CIS resolution as one of major marketing tools. SEC recently launched 108MP CIS and plans to roll out even higher resolution CIS.
 - ✓ (2) **Smaller pixel size:** SEC concentrates on producing CIS chips with smaller chip size, mainly due to: 1) lower costs with more net die; and 2) minimize CIS size which is critical for smartphone design (especially for front-end)
- Our analysis suggests that SEC's net die and known good die (KGD) will sharply decline for higher resolution CIS despite pixel size shrink.
 - ✓ Given that smaller pixel size will translate into more net die per wafer, decreasing net die from higher resolution CIS will be offset to some extent. As higher resolution CIS lower net die significantly, however, SEC's CIS net die and KGD will sharply decrease for higher resolution CIS, even taking into account net die growth from pixel size shrink.

CIS net die growth from pixel size shrink



SEC's CIS net die and KGD by pixel size



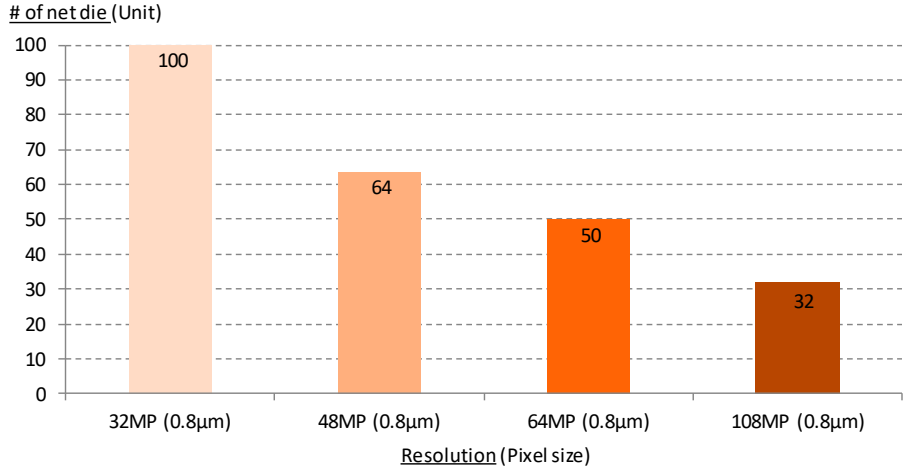
Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

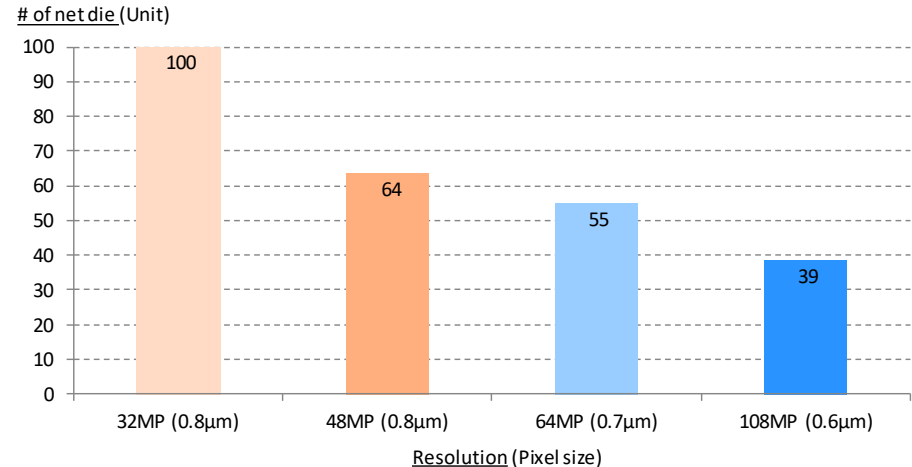
Relative net die comparison

- Net die growth from pixel size shrink gets decelerating for smaller pixels.
 - ✓ From 1.0μm to 0.9μm: Net die size shrink of ~20% and net die growth of ~15%
 - ✓ From 0.9μm to 0.8μm: Net die size shrink of ~15% and net die growth of ~10%
- Even assuming SEC could achieve 10% net die growth from pixel size shrink for below 0.8μm, our analysis suggest that SEC's CIS net die will sharply decline for higher resolution CIS products.
 - ✓ Number of net die for 64MP CIS with 0.7μm pixel size will be 55% compared to number of net die for 32MP CIS with 0.8μm pixel size.
 - ✓ Number of net die for 108MP CIS with 0.6μm pixel size will be 39% compared to number of net die for 32MP CIS with 0.8μm pixel size.

Relative net die for same pixel size



Relative net die for different pixel size



Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

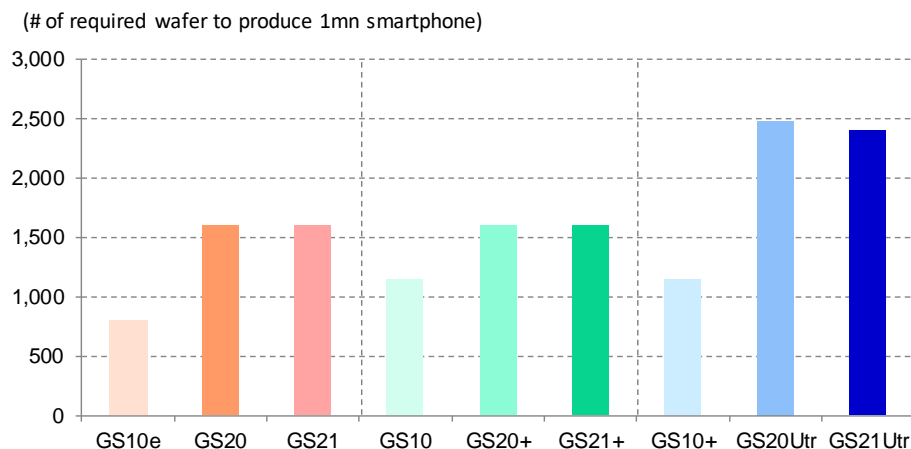
CIS demand comparison: GS10 vs. GS20 vs. GS21

- Samsung Mobile has significantly upgraded camera specifications for GS20, especially focusing on enhancement in camera resolution, which will lead to substantial demand growth for CIS. We also note that chip sizes for higher resolution CIS are exponentially increasing, which, in turn, results in sharp dips in the number of net CIS die per wafer. Accordingly, we anticipate that incremental demand for higher resolution CIS will eventually require substantial capacity expansion for CIS.
 - ✓ For instance, in order to produce 1mn GS10e smartphones (which adopt dual camera of 12MP+16MP), around 800 wafers (12-inch; same basis used below) is required, as per our estimates. When it comes to GS20 (which adopt triple camera of 12MP+12MP+64MP), it requires approximately 1,600 wafers to produce 1mn GS20smartphone units.
 - ✓ Likewise, GS20+ and GS20 Ultra will likely require 40% and 117% increase in CIS wafer capacity, compared to GS10 and GS10+, respectively, even excluding additional capacity required for TOF, according to our estimates.
- Although GS21/GS21+ maintain rear camera specifications similar to GS20/GS20+, GS 21 Ultra slightly lower camera specifications compared to GS 20 Ultra, leading to slight decrease in CIS wafer capacity required for smartphone production.

GS10 vs. GS20 vs. GS21: Rear cam specifications

2019	GS10e	Dual	12MP	16MP		
	GS10	Triple	12MP	12MP	16MP	
	GS10+	Triple	12MP	12MP	16MP	
	GS10 5G	Quad	12MP	12MP	16MP	TOF
2020	GS20	Triple	12MP	12MP	64MP	
	GS20 5G	Triple	12MP	12MP	64MP	
	GS20+	Quad	12MP	12MP	64MP	TOF
	GS20+ 5G	Quad	12MP	12MP	64MP	TOF
	GS20 Ultra 5G	Quad	12MP	48MP	108MP	TOF
2021	GS21 5G	Triple	12MP	12MP	64MP	
	GS21+ 5G	Triple	12MP	12MP	64MP	
	GS21 Ultra 5G	Quad	10MP	10MP	12MP	108MP

CIS wafer capacity required for 1mn smartphones



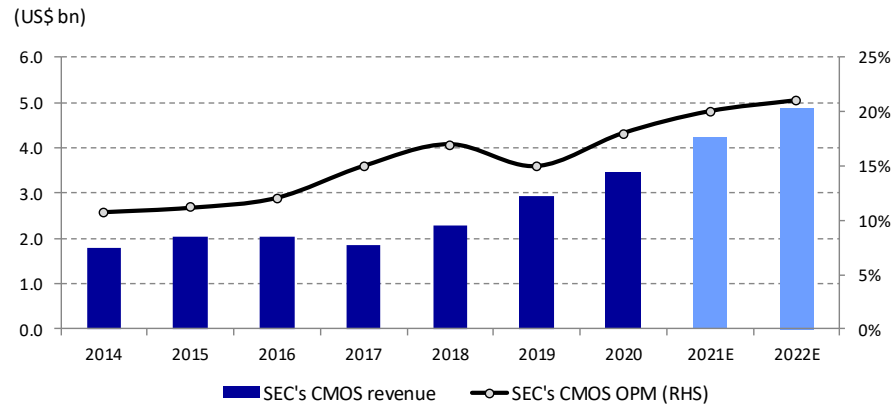
Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

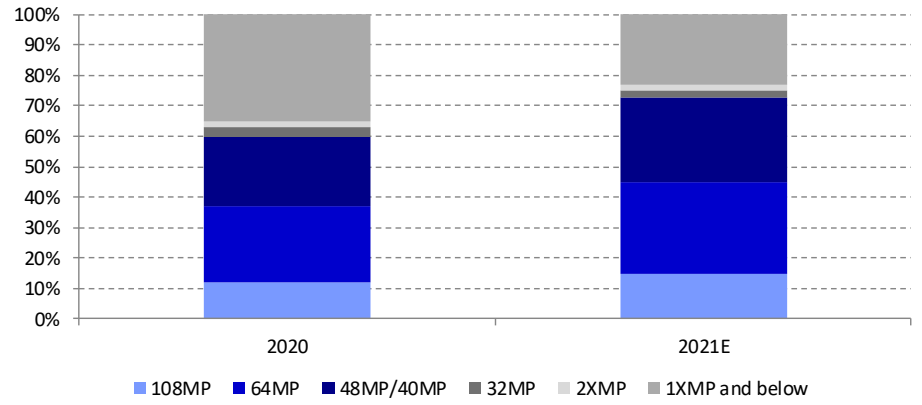
SEC to focus on high resolution CIS

- In 2019, SEC’s CIS revenue increase 30% YoY to US\$3.0bn in 2019 from US\$2.3bn in 2018, in light of strong CIS demand growth from smartphones as well as ASP enhancement with incremental contribution from high resolution CIS. However, SEC’s CIS OP margin decline to 15% in 2019 from 17% in 2018, as a consequence of incremental costs from increasing R&D costs as well as lower-than-expected production yield.
- Along with strong CIS demand growth from accelerating multiple camera adoptions in smartphones, SEC increased its CIS revenue to around US\$3.5bn in 2020 with OP margin improving to 18% in light of solid top-line growth. In our view, solid revenue growth from SEC’s CIS will be largely attributable to expanding CIS demand from existing customers led by rapid adoption of multiple camera in smartphones rather meaningful customer diversifications. We project that SEC will likely focus on high resolution CIS promotion so as to: 1) further enhance its ASP within existing customers; and 2) attempt to diversify customer base in the future.
- For 2021, SEC targets to increase its CIS revenue to US\$4.3bn with OPM of 20%, mostly driven by robust demand for high resolution CIS as well as further customer diversification.

SEC’s CIS revenue and OPM trend



SEC’s CIS product mix by resolution



Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

SEC's new CIS product line-ups

- In January 2021, SEC introduced its new 108MP mobile image sensor, Samsung ISOCELL HM3, with pixel size of 0.8 μ m.
 - ✓ HM3 integrates Super PD Plus adding AF-optimized micro-lenses over the phase detection focusing agents which can increase measurement accuracy of the agents by 50% compared to previous products.
 - ✓ HM3 also adopts Smart ISO Pro, a high-dynamic-range imaging technology which uses an intra-scene dual conversion gain (iDCG) solution.
- SEC announced that the company introduced ISOCELL images sensor line-ups with 0.7 μ m pixel including 108MP (HM2), 64MP (GW3), 48MP (GM5), and 32MP (JD1).
 - ✓ SEC indicates that its CIS products with 0.7 μ m can lower CIS size up to 15%, compared to CIS products with pixel size of 0.8 μ m.
 - ✓ In addition, SEC claims that 0.7 μ m CIS products can reduce the height of the camera module by up to 10%, compared to 0.8 μ m CIS products.



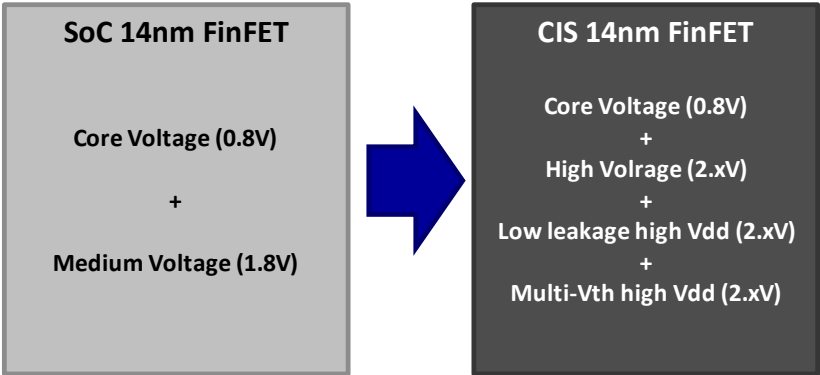
Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

SEC's CIS product and fabrication roadmap

- In order to differentiate itself from competitors, SEC continues to focus on high resolution CIS products. In 4Q19, SEC introduced 108MP CIS product which has been adopted by flagship smartphones such as Mi Note 10 and GS20 Ultra. Although several news articles expect SEC will likely introduce 150MP CIS in 2H20, our checks suggest that SEC is planning to launch 200MP CIS product in 1H21, skipping 150MP products.
- At IEDM forum 2019 on December 2019, SEC unveiled a 14nm FinFET process for 144MP CIS fabrication, which will be able to meaningfully lower power consumption of CIS chips. According to SEC, 14nm FinFET will lower power consumption of 12MP and 144MP CIS chips by up to 37% and 42%, respectively, compared to 28nm. However, we expect SEC to utilize 28nm process for the next couple of years for its major fabrication technology as: 1) Samsung Foundry's investment will likely focus on advanced node (i.e. 7nm and less); and 2) Samsung Foundry observes tight capacity for its 14nm process. To reduce power consumption, on the flip side, we expect SEC to introduce FD-SOI process on 22nm from 2022.

SEC's 14nm FinFET



SEC's CIS fabrication roadmap

	2017	2018	2019	2020	2021E	2022E	2023E
65nm/45nm							
28nm							
22nm (FD-SOI)							

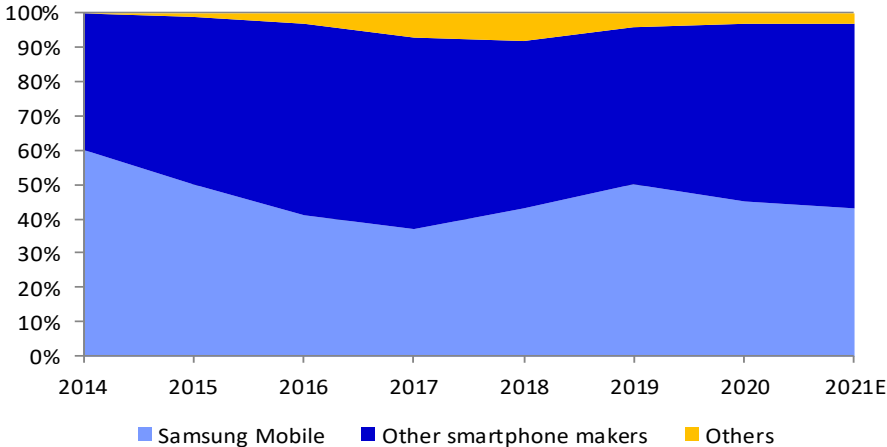
Source: Mizuho Securities Equity Research from company data

Samsung Semiconductor: CMOS Image Sensor

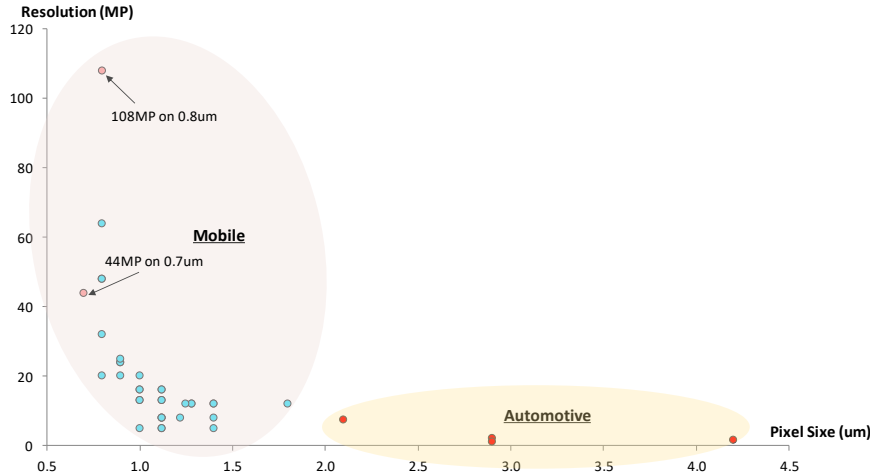
SEC plans to expand CIS with The DRVLIN platform

- As a consequence of its focus on handset, SEC's CIS business is heavily dependent on smartphone. As of 2019, over 90% of SEC's CIS revenue will be generated by smartphone. On the flipside, we estimate that automotive will likely become a major driver for CIS market growth along with development of autonomous driving. Accordingly, SEC's key task for sustainable CIS business growth is to diversify its end-application base to non-IT areas.
- Recently, SEC announced The DRVLIN, an open platform for ADAS solution, together with Harman. The DRVLIN platform incorporates several best-in-class components and technologies, which leverage SEC's global expertise in electronics, IoT, and embedded systems, including in-car compute for Levels 3, 4, and 5 automation. It also includes a brand-new ADAS forward-facing camera system, which is engineered to meet upcoming New Car Assessment Program standards including lane departure warning, forward collision warning, pedestrian detection, and automatic emergency braking. We view that SEC will try to expand CIS business to automotive with its DRVLIN camera system.

SEC's CIS revenue mix by customer



SEC's CIS product portfolio

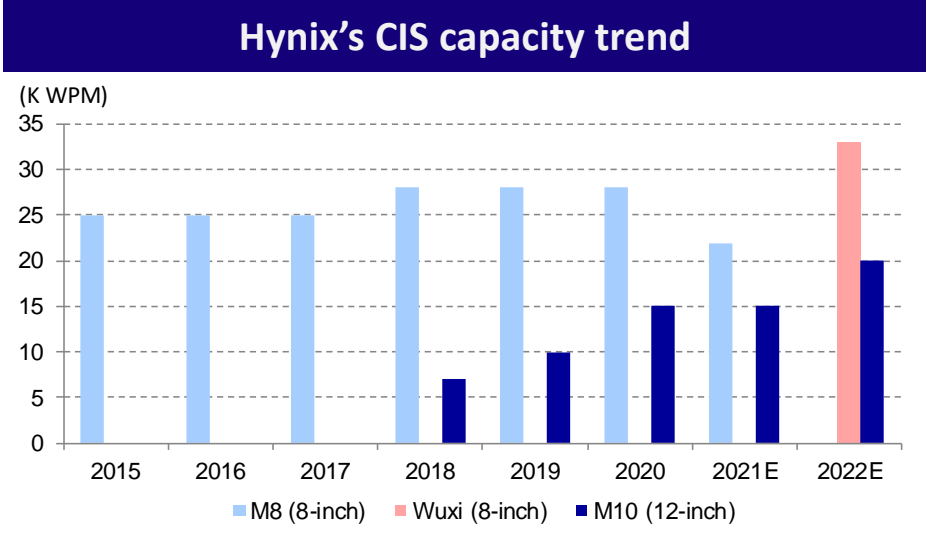


Source: Mizuho Securities Equity Research from company data

SK Hynix: CMOS Image Sensor

SK Hynix gradually increasing CIS capacity for both 8-inch and 12-inch

- Although Hynix started its CIS business in 2007, the company did not focus on customer diversification and product development for CIS as its motivation for CIS business was to utilize idle 8-inch capacity due to wafer migration to 12-inch. Along with incremental CIS demand growth from rapidly increasing smartphones with multiple camera, Hynix started to focus more on CIS business, transferring 12-inch DRAM at M10 to CSI from 2018. As of 2020, Hynix had CIS capacity of 28K WPM 8-inch (M8) and 15K WPM 12-inch (M10).
- Hynix is planning to transfer its 8-inch foundry capacity at M8 to Wuxi so as to expand its customer base more efficiently. We expect Hynix to gradually transfer 8-inch foundry equipment from 2021, targeting to ramp up Wuxi’s foundry capacity in 2022.
 - ✓ Due to the capacity transfer, Hynix’s 8-inch CIS capacity will slightly decline in 2021, but its 8-inch capacity will increase to around 33K WPM in 2022 in light of capacity ramp up at the Wuxi fab.
 - ✓ We anticipate that Hynix plans to increase its 12-inch CIS capacity to around 20K WPM in 2022 on the premise that the company can successfully expand its CIS customer base in 2021.



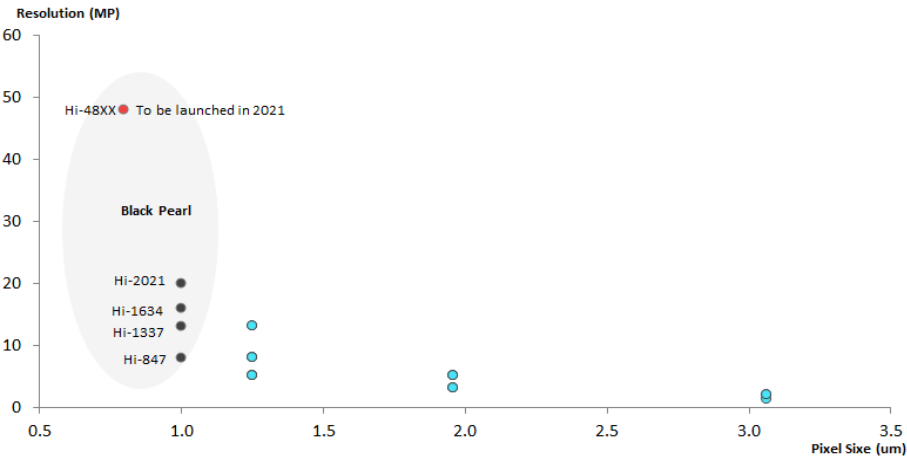
Source: Mizuho Securities Equity Research from company data

SK Hynix: CMOS Image Sensor

SK Hynix launching Black Pearl line-ups

- In order to penetrate into mid/high-end CIS market, Hynix has launched new CIS product line-ups named ‘Black Pearl’. Hynix has reduced the pixel size from 1.12µm in the previous products to 1.0µm for the four Black Pearl CIS products. Hynix’s Hi-1634 (16 MP) and Hi-2021 (20 MP) products focus on ultra-wide-angle functionality while Hi-847 (8 MP) and Hi-1337 (13 MP) provide 3X and 2X zoom functionality, respectively.
- Although Hynix planned to launch 48MP CIS product with 0.8µm in 2H20, our check suggests that its 48MP CIS product launch will be delayed in 2021. Even though Hynix will continue to expand its CIS product portfolio to the mid/high-end segment with Black Pearl line-ups, we view that it will take considerable time for the company to enter into the mid/high-end CIS market given limited resources together with high entry barriers in terms of both competitive landscape and technical challenges.

Hynix’s CIS product portfolio



Hynix’s Black Pearl line-ups

	Resolution	Pixel Size	Mass production	Features
Hi-847	8MP	1.0µm	Feb-20	3X zoom
Hi-1337	13MP	1.0µm	Mar-20	2X zoom
Hi-1634	16MP	1.0µm	Jan-20	Ultra-wide-angle
Hi-2021	20MP	1.0µm	Jan-20	Ultra-wide-angle
Hi-48XX	48MP	0.8µm	2021	TBD

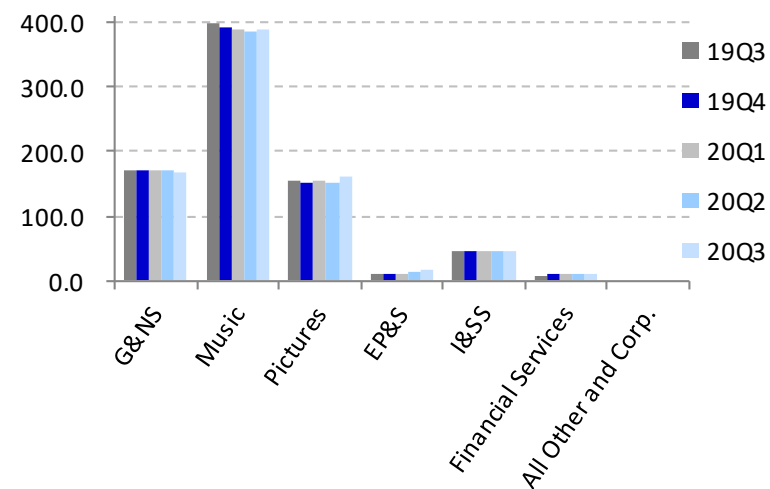
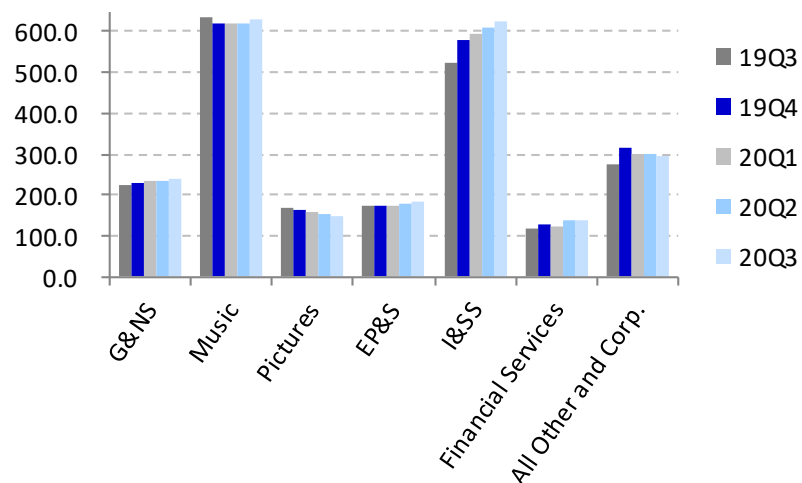
Source: Mizuho Securities Equity Research from company data

Sony: Property / Goodwill by segment

(JPY bn)

Long-lived assets and right-of-use assets					
	19Q3	19Q4	20Q1	20Q2	20Q3
G&NS	226.0	230.7	235.2	235.3	237.6
Music	635.2	619.5	618.0	617.7	631.9
Pictures	168.7	161.8	158.7	153.4	149.9
EP&S	175.0	175.5	176.4	178.8	181.7
I&SS	523.2	579.1	596.2	610.3	624.7
Financial Services	118.1	127.0	125.1	137.6	140.4
All Other and Corp.	274.7	314.0	302.5	300.0	296.9
Consolidated total	2,120.9	2,207.6	2,212.1	2,233.1	2,263.1

Goodwill					
	19Q3	19Q4	20Q1	20Q2	20Q3
G&NS	171.7	171.0	170.6	169.8	169.1
Music	400.2	391.3	389.5	387.3	387.8
Pictures	155.0	152.4	154.4	152.4	161.8
EP&S	12.2	12.2	12.2	12.3	16.1
I&SS	46.3	46.2	46.0	45.7	45.3
Financial Services	7.2	10.8	10.8	10.8	10.8
All Other and Corp.	0.0	0.0	0.0	0.0	0.0
Consolidated total	792.6	783.9	783.5	778.3	790.9



Source: Mizuho Securities Equity Research from company data

Sony FPD Business: TV, OLED Monitor and OLED

■ **TVs:** TV business necessary (Sustainable operation for stable earnings is crucial.)

- FY20: Our estimates: volume of 9.4M, sales of ¥693.6b, OP of ¥27.5b (increase). Sales of 65"/75"/85" and OLED is the key to upside.
- Corporate spin-off: Sony Visual Products relatively slim with only around 900 employees. It has module team in Malaysia.
- A large plant is in Malaysia only (6M/year), the new company focuses on TV and LCM(B/L) design and sale.
- Margins: Stable profitability in Asia, Europe and China, improving in US. Around B/E for some developing countries → difficult phase in general due to reduced volume by the impact of Covid-19.
- Production: Production output at Sony's own plants is 6-7m (in Malaysia, Shanghai and Brazil) with other products from EMS operations (HH Mexico/Slovakia) and ODMs (TPV).
- Appropriate strategy: Minimization of operations in Japan, Europe and the US, with expansion of sales in Asia. Temporary contraction in Eastern Europe, Russia, the Middle East and South America on forex factors.
- Shift to the high end: There is not much volume upside from the current 9-10m per year, and increasing value sales will require an increase in the ASP. Keys now will be increased sales of large-screen (65-in and over) and 4K/8K TVs and PLED-TVs and **co-operation with other hardware and entertainment businesses. Monitors/tablet business is also needed.**
- Topics: Restructuring completed. Little further scope for cutting fixed costs. Main risk for the future is changes in variable costs for panels and inventories.

■ **OLED monitors:** Strong reputation and high share for commercial units

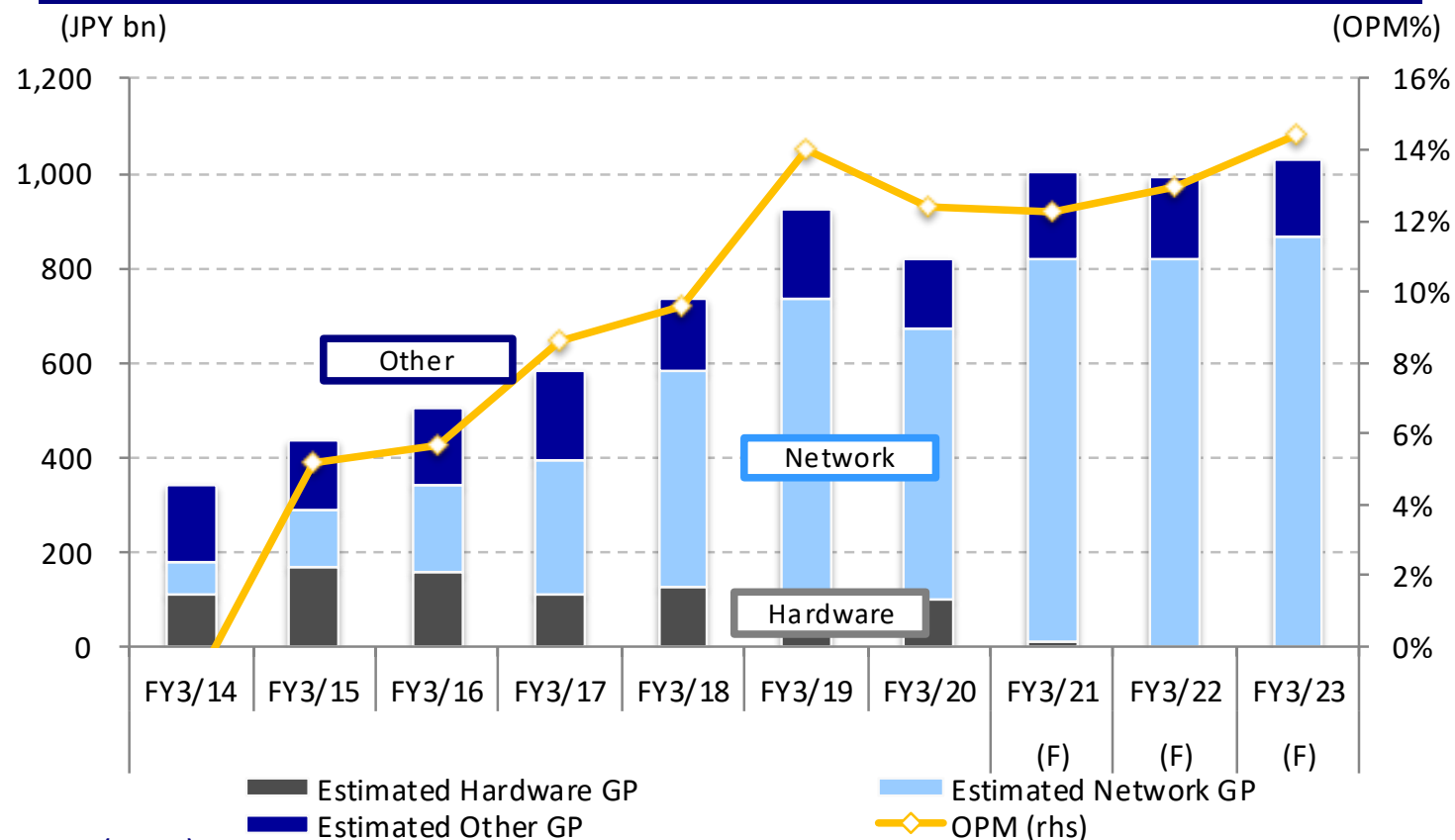
- BtoB (Professional Solutions) division: Main business is equipment such as cameras, monitors, TV conferencing systems and projectors, for commercial broadcasting and also for security, medical and corporate applications.
- OLED monitors (niche business but strong presence): volumes around 10k per month, but company is market leader for monitors for broadcasting and movie production companies. Supplies 7.4-in qHD and 17-in to 15-in FHD. Expanding applications to cover security and medical fields. Introducing 30-in 4K monitor. Also procured 55" OLEDs from LGD and 21.6" OLED from JOLED.
- Future developments: OLED panels produced only in Higashiura plant but scale and substrate size extremely small. Needs tie-up with J-OLED.

■ **OLED panels:** important technology, but difficult to justify in-house investment

- Higashiura Plant: BP procurement from G3.5 LTPS plant (owned by JDI); wind down OLED processes heretofore carried out in-house.
- Head office TV division co-operating with AUO. Announced test model for 56-in 4K unit, but mass production still not economically viable.
- Company needs OLED investment to differentiate its own products but scale insufficient to make commercial monitors, and currently difficult to recoup investment in TVs.
- Company will retain Higashiura plant and shift development staff at Atsugi onto OLED. Expectations of further tie-ups.

Sony : Game & Network Services

G&NS segment GP breakdown (Estimates) & operating margin forecasts



(Note)

Hardware: Home console (PS4, PS3), Portable (PS Vita), **PS VR**

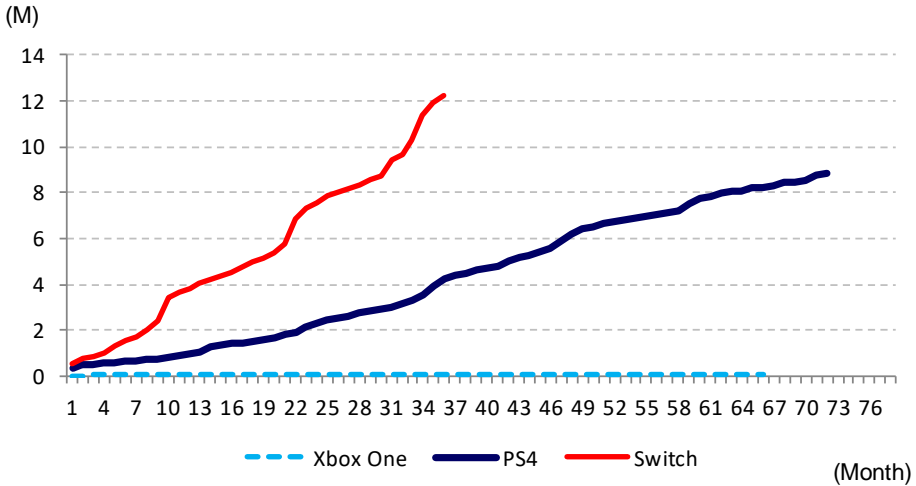
Network: Software sales via network, PS plus (paid membership), PS Music, PS Video, **PS Now**

Other: Disk software (via retailers), peripherals (controller, memory card, etc.)

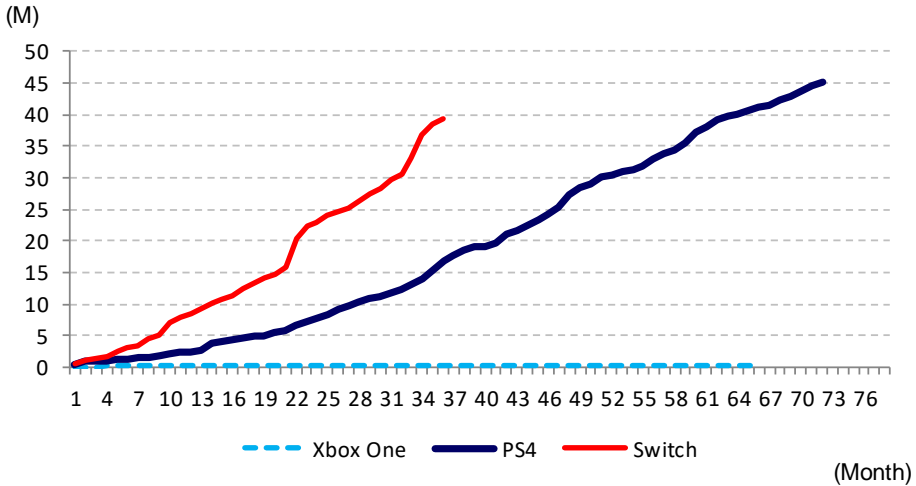
Note: Actual figures are estimated by Mizuho Securities Equity Research and forecasts are by Mizuho Securities Equity Research
 Source: Compiled by Mizuho Securities Equity Research from company data

Game - PS4 / Xbox One / Nintendo Switch: Total sales since launch

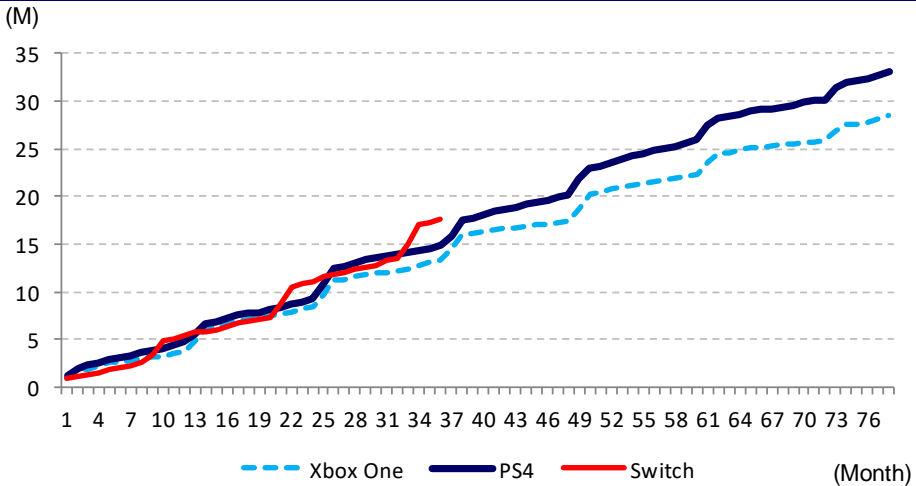
Japan hardware: total number of units sold since launch



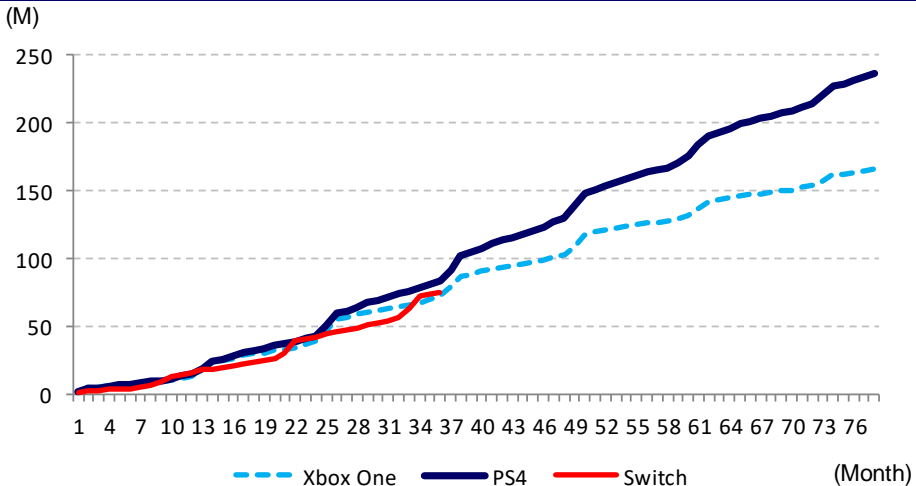
Japan software: total number of units sold since launch



US hardware: total number of units sold since launch



US software: total number of units sold since launch



Source: Mizuho Securities Equity Research from NPD

Game – Software: Greater earnings opportunities from additional content

Comparison of main downloadable content (DLC)

- DLC (downloadable content) = Additional content distributed on networks. Allows play on new stages and with new characters.
- Many titles on the PS4 include DLC. On the Nintendo Switch, DLC has been gradually increasing.

Hardware	Smash Bros.Title	Date	Price	Hardware	Title	Date	Price
Nintendo Switch	Pokemon Sword Shied Expansion Pass	2020/1	¥2,980	Play Station 4	Yakuza Success Support Pack Vol.7	2020/2	free
Nintendo Switch	Super Smash Bros. Ultimate Fighter Pass Vol.2	2020/1	¥3,300	Play Station 4	Monster Hunter: world DLC Collection	2019/9	¥3,462
Nintendo Switch	One Piece Pirate Warriors4 Character Pass	2020 summer	¥1,200	Play Station 4	PERSONA 5 The Royal Costume & BGM Set	2019/11	¥800
Nintendo Switch	PERSONA 5 Battle BGM set	2020/2	¥300	Play Station 4	Dragon Quest Builders 2 Modern Architecture Pack	2019/5	¥1,200
Nintendo Switch	Luigi's Mansion 3 Multiplayer Pack	2020/3	¥1,000	Play Station 4	Biohazard Re:3 Jill & Classical Costume Pack	2020/5	¥300
Nintendo Switch	Fire Emblem Three Houses Expansion Pass	2019/7	¥2,500	Play Station 4	Tekken 7 DLC Season Pass 3	2019/9	¥2,750
Nintendo Switch	Taiko no Tatsujin Pops Pack Vol.5	2020/6	¥400	Xbox One	Call of Duty Modern Warfare DLC Season 1	2019/12	free
Nintendo Switch	Hatsune Miku Project DIVA MEGA39's Additional Songs Pack 6th	2020/5	¥900	Xbox One	SAMURAI SPIRITS Season Pass 2	2020/2	¥2,200
Nintendo Switch	My Hero One's Justice2 2 Seasons Pass	2020/3	¥1,980	Xbox One	JUMP FORCE Character Pass 2	2020/5	¥1,980

Source: Mizuho Securities Equity Research from company data

Game – Outline of each company's monthly billing services

Comparison of services			
	Nintendo Switch	Sony PlayStation 4	Xbox One
	Nintendo Switch Online	PlayStation Plus	Xbox Live
Service launch date	2018	2010	2002(US) 2003(Japan)
Price	¥305(for 1 month) ¥815(for 3 months) ¥2,400 per year(plan)	¥850(for 1 month) ¥2,150(for 3 months) ¥5,143(for 1 year)	Free Gold : ¥842(for 1 month)
Subscriber rate	-	Around 40% of total sales volume on a sell-through basis	?
Ability to	Use the Switch for online battles Link up smartphones and games Invite friends via online lounge Voice chat Access to golden-oldie games	Available on PS5/4, PS3, and PS Vita Online multi-play Free trials of some games Early access to trial versions Discounts at PlayStation Store Ability to back up game data	(In the case of Xbox Live Gold) Online multi-play \$350-worth of Xbox One games free every year \$350-worth of Xbox 360 games free every year Discounts at Xbox Store Party chat Also accessible to family

Source: Mizuho Securities Equity Research from company data

What is PlayStation Plus?

Overview of PlayStation Plus

✓ PlayStation Plus is service allowing users access to a variety of contents and system services on the PlayStation 3, 4, Vita, and Vita TV for a flat fee

Online multiplayer

- Online connection allows players ability to link up and compete against gamers all around the world
- Users can access PS3, Vita, and Vita TV content for free (some paid titles)

Freeplay

- Some games available via PlayStation Store have unlimited playability
- Termination of distribution for PS3/PS Vita*1

Discount

- Users can get discounts on some content bought via PlayStation Store

Advanced distribution

- Early access to beta testing, exclusive access to demo versions of games, early access to paid content

Game trial

- Subscribers can play some of the games available via the PlayStation Store for free for a certain time period

Special

- Users provided with an avatar and “dynamic customized themes” *2

Saving data (online storage)

- Saved game data can be backed up online
- Gameplay can continue on separate devices using one PS Plus account

Automatic trophy*3 synchronization

- Trophy info is automatically synched with servers at predetermined intervals

Automatic downloads

- Automatic data updates for game software

*1 The contents added by the termination are available.

*2 A function allowing customization of icons and wallpaper displayed on the home screen (XMB)

*3 A virtual trophy can be won if certain conditions within a game are met (e.g., high score)

Pricing			
	For 1 month	For 3 months	For 12 months
Japan	¥850	¥2,150	¥5,143
US	\$9.99 (¥1,049)	\$24.99 (¥2,624)	\$59.99 (¥6,299)
Europe	€8.99 (¥1169)	€24.99 (¥3,249)	€59.99 (¥7,799)
UK	£6.99 (¥1,049)	£19.99 (¥2,999)	£49.99 (¥7,499)

※Calculated as USD1.00=¥100, EUR1.00=¥115, GBP1.00=¥135

Price revision

- Japan: 1m/¥514, 3m/¥1,337, 12m/¥5,143 (tax included) till Jul.31,2019
- Europe: 1m/€7.99, 3m/ €24.99, 12m/ €59.99 till Jul.31, 2019
- UK: 1m/£5.99, 3m/£14.99, 6m/£39.99 till Aug.31, 2019
- US: 3m/\$17.99, 12m/\$49.99 till Sep.21, 2016(Prices to increase in Canada at the same time)

List of corresponding services by game models

	PS4	PS3	PS Vita	PS Vita TV
Online multiplayer	○	●	●	●
Freeplay	○	○	○	○
Discount	○	○	○	○
Advanced Distribution	○	○	○	○
Game trial	-	○	○	○
Special	○	○	○	○
Saving data (Online storage)	○	○	○	○
Automated trophy synchronization	●	○	○	○
Automated downloads	●	○	○	○

○(Ps Plus member only), ●(All users)

Transition

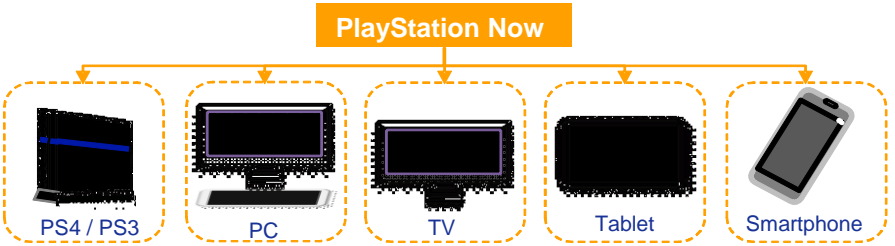
2010 Jun.29 : The services start
2012 Nov.20 : Start to correspondence in VITA
2013 Aug.08 : Start to offer 90 day's use (currently 3 month's use) Dec.28 : Subscribership grows by 90% YoY (Cumulative total of 4.2m PS4 sold-through in the world)
2014 Oct.30 : Subscribership quadruples YoY Oct.31 : Subscribership reaches 7.9m
2015 Jan.02 : Cumulative total subscribership reaches 10.9m Nov.22 : Cumulative total of 30.2m PS4 sold-through in the world Dec.31 : Cumulative total of 37.7m PS4 (sell-in base)
2016 Jan.3 : Subscribership grows by 60% YoY (Cumulative total of 35.9m PS4 sold-through in the world) Mar.31 : Cumulative total subscribership reaches 20.8m May.22 : Cumulative total of 40.0m PS4 sold-through in the world Dec.7 : Cumulative total of 50.0m PS4 sold-through in the world
2017 Jan.5 : Cumulative total of 53.4m PS4 sold-through in the world
2018 Jul.22 : Cumulative total of 81.2m PS4 sold-through in the world Dec.31 Cumulative total subscribership reaches 36.3m Dec.31 : Cumulative total of 91.6m PS4 sold-through in the world
2019 Mar.8 : Content delivery termination of PS3/PS Vita free play Mar.30: Cumulative total subscribership reaches 36.4m Dec.31 : Cumulative total of 106m PS4 sold-through in the world Dec.31: Cumulative total subscribership reaches 38.0m

Source: Mizuho Securities Equity Research

What is PlayStation Now?

Overview of PlayStation Now

- This is a cloud-type game streaming service provided by SCE
 - ✓ Games can be played any time anywhere given a compatible handset
 - ⇒ system works with various handsets
 - ✓ First official service started in the US on 13 Jan 2015 (for PS4)
 - ✓ In Japan, a β service started on 16 Oct 15 for PS4, PS Vita and PS Vita TV
 - ✓ premium subscribers of just under 3m and capacity of 5m
 - ⇒ 3% out of cumulative total of 110m PS4 sold-through
- The system uses Gaikai technology to provide PS3 games
- Fee system: fixed cost package
 - ✓ \$9.99 for 1 month, \$24.99 for 3 months, \$59.99 for 1 year



Overview of Gaikai

- Gaikai (head office: California, USA)
 - ✓ Developing and providing cloud game services, primarily in the USA
 - ✓ Acquired by SCE in July 2012
- Key points of cloud game services provided by Gaikai
 - ✓ Game operation processing on the cloud server allows streaming distribution service of game screen video data
 - ⇒ Since the user's handset does not require high-resolution processing functions and memory devices, high-grade gaming can be enjoyed on more different types of handset than possible previously.
 - ✓ Possibility of enjoying games by using an internet browser to access games installed on a host server,
 - ⇒ No need for users to buy packages complete with game handset or to install games on PCs

Handsets compatible with PlayStation Now

- First providing PS3 games to PS4 and PS3, then supplying games PS Vita (PS2 games undecided)
- Expected to be compatible with tablet PCs and smartphones
- Service to Samsung Smart TV in the US started in June 2015
- PS Now services to Vita / Vita TV / BRAVIA ended on Aug.15, 2017

Support ends

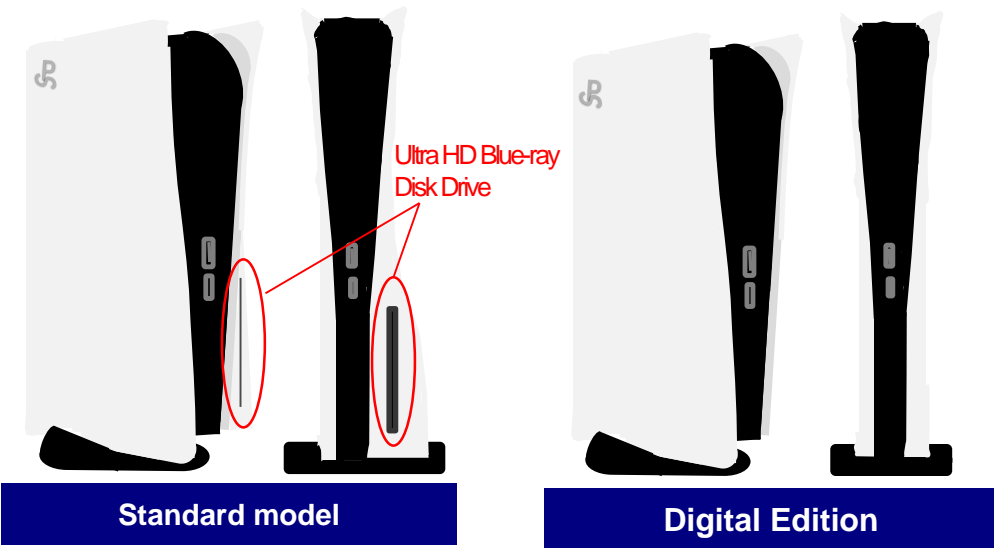
Handset	PS4	PC	PS3	PS VITA	BRAVIA (TV)	PlayStation TV
Open beta version service provision start(US)	31 July 2014	13 January 2015	18 September 2014	14 October 2014	End-2014	14 October 2014
Applicable games	PS3,PS4 games	PS3,PS4 games	PS3,PS4 games	PS3,PS4 games	PS3,PS4 games	PS3,PS4 games
Input devices (official support)	DUALSHOCK 4	DUALSHOCK 3 DUALSHOCK 4	DUALSHOCK 3	PS Vita System	DUALSHOCK 3 DUALSHOCK 4	DUALSHOCK 3 DUALSHOCK 4

Additional software (Jun.1, 2020)

Marvel's Spider-Man (Distribution till Jul.7,2020)	Bloodborne	PLAYERUNKNOWN'S BATTLEGROUNDS	PREY	Dishonored 2 (Limited time distribution, Undecided end date)	METRO EXODUS (Distriubtion till Nov.2.2020)
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Source: Mizuho Securities Equity Research

PlayStation 5



Standard model

Digital Edition

With Ultra HD Blue-ray disk drive

Without disk drive

¥49,980 plus tax

¥39,980 plus tax

GPU(AMD “Radeon RDNA2”)

Clock speed: 2.23GHz (variable); performance: 10.3TFLOPS

- Arithmetic performance: approx. 5x PS4, approx. 2x PS4 Pro
- Variable clock: high clock speed while suppressing heat

Real time ray tracing

- More realistic expressions, overwhelmingly immersive

Compatible with PS4

- Unavailable models with PS4 only are 2 for Japan and 10 for US

3D Sound System

Tempest 3D Audio

- Real-time calculation of how sounds are heard using the head-related transfer function (HRTF)

Reproduces 360-degree/dimensional sound

- Expresses footsteps from behind, rain from above, river underfoot

Five pre-sets to adapt to preferences

- Users can choose one of five HTRF pre-sets
- Aims to create functions adapted to each person in the future

SSD

825GB capacity, 5.5GB/s bandwidth

- Capacity can be increased by adding external HDD and M.2 SSD

Bandwidth is over 100x of PS4 incl. seek-time reductions

- High-speed access increases memory efficiency
- Games can be played with no loading time

CPU(AMD Ryzen “Zen 2”)

8 core 16 thread; up to 3.5GHz (variable)

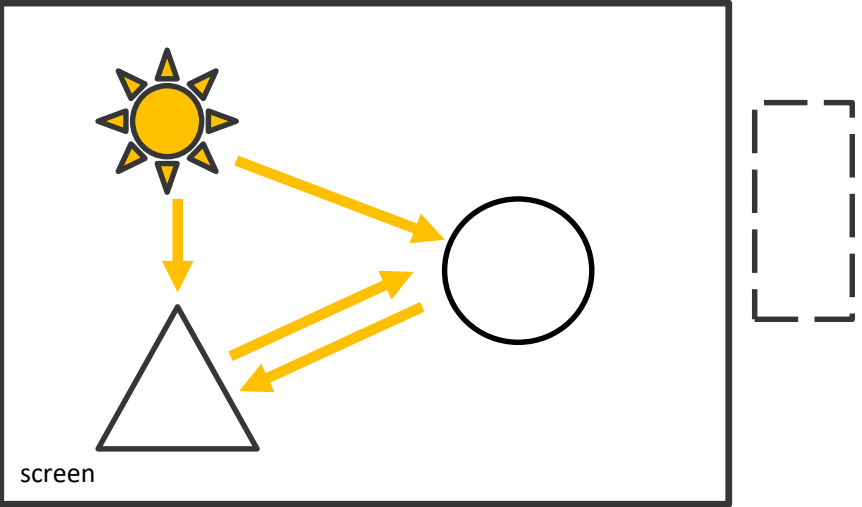
Source: Mizuho Securities Equity Research

PlayStation 5 : Real Time Ray Tracing

Shadows and reflections mimic the real world

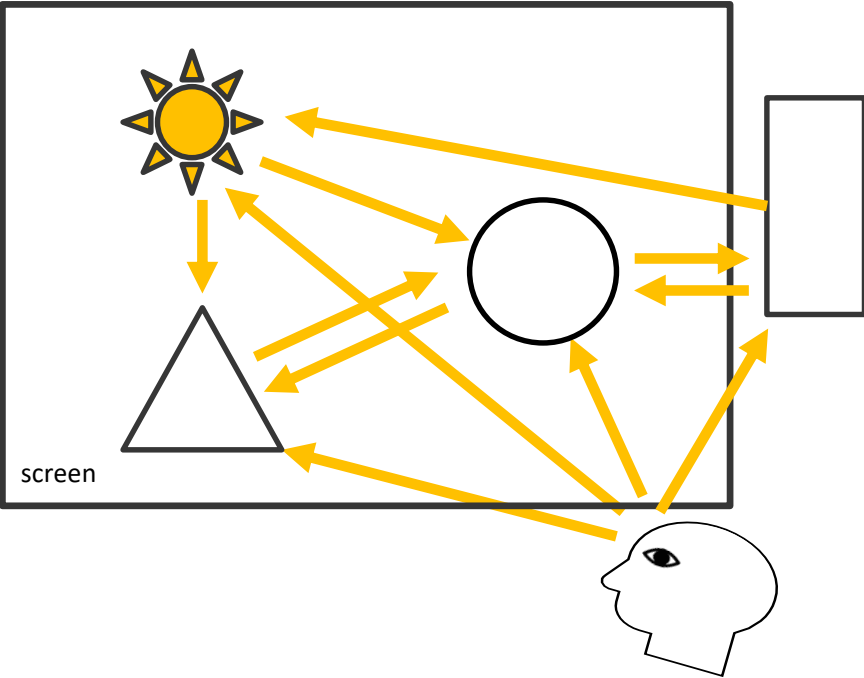
- ✓ Follows the light trajectory from the viewpoint to the light source, calculates and expresses. Accounts for reflection from objects outside the screen.
- ✓ Games in which objects dynamically change will be more of a burden, but can realized by improving GPU computing performance.
- ✓ Realistic light reflection and shadow expression. Gradation expression and contrast greatly improved for more realistic image..
- Rasterization: Expressed in traditional games. The rough relationship between the light source and the object is calculated and expressed. Objects outside the screen are not considered (for example, reflection on the object).
- *Gran Turismo 7, Ratchet & Clank, Pragmata* use ray tracing.

Rasterization



¹Some arrows omitted

Ray Tracing¹



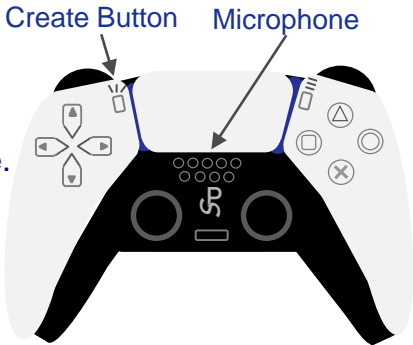
Source: Mizuho Securities Equity Research

PlayStation 5 : Peripheral Equipment

PS5 Peripheral Equipment

- PS5 is released on Nov.12. Standard model: \$499, Digital edition: \$399。
- Dual Sense Wireless Controller(\$69.99) : Embedded mic, Create button, haptic feedback, adaptive trigger.
- ✓ Mic: Embedded in controller. Allows players to communicate with other players without headset.
- ✓ Create Button : Dualshock4's Share button removed. Allows users to share content.
- ✓ Haptic feedback: Able to experience the effect and impact of in-game action
- ✓ Adaptive trigger: Embedded in L2, R2 buttons. Resistance changes depending on the action in the game.
- PULSE 3D Wireless Head Set(\$99.99) : Embedded noise cancelling function, creates 3D audio.
- Media Remote(\$29.99) : Embedded mic; easy control of streaming services etc.
- HD Camera(\$59.99) : Full HD dual camera.
- Dual Sense charging stand(\$29.99): Charges two controllers simultaneously.

Dualsense Wireless Controller



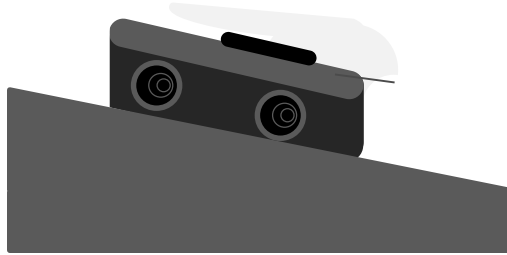
PULSE 3D Wireless Head Set



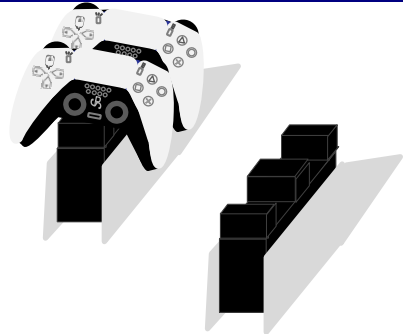
Media Remote



HD Camera



Dual Sense charging stand



Note: All prices are without tax.
Source: Mizuho Securities Equity Research from PlayStation Blog, famitsu.com, Game Watch company HP

PlayStation 5 : Abundant first/third party titles

List of PS5 game software

- The following are PS5's popular game programs, of which ten are being developed by SIE.

Now on Sale

Title	Publisher
Astro's Playroom	JAPAN Studio
Demon's Souls	Bluepoint Games / JAPAN Studio
Destruction All Stars	Lucid Games / XDEV
Horizon Forbidden West	Guerrilla Games
Marvel's Spider-Man Miles Morales	Insomniac Games
Ratchet & Clank: Rift Apart	Insomniac Games
Returnal	Housemarque / XDEV
Sackboy A Big Adventure	Sumo Digital / XDEV
Gran Turismo 7	POLYPHONY DIGITAL
Call of Duty Cold War	Activision
DEATHLOOP	Bethesda
WATCDOGS LEGIONS	Ubisoft
Godfall	Gearbox Publishing / Counterplay Games
Goodbye Volcano High	KO-OP

Scheduled to come on sale

Title	Publisher
FIFA 21 NXT LVL EDITION	Electronic Arts
Nioh Remastered Complete Edition	KOEI TECMO GAMES
Speed Limit	Gamechuck
RETURNAL	Housemarque
OUTRIDERS	People Can Fly
GUILTY GEAR –STRIVE-	ARC SYSTEM WORKS
DEATHLOOP	Arkane Studios
Back 4 Blood	Turtle Rock Studios
SCARLET NEXUS	BANDAI NOMCO Studios
GHOSTWIRE: TOKYO	Tango Gameworks
BIOHAZARD VILLAGE	CAPCOM
Gotham Nights	WB Games Monteval
LITTLE NIGHTMARES 2	Tarsier Studios
HOGWART LEGACY	Warner Bros./Avalanche

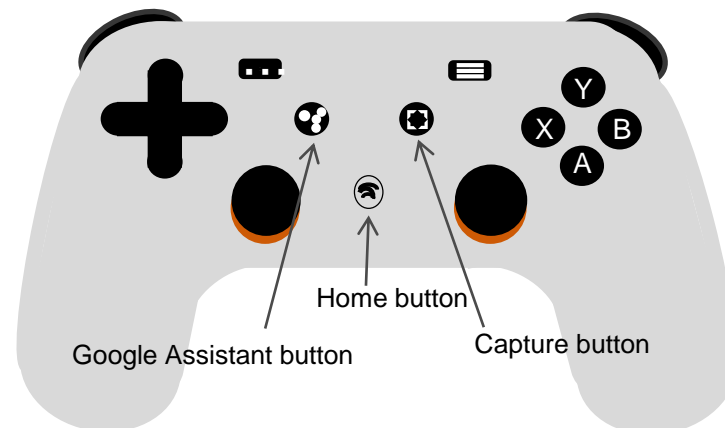
※Titles in the red box are being developed by Sony Interactive Entertainment (SIE).

Source: Mizuho Securities Equity Research from PlayStation Blog, famitsu.com, Game Watch company HP

Stadia: Overview: Google's new cloud-based gaming platform

What is Stadia?

- A new cloud-based game streaming service unveiled by Google
- Allows game play using a variety of devices via the internet (e.g., Google Chrome)
- Features a proprietary wireless game pad (right) with WiFi connectivity
- Utilizes Google's worldwide network of data centers to facilitate high-volume data transmission with low latency/lag time
 - High-speed internet connections minimize both input and output lag
 - Rendering completed within the data centers



Stadia's characteristics

- **Stadia features**
 - **State Share:** A streaming game in progress can be shared in the same save state with other players/viewers in real time
 - **Crowd Play:** Games can be streamed onto YouTube, and from there be joined instantly by other participants for multi-player gaming
 - **Stream Connect:** In split screen, virtual hardware can be assigned to each screen to facilitate more advanced game play
 - **Google Assistant:** Players can launch Google Assistant right from the controller to search for game play tips and other content by voice
- **Specs**
 - Up to 4K with HDR at 60FPS (requires 25Mbps internet connection)
 - **GPU performance:** 10.7TFLOPS (Play Station 4 Pro delivers 4.2TFLOPS), 56 compute units, HBM2 memory
 - **CPU performance:** CPU clock speed of 2.7GHz per instance, with support for hyperthreading and AVX2 instructions
- **At least 100 game titles to be available for streaming by the service launch date**
 - Expected titles include Assassin's Creed Odyssey (Ubisoft) and DOOM Eternal (id Software)
- **Scheduled to launch in North America and Europe sometime during 2019; no word yet on Stadia launch date or pricing for Japan**

Source: Compiled by Mizuho Securities Equity Research from company data and various media sources

VR : Oculus Quest 2

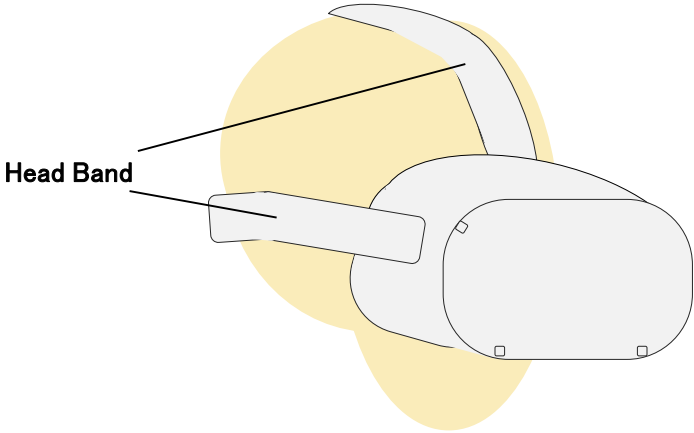
What is Oculus Quest 2?

- A new Oculus Quest product announced on October 2020. Casually play VR games on the store via Wi-Fi, using just a headset and controller (no PC, externals sensors, cameras, etc. required).

Spec

- Price: 64GB/¥37,100 (tax included); 256GB/¥49,200 (tax included)
- Sensor: 6 degrees of freedom (forward-back, left-right, up-down tracking)
- CPU: Qualcomm Snapdragon XR2, RAM : 6GB
- Resolution: 1,832 x 1,920; refresh rate: 90Hz
- Fit: worn on head, adjusting left/right band to fix in place
- Controller: Rift Controllers completely redesigned, with left and right controller-dedicated features. Both left and right controller have operable sticks/buttons on the top and embedded sensors. Trigger buttons are also included on the grip area.
- Weight : 503g (headset only)
- Design : Black and white base

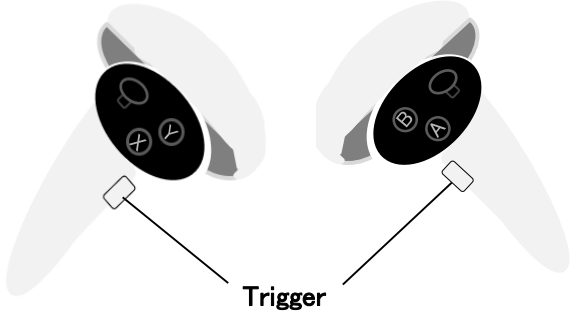
Head Set



Features

- Less motion sickness: VR-related motion sickness reduced versus earlier product thanks to improved CPU, GPU, resolution and other specs.
- Pick-up-and-play: No external camera/sensors needed to capture user’s movement. Play with just a controller and headset (no PC needed). However, requires initial syncing with “Oculus” smartphone app.

Controller



Source: Mizuho Securities Equity Research from famitsu.com and company HP

VR Hard spec by companies

Company	Trade Name	Released Date	Price	Weight	Resolution (/eye)	ppi	Display Size and Type	Latency (ms)	Refresh Rate *1	View Angle
Oculus	Oculus Quest 2	Oct-2020	¥37,100~	503g	1,832x1,920	N/A	LCD	20	90Hz	Unknown*2
	Oculus Rift S	May-19	¥49,800	Heavier than Rift (over 470g)	1280x1440	N/A	LCD	20	80Hz	115°
	Oculus Go	May-18	¥23,800~	468g	1280x1440	350ppi	5.5" LCD	N/A	72Hz	110°
	Quest	May-19	¥49,800~	571g	1440 × 1600	N/A	OLED	N/A	72Hz	100°
Sony Interactive Entertainment	Playstation VR CUH-ZVR2	Oct-18	¥34,980	600g	960x1080	N/A	5.7" OLED	N/A	120Hz	100°
HTC	VIVE Cosmos	Oct-19	¥89,882	651g	1440 × 1700	N/A	3.4" LCD	N/A	90Hz	110°
	VIVE Cosmos Elite	Mar-20	¥73,810 (body only) ¥120,989 (incl. Base Station and others)	651g	1440 × 1700	N/A	3.4" LCD	N/A	90Hz	110°
Samsung	Galaxy Gear VR	Oct-18 (Support/sales ended in Sep.2020)	¥15,220	345g	N/A	N/A	N/A	N/A	N/A	101°
Lenovo	Mirage Solo	Apr-18	¥34,749~	645g	1280x1440	350ppi	5.5" LCD	N/A	75Hz	110°

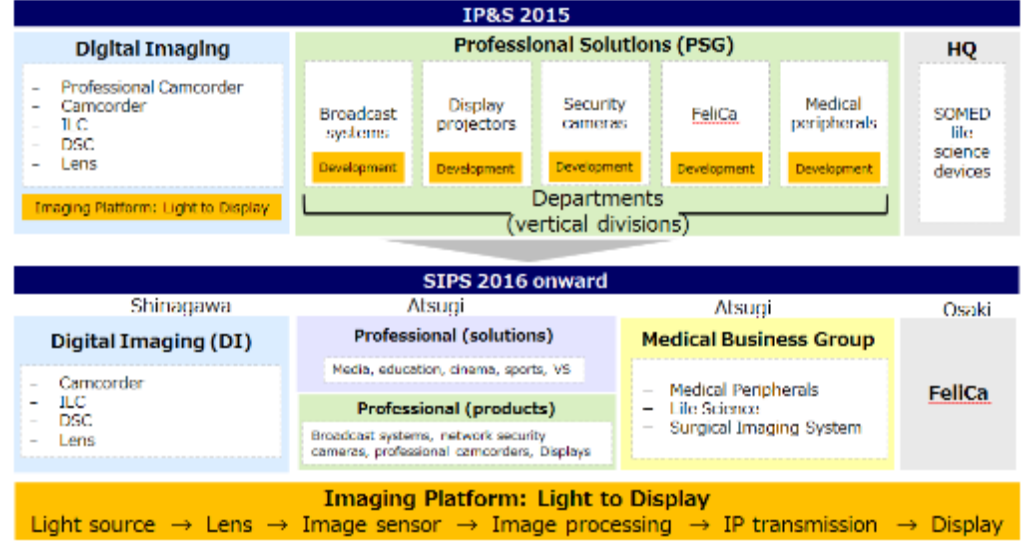
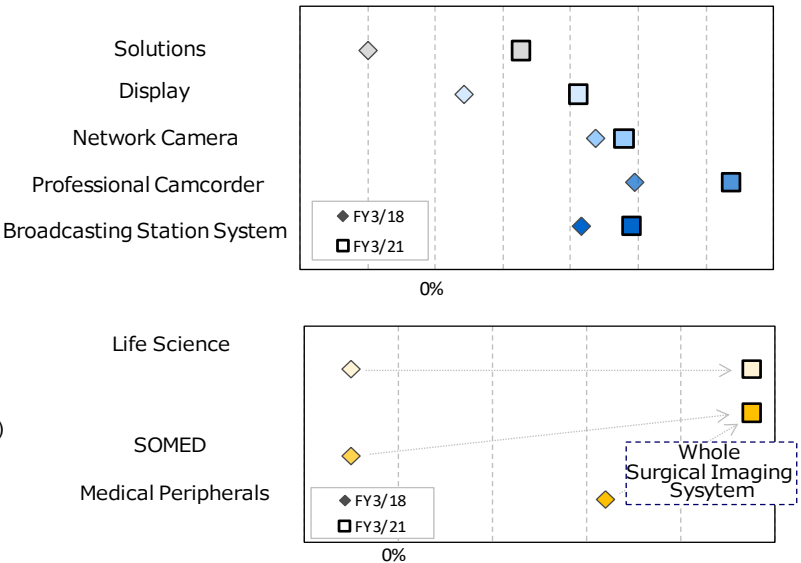
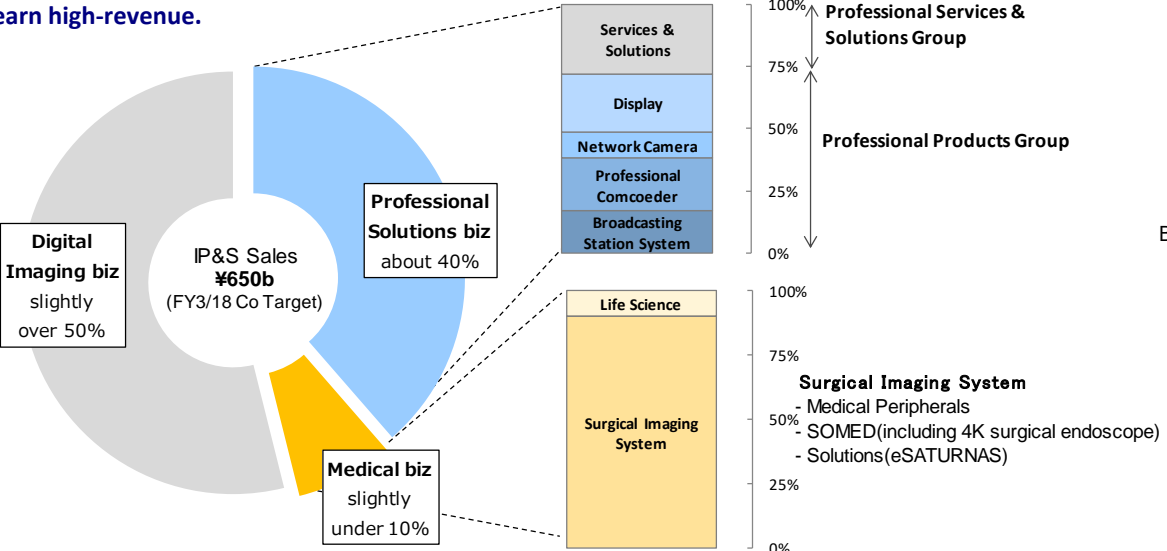
*1The number of frames per second the television can display.

*2 No official announcement.

Source: Compiled by Mizuho Securities Equity Research from company data

Sony : IP&S > professional solutions business/medical business

IP&S sales composition: approximately 40% from digital imaging, over 50% from professional solutions, and less than 1% from medical. Hardware, such as professional cameras, earn high-revenue.



- Sony's IP&S business was spun off in April 2017.
- The professional solutions and medical businesses offices are located in Atsugi, Kanagawa. Semiconductor business also has its own R&D center.
- Strengths lie in core technology covered by the Imaging Platform, "Light to Display". This platform ranges from light source, lens (optical design), image sensor (collab. with semiconductor business), image processing, IP transmission, to display.
- In 2016, departments in charge of design and development for each business (including digital imaging) were consolidated within IP&S as the "Imaging Platform: Light to Display". This consolidation reduced fixed costs and contributed to a more active personnel exchange. This also resulted in business synergies such as the digital imaging business releasing a line of professional cameras, and the digital imaging and professional services businesses sharing sales channels (directly/through dealers).

Source: Mizuho Securities Equity Research from company data

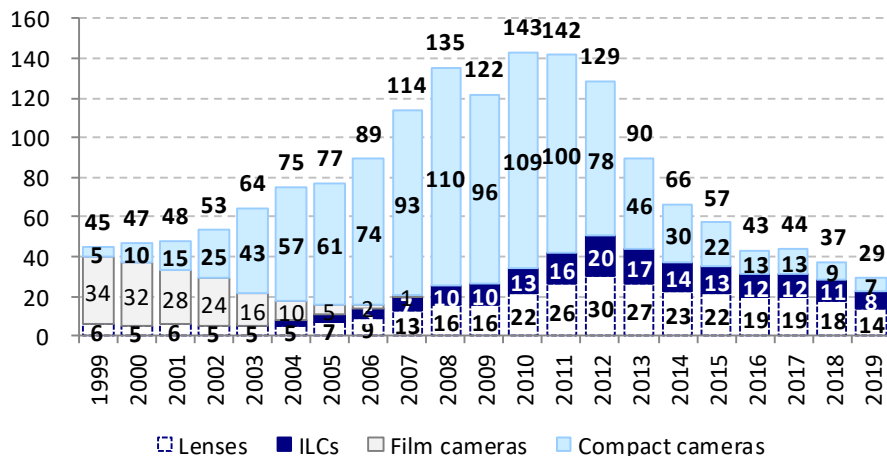
Sony(IP&S): Canon/Nikon entered into full-frame MILC market and the situation looks like a three-way competition

Full-frame MILC is released in Oct.2018 by Canon and in Nov.2018 by Nikon. Panasonic's first and in Sep. by Canon. Panasonic's first full-frame MILC is to be released in Mar.2019. DSLR

	DSLR				Mirror-less ILC			
	Camera body		Lens mount		Camera body		Lens mount	
	(full frame)	(APS-H & smaller)	(full frame)	(APS-H & smaller)	(full frame)	(APS-C & smaller)	(full frame)	(APS-C & smaller)
Canon	○ EOS	○ EOS	EF mount (EF lens)	EF mount (EF-S lens)	New entry EOS R	○ EOS M	RF mount (RF lens)	EF mount (EF-M lens)
Nikon	○ D series	○ D series	F-mount (FX format)	F-mount (DX format)	New entry Z series	NewEntry(APS-C) Discon:Nikon 1	Z-mount (FX format)	Z-mount (DX format)
Sony	○ α series	○ α series	A-mount	A-mount (DT lens)	○ α series	○ α series	E-mount (FE lens)	E-mount (E lens)
Ricoh (Pentax)	○ K series	○ K series	K-mount (FA lens)	K-mount (DA lens)	-	○ K/Q series	-	K-mount, Q-mount
Fujifilm	-	-	-	-	-	○ X series	-	X-mount
Olympus => decided to exit	-	(discontinued) E series	-	4/3	-	○ OMPEN	-	micro 4/3
Panasonic	-	(discontinued) Lumix	-	4/3	New entry Lumix S	○ Lumix	Leica L mount	micro 4/3

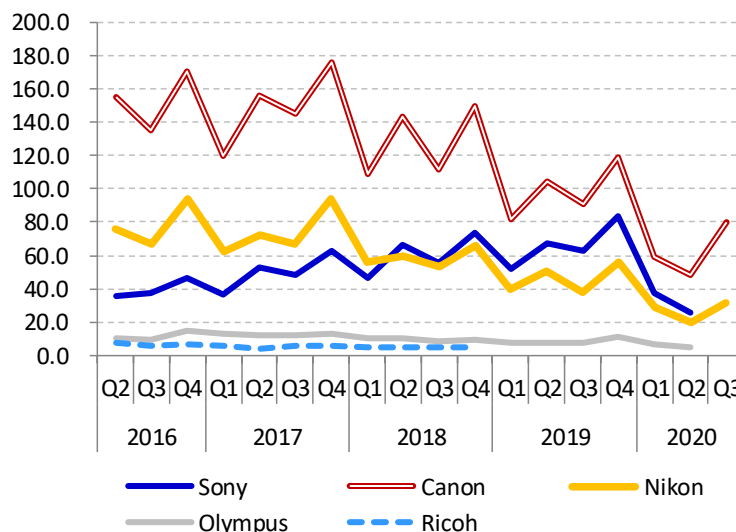
Shipment volume (body and lenses)

(m units)



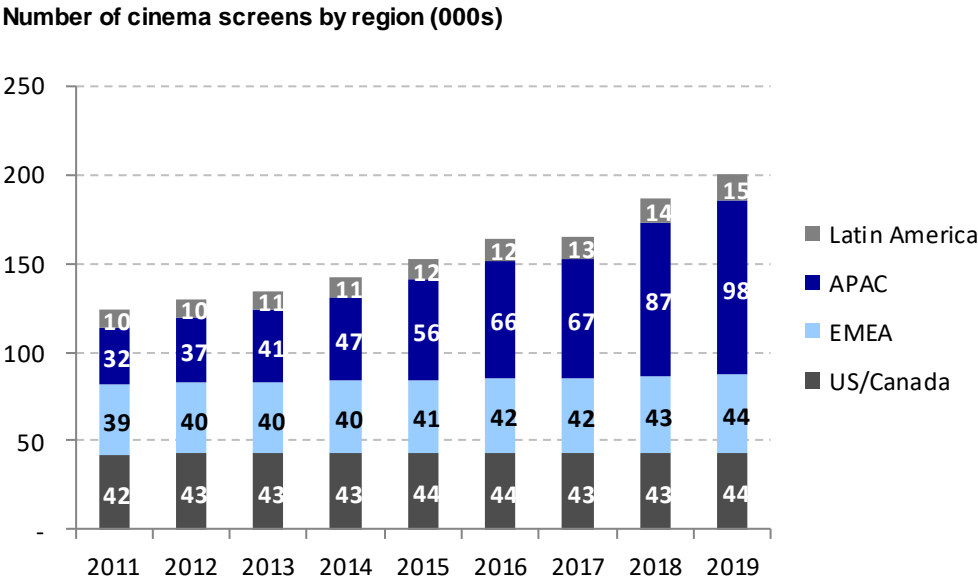
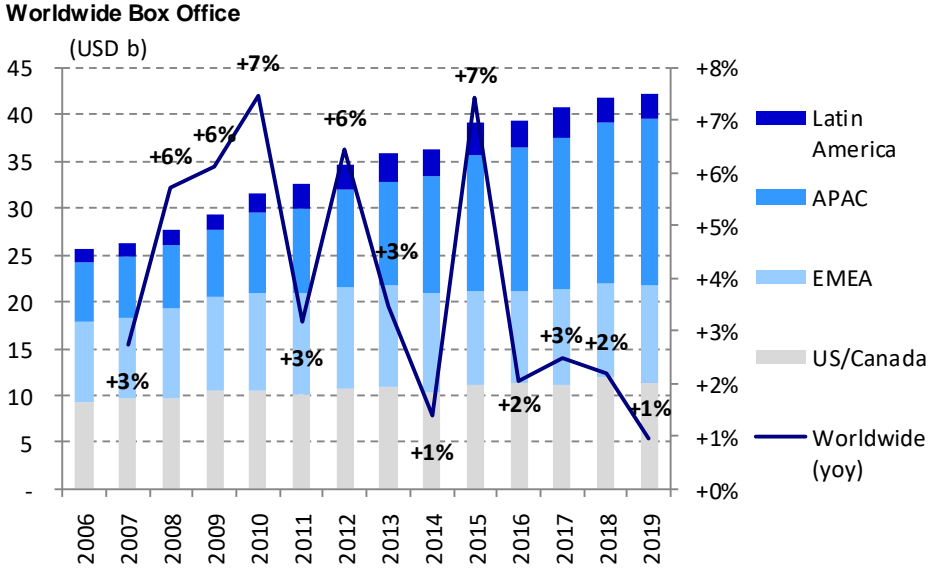
Source: Mizuho Securities Equity Research from company data, CIPA

ILC market share (value basis, JPYb)



Sony: Pictures segment (motion pictures)

- Sony Pictures Entertainment, known simply as Sony Pictures is composed of three segments: 1) **motion pictures**; 2) **television production**; and 3) **media networks**. In motion pictures, the main operating units are studios such as Columbia Pictures, while in the television production business the main operating unit is Sony Pictures Television (SPT). The media networks segment is centered on subsidiary groups such as GSN.
- **Motion Pictures:** This is the so-called Hollywood motion pictures business. Major studios are involved in all aspects of the business, from motion picture planning to fund raising, production, and distribution. Sony entered the business through the acquisition of Columbia Pictures in 1989 for \$4.8b.
- The six industry leaders include **Sony Pictures Entertainment** (Sony/Columbia, Tristar, and others), **Warner Brothers** (Comcast), **Walt Disney Corporation**, **Universal Studios** (NBC Universal), **20th Century Fox** (21st Century Fox), and **Paramount Pictures** (Viacom). The industry has recently seen box-office leading movies from relative newcomers such as Lionsgate.
- Global box office income continues to rise by about 4% annually. Emerging markets continue to show favorable growth, with increases in the number of screens ongoing.
- The US market is mature, yet remains the world's largest. Box-office draw in the first week of a movie's release is widely considered an indicator for its overall sales performance.
- While the market for Blu-ray discs and DVDs is contracting, the streaming market is expanding on the spread of network-enabled (smart) TVs.



Source : Mizuho Securities Equity Research from MPAA

Motion Pictures: North American box office rankings (2015-2020)

2016 was a tough year for Sony Pictures, while Spider-Man: Homecoming/Jumanji doing well in 2017 and 2019. Three films ranked in the top 20 in 2018 and two in 2020.

2015				2016				2017						
	Studio	DBO	Theatres		Studio	DBO	Theatres		Studio	DBO	Theatres			
		(US\$ m)				(US\$ m)				(US\$ m)				
1	Star Wars: The Force Awakens	BV	937	4,134	1	Rogue One: A Star Wars Story	BV	532	4,157	1	Star Wars: The Last Jedi	BV	620	4,232
2	Jurassic World	Uni.	652	4,291	2	Finding Dory	BV	486	4,305	2	Beauty and the Beast (2017)	BV	504	4,210
3	Avengers: Age of Ultron	BV	459	4,276	3	Captain America: Civil War	BV	408	4,226	3	Wonder Woman	WB	413	4,165
4	Inside Out	BV	356	4,158	4	The Secret Life of Pets	Uni.	368	4,381	4	Jumanji: Welcome to the Jungle	Sony	402	3,849
5	Furious 7	Uni.	353	4,022	5	The Jungle Book (2016)	BV	364	4,144	5	Guardians of the Galaxy Vol. 2	BV	390	4,347
6	Minions	Uni.	336	4,311	6	Deadpool	Fox	363	3,856	6	Spider-Man: Homecoming	Sony	334	4,348
7	The Hunger Games: Mockingjay - Part 2	LGF	282	4,175	7	Zootopia	BV	341	3,959	7	It	WB (NL)	327	4,148
8	The Martian	Fox	228	3,854	8	Batman v Superman: Dawn of Justice	WB	330	4,256	8	Thor: Ragnarok	BV	315	4,080
9	Cinderella (2015)	BV	201	3,848	9	Suicide Squad	WB	325	4,255	9	Despicable Me 3	Uni.	265	4,535
10	Spectre	Sony	200	3,929	10	Sing	Uni.	270	4,029	10	Justice League	WB	229	4,051
11	Mission: Impossible - Rogue Nation	Par.	195	3,988	11	Moana	BV	249	3,875	11	Logan	Fox	226	4,071
12	Pitch Perfect 2	Uni.	184	3,660	12	Fantastic Beasts and Where To Find Them	WB	234	4,144	12	The Fate of the Furious	Uni.	226	4,329
13	The Revenant	Fox	184	3,711	13	Doctor Strange	BV	233	3,882	13	Coco	BV	209	3,987
14	Ant-Man	BV	180	3,868	14	Hidden Figures	Fox	170	3,416	14	Dunkirk	WB	188	4,014
15	Home (2015)	Fox	177	3,801	15	Jason Bourne	Uni.	162	4,039	15	Get Out	Uni.	176	3,143
16	Hotel Transylvania 2	Sony	170	3,768	16	Star Trek Beyond	Par.	159	3,928	16	The LEGO Batman Movie	WB	176	4,088
17	Fifty Shades of Grey	Uni.	166	3,655	17	X-Men: Apocalypse	Fox	155	4,153	17	The Boss Baby	Fox	175	3,829
18	The SpongeBob Movie: Sponge Out of Water	Par.	163	3,680	18	Trolls	Fox	154	4,066	18	Pirates of the Caribbean: Dead Men Tell No Tales	BV	173	4,276
19	Straight Outta Compton	Uni.	161	3,142	19	La La Land	LG/S	151	3,236	19	The Greatest Showman	Fox	171	3,342
20	San Andreas	WB (NL)	155	3,812	20	Kung Fu Panda 3	Fox	144	3,987	20	Kong: Skull Island	WB	168	3,846

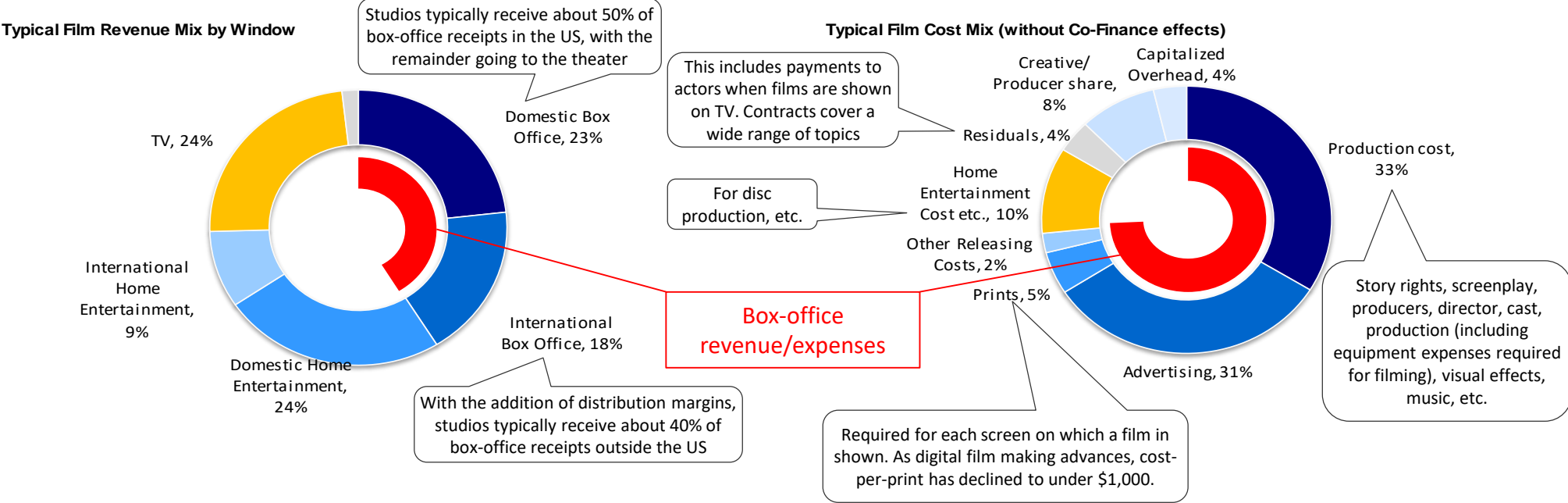
2018				2019				2020							
	Studio	DBO	Theatres		Studio	DBO	Theatres		Studio	DBO	Theatres	Release			
		(US\$ m)				(US\$ m)				(US\$ m)		Date			
1	Black Panther	BV	700	4,020	1	Avengers: Endgame	BV	858	4,662	1	Bad Boys for Life	Sony	206	3,775	17-Jan
2	Avengers: Infinity War	BV	679	4,474	2	The Lion King	BV	544	4,802	2	Sonic the Hedgehog	P/DW	149	4,198	14-Feb
3	Incredibles 2	BV	609	4,410	3	Star Wars: Episode IX - The Rise of Skywalker	BV	515	4,406	3	Birds of Prey	WB	84	4,236	7-Feb
4	Jurassic World: Fallen Kingdom	Uni.	418	4,475	4	Frozen II	BV	477	4,440	4	Dolittle	UB	77	4,155	17-Jan
5	Aquaman	WB	335	4,125	5	Toy Story 4	BV	434	4,575	5	The Invisible Man	UB	70	3,636	28-Feb
6	Deadpool 2	Fox	318	4,349	6	Captain Marvel	BV	427	4,310	6	The Call of the Wild	BV	62	3,914	21-Feb
7	Dr. Seuss' The Grinch (2018)	Uni.	271	4,141	7	Spider-Man: Far from Home	Sony	391	4,634	7	Onward	BV	62	4,310	6-Mar
8	Mission: Impossible - Fallout	Par.	220	4,386	8	Aladdin	BV	356	4,476	8	Tenet	WB	58	350	3-Sep
9	Ant-Man and the Wasp	BV	217	4,206	9	Joker	WB	335	4,374	9	The Croods: A New Age	UB	35	2,211	25-Nov
10	Bohemian Rhapsody	Fox	216	4,000	10	Jumanji: The Next Level	Sony	317	4,227	10	Wonder Woman 1984	WB	29	-	25-Dec
11	A Star is Born (2018)	WB	215	3,686	11	It Chapter Two	WB	212	4,570	11	Fantasy Island	Sony	27	2,784	14-Feb
12	Solo: A Star Wars Story	BV	214	4,381	12	Us	Uni.	175	3,743	12	The New Mutants	BV	24	2,754	28-Aug
13	Venom (2018)	Sony	214	4,250	13	Fast & Furious Presents: Hobbs & Shaw	Uni.	174	4,344	13	Like a Boss	P/DW	22	3,081	10-Jan
14	Ralph Breaks the Internet	BV	201	4,017	14	John Wick: Chapter 3 - Parabellum	LG/S	171	3,850	14	Unhinged	Sol	21	2,402	14-Aug
15	Spider-Man: Into The Spider-Verse	Sony	190	3,813	15	Knives Out	LG/S	165	3,461	15	The Photograph	UB	21	2,516	14-Feb
16	A Quiet Place	Par.	188	3,508	16	How to Train Your Dragon: The Hidden World	Uni.	161	4,286	16	The War with Grandpa	101	19	2,365	9-Oct
17	Crazy Rich Asians	WB	175	3,384	17	1917	Uni.	159	3,987	17	Underwater	Fox	17	2,791	10-Jan
18	Mary Poppins Returns	BV	172	4,090	18	The Secret Life of Pets 2	Uni.	159	4,564	18	The Turning	UB	15	2,571	24-Jan
19	Hotel Transylvania 3: Summer Vacation	Sony	168	4,267	19	Pokémon Detective Pikachu	WB	144	4,248	19	Grete! & Hansel	UA	15	3,007	31-Jan
20	Fantastic Beasts: The Crimes of Grindelwald	WB	160	4,163	20	Once Upon a Time... in Hollywood	Sony	143	3,659	20	Honest Thief	ORF	14	2,502	9-Oct

Note: DBO = Domestic Box Office(North American Box office), BV = Buena Vista (Disney), Fox = 20th Century Fox, LG/S, LGF = Lionsgate, Par., P/DW = Paramount (Viacom), Sum. = Summit Entertainment(Lionsgate), Uni. = Universal, WB, WB (NL) = Warner Bros., Wein. = Weinstein Company., Sol = Solstice Studios., 101 = 101 Studios., UA = United Artists Corporations, ORF = Open Road Films.

Source: Mizuho Securities Equity Research from boxofficemojo

Motion Pictures: An outline of revenue and costs

- The flow of motion picture production comes in three stages: 1) pre-production, which includes planning, composition and scenario creation, acquisition of story rights, staffing and casting, budgeting, arranging financing for expenses, and securing insurance; 2) production, which includes filming and CGI operations; and 3) post-production, which includes cutting filmed scenes, video and audio processing, including visual effects (VFX) and special effects (SFX), creating copies (prints) of the completed work, and conversion to Blu-ray disc and DVD formats. The production period span can of course vary depending on the film.
- Sony Pictures follows an accounting method that allows the company to defer part of the film's production costs. Under this method, capitalized expenses can be amortized in line with total sales associated with the film, including sales outside the box-office revenue window (this is in some sense similar to the production output method). There are only a limited number of films where production and advertising costs can be recovered through box office receipts alone, and recovery of investment through non box-office revenue windows/ancillaries such as TV broadcasting, paid channels and video on demand/subscription video on demand, as well as blue-ray discs and DVDs is considered standard in the industry.
- The business model is considered highly volatile for investment, with a hit motion picture producing major changes. A large-scale production can involve costs of at least ¥10b.
- The industry has seen a growing number of projects in which risk is dispersed through co-financing, with funding from individuals and funds, and by production being completed by multiple studios.
- It is also possible for studios to secure revenue through the buying and selling of copyrights on owned properties.

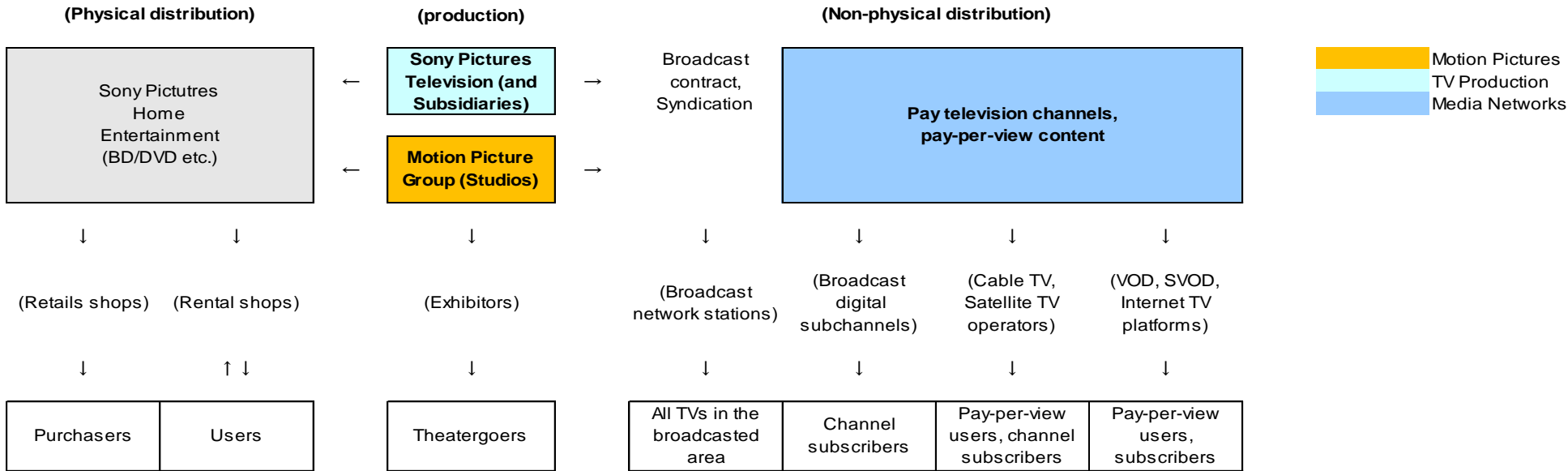


Source : Mizuho Securities Equity Research from MPAA

TV Production and Media Networks

- **TV Production:** The TV Production segment is operated by subsidiary company Sony Pictures Television (SPT). The company is responsible for producing a wide range of program content, including comedies and series-based programs such as game shows and dramas. Operations are not confined to just the US, with the company owning 18 studios in locations around the world.
- Competition in the TV production business includes companies with major broadcasting networks within their respective groups. Due to FCC regulations, Sony does not maintain a major TV broadcasting business in the US. Rather, many of the programs produced by the company are broadcast by external networks through license agreements or aired through syndication.
- Some of the company's productions have not been aired on TV, but have since their inception been planned for Blu-ray disc/DVD sales.
- **Media Networks:** the media networks segment supplies content (programs) for cable, satellite and internet distribution operators.
- Distributed content includes a wide-range of programming, including projects from the motion picture and TV production segments, as well as sports-related programming. The segment includes a number of subsidiaries outside the US, with some of these subsidiaries also producing their own original content.
- Paid channel content is distributed to contracted consumers through telecommunication carriers such as Dish and DirecTV (and in Japan through carriers such as J:COM). Sony does not conduct infrastructure-related operations. It entered the Game and Network business with the launch of PS Vue, but withdrew in 2019.

Film contents flow in pictures segment



Source : Mizuho Securities Equity Research

TV Production: an industry outline (US TV broadcasting: network broadcasting)

The major broadcasting networks in the US include the so-called “big 3” TV networks (ABC, CBS, and NBC), as well as Fox, and The CW (a 50/50 joint-venture between Warner Brothers and CBS)

Types of TV stations: 1) **Owned and operated (O&O)**: these include stations that are owned and operated by the aforementioned major networks. In line with FCC regulations, there is a limit on the number of stations that any single major network may own. 2) **Affiliates**: these include local stations that broadcast content from the major networks under contract. This is often the case in areas in which the major network cannot directly operate a station. This arrangement is somewhat akin to convenience store franchises in Japan. 3) **Independent stations**: these include stations broadcasting in-house content and externally procured content, including syndicated content.

Syndication: Rather than licensing programming to major broadcasting networks on an individual basis, syndication allows the licensing of programming to a number of broadcasting stations (one in each area) through use of a syndicator. There are more than 200 broadcasting regions in the US. In “First-run” syndication, a program is broadcast for the first time as a syndicated show (not being broadcast on any major network). In contrast, “Off-network” syndication, a program that originally aired on network television (or in some cases “first-run syndication) is licensed for broadcast to other networks. Ownership of program content is maintained by the production company.

The US syndication market: This refers to the trading market for television programming. Market participants include: 1) syndicators (distributors that are basically TV production group departments) providing content; 2) TV stations; and 3) advertisers. Items for trading include licensing of broadcasting rights, advertising fees, and commercial allotment time.

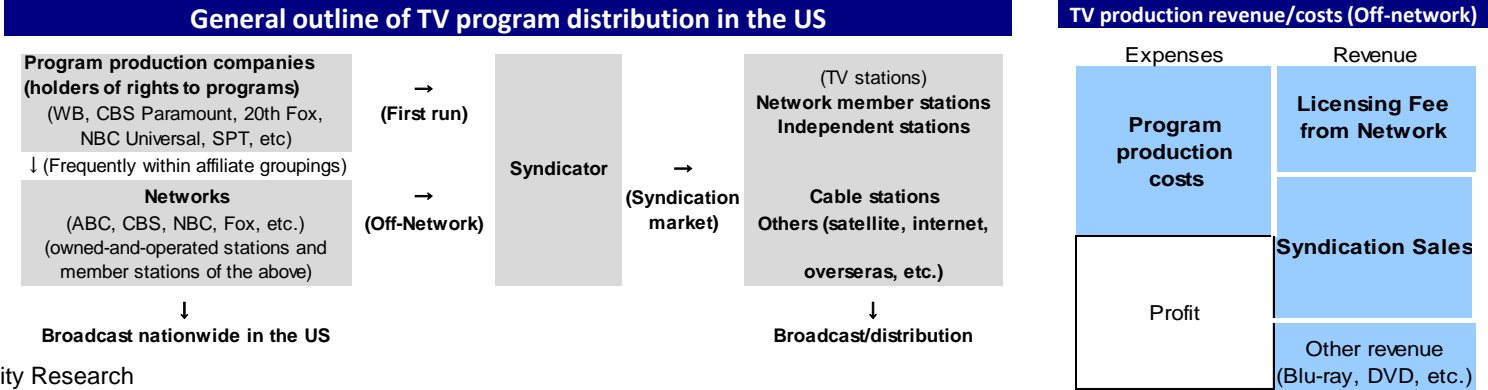
The program content market (syndication market) has been fostered by the regulations outlined below in an effort to prevent dominance of the market by the three largest networks.

1) Prime Time Access Rule (PTAR, 1970 - 1996): This rule restricted owned and operated, as well as affiliate stations from airing more than three hours of network programming during the four-hour “prime-time” window (7:00pm through 11:00pm). This regulation results in a large number of local stations having to procure at least some programming from outside sources.

2) Fin-Syn Rules (Financial Interest and Syndication Rules, 1970-1996): These regulations prevented the major networks from: a) owning rights, including the right to receive monetary compensation, for programs broadcast during Prime Time; and 2) airing syndicated programming (through owned and operated as well as affiliate stations) in which they had a financial stake. These regulations resulted in CBS spinning off its syndication (formerly Viacom) section.

Both of these regulation were subsequently repealed, due in part to the expanding share of networks other than the big three (including FOX), and the spread of cable channels and other media outlets.

Television deficit financing is the practice of a network paying a studio that creates a show a license fee in exchange for the right to air a show. Since this license fee is usually not enough to cover expenses, the studio bears the additional cost. However, if the show is successful and sold into syndication, the studio could recoup significantly more money.



Source : Mizuho Securities Equity Research

TV Production: recipients of Sony Pictures Television (SPT) programming

- Supplying programming to the three major US networks: As of the end of December 2020, Sony Pictures Television (SPT) was supplying *For Life*, *Shark Tank*, *The Good Doctor* to ABC, *S.W.A.T.*, *The young and the Restless* to CBS, and *Days of our Lives* and *The Blacklist* to NBC. While the company does supply some programming to Fox, the amount is less than for the three major networks.
- In addition to providing programming to the major networks, cable providers and satellite broadcasters, the company is gradually expanding programming offered to Internet-distribution platforms.
- First-run syndication programs include *Wheel of Fortune*, *Jeopardy!*, and *The Dr. Oz Show*. *Wheel of Fortune* and *Jeopardy!* Are both long-running game shows and appear to be earnings pillars for the TV production business.
- There have been a substantial number of cases in which negotiations have been settled at the beginning of a customer's fiscal term, and since many of these customers have fiscal terms ending in December, earnings in the business can be weighted toward the Jan-Mar quarter.

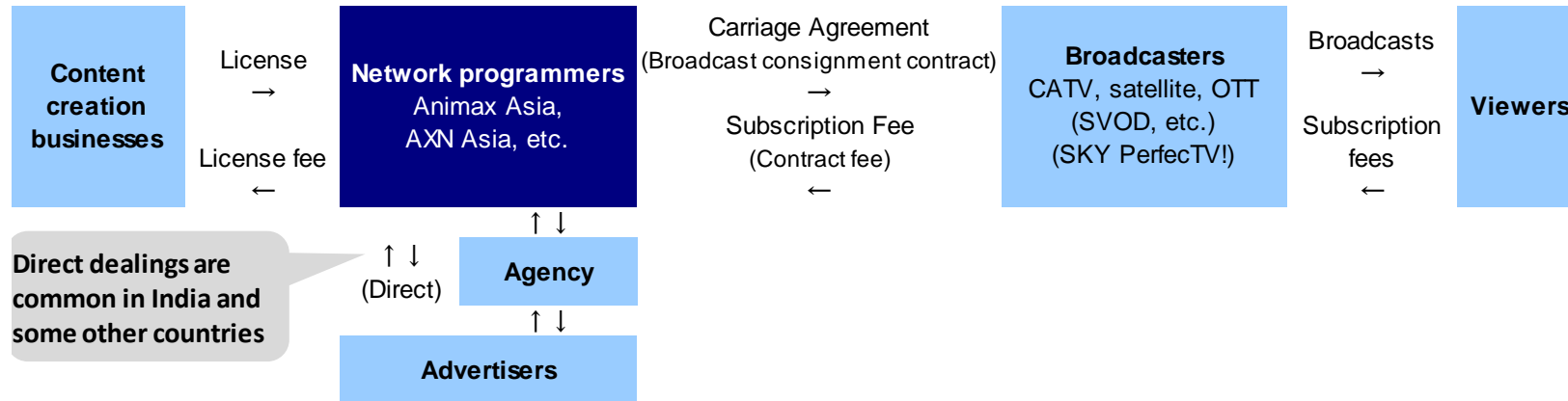
Number of SPT's TV programs(series) by channel/network

Network/Channel	Network type	Channel genre	(CY)																																			
			1Q13	2Q13	3Q13	4Q13	1Q14	2Q14	3Q14	4Q14	1Q15	2Q15	3Q15	4Q15	1Q16	2Q16	3Q16	4Q16	1Q17	2Q17	3Q17	4Q17	1Q18	2Q18	3Q18	4Q18	1Q19	2Q19	3Q19	4Q19	1Q20	2Q20	3Q20	4Q20				
First Run Syndicati	Syndication	-	3	4	4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3				
ABC	Big 3 network	-	2	2	2	2	2	2	2	2	3	2	3	4	5	4	5	3	4	5	4	3	4	4	3	3	4	4	3	3	4	4	5	5	6	4	-	4
CBS	Big 3 network	-	2	2	1	1	3	3	2	3	3	2	1	1	1	1	2	2	2	2	2	3	3	3	2	2	2	2	1	1	2	2	1	2	2	1	2	
NBC	Big 3 network	-	3	3	5	4	4	3	4	4	3	2	3	2	5	2	3	3	4	4	3	2	3	3	1	2	2	2	1	2	4	3	2	2	-	-		
FOX	Big 4 network	-	-	-	-	1	1	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CW	Big 5 network	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
A&E	Cable/Satellite channel	Entertainment	-	-	-	-	-	-	-	-	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Adult Swim	Cable/Satellite channel	Entertainment	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
AMC	Cable/Satellite channel	Entertainment	1	3	-	-	-	-	1	1	1	-	1	2	4	2	2	1	-	4	2	1	1	1	2	1	-	-	1	-	-	-	1	-	-	1		
FX	Cable/Satellite channel	Entertainment	1	-	-	1	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
GSN	Cable/Satellite channel	Entertainment	1	-	-	-	-	-	-	-	1	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Syfy	Cable/Satellite channel	Entertainment	-	-	-	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	
TBS	Cable/Satellite channel	Entertainment	1	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1	1	-	-	1	-	-	-	-	-	-	-	-	-	
TNT	Cable/Satellite channel	Entertainment	1	1	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Univision	Cable/Satellite channel	Entertainment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	
USA	Cable/Satellite channel	Entertainment	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
WGN America	Cable/Satellite channel	Entertainment	-	-	-	-	-	-	-	-	-	-	2	2	2	-	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MTV	Cable/Satellite channel	Entertainment	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Telemundo	Cable/Satellite channel	Entertainment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-	
Lifetime	Cable/Satellite channel	Lifestyle	2	1	1	1	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	
Freeform	Cable/Satellite channel	Lifestyle	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	
VH1	Cable/Satellite channel	Entertainment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
OWN	Premium Cable/Satellite	Lifestyle	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cinemax	Premium Cable/Satellite	Premium movies	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Showtime	Premium Cable/Satellite	Premium movies	1	1	1	-	-	1	-	-	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1	1	-	1	-	1	1	1	-	-	
Starz	Premium Cable/Satellite	Premium movies	-	-	-	-	1	-	-	-	1	-	-	1	-	1	-	-	-	-	1	1	1	-	-	-	1	1	-	-	-	-	-	-	-	1	1	-
Pop TV	Premium Cable/Satellite	Entertainment	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Direct TV	Satellite TV operator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Amazon	Over the top (Internet)	-	-	-	-	-	-	-	-	-	-	1	-	1	-	1	-	1	-	-	2	-	4	-	-	-	2	2	1	1	-	-	1	1	-	1	1	
Crackle	Over the top (Internet)	-	-	-	-	1	1	1	1	1	2	1	1	1	1	1	1	-	-	1	-	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	
Netflix	Over the top (Internet)	-	-	-	-	-	-	1	-	-	-	-	1	-	1	-	-	-	2	1	1	1	-	1	1	1	1	-	2	-	-	1	-	-	1	-	1	
Playstation	Over the top (Internet)	-	-	-	-	-	-	1	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hulu	Over the top (Internet)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	
Others	Over the top (Internet)	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	2	-	-	2	1	2	2	1	2	-	4	-	-	2	2	1

Source : Mizuho Securities Equity Research

Media Network: Business model

Outlook for business model



- The Media Network segment conducts programming and supply operations. Customers include cable, satellite, and internet-based distributors. Content distributed includes film and TV programs produced within the Sony group, and sports-related programming. Sony does not operate in the broadcasting business.
- Revenue sources consist largely of advertising fees and contract fees. While the advertising fees can vary significantly depending on the popularity of a given program, contract fees remain generally stable. In India, there are a number of direct contracts in which advertising agencies are not utilized.

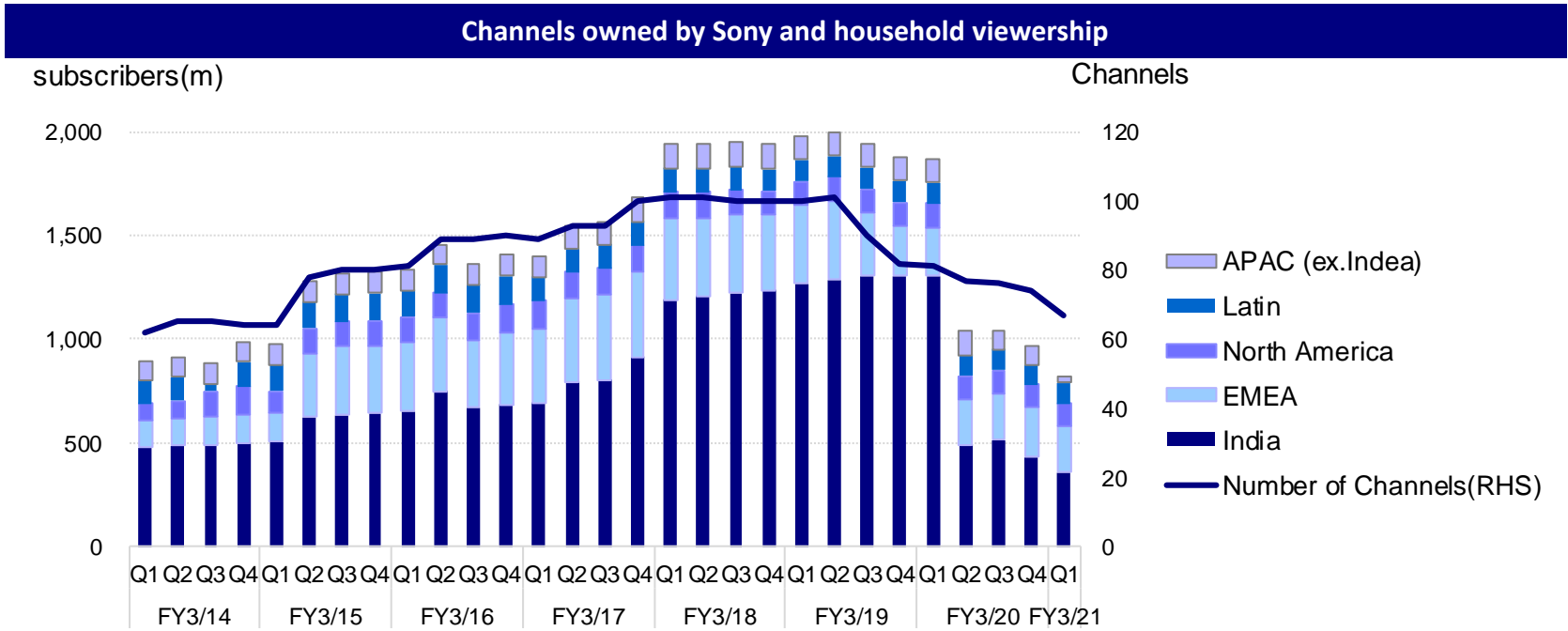
(News flow for the segment)

- In June 2014, Sony Pictures Television acquired CSC Media Group (UK). SPT acquired the firm's 16 channels, including those dedicated to children's programming, music, and movies, with an aim to convert the peaking film business to a broadcasting business.
- In July 2015, Sony Pictures TV reached an agreement to acquire South America's largest Internet advertiser IMS Internet Media Services in a bid to strengthen its advertising business.
- In April 2016, Sony Pictures TV established a joint venture with Turkish advertising company Satis Ofisi, acquiring a majority stake in Planet TV Channels Group. The firm maintains four channels, one each for children's programming, dramas, films, and cooking.
- In August 2016, Sony Pictures TV reached an agreement with ZEE to acquire all shares of TEN Sports Network (India). TEN Sports Network supplies sports programming to not only India (its main market), but also the Middle East, Hong Kong, and Singapore. On the back of an expansion in the channel network, the company aims to boost OPM from 4% to 7% in FY17.

Source : Mizuho Securities Equity Research

Media Network: business outline

- Sony owned 101 channels as of the end of September 2018 (with 198 channel feeds). Gross viewership was 2.00b households (with about 63.2% in India). India accounted for about 33.3% of sales.
- Sony does not operate in the distribution infrastructure business as companies such as AT&T and Dish do, or in the general TV broadcasting business as companies such as ABC, CBS, and NBC do.
- Mainstay subsidiaries include Game Show Networks (GSN), in which Sony holds a 58% stake and AT&T the remainder, Crackle (an online TV distribution platform), Sony ESPN(a sports channel in India in which the company has a 50% stake, with the remainder held by ESPN Inc., a Disney subsidiary, and CSC Media, a UK firm acquired in 2014).
- Sales revenues are about evenly split between advertising revenue and content supply fees from distribution platforms, including cable & satellite broadcasting companies.
- In June 2014, Sony Pictures Television acquired independent channel distribution leader CSC Media Group (UK) for £107m (about ¥18b), expanding channel count and household viewership.
- In August 2016, Sony announced the acquisition of TEN Sports Network for ¥39.7b

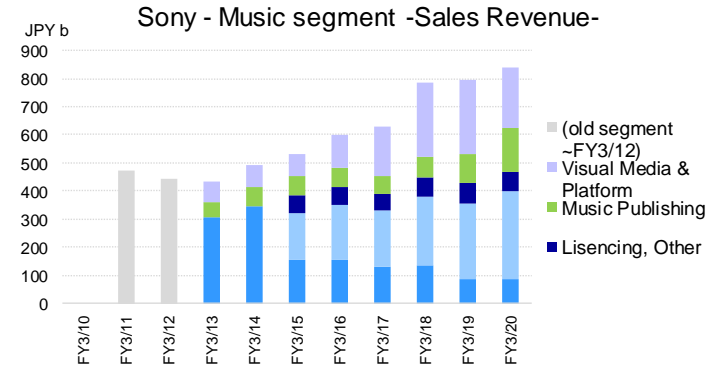
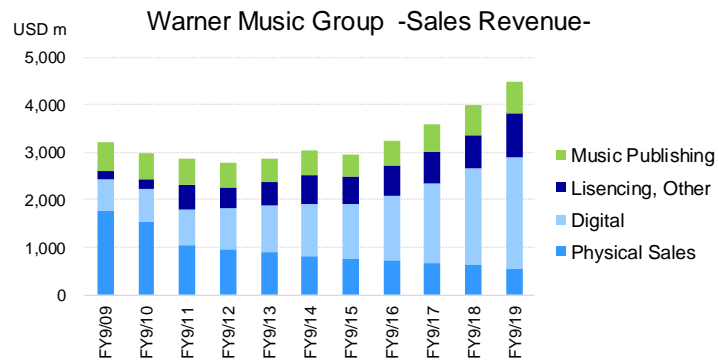
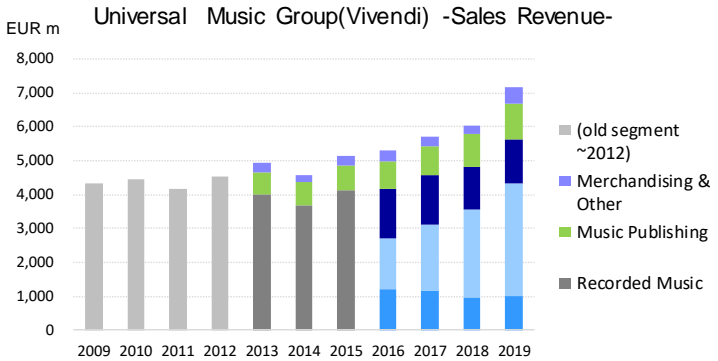


Source : Mizuho Securities Equity Research from company data

Sony: Music – Global income structure

- **Recorded Music** (master licenses for recorded audio, neighboring rights in Japan)
- Earnings consist of physical goods sales such as CDs, distribution platform revenue (iTunes, Spotify, Pandora etc), live performance management revenue, and royalties from music broadcasting. Expenses include payments to artists, master sound production, and sound track usage copyright fees.
- **Music Publishing** (copyright for lyrics, music composition)
- Earnings consist of copyright fees for the use of music. Earnings revenue is fairly stable, with only small market share changes between the major music labels (excluding catalogue acquisitions through M&A). Expenses include payments to lyricists and songwriters, and management expenses.

Recorded music	Sale of content, licensing centering on master licenses (=audio data)
Earnings	
Physical	Sales of CDs, DVDs
Digital	Music royalties from downloads, streaming service companies
Artist services	Revenue from sponsor management, fan club and website management
Licensing	Royalties from use of music in film, TV, games and public locations
Expenses	
Artist expenses	1) Artist, producer, songwriter 2) Artist discovery, training & development 3) Mastering
Production expenses	Package preparation, distribution, artist services
Marketing, SG&A	-
Music publishing	Music score (lyrics, music composition) copyright management
Earnings	
Performance	Performances using music scores (TV and radio airtime, concerts)
Mechanical	Sales of sound sources (CD/DVD) recorded from music scores
Digital	Distribution of sound scores recorded from music scores (downloads/streaming)
Synchronization	Use of music score on TV or in movie, toy or game
Others	Other music score usage
Expenses	
Lyricist, songwriter consideration	1) Consideration to lyricist, songwriter, joint publisher and other copyright holders 2) Expenses for lyricist, songwriter discovery and training/development, content acquisition costs
General management expenses	-

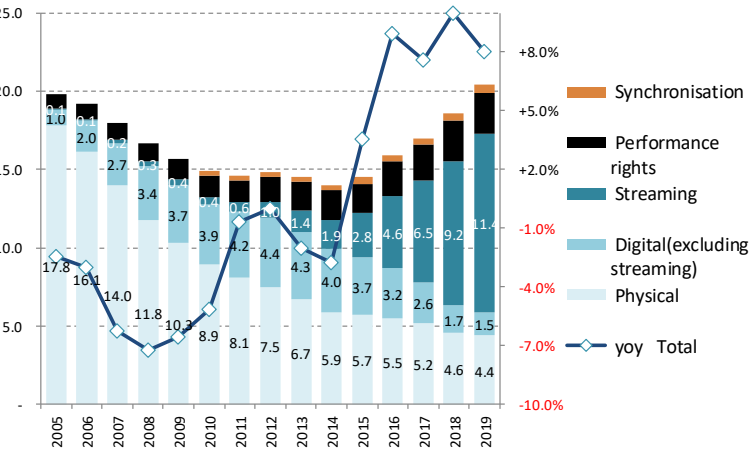


Source: Mizuho Securities Equity Research from company data and IFPI

Sony: Music business - global trends

- Recorded Music: Recovering off a 2014 bottom, with streaming the driving force. The US is the largest market (70% of sales were digital in 2016), followed by Japan (20%), the UK (47%), Germany (32%), and France (30%) – combined, these top five countries account for 72% of the global market.
- Physical earnings from CDs and other sources continue to fall, while digital earnings via internet distribution platforms are trending upwards. The digital share of the market is fairly uneven: almost 80% of music sales in Japan are still physical (CDs etc), while the digital ratio is much higher in North European countries such as Sweden (the home of Spotify) and emerging economies.
- 2011 saw major global restructuring, with EMI selling off its recorded music unit to Universal (Vivendi), and its music production unit to a Sony/ATV-led consortium.
- The three major music labels are now Sony/ATV (+EMI's recorded production unit), Universal (+EMI's recorded music unit) and Warner.
- The three majors have other music publishing companies under their umbrella (Sony/ATV Music Publishing + EMI Publishing, Universal Music Publishing, Warner/Chappell Music). The three majors combined have a 63% market share by value in the music publishing sector (2015).

Worldwide Recorded Music industry: Revenues (USD bn)



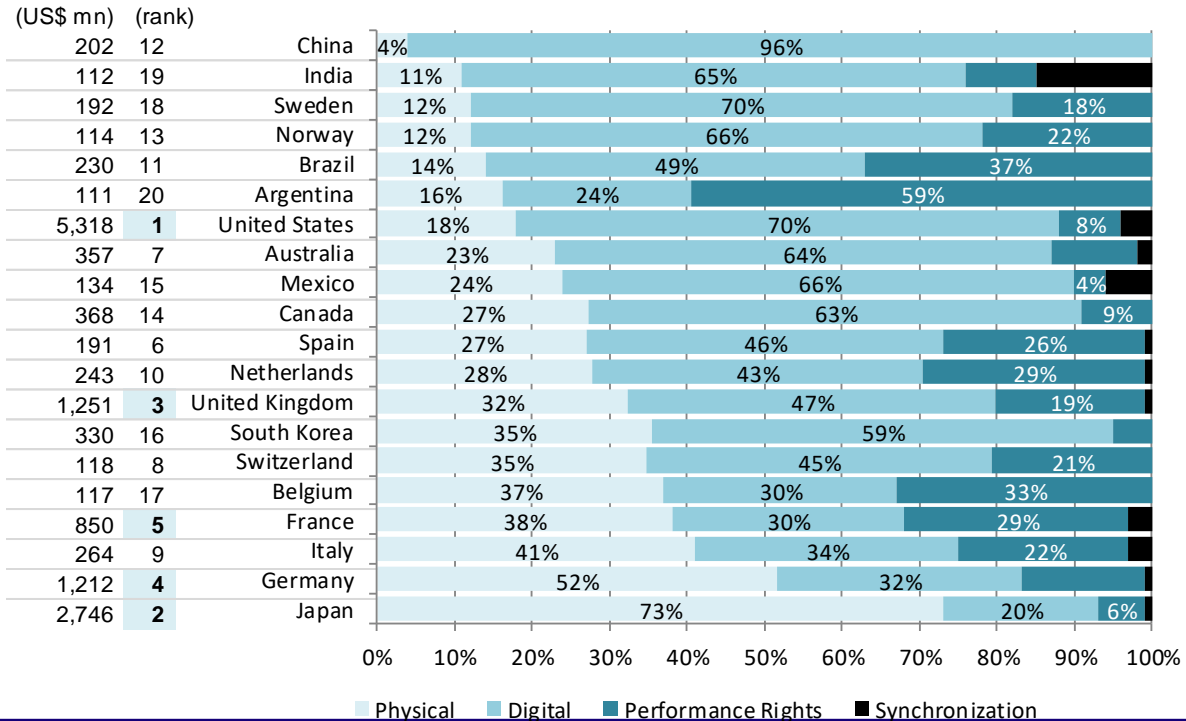
(Music publishing)

Worldwide Music & Copy right revenue share for CY15

1 Sony / ATV + EMI publishing	28%
2 Universal Music Publishing Group	23%
3 Warner Music Group	12%
4 Bertelsmann Music Group	6%
5 Kobalt Music	5%
All others	26%

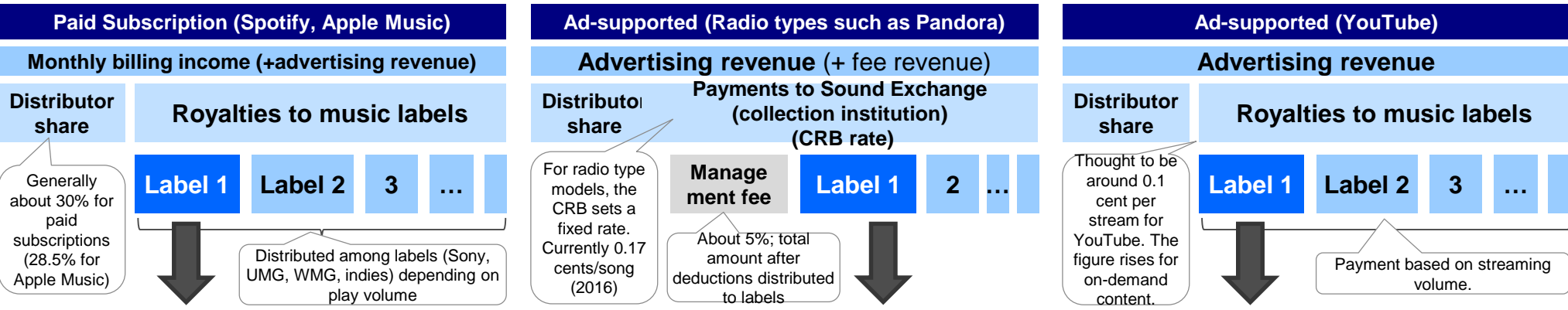
Source: Mizuho Securities Equity Research from company data and IFPI

Recorded Music Market size by region - 2016

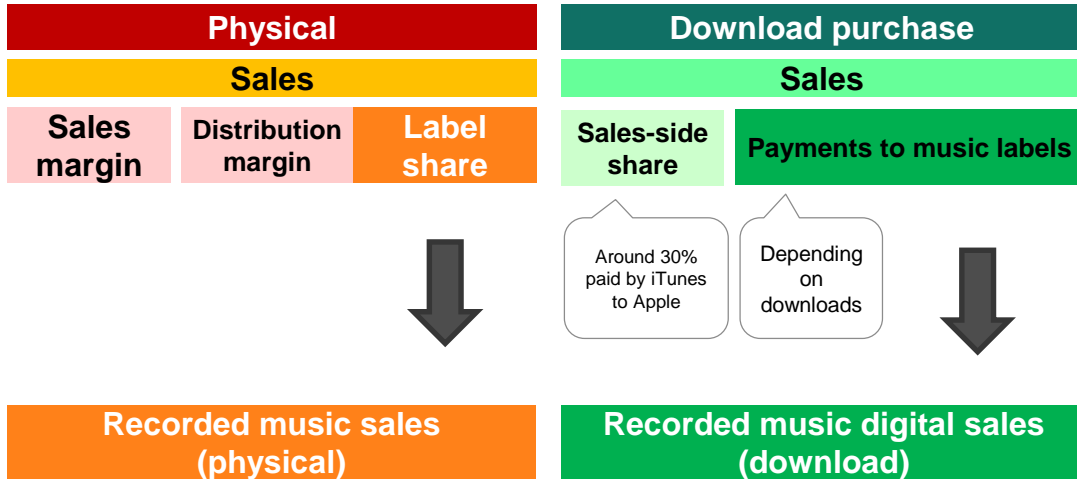
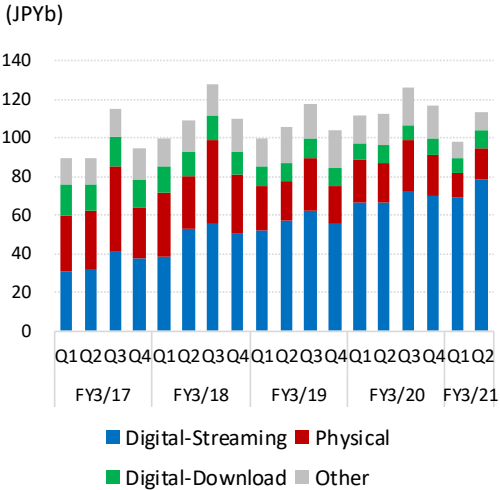
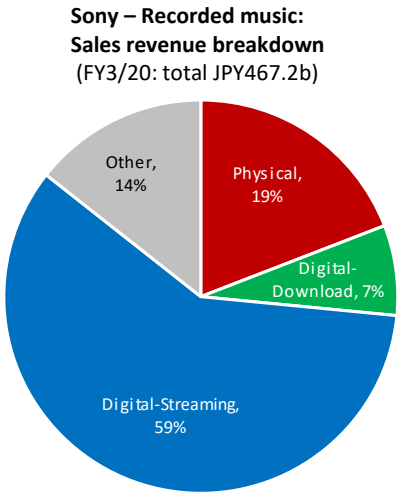


Sony: Digital distribution platform earnings models

Started releasing streaming sales (recorded music) figures from 4Q FY3/16, 4Q FY3/18 streaming sales up 34% YoY



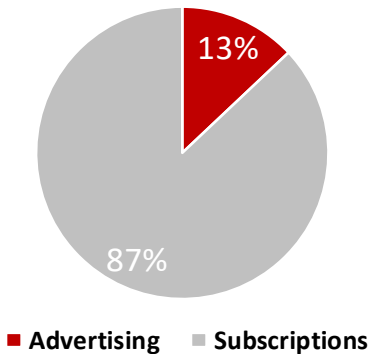
Recorded music digital sales (streaming)



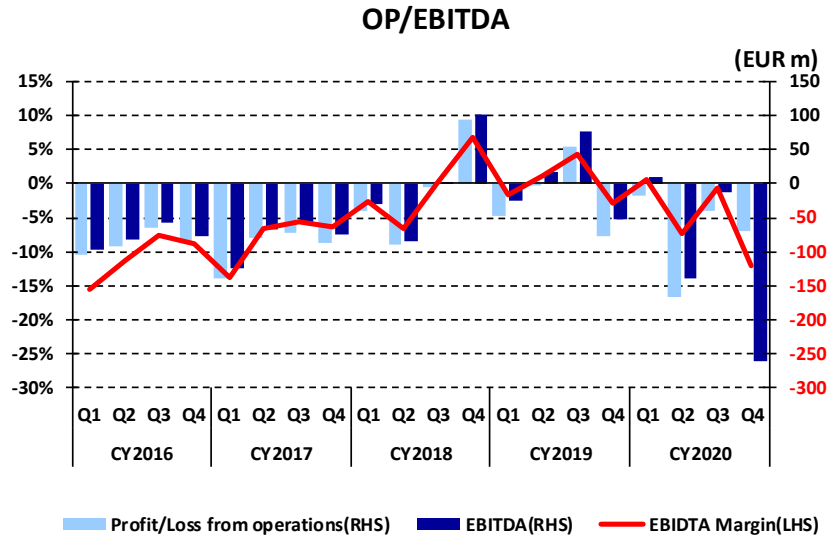
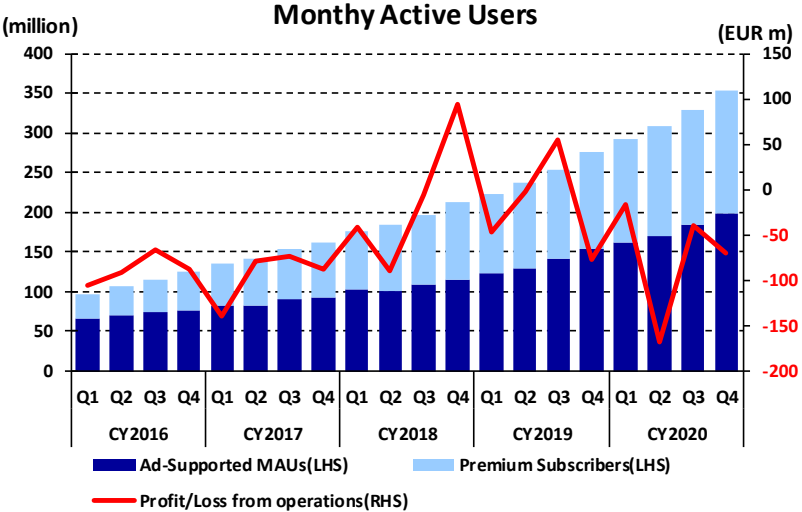
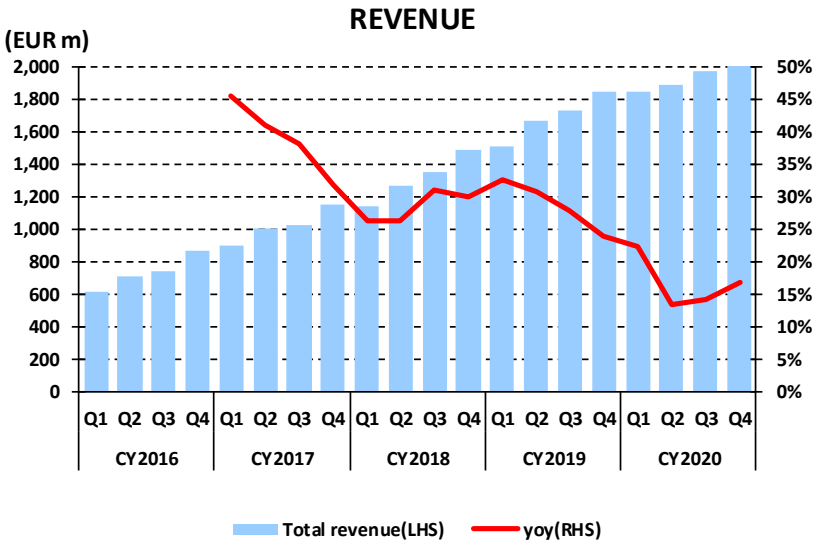
Note: The above is a guideline only, and in practice, some cases include conditions such as revenue share and minimum fee guarantees.
 Source: Mizuho Securities Equity Research from company data, Copyright Royalty Board (CRB) and www.musicman-net.

Spotify: Earnings structure for music services

Spotify:Revenue(2020 4Q)



- 87% of revenue is from usage fees for premium subscribers (2020).
- Both ad-supported and premium subscriber totals increasing.
- As of the end of December 2020 : Amongst 345m MAUs (monthly active users), 155m premium subscribers (62m in EU, 47m in NA, 31m in SA, and 15m in other regions)
- As of the end of December 2020: 199m ad-supported and 155m premium subscribers
- Spotify announced "Spotify Clips" and "HiFi" on Feb.22, 2021
 - ✓ Clips: for creators to contribute short moving image
 - ✓ HiFi: new subscription services with same quality as CD level



Source: Compiled by Mizuho Securities Equity Research from company data

What is “One Sony Corporation”?

Examples of One Sony Corporation

✓ Development of new products and services that cut across multiple fields; cross-business collaboration

Game & network services (G&NS) x music/movies x IP&S

- ◆ **xR Solution**
 - Creation of high image quality VR using SIPS’ movie cameras
 - Adaptable not just for music but sports and live events
- ◆ **Virtual reality (VR) content using Sony artists**
 - Jyaran Nogizaka Onsen: VR de Nogizaka to Ryoko Taiken!
 - Kingdom Hearts’ theme song: Utada Hikaru’s “light” Hikaru Utada Laughter in the Dark Tour 2018-“light”-VR
- ◆ **Anime from Aniplex (Sony Music Artists subsidiary)**
 - Kimetsu no Yaiba’s theme song is LiSA’s (Sony artist) Gurenge, also provides smartphone apps and games (PS4)

Smartphone (MC) x HE&S/IP&S/movies

- ◆ **Adoption of AV technology for use in Xperiall**
 - **Cinematography Pro**
 - Directed by the movie filming camera development team, facilitates full-fledged cinema filming (reflecting CineAlta hue and image making)
 - **Dolby Atmos**
 - Sony Pictures’ mixer-directed movie theater stereophonic sound technology
 - **High image quality technology developed in BRAVIA (TV) business**
 - HDR remastering: Adjust contrast by individual areas within the screen and convert SDR video to the HDR level
 - X1 for mobile image-quality engine
 - **Digital SLR camera technology and collaboration**
 - Pupil AF compliance, AF/AE follow 20 frames/second consecutive shooting
 - Supports use of digital SLR camera α as a sub-monitor, remote photography and photograph data automated transfers

HE&S/IP&S x movies/TV

- ◆ **Use of in-house products in production of movies and TV shows**
 - Movie cameras
- ◆ **5G Solutions**
 - Using 5G to transmit images live allows for production of low-cost live images for viewing/experiencing
 - Online support for live sports coverage and other wired cameras
- ◆ **Virtual production**
 - Film commercials and movies that use 3D data filmed ahead of time as background imagery on the proprietary micro-LED display (Crystal LED)

G&NS x movies

- ◆ **Making movies using gaming intellectual property**
 - Movies based on the Resident Evil series
 - Established PlayStation Productions
 - ✓ Making a drama and movies for The Last of US
- ◆ **Developing games for popular movies**
 - Jumanji: Jumanji The Video Game (PS4)
 - Spider-Man: Marvel’s Spider-Man : Miles Morales (PS4/PS5)

- **Medical x IP&S:** Utilization of imaging sensors and video filming and transmission technologies in surgical endoscopes and surgical microscopes
- **Financial x technology:** Provision of payment services to group firm Minnano Taxi and AI-based marketing analysis of GOOD DRIVE auto insurance, a new product, and non-life insurance business

Source: Mizuho Securities Equity Research from company data

Funai Electric (6839)

(JPY m)	FY3/13	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18E	FY3/19E	FY3/20E
Sales	191,082	233,802	216,553	170,041	133,838	130,586	129,076	131,633
OP	-6,568	-6,071	-659	-10,539	-6,775	-10,620	-3,294	-915
NP	-9,869	-7,400	31	-33,839	-6,745	-24,449	-2,723	-86
EBITDA	-1,304	408	5,196	-6,041	-2,677	-8,442	-2,168	167
EPS	-289.3	-216.9	0.9	-991.8	-197.7	-716.6	-79.8	-2.5
BPS	3,461.2	3,328.6	3,576.2	2,442.3	2,242.4	1,511.3	1,431.5	1,418.9
DPS	35.0	35.0	35.0	30.0	10.0	-	10.0	13.0
Net cash per share	1,564	1,094	1,602	1,305	1,154	797	678	626
PER	-	-	1,504.3	-	-	-	-	-
PBR	0.33	0.31	0.39	0.40	0.42	0.53	0.56	0.56
EV/EBITDA	10.7	-	-	1.8	2.7	-	-	35.6

Rating: Neutral
 Price Objective..... **¥800**
 Valuation metric: FY18/3 Net cash / share

Share Price Drivers

- US personal consumption, Walmart sales
- TV sales trends at Yamada Denki
- LCD TV demand in US/Japan, BD recorder demand in Japan
- LCD panel, component price trends
- New ODM customers, new tie-up
- Dealing with new business including EV

Note: valuations for each period are based on our price objective. The earnings results for FY3/18 and FY3/19 are already announced, forecast by Mizuho Securities is as of May 9, 2018.

The stock is undervalued, but any catalysts that may boost the shares cannot be seen. Can the company return to the black before FY3/20?

- The shares are abnormally low EV (market valuation < net cash)
- The company's mainstay LCD TV business has continued to book net losses due to growing competitions for its Chinese brand and Tier2. We envisage operating losses for FY3/19 and FY3/20, and do not see any catalysts that may boost the shares.
- We believe the market may reevaluate the share price if the company's OP appeared to be returning to positive territory in a relatively short amount of time (versus our forecast) from the success of initiatives for revamping its printer business (currently underway) and further expanding its video equipment business
- Funai Electric's strengths lie in its factories' competitiveness and its design expertise, in which it can reduce CoGs while maintaining product quality. We think the company will need to produce a minimum of around 4.5m LCD TVs per year (although it will also depend on its product mix) in order to return to positive territory.
- Share price catalysts: 1) returning to a positive OP figure as soon as possible by selling more TVs in North America (mainly Walmart) and Japan (at Yamada Denki); and 2) reducing fixed costs by further restructuring efforts for its information equipment business and the company overall.
- Risks: 1) the price of TVs and panels falling beyond expectations and growing competition for its Chinese brand; 2) a buildup of inventory of large/high-end TVs; and 3) revenue taking a long time to recover for its information equipment.

Source: Mizuho Securities Equity Research

Funai Electric : Earnings estimates by segment (half year/ full year)

(JPY bn)

	FY3/17		FY3/18		FY3/19		FY3/20		FY3/17	FY3/18	FY3/19	FY3/20
	1H	2H	1H	2H	1H	2H	1H				CoE	
Net sales	66.1	67.7	72.1	58.0	46.7	58.8	42.1	133.8	130.1	105.5	85.0	
	yoy	-23.6%	-18.9%	+9.1%	-14.4%	-35.2%	+1.4%	-21.3%	-2.8%	-18.9%	-19.5%	
AV Equipment	57.5	57.7	68.5	54.1	42.0	55.1	37.8	115.2	122.6	97.1		
LCDTV	47.4	46.6	58.4	45.7	35.5	48.5	33.4	94.0	104.1	84.0		
units	000s	1,970	1,800	1,710	1,480	1,620	2,290	3,770	3,190	3,910		
Blu-Ray	5.6	6.9	8.2	6.8	5.6	5.2	3.8	12.5	15.0	10.8		
Others	0.7	0.9	0.5	0.2	0.3	0.7	0.5	1.6	0.7	1.0		
Information Equipment	2.1	3.0	1.9	1.4	1.9	1.4	1.8	5.1	3.3	3.3		
Others	6.5	7.0	1.7	2.5	2.8	2.3	2.5	13.5	4.2	5.1		
Operating income	-3.6	-3.2	-4.0	-6.8	-1.6	2.3	-1.9	-6.8	-10.9	0.7	-3.0	
Operating margin	-5.5%	-4.7%	-5.6%	-11.8%	-3.5%	4.0%	-4.5%	-5.1%	-8.4%	0.6%	NA	
AV Equipment (estimate)	-1.1	-0.7	-2.2	-6.1	-1.5	2.6	-2.1	-1.8	-8.3	1.1		
Information Equipment (estimate)	-1.9	-2.3	-1.7	-0.7	-0.2	-0.4	0.1	-4.2	-2.4	-0.6		
Others (estimate)	-0.6	-0.1	-0.1	0.0	0.1	0.0	0.1	-0.7	-0.1	0.1		
Ordinary income	-7.5	-0.2	-3.6	-8.3	-0.2	1.6	-1.8	-7.7	-12.0	1.4	-3.1	
Net income	-7.6	0.9	-13.1	-11.6	0.7	2.0	-1.8	-6.7	-24.7	1.5	-3.2	
Capex (tangibles)	1.5	1.5	1.0	1.1	0.8	0.6	0.6	3.0	2.5	2.2	-	
Depreciation (tangibles)	1.3	1.5	1.3	0.4	0.3	0.6	0.5	2.8	1.7	0.7	-	
R&D expenditure	3.5	3.9	3.2	3.0	2.8	2.7	2.6	7.4	6.5	6.0	-	

Source: Mizuho Securities Equity Research from company data

Funai Electric : Earnings estimates by segment (quarter)

(JPY bn)

	FY3/17				FY3/18				FY3/19				FY3/20		
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q
Net sales	25.1	41.0	37.3	30.4	32.1	40.1	36.6	21.4	21.7	25.1	34.3	24.5	15.6	26.5	28.1
yoy	-33.7%	-15.8%	-20.2%	-17.1%	+27.8%	-2.3%	-1.8%	-29.8%	-32.5%	-37.4%	-6.4%	+14.8%	-27.8%	+5.6%	-18.0%
AV Equipment	20.7	36.8	32.4	25.3	30.6	37.9	35.0	19.1	18.9	23.1	32.5	22.6	13.6	24.2	25.8
LCDTV	16.0	31.4	25.5	21.1	25.6	32.8	29.9	15.8	15.4	20.1	28.9	19.6	11.2	22.2	22.4
units	650	1,320	950	850	790	920	880	600	740	880	1,350	940	460	780	990
000s															
Blu-Ray	2.6	3.0	4.2	2.7	4.1	4.1	4.4	2.4	3.0	2.6	2.7	2.5	2.0	1.8	3.3
Others	0.3	0.4	0.5	0.4	0.3	0.2	0.1	0.1	0.1	0.2	0.4	0.3	0.3	0.2	0.1
Information Equipment	0.9	1.2	1.4	1.6	0.7	1.2	0.7	0.7	1.0	0.9	0.7	0.7	0.7	1.1	1.2
Others	3.4	3.1	3.5	3.5	0.7	1.0	0.9	1.6	1.7	1.1	1.1	1.2	1.3	1.2	1.1
Operating income	-2.9	-0.7	-1.0	-2.2	-2.3	-1.7	-1.8	-5.0	-1.2	-0.4	1.2	1.2	-0.9	-1.0	0.0
Operating margin	-11.5%	-1.8%	-2.7%	-7.1%	-7.3%	-4.3%	-5.0%	-23.4%	-5.7%	-1.6%	3.4%	4.8%	-5.8%	-3.8%	0.1%
AV Equipment (estimate)	-1.3	0.2	0.4	-1.1	-1.5	-0.7	-1.2	-4.9	-1.1	-0.4	1.3	1.3	-1.0	-1.1	-
Information Equipment (estimate)	-1.0	-0.9	-1.3	-1.0	-0.7	-1.0	-0.6	-0.1	-0.1	-0.1	-0.2	-0.2	-	0.1	-
Others (estimate)	-0.5	-0.1	-0.1	-	-0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0
Ordinary income	-5.9	-1.6	2.6	-2.9	-2.2	-1.5	-2.2	-6.0	-0.9	0.7	0.1	1.5	-1.1	-0.7	0.3
Net income	-5.7	-1.9	2.3	-1.4	-1.5	-11.6	-2.4	-9.2	-0.0	0.7	0.1	1.9	-1.1	-0.7	0.3
Capex (tangibles)	0.6	0.9	0.4	1.1	0.5	0.5	0.4	0.7	0.3	0.5	0.5	0.1	0.3	0.3	0.5
Depreciation (tangibles)	0.6	0.7	0.7	0.8	0.7	0.6	0.2	0.2	0.1	0.2	0.3	0.3	0.2	0.3	0.4
R&D expenditure	1.7	1.8	1.8	2.1	1.7	1.5	1.5	1.5	1.3	1.5	1.4	1.3	1.3	1.3	1.2

Source: Mizuho Securities Equity Research from company data

Funai Electric : BS/CF

Consolidated balance sheet	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19
Cash and deposit	66.8	57.6	40.1	32.4	35.4
Account receivables	38.2	24.1	15.6	10.0	7.7
Inventory	41.8	37.2	26.3	23.6	25.3
Current assets	154.0	123.2	85.5	67.3	70.0
Tangible fixed assets	21.3	18.2	13.0	8.2	8.2
Intangible fixed assets	6.1	4.9	3.3	0.1	0.1
Investments and other assets	7.5	7.9	6.9	4.7	5.1
Fixed assets	34.9	31.0	23.2	13.0	13.3
Total assets	188.9	154.2	108.7	80.3	83.3
Account payables	31.6	15.6	18.6	11.8	15.6
Short-term debt	4.0	5.1	-	-	-
Current liabilities	55.2	59.8	29.6	26.8	28.1
Long-term debt	6.7	6.0	-	-	-
Fixed liabilities	10.4	9.9	2.5	2.7	1.1
Total liabilities	65.7	69.8	32.0	29.5	29.2
Capital stock	31.3	31.3	31.3	31.3	31.3
Capital surplus	33.3	33.3	33.6	33.6	33.6
Retained earnings	89.9	54.8	47.0	22.0	24.6
Treasury stock	-24.3	-24.3	-24.3	-24.3	-24.3
Shareholder's equity	130.1	95.1	87.6	62.5	65.2
Accumulated other comprehensive income	-8.1	-11.7	-11.1	-11.8	-11.1
Share warrants	0.1	0.1	0.1	0.0	0.0
Minority interests	1.1	1.0	-	-	-
Net assets	123.2	84.4	76.7	50.7	54.1
Total liabilities and net assets	188.9	154.2	108.7	80.3	83.3
Own capital	122.0	83.3	76.5	50.7	54.0
Equity ratio (%)	64.6%	54.0%	70.4%	63.2%	64.9%
Gross interest-bearing debt (end-FY)	10.7	11.1	-	-	-
Net cash (end-FY)	56.1	46.5	40.1	32.4	35.4
Net cash per share (end-FY) (¥)	1,645.0	1,362.3	1,176.4	949.3	1,038.0
	15/3期	16/3期	17/3期	18/3期	19/3期
Income (loss) before income taxes and minority interests	0.9	-32.0	-7.3	-24.3	1.4
Depreciation	5.9	4.5	4.1	2.3	1.0
Net cash provided by (used in) operating activities	16.9	-7.5	-13.3	-5.4	3.5
Purchase of property, plant and equipment	-3.2	-2.1	-3.0	-2.1	-1.4
Purchase of intangible assets	-0.3	-0.3	-0.1	-0.3	-0.0
Net cash provided by (used in) investment activities	-17.4	11.8	13.3	-2.2	-0.8
Cash dividends paid	-1.2	-1.2	-1.0	-0.3	-
Net cash provided by (used in) financing activities	-2.7	0.1	-11.2	-0.6	-0.2
Cash and cash equivalents at end of period	43.0	47.1	39.0	30.7	33.5
(Free cash flow)	-0.5	4.3	-0.1	-7.5	2.7

(JPY bn)

Source: Mizuho Securities Equity Research from company data

Hon Hai Precision (2317.TT)

Summary income statement	Dec 14	Dec 15	Dec 16	Dec 17	Dec 18
Revenue (TWDm)	4,213,172	4,482,146	4,358,733	4,706,736	5,293,803
Net profit (TWDm)	130,535	146,867	148,663	138,734	129,065
EPS (TWD)	7.59	8.51	8.60	9.89	7.95
EPS growth	20.21%	12.12%	0.98%	(6.85%)	0.28%
P/E (x)	9.80	8.74	8.66	9.63	8.91
BVPS (TWD)	57.27	61.46	65.55	78.20	87.40
P/B (x)	1.30	1.21	1.13	1.22	0.81
ROAE	14.92%	14.36%	13.55%	11.86%	10.80%
Dividend yield	1.85%	4.38%	4.86%	5.52%	2.82%

Investment Rating.....Neutral
 Price Objective..... NT\$91.0
 Valuation method FY17/12 PER11x

■ **Share Price Drivers**
 iPhone sales trends and functional evolution, company orders
 Demand trends in PCs, smartphones, tablets, game consoles, and servers
 Sharp (earnings, progress in structural reform, OLED investment)

Well positioned to benefit from iPhone8, but key to medium- to long-term is Sharp OLED investment, reduced dependence on Apple

- Price objective of NT\$91 based on FY12/17 PER of 11x (average since collapse of Lehman Brothers).
- iPhone8: expected to receive 100% of OLED model assembly orders, could also benefit from utilization of glass hybrid casing.
- Sharp: voting rights based on direct/indirect investment at about 66%, but groups' stake is about 45%, and with Sharp as an equity-method affiliate, earnings are not consolidated (recognition of investment losses and gains).
- Investment in Sharp: 1) increase sales per iPhone; 2) establish footholds in new businesses; 3) leverage display business to pursue rational development. Issues include: 1) rather expensive price considering Sharp's corporate value; 2) management rights acquired without Sharp's business portfolio, fixed assets, and organizational structure having been optimized.
- Synergies with Sharp: uncertainties remain before these can manifest. Requirements from now include: 1) re-examination and improved operating efficiency established in flow of each business, from development to sales; 2) revision of the company's operating portfolio (including potential impairment for or withdrawal from LED business, some electronics components, thin-film solar cells); 3) consolidation of production facilities (especially in Chinese factories, including for white goods, mobile phone assembly, TV assembly, large/medium/small LCD modules); 4) shutdown of production capacity with low levels of competitiveness or surpluses, including for LCDs and solar cells; 5) slim down head office and various divisions (management, sales, etc.), review R&D, reorganize overseas sales.
- Risks: increased demand for iPhones/improved share for large models (+), increased contribution from high margin components business (+), profit margin improvements on enhanced operational efficiency, automated production (+), downturn in final demand for iPhone products (-), growing price pressure from Apple(-), heightened competition from other EMS/ODM firms (-), downturn in Sharp earnings, additional funding needs (-), conflict of interest with customers in branded business (-).

Source: Mizuho Securities Equity Research

Hon Hai Precision Subgroup details : Casings the largest earner, followed by NW and PC; small earnings from smartphones

Subgroup details

Chinese name	English name	Sub Groups	Key Products	Major customers	Main locations	% of 2016 sales	% of 2017 sales	% of 2018 sales
数位产品事业群	iDPBG	A	iPhone assembly	Apple	Zhengzhou	34%	33%	32%
创新数位系统事业群	iDSBG	B	iPad/Mac assembly	Apple	Chengdu	8%	8%	8%
鸿超准产品事业群	SHZBG	C	Apple metal casings	Apple	Taiyuan/Jincheng	7%	7%	8%
企业资讯系统产品事业群	PCEBG	D	PC, printer, Xbox, MB	HP, Dell, Microsoft	Wuhan	19%	16%	14%
消费电子产品事业群	CCPBG	E	game console and TV	Sony, Nintendo	Yantai	7%	7%	7%
雲運算事业群	CESBG	F	server ODM	HP, Dell, Cisco, IBM	Tianjin	4%	5%	5%
网通产品事业群	CNSBG	G	networking ODM	Huawei, ZTE, Cisco	Zhongshan	7%	7%	8%
网络连接产品事业群	NWInG	L	connectors	Apple, HP, Sony	Huaian	2%	3%	3%
科技整合服务事业群	TMSBG	-	IoT, e-reader and LED	Amazon	Hengyang	1%	1%	1%
无线通讯机构产品事业群	FIH Mobile	A	smartphone ODM	Nokia, Huawei, Sony	Shenzhen, Langfang	5%	8%	9%
移动连接产品事业群	MIPBG	-	PCB	Apple, HP, Dell, Sony	Shenzhen, Qinhuangdao	4%	4%	4%
OTHERS	-	-	software/service/auto			2%	1%	1%

Profit breakdown by subgroup (FY12/18 estimates)

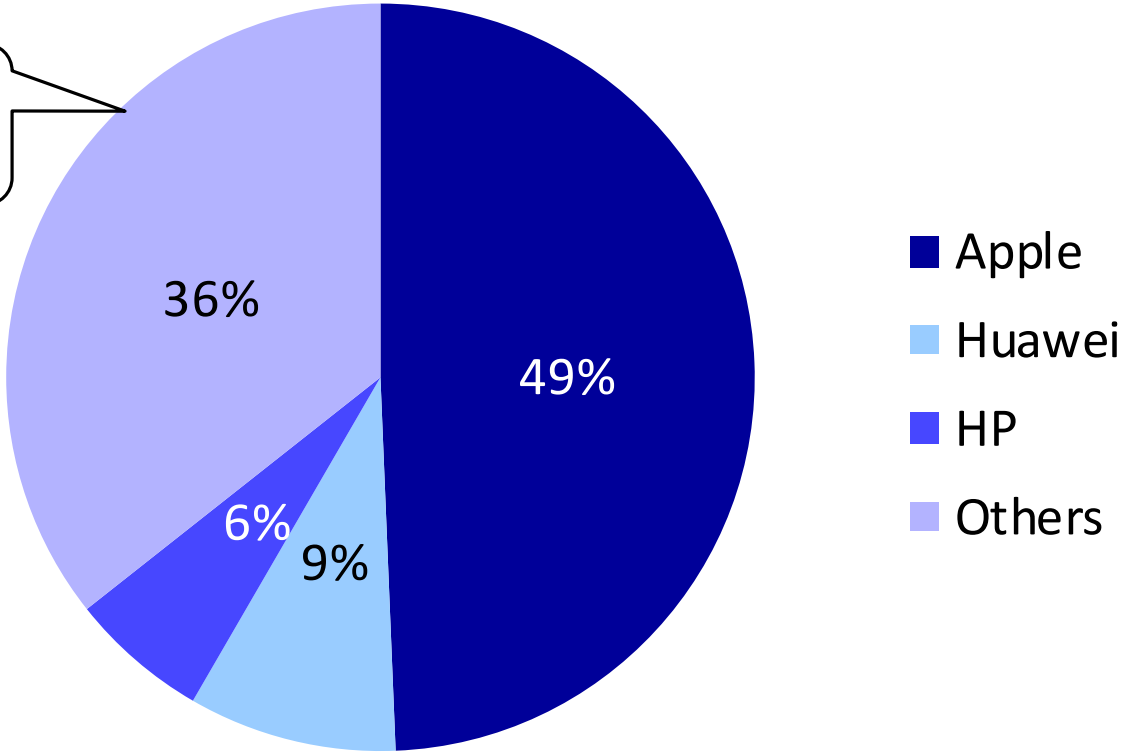
Sub group	Focus business	Major BG (Business groups)	Group head	Profit contribution in 2018E (NT\$bn)
Sub A	Smartphone	iDPBG, FIH Mobile	池育陽	-20
Sub B	Tablet, white goods	iDSBG (white goods)	姜志雄	1
Sub C	Metal casing/CCM	SHZBG, Foxconn Tech, GIS	徐牧基	46 (NT\$bn)
Sub D	NB/DT PC	PCEBG	簡宜彬	26
Sub E	TV/game console	CCPBG (TVs/game consoles)	戴正吳	4
Sub F-G	Cloud/networking	CESBG, CNSBG, Ennoconn	呂芳銘	28
Sub H	e-commerce	n/a	陳振國	
Sub I-J	Finance / investment	n/a	黃秋蓮	12
Sub K	TFT-LCD panel	Innolux, Century	王志超	
Sub L	Connector/PCB	NWInG (FIT), Zhen Ding, JMO	盧松青	6
Sub M	Healthcare	n/a	吳良襄	

Note: Business group details are not disclosed. Figures listed are estimates from either Mizuho Securities Equity Research
Source: Mizuho Research Equity Research from company data

Hon Hai Precision : Sales by customer (FY12/18 estimates)

Breakdown of sales by customer (FY12/18 estimates)

Sony and Dell represent about 10% of this



Source: Mizuho Research Equity Research from company data

Hon Hai Precision: Group sales and earnings on products to Apple

OP profits from Apple's products (FY12/19E)			
	iPhone	iPad	Macbook
Total Units (m)	194	45	17
Hon Hai market share (%)	66%	50%	20%
ASP (US\$) - MVA	25	22	50
Sales (US\$m)	3,201	495	170
OPM (%)	34%	32%	25%
OP (US\$m)	1,088	158	43
OP (TWD\$m)	33,739	4,910	1,318

Estimated Hon Hai group sales per iPhone (FY12/19)		
Component	Hon Hai/Sharp ASP (US\$)	Note
PA SiP module	6.0	by Shunsin (30% share)
LTPS LCD panel	57.8	by Sharp (30% share)
3D touch module	8.4	by GIS (60% share)
Rear camera module	22.5	by Sharp (40% share)
- rear camera lens	2.0	by Kantatsu (8% share)
3D camera module	17.0	by Sharp (40% share)
Al metal casing	65.0	by Hon Hai (66% share)
FPC	13.7	by Zhen Ding (23% share)
Assembly	21.4	by Hon Hai (62 % share)
Total ASP	211.8	

Source: Mizuho Research Equity Research

Hon Hai Precision: Major listed group companies

Companies	Ticker	Mkt cap (USDmn)	Hon Hai's stake (including indirect investment)	Year of investment	Main products	Earnings to Hon Hai
Sharp (夏普)	6753.JT	5,887	44%	acquired in 2016	consumer electronics	Equity method
Foxconn Tech (鴻準)	2354.TT	2,896	30%	listed in 1996 (Q-Run)	Metal casing for Apple	Equity method
Innolux (群創)	3481.TT	3,213	4%	invested CMO in 2010	TFT-LCD	Equity method
Hon Teng (鴻騰)	6088.HK	3,299	na	listed in 2016	Connector	Consolidated
FIH Mobile (富智康)	2038.HK	931	72%	listed in 2005	non-Apple smartphone EMS/ODM	Consolidated
Zhen Ding Tech (臻鼎)	4958.TT	2,394	41%	listed in 2011	Flex PCB	Equity method
APTG (亞太電信)	3682.TT	999	15%	acquired in 2014	4G telecom service	Equity method
Ennoconn (樺漢)	6414.TT	774	43%	listed in 2014	Industrial PC	Equity method
Simplo (新普)	6121.TT	1,380	9%	invested in 2009	NB battery pack	Cost method
General Interface Solution (英特盛)	6456.TT	1,338	38%	listed in 2015	Touch panel module and LCM	Equity method
Pan International (廣宇)	2328.TT	381	27%	listed in 1993	Components and PCBs	Equity method
Shunsin (訊芯)	6451.TT	381	61%	listed in 2015	PA semi module and SiP	
Eson (乙盛)	5243.TT	191	37%	listed in 2013	machanical component	
CyberTan (建漢)	3062.TT	172	12%	acquired in 2005	consumer networking	
Microelectronics (台揚)	2314.TT	192	65%	acquired in 2015	LNB, BTS	
Fitpower Integrated Technology (天鈺)	4961.TT	255	38%	listed in 2010	Driver IC and PMIC	
AOT (榮創)	3437.TT	84	47%	listed in 2014	LED packaging	
G-Tech (正達)	3149.TT	91	22%	listed in 2012	smartphone cover glass	
BioNET (訊聯生物)	1784.TT	57	9%	invested in 2009	Bio-tech	
UVAT (友威)	3580.TT	45	13%	listed in 2007	sputtering system for NB shielding	

Source: Mizuho Research Equity Research from company data

Challenges faced by the Hon Hai Group: management, business, and finances

■ **Management:** Who will manage? How about Terry Gou's position?

- Past (Before Shareholders Meeting/ before the announcement of running for president of Taiwan): Each business was managed by a sub group leader, but group strategy, investments, and HR was led by Gou.
- Current (after Shareholders Meeting): Management ceded to nine-member operations committee. Decisions require two-thirds support before moving onto the board of directors. Operations committee composed of 3 directors, CFO, and group chair.
- Operations committee will preside over subsidiaries of Hon Hai Precision, FII (finished products) , FIT (components), FIH (OEM). Does not include Sharp, Innolux or any of Gou's investments.
- What about Gou? He will remain a director but will remove himself from management and will not be a part of the operations committee. Sharp CEO J.W. Tai will also not be a member of the committee.
- Towards investors: Held no briefings and the amount of information released was limited, but intend to hold a briefing semiannually.

■ **Business management:** Electronics manufacturing services (EMS), Apple, limited to China

- Amount reliant on Apple: about 50% of sales. Adding in Huawei, HP, and Sony and the number is over 70%.
- Growth limit for EMS business: mostly dominated by consumer electronics. Limited upside as long as South Korean and Chinese EMS do not increase their market share.
- Poorer earnings from the EMS business: charges a processing fee of several dollars per unit. Meanwhile, higher personnel costs (e.g., in China) and tighter supply/demand for components are weighing down earnings.
- Component related: connectors and casings have high margins. Demand continues to grow, but their rapid growth phase has passed.
- Reliance on China: several issues such as personnel costs rising sharply and US-China trade tension
- Finding R&D staff: A high-rated company, but not for its work environment.

■ **Future business strategy:** What will be used to drive growth going forward?

- New fields: automotive, semiconductors, SPE, robots, service-related. Will take some time before they pay off.
- Expanding into EMS brands: Sharp is key
- Semiconductors: Sharp is surprisingly important for this as well. How will it secure funds and technology?
- Displays: the large panel display business will have too much production capacity when combining SDP and the Guangzhou plant as part of the updated Sky Tiger Plan (lower demand from within the group). What 's the plan for OLED?
- Making production facilities no longer reliant on China: produce in the US? produce locally (where the products will be sold)? In that case, can it take advantage of its operational strengths?
- Potential for FCF to worsen: With all the investments, earnings and operating cash flow could become stagnant in the near term.

MegaChips (6875)

(JPY mn)	FY15/3	FY16/3	FY17/3	FY18/3	FY19/3	FY20/3	FY21/3 E	FY22/3 E	FY23/3 E
Sales	64,238	55,663	67,438	89,029	95,145	65,765	83,550	68,245	64,511
OP	4,896	-335	1,927	2,709	574	972	4,298	4,045	3,492
Adj OP	4,896	3,513	4,923	5,520	3,153	3,449	4,881	4,045	3,492
NP	1,252	-783	-948	1,948	-1,727	-1,792	3,207	2,517	2,881
Adj NP	1,252	3,065	2,048	4,759	852	685	3,790	2,517	2,881
EBITDA	5,873	3,691	6,162	7,365	5,719	6,199	6,315	5,493	5,051
EPS	55.6	-35.2	-44.1	90.1	-79.4	-82.4	147.3	115.7	132.4
Adj EPS	55.6	138.0	95.4	220.0	39.1	31.5	174.1	115.7	132.4
BPS	1,438.1	1,341.9	1,280.7	1,435.4	1,205.0	1,295.2	1,420.1	1,501.7	1,600.1
DPS	34.0	34.0	34.0	34.0	17.0	17.0	34.0	34.0	34.0
P/E	25.0	n/a	n/a	42.5	n/a	n/a	18.7	23.8	20.8
Adjusted P/E	25.0	9.2	32.0	17.4	43.4	49.4	15.8	23.8	20.8
P/B	0.97	0.94	2.38	2.67	1.41	1.20	1.94	1.83	1.72
EV/EBITDA	7.7	12.1	14.6	14.7	13.9	7.7	11.1	11.7	12.2

Note: Valuation based on Price Objective.

Investment Rating Neutral
 Price Objective **¥2,750**
 Valuation method FY3/22 P/E 24x

■ Share Price Drivers

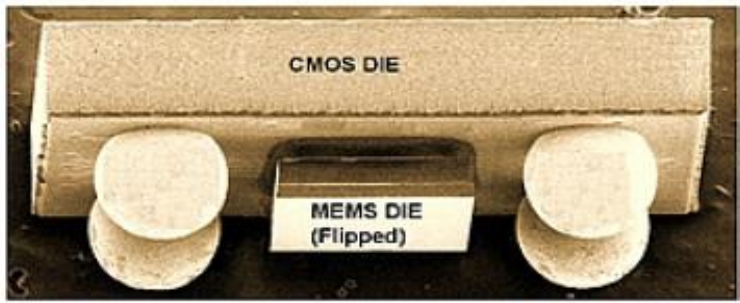
- Stock price of SiTime
- Sales volumes for Switch hardware/software
- Macronix's ROM inventory
- Progress with projects (SiTime, Ethernet) in 5G, automotive, and FA spaces

• **Amusement may be peaking but unrealized gains from holding of SiTime shares will likely limit downside. We expect MegaChips shares to remain rangebound for now.**

- Price objective (¥2,750): 7-year historical PER+1 σ = about 24x our FY3/22 forecast. We now use non-adjusted PER as a result of the removal of SiTime from consolidated accounts, and apply a +1 σ premium to reflect unrealized gains for the holding of SiTime shares.
- OP forecasts: ¥4.3b in FY3/21, ¥4b in FY3/22, and ¥3.5b in FY3/23. Expecting big profit increase in FY3/21, but mainly thanks to technical factors (no more loss contributions/a smaller goodwill amortization burden from the SiTime deconsolidation).
- Structural reform: Sales of system division (announced November 2018), decision to consolidate T-con business and encourage voluntary early retirement (announced March 2019), and sales of DisplayPort business (announced November 2019).
- Amusement: COVID-19 has driven a rapid rise in the download ratio (over 50% for Animal Crossing). Underlying demand has also been firm recently, but the risk is that download ratios will remain high after things normalize.
- SiTime (1): Converts into wholly-owned subsidiary for \$200m in 2014, lists on NASDAQ in November 2019 (reduces stake from 100% to 66%), converts into equity affiliate in June 2020 by selling some of its shares (further reduces stake from 66% to 44%)
- SiTime (2): Market shares for iPhone12 recovering, likely driven by strong demand for TCXO, may benefit from plant fire at Asahi Kasei's subsidiary (AKM) and tightening demand for TCXO.
- ASIC/ASSP: Automotive projects (automotive ethernet) to contribute to sales from FY3/23, in earnest from FY3/24. Upfront R&D costs to be booked over the near-term.
- Catalysts: Expanded Nintendo game lineup, increased approval for game launches in China, and chance for 5G business talks. Risks: Fall in Switch software sales volume, greater-than-expected increase in game download mix, development delays, technological advances with existing LCD devices, and the appearance of competitors.

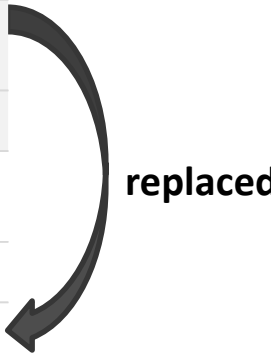
Source: Mizuho Securities Equity Research

SiTime: aiming to replace crystal with MEMS. Can build track record by implementing MEMS into Apple products



1.55 x 0.85 x 0.55 mm
L x W x H

Oscillator	Structure	Outline
Atomic oscillator	Corrects errors, including in crystal oscillators, using resonance frequency of cesium atoms	Exceptionally high frequency accuracy, used as a reference signal source in atomic clocks, GPS satellites
Crystal oscillator	Comprised of a crystal resonator + an oscillation circuit	Has a long history of being used in devices; a clock signal is generated using the mechanical resonance of a vibrating crystal (SiO2 crystal) via the reverse voltage effect
Package quartz crystal oscillator (XO/SPXO)	A general purpose crystal oscillator not temperature controlled or temperature compensated.	Frequency stability of about 10–100ppm
Voltage-controlled crystal oscillator (VCXO)	Crystal oscillator where frequency can be varied through voltage	
Temperature compensated crystal oscillator (TCXO)	Crystal oscillator with improved frequency stability in the face of temperature changes thanks to temperature compensation circuit	Frequency stability of about 0.1–5ppm
Oven controlled crystal oscillator (OCXO)	Crystal oscillator with improved frequency stability, with temperature maintained by thermostatic oven	Frequency stability of about 0.5–100ppb
Ceramic oscillator	Rather than using crystal, clock is generated using ceramics with a similar piezoelectric element	Low prices, but frequency stability is weak, generally about 0.1%–0.5%. Errors due to temperature changes can be substantial. Used in automotive LAN, USB communications equipment.
Si (silicon) oscillator	Oscillator using oscillating circuit (including LC)	Frequency stability low (several percentage points), impact resistant, strong EMI properties
MEMS oscillator	MEMS-based resonator element with specific frequency on silicon substrate. Can be manufactured using same process as for semiconductors	Typically a frequency error of around 10ppm-50ppm, but temperature compensation circuits allow for their precision to be increased to the same level as a crystal (5ppm). Special characteristics include their small size, low energy consumption, and their impact resistance.



Source: Compiled by Mizuho Securities Equity Research from SiTime data

MegaChips > SiTime : Earnings estimates

Apple:

- Largest customer. Estimate around 60% of FY3/18 sales were to Apple (CY17 for SiTime). Decreased to just under 50% in CY18.

Apple Watch

- Ongoing use since 2015, TCXO (2nd generation)

iPhone

- Adoption (7/7+) from 2016 . TCXE (same as Watch). Paired with Intel's Baseband. Intel's share (vs QCOM) estimated at 55%.
- In 2017 (8/8+X), adopted XO (32kHz) in addition to TCXO. XO is on cheap side.
- No adoption of TCXO in 2018. Rapid drop in use of XO, headed toward zero adoption
- Could be used again in conjunction with Intel's Baseband chip for 5G in 2020. ⇒ Zero chance following withdrawal of Intel. Market share recovered in 2020 thanks to iPhone12 (and possibly driven by tight demand for TCXO), 1 socket/unit?

Other Apple products

- XO Used in Apple TV remotes. We suspect XO (MHz) also used in iPad

5G/automotive applications

- Estimated ¥0.4b sales in auto space in FY3/19
- Super-TCXO (2.5 gen) to contribute to sales from FY3/19
- OCXO (3rd gen): mass production in 2Q 2019 ⇒ Slightly lagging on resistance to age deterioration

Estimates / Forecasts		2015	2016	2017	2018	2019	E 2020	E 2021	E 2022
Revenue (\$m)		40	66	102	87	87	115	145	179
	(yoy%)	+111%	+65%	+54%	-15%	+1%	+31%	+26%	+23%
Consumer/Industrial/NW+Automotive		26	30	32	33	39	49	51	56
Mobile/Wearable		14	36	70	51	43	51	64	69
5G (Super-TCXO/OCXO)		-	-	-	3	6	15	30	53
Consumer/Industrial		21	24	24	26	30	36	36	42
Network/Storage		5	7	7	10	14	28	44	68
XO (Gen1)		3	4	4	4	5	6	6	6
TCXO (Gen2)		2	2	3	3	4	7	8	8
Super-TCXO (Gen2.5)		-	-	-	3	6	12	23	36
OCXO (Gen3)		-	-	-	-	-	3	7	18
Mobile/Wearable		14	36	70	51	43	51	64	69
Apple		6	29	62	41	29	36	47	51
TCXO Watch/IP8/Pad(?)		4	26	44	25	17	13	10	11
XO TV remote-controller etc.		2	3	18	16	12	24	37	39
Other Mobile/Wearable (XO)		8	7	8	10	14	15	17	18
Shipments (m units)		125	250	450	410	410	540	680	780
	(yoy%)	+92%	+100%	+80%	-9%	-	+32%	+26%	+15%
Consumer/Industrial		55	75	80	90	110	135	140	170
Network/Storage		19	25	28	31	38	58	64	69
XO (Gen1)		15	19	20	22	25	35	35	35
TCXO (Gen2)		4	6	8	8	12	20	24	25
Super-TCXO (Gen2.5)		-	-	-	0.5	1.2	2.5	5.0	8.0
OCXO (Gen3)		-	-	-	-	-	0.2	0.4	1.0
Mobile/Wearable		51	150	339	288	263	348	480	541
Apple		23	98	274	208	153	223	335	381
TCXO (Watch/IP8/Pad?)		11	79	136	81	55	40	35	40
XO (TV remote-controller etc.)		12	19	137	127	98	183	300	341
Other Mobile/Wearable (Fitbit : adopted with :		28	52	65	80	110	125	145	160
ASP (cents)		32	26	23	21	21	21	21	23
	(yoy%)	+9%	-18%	-14%	-7%	+1%	-0%	+0%	+8%
Consumer/Industrial		39	32	31	29	28	27	26	25
Network/Storage		25	26	25	32	38	48	69	98
XO (Gen1)		21	22	20	19	18	18	18	17
TCXO (Gen2)		40	40	38	36	34	34	34	33
Super-TCXO (Gen2.5)		-	-	-	500	480	465	456	447
OCXO (Gen3)		-	-	-	-	2,000	1,950	1,853	1,760
Mobile/Wearable		27	24	21	18	16	15	13	13
Apple		28	30	23	20	19	16	14	13
TCXO Watch/IP8/Pad(?)		40	33	32	31	31	31	30	28
XO TV remote-controller etc.		17	16	13	13	12	13	12	12
Other Mobile/Wearable		27	13	13	13	12	12	12	12

Source: Mizuho Securities Equity Research

MegaChips > SiTime: timing device industry trends and SiTime's product lineup

- Currently SiTime's only products are oscillators and it does not sell resonators separately.
- Therefore, the company faces a risk if resonators + thermistors (=TSX) spread (market share for TCXO shrinks)
- Currently Qualcomm only sells thermistors. Intel sells mostly TXCO. Will MediaTek and Spreadtrum switch to thermistors?

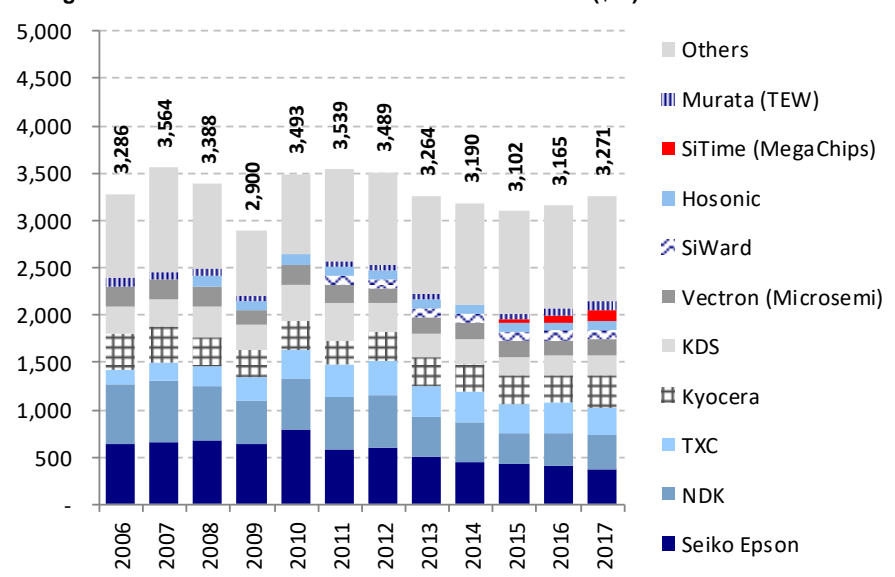
Chipset companies' resonator/oscillator strategies

	PLL	GPS
Qualcomm	Thermistors	
MediaTek	TCXO*1 → Thermistors?	TCXO*1
Samsung	TCXO*1	-
Broadcom	-	TCXO*1
HiSilicon	TCXO*1 → Thermistors?	TCXO*1

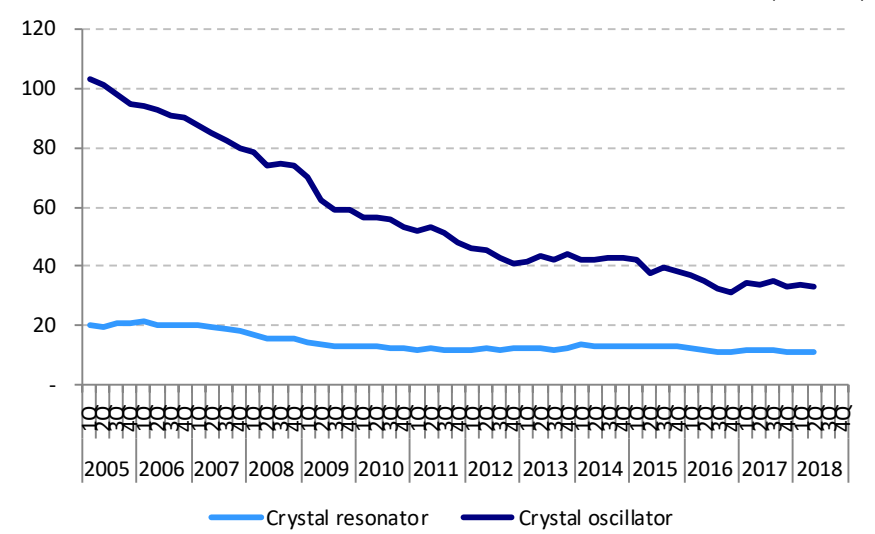
SiTime's product line-up

Frequency Control Products		Frequency	Stability (ppm)	Price	SiTime
X'tal	Resonator	KHz/ MHz	20 ~ 100	low	under development
XO/SPXO	Oscillator	KHz/ MHz	10 ~ 100	low - mid	Yes
VCXO	Voltage Controlled Oscillator	MHz	10 ~ 100	low - high	Yes
TCXO - Mobile	Temperature Compensated Oscillator	MHz	0.5 ~ 2.5	low - mid	Yes
TCXO - Infrastructure	Temperature Compensated Oscillator	MHz	0.28 ~ 10	very high	Yes
Super-TCXO	TCXO w/ best dynamic stability	KHz/ MHz	0.1 ~ 5	mid - very high	Yes
OCXO	Oven Controlled Oscillator	MHz	0.001 ~ 0.05	extreme high	Announced

Timing Device Market



ASP



Source: Compiled by Mizuho Securities Equity Research from TXC, SiTime, Nihon Dempa Kogyo and QIAJ data

Nikon (7731)

(JPYb)	FY3/14	FY3/15	FY3/16	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Sales	980.6	857.8	841.0	749.3	717.1	708.7	591.0	458.4	498.9	473.9
OP	62.9	43.4	35.3	0.8	56.2	82.7	6.8	-48.8	20.8	18.7
(Restructuring charges)	-	-	0.0	-53.3	-8.6	-1.7	-4.4	-5.0	0.0	0.0
Pre-tax profit	74.7	35.2	39.5	3.1	56.3	87.9	11.9	-39.1	23.8	21.7
NP	46.8	18.4	29.9	4.0	34.8	66.5	7.7	-28.1	17.8	16.4
EBITDA	105.4	81.9	74.1	34.7	87.9	110.5	40.9	-22.8	45.8	43.7
EPS	118.1	46.3	75.5	10.0	87.8	167.9	19.9	-76.5	48.5	44.7
EPS_diluted	118.1	46.3	75.4	10.0	87.5	167.3	19.9	-76.2	48.3	44.5
BVPS	1,378	1,441	1,354	1,357	1,446	1,554	1,473	1,376	1,405	1,429
DPS	32.0	32.0	18.0	16.0	36.0	60.0	40.0	20.0	20.0	20.0
Share price (period end)	1,662	1,610	1,722	1,614	1,896	1,561	998	800	800	800
P/E	14.1	34.8	22.8	161.7	21.7	9.3	50.3	-10.5	16.6	18.0
P/B	1.2	1.1	1.3	1.2	1.3	1.0	0.7	0.6	0.6	0.6
EV/EBITDA	5.3	6.0	7.3	13.3	5.6	3.0	4.1	-6.2	2.3	2.3

Note: Data for FY3/15 based on JGAAP. Valuation based on Price Objective.

Investment Rating.....Underperform
Objective.....¥800
Valuation method.....FY3/22- PER16.5x

■ Share Price Drivers

- Sales, price of mirrorless (Z7II/Z6II/Z5/Z50)
- Profitability of precision equipment business (shift personnel from imaging)
- FPD capex, Intel's capex, expansion of SPE customer base
- Applications and tie-up announcements with DMG MORI for laser processing business, news flow for new products.

• Underperform: FY3/22 recovery small on early FPD bookings. Imaging and precision equipment also harsh in the medium to long term.

- **PO (¥800): PER of 16.5x our end-FY3/22 (previously BPS estimate 0.5x):**No particular change to fundamentals versus share price rise in value market. We feel the stock looks more overvalued.
- **Imaging System (Cameras):** Domestic fixed costs centered on R&D to remain in FY3/22. Even if a swing to profitability in FY3/22, it would stem only from a transitory and pseudo recovery in the external environment (rebound from COVID crisis) and cost shifting, and a swing back to losses from FY3/23 would be likely. Improvement in profitability will require cuts in domestic fixed costs.
- **FPD lithography systems:** Installation work resumed from July. Due to delays, G10.5 peak may be FY3/23. As for G6, market share in China is growing, but due to installation delays in FY3/21, volume growth likely pushed back to FY3/22 Nikon's odds of winning orders for new G8 projects (CSOT T8/T9) seem low. For G10.5, there is some possibility of additional investment in BOE B17, but no new G10.5 investment in the near term.
- **SPE lithography systems:** Intel's 7nm development delays and possibility of foundry utilization emerge, raising risk of postponement/decline in lithography system demand. Impact likely to continue in FY3/22 and beyond.
- **Healthcare:** Plan for a turn to profit in FY3/21 pushed back by a year due to COVID-19. Focus on phase 3 results for Helios/MultiStem in 2020.
- **New business:** Material processing making progress in collaboration with Mori Seiki, but FY3/21 and FY3/22 contributions to be limited. Lithobooster used in Intel mass production (from 10nm), may see use expand to CMOS sensors and logic.
- **Potential catalysts:** Changes in management policy, including business portfolio reorganization, M&A, etc., new investments in FPD. Risks: rapid yen appreciation, more rapidly shrinking imaging market, escalating competition, overvalued M&A, cancellation/ large delay of FPD biz.

Source: Mizuho Securities Equity Research

Nikon > Earnings estimates: P/L summary (FY : Sales)

		FY3/18	FY3/19	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21	(JPY b)
					E	E	E	CoE	
Exchange rate	USD/JPY	111	111	109	106	105	105	106	
	EUR/JPY	130	129	121	124	125	125	121	
Sales revenue(IFRS)	(JPYb)	717.1	708.7	591.0	458.4	498.9	473.9	450.0	
	(yoy%)	-4.3%	-1.2%	-16.6%	-22.4%	+8.8%	-5.0%	-23.9%	
Imaging Products		360.7	296.2	225.9	150.8	150.6	129.0	145.0	
	(yoy%)	-5.8%	-17.9%	-23.7%	-33.3%	-0.1%	-14.3%	-35.8%	
(shipment volume)									
ILC	(m units)	2.62	2.06	1.62	0.87	0.89	0.73	0.85	
Lens	(m units)	4.01	3.17	2.65	1.42	1.49	1.25	1.40	
Compact	(m units)	2.51	1.60	0.84	0.27	0.26	0.17	0.25	
Precision Equipment		226.3	274.5	245.0	190.8	220.6	211.1	190.0	
	(yoy%)	-8.7%	+21.3%	-	-22.1%	+15.6%	-4.3%	-22.4%	
SPE									
Equipment		68.4	77.9	115.7	73.7	81.0	105.5		
Services		31.2	31.9	33.3	32.8	35.2	36.0		
FPD									
Equipment		112.0	149.3	82.5	72.4	91.8	56.7		
Services		14.7	15.4	13.3	12.1	12.6	12.9		
(shipment volume)									
SPE-New	(units)	17	21	34	17	21	27	17	
i-line	(units)	2	4	7	5	7	7	5	
KrF	(units)	2	0	1	0	1	1	0	
ArF	(units)	8	11	13	7	5	8	7	
ArFi	(units)	5	6	13	5	8	11	5	
SPE-Refurbished	(units)	13	20	11	10	14	14	10	
FPD-G6	(units)	34	16	4	9	28	17	9	
FPD-G8	(units)	30	37	5	5	0	5	5	
FPD-G10.5	(units)	3	17	18	14	15	7	14	
Healthcare		56.8	65.4	62.0	60.9	67.8	70.8	60.0	
	(yoy%)	+1.8%	+15.2%	-5.2%	-1.8%	+11.3%	+4.4%	-3.3%	
Industrial Metrology and others		73.2	72.5	58.0	55.8	59.9	63.0	55.0	
	(yoy%)	+17.3%	-1.0%	-	-3.7%	+7.3%	+5.2%	-5.2%	

Source: Mizuho Securities Equity Research

Nikon > Earnings estimates: P/L summary (FY: Profit)

FY3/20: Transient factors include ¥3.8b gain from sale of idle land in 1Q, ¥10.3b drag from impairments in 4Q (¥6.6b for imaging products, ¥3.6b for industrial metrology and others), ¥10.0b drag on OP from COVID-19 impact.

FY3/21: One-off factors include 2Q impairment loss of ¥18.8b (¥15.2b in imaging, ¥3.2b in industrial/others), inventory valuation loss of ¥9.2b (precision equip) 3Q inventory valuation loss of ¥5.6b (precision equipment).

(JPY b)

		FY3/18	FY3/19	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21
					E	E	E	CoE
Exchange rate	USD/JPY	111	111	109	106	105	105	106
	EUR/JPY	130	129	121	124	125	125	121
Operating profit (IFRS)	(JPYb)	56.2	82.7	6.8	-48.8	20.8	18.7	-65.0
	(yoy%)	+7,166%	+47%	-92%	-	-	-10%	-
	(margin%)	7.8%	11.7%	1.1%	-10.6%	4.2%	3.9%	-14.4%
Imaging Products		30.2	22.1	-17.2	-41.0	-3.8	-6.9	-40.0
Precision Equipment		53.4	81.7	48.0	14.9	34.8	30.7	4.0
SPE		4.7	21.1	14.5	-14.9	-0.9	10.5	
FPD		48.6	60.6	33.5	29.7	35.6	20.2	
Restructuring expenses		0.0	0.0	0.0	0.0	0.0	0.0	
Healthcare		-3.3	-1.9	-2.5	-1.3	2.4	4.8	-4.0
Industrial Metrology and others		5.0	6.9	1.8	-0.3	4.2	5.1	-2.0
Corporate		-29.1	-26.1	-23.6	-21.0	-16.8	-15.0	-23.0
Restructuring expenses	(JPYb)	-8.6	-1.7	-4.4	-5.0	-	-	-5.0
Imaging Products		-5.8	-0.6	-2.7	-5.0	-	-	-5.0
Precision Equipment		-	-	-	-	-	-	-
Healthcare		-	-	-	-	-	-	-
Industrial Metrology and others		-2.8	-0.6	-	-	-	-	-
Corporate		-	-0.5	-1.7	-	-	-	-
Pretax profit	(JPYb)	56.3	87.9	11.9	-39.1	23.8	21.7	-60.0
	(margin%)	7.8%	12.4%	2.0%	-8.5%	4.8%	4.6%	-13.3%
Net profit -	(JPYb)	34.8	66.5	7.7	-28.1	17.8	16.4	-42.0
attributable to shareholders	(yoy%)	+777%	+91%	-88%	-	-	-8%	-
	(margin%)	4.8%	9.4%	1.3%	-6.1%	3.6%	3.5%	-9.3%

Note: Figures for FY3/20 have been retroactively adjusted to reflect reclassification for the precision equipment segment and industrial and others segment

Source: Mizuho Securities Equity Research

Statement of Financial Position (IFRS)

	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Cash and cash equivalents	319.0	388.4	411.1	324.0	326.5	327.8	319.8
Trade and other receivables	96.2	104.5	115.8	87.8	68.1	74.1	70.4
Inventories	220.4	235.6	253.3	246.5	232.3	205.0	188.3
Others	23.3	25.7	18.5	18.9	14.6	15.9	15.1
Total current assets	659.0	754.2	798.7	677.2	641.5	622.9	593.5
Property, plant and equipment	121.8	118.8	116.1	106.4	117.5	125.2	130.3
Goodwill and intangible assets	67.8	61.0	59.2	46.9	39.7	34.1	29.9
Others	169.8	164.4	161.0	175.4	175.4	175.4	175.4
Total non-current assets	359.3	344.2	336.3	328.7	332.7	334.7	335.7
Total assets	1,018.4	1,098.3	1,135.0	1,005.9	974.2	957.6	929.2
Trade and other payables	112.9	118.7	96.5	68.9	53.4	58.1	55.2
Bonds and borrowings	23.6	12.2	14.4	21.0	33.6	12.9	12.9
Others	205.4	258.9	272.7	240.3	211.5	213.4	191.7
Total current liabilities	341.9	389.8	383.6	330.2	298.6	284.4	259.8
Bonds and borrowings	114.5	113.1	112.0	102.8	138.2	125.4	112.5
Others	23.8	21.9	22.7	31.2	31.2	31.2	31.2
Total non-current liabilities	138.3	135.0	134.7	134.0	169.4	156.5	143.6
Total liabilities	480.2	524.8	518.3	464.1	468.0	440.9	403.4
Capital stock	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Capital surplus	81.2	81.3	81.4	46.4	46.4	46.4	46.4
Treasury stock	-13.2	-13.2	-13.0	-17.6	-17.6	-17.6	-17.6
Other components of equity	-25.4	-18.3	-20.0	-39.5	-39.5	-39.5	-39.5
Retained earnings	429.5	457.6	502.1	485.9	450.5	461.0	470.0
Equity attributable to owners of the parent	537.5	572.9	615.9	540.7	505.2	515.7	524.7
Non-controlling interests	0.6	0.6	0.8	1.1	1.0	1.0	1.1
Total equity	538.2	573.5	616.7	541.8	506.2	516.7	525.8
Total liabilities and equity	1,018.4	1,098.3	1,135.0	1,005.9	974.2	957.6	929.2

Source: Mizuho Securities Equity Research

Nikon > Earnings estimates: CF, Financial indicators

(JPY b)

Statement of Cash Flows (IFRS)

	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Profit before income taxes	3.1	56.3	87.9	11.9	-39.1	23.8	21.7
Depreciation and amortization	34.0	31.7	27.8	34.1	26.0	25.0	25.0
Decrease (increase) in trade and other receivables	7.4	-7.0	-12.1	25.8	19.7	-6.0	3.7
Decrease (increase) in inventories	42.2	-14.5	-18.2	1.0	14.2	27.3	16.8
Increase (decrease) in trade and other payables	-13.1	6.1	-18.7	-24.5	-15.5	4.7	-2.9
Increase (decrease) in advances received	5.7	66.0	15.1	-15.6	-21.5	-6.7	-21.3
Others	18.1	-13.5	-13.0	-16.3	7.9	1.2	-4.8
Net cash provided by (used in) operating activities	97.3	125.1	68.9	16.4	-8.3	69.3	38.2
Purchases of property, plant and equipment	-21.3	-28.1	-20.8	-19.5	-22.5	-20.3	-19.5
Purchases of intangible assets	-9.1	-7.7	-7.6	-6.0	-7.5	-6.8	-6.5
Others	-10.3	0.9	3.1	4.2	0.0	0.0	0.0
Net cash used in investing activities	-40.7	-34.8	-25.3	-21.3	-30.0	-27.0	-26.0
Repayment of borrowings and bonds	25.9	-11.5	-0.1	-2.3	48.1	-33.6	-12.9
Cash dividends paid	-8.7	-7.2	-20.6	-23.6	-7.3	-7.3	-7.3
Share buyback	0.0	0.0	0.0	-40.0	0.0	0.0	0.0
Others	-1.6	-1.3	-0.9	-6.9	0.0	0.0	0.0
Net cash used in financing activities	15.5	-20.0	-21.6	-72.7	40.7	-41.0	-20.3
Cash and cash equivalents at the end of the period	319.0	388.4	411.1	324.0	326.5	327.8	319.8
Financial indicators	FY3/17	FY3/18	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Owned capital	537.5	572.9	615.9	540.7	505.2	515.7	524.7
Equity ratio	52.8%	52.2%	54.3%	53.7%	51.9%	53.9%	56.5%
Gross debt	138.1	125.3	126.4	123.7	171.9	138.2	125.4
Net debt	-181.0	-263.1	-284.6	-202.6	-154.6	-189.6	-194.4
Free cash flow	56.6	90.3	43.6	-4.9	-38.3	42.3	12.2

Source: Mizuho Securities Equity Research

Yamaha (7951)

	(JGAAP) (JPYb)	(JGAAP) FY3/15	(JGAAP) FY3/16	(JGAAP) FY3/17	(JGAAP) FY3/18	(IFRS) FY3/19	(IFRS) FY3/20	(IFRS) FY3/21E	(IFRS) FY3/22E	(IFRS) FY3/23E
Sales		432.2	435.5	408.2	433.0	434.4	414.2	368.8	427.9	445.4
Core OP		n/a	n/a	n/a	n/a	52.7	46.4	35.3	54.3	63.8
OP		30.1	40.7	44.3	48.8	52.8	43.3	33.0	54.3	63.8
PTP		28.5	41.6	42.9	74.5	56.5	47.2	33.5	57.3	67.8
NP		24.9	32.6	46.7	54.4	40.3	34.6	24.5	42.1	49.8
EBITDA		45.6	62.9	57.8	59.7	69.4	60.7	50.0	71.8	81.3
EPS		128.7	168.9	249.2	291.8	222.1	194.7	139.5	239.4	283.2
BVPS		1,787	1,602	1,948	2,126	1,993	1,851	1,924	2,098	2,303
DPS		36.0	44.0	52.0	56.0	60.0	66.0	66.0	71.0	85.0
Share price (period end)		2,104	3,390	3,065	4,675	5,530	4,215	7,150	7,150	7,150
P/E		16.3	20.1	12.3	16.0	24.9	21.6	51.3	29.9	25.2
P/B		1.2	2.1	1.6	2.2	2.8	2.3	3.7	3.4	3.1
EV/EBITDA		7.5	10.0	8.6	12.4	13.4	11.3	25.8	17.1	14.4

Investment Rating..... Buy
 Price Objective..... ¥7,100
 Valuation method.....ex-cash FY3/23 PER 23x

■ Share Price Drivers

- CoVID-19 impacts (both supply/demand)
- Impact of AKM plant fire / guidance revisions
- Currency movement (weak yen: positive)
- China's piano market
- Shareholder returns (buybacks)

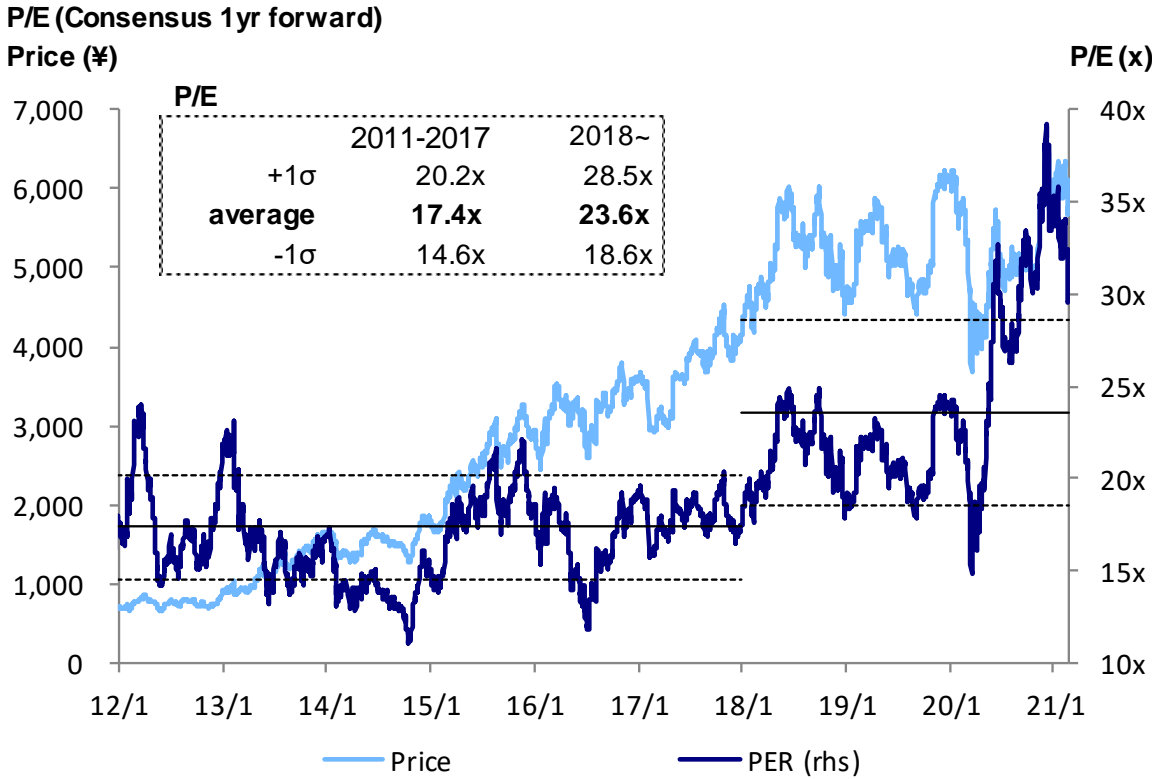
Note: Valuation based on Price Objective.

• Maintain Buy rating. Record-high profit possible in FY3/22 on demand recovery to pre-COVID-19 levels, orders carried over to FY3/22, and ongoing company-specific efforts

- Price objective (¥7,100) based ex-cash FY3/23 PER of 23x (average since 2018). We added net cash to our expectations for shareholder returns in FY3/23.
- Supply: Capacity utilization at Indonesia plans recovered from 50% in Apr-Jun to 85% in Jul-Sep, over 90% in Oct-Dec. Expecting over 90% in Jan-Mar also.
- AKM plant fire: Progressively shifting to products from other companies (TI etc.); impact is weakening. 4Q FY3/21 sales down ¥4.0b, 1Q FY3/22 sales down ¥5.0b. Products supplied to Yamaha include digital-analog converters (DAC), communication LSIs, etc. Used in musical instruments (electronic pianos, portable keyboards, hybrid pianos), AV equipment (AV receivers, PA equipment, ICT equipment). However, for electronic instruments (ex high-end instruments), obstacles to using alternative suppliers (e.g., TI, ADI) are apparently low.
- Demand: In End-Dec, order backlog increased further, to ¥28.0b above normal levels; demand strong. China piano sales down 50% Jan-Mar, down 25% Apr-Jun, up 7% Oct-Dec.
- Forex: ¥1 appreciation against \$ lowers full-year core OP by ¥70m. It lowers this figure by ¥390m against € and by ¥820m against RMB. We assume ¥105/\$, ¥125/€. Company guidance is premised on ¥106/\$ and ¥121/€ (rate of ¥126/€ already booked for 3Q FY3/21).
- Musical instruments: China and emerging nations are growth drivers. Demand to see slow growth or be flat in developed nations even after excluding forex and one-offs. Instrument hardware OPM was nearly 20% in FY3/19, with the highest earners being electronic instruments (over 25%), wind instruments (15%-20%), and pianos (around 15%). We think there is room for improvement for string instruments (under 5%).
- Audio equipment: Pace of contraction of legacy AV receiver market accelerating, particularly in US and Europe (however we note that there is extraordinary demand from COVID-19 at present); M&A is crucial for longer-term growth.
- Potential catalysts: 1) yen depreciation (appreciation: negative); 2) better shareholder returns; 3) larger share of guitar, drum markets; and 4) equity tie-ups, M&As expected to generate synergies. Risks: 1) Economic downturn, weaker consumer mindset in developed markets; 2) lack of sales growth in China due to structural factors; 3) much higher labor costs; 4) news flow that hurts brand; and 5) Additional US tariffs, etc.

Source: Mizuho Securities Equity Research

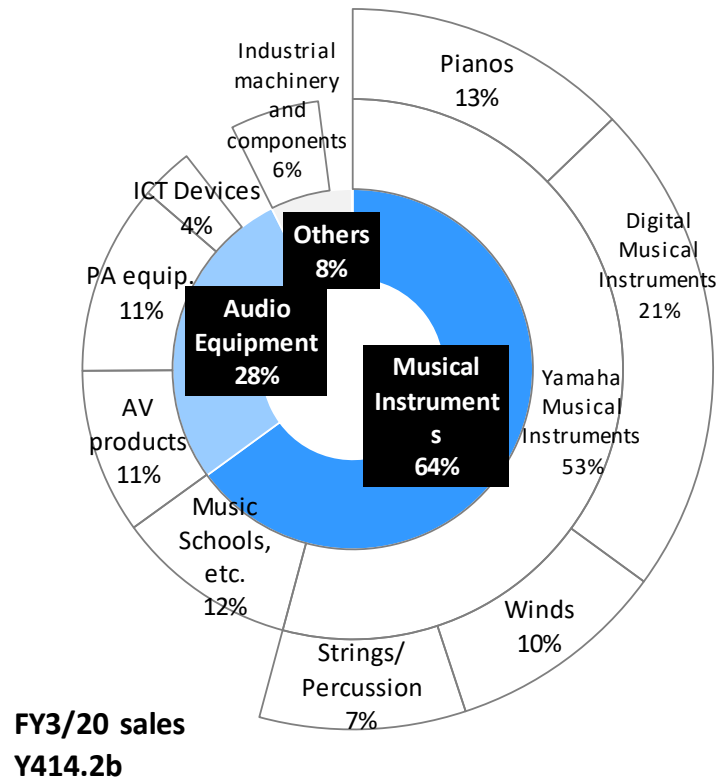
Yamaha > Valuation: PER clearly rising from 2018



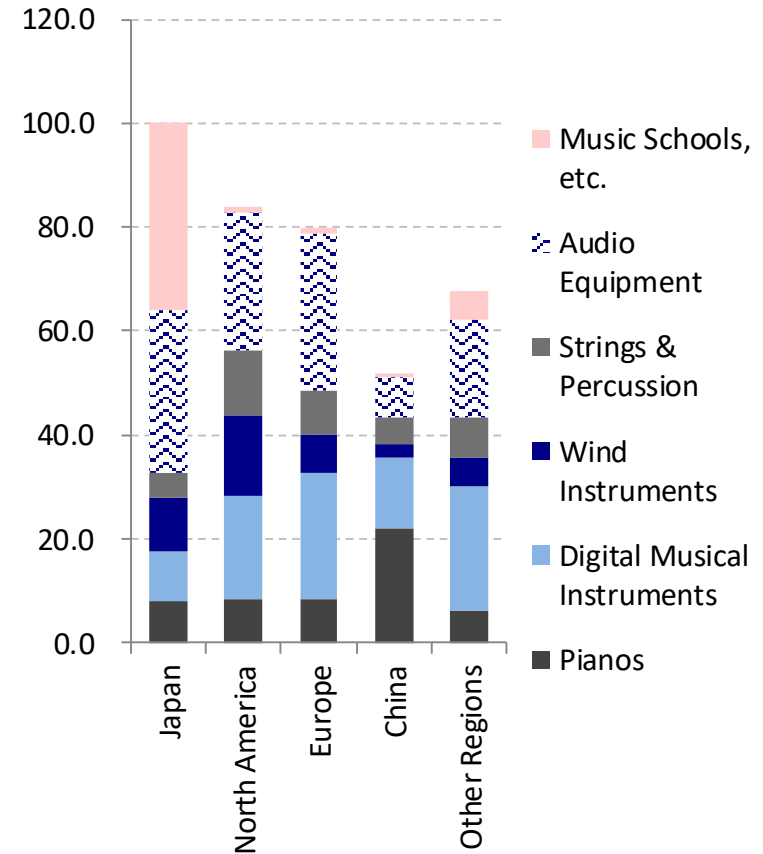
Source: Mizuho Securities Equity Research from Bloomberg

Yamaha > Business overview: mainstay products are musical instruments and audio equipment

Sales by business (FY3/20, IFRS)



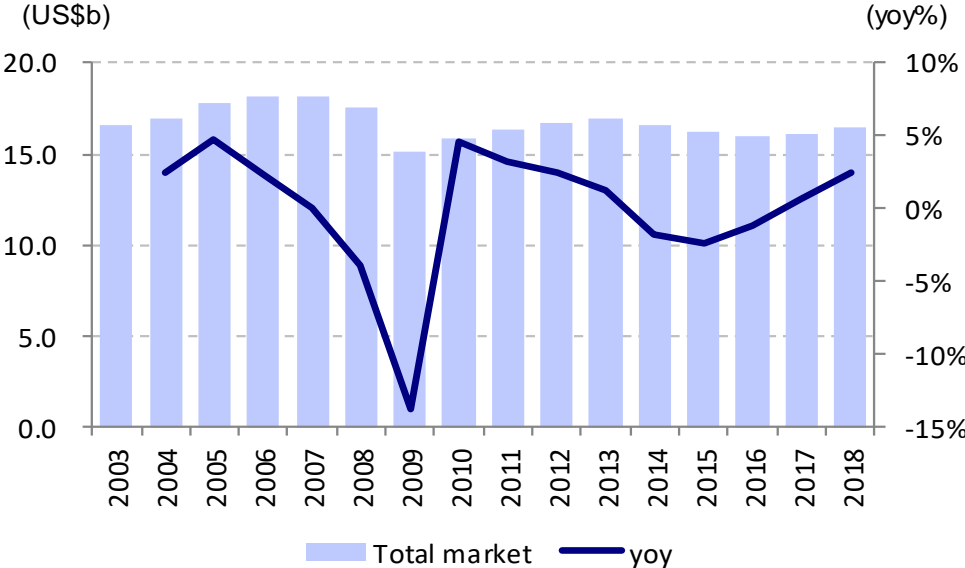
Sales by region (FY3/20, ¥b, IFRS)



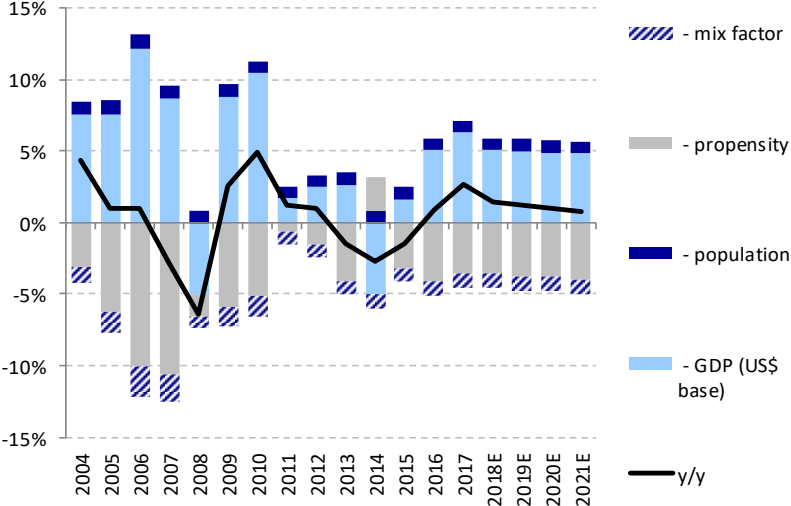
Source: Mizuho Securities Equity Research from company data

Yamaha > Musical instruments: global markets

Global Music Instruments market (retail sales base, US\$)



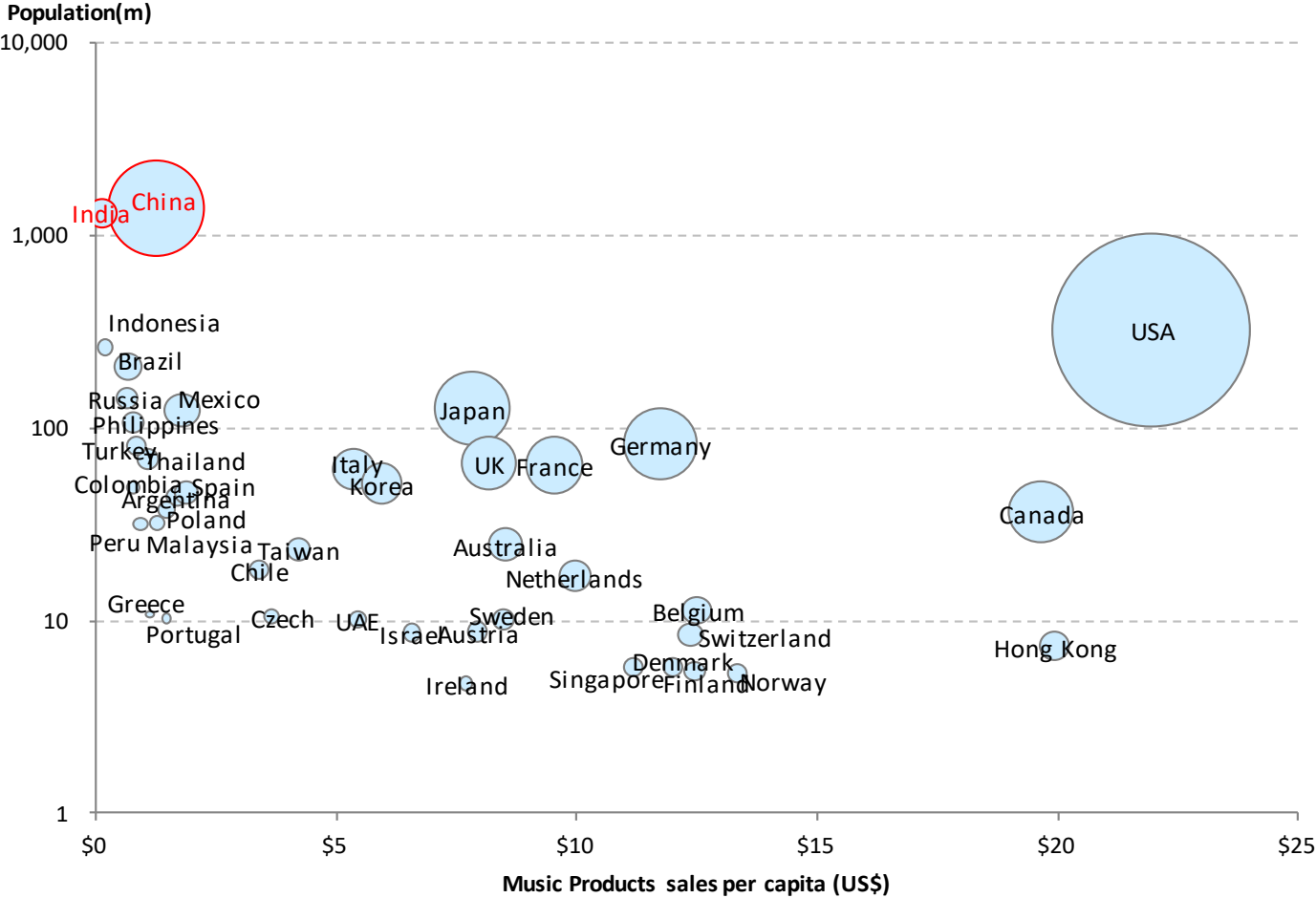
Breakdown by growth factor



Source: Mizuho Securities Equity Research from Music Trades, Estimates are by Mizuho Securities Equity Research

Yamaha > Musical Instruments: growth potential in China and India

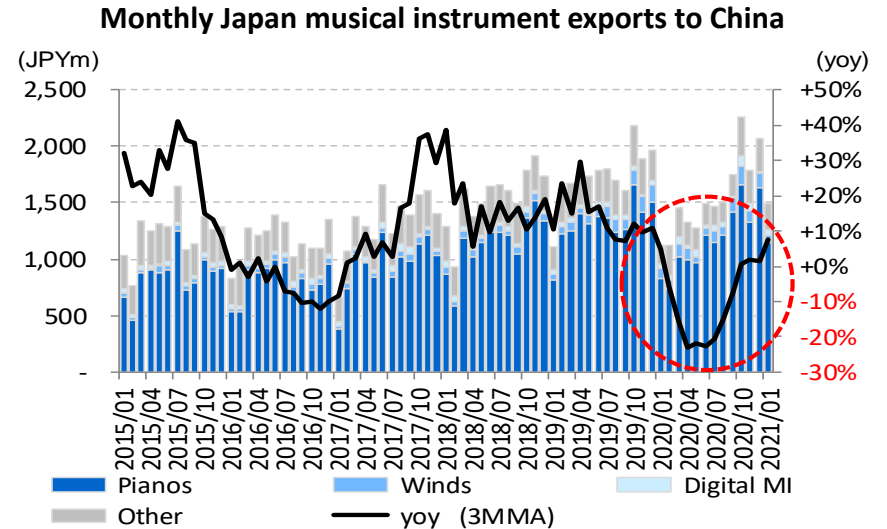
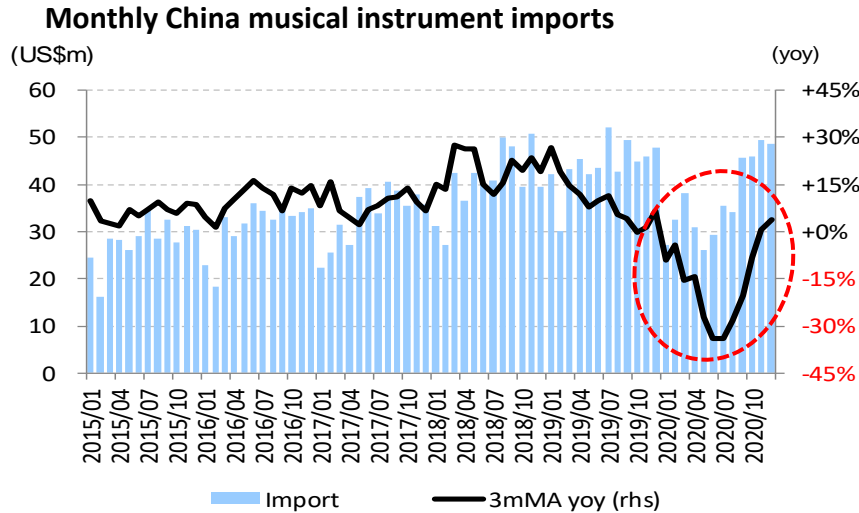
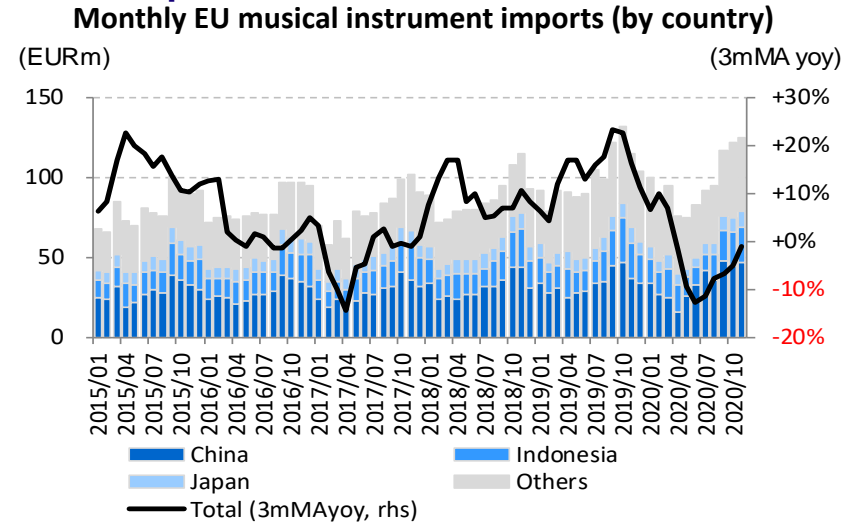
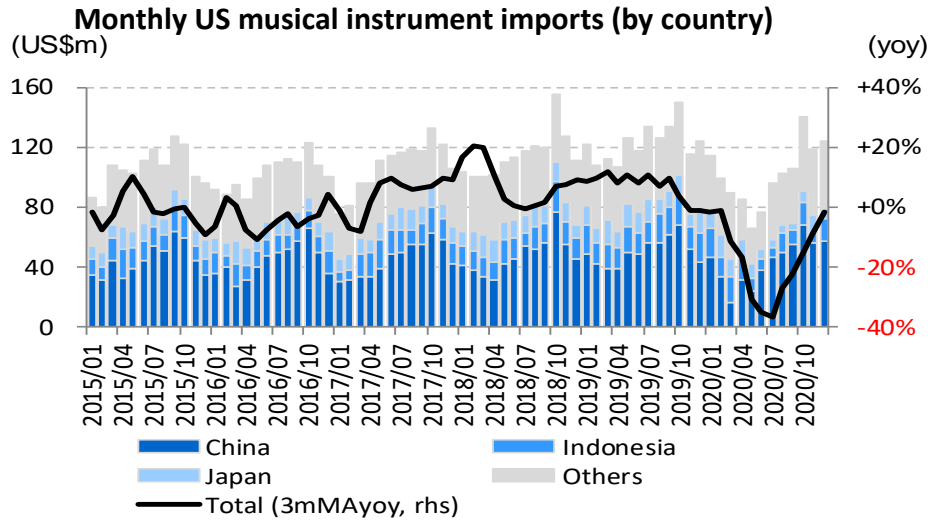
Breakdown of each county's musical instrument market : (population) × (musical instrument sales per capita) (2017)



Note: Vertical scale (population) is logarithmic; size of circle represents market scale.
 Source: Mizuho Securities Equity Research from Music Trades, IMF

Yamaha > Musical instruments: Trade statistics (demand→imports by country)

In China, Yamaha is promoting local production for local consumption; statistics for reference only. Slower growth in Chinese imports (= demand) is a concern, but US and Europe still firm.

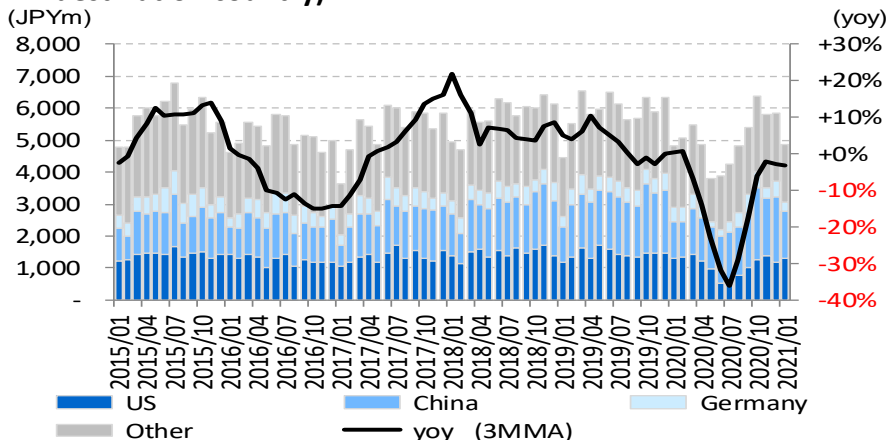


Source: Mizuho Securities Equity Research from USA Trade Online, Eurostat, General Administration of Customs PR China and MOF.

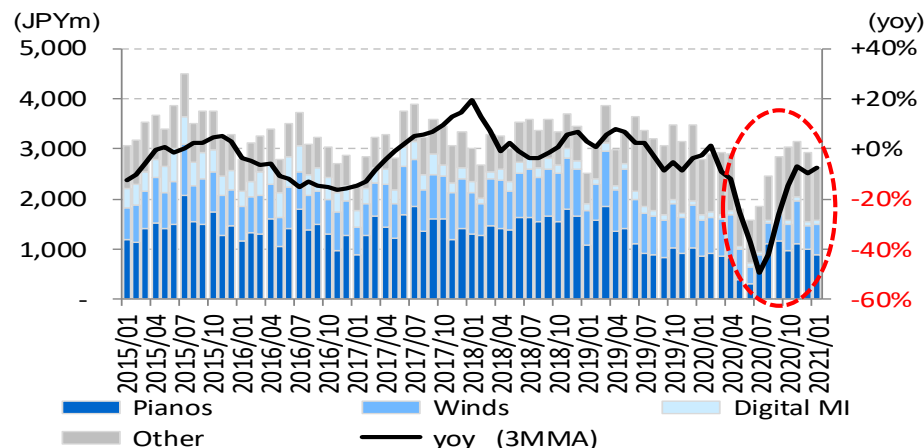
Yamaha > Musical instruments: Trade statistics (production→exports by country)

Exports of high-end pianos from Japan weak (exported from Shizuoka); referenced because overall Japanese exports include used instruments (mainly pianos). Indonesian exports reach record high for a single month.

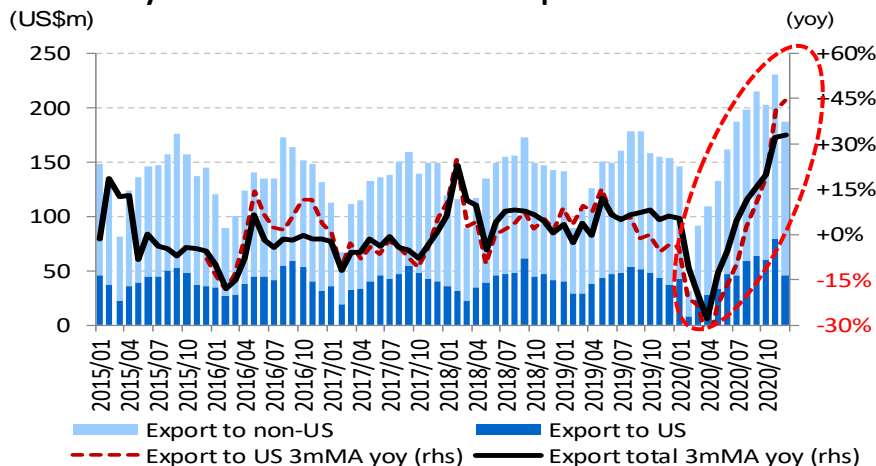
Monthly Japan musical instrument exports (overall/by destination country)



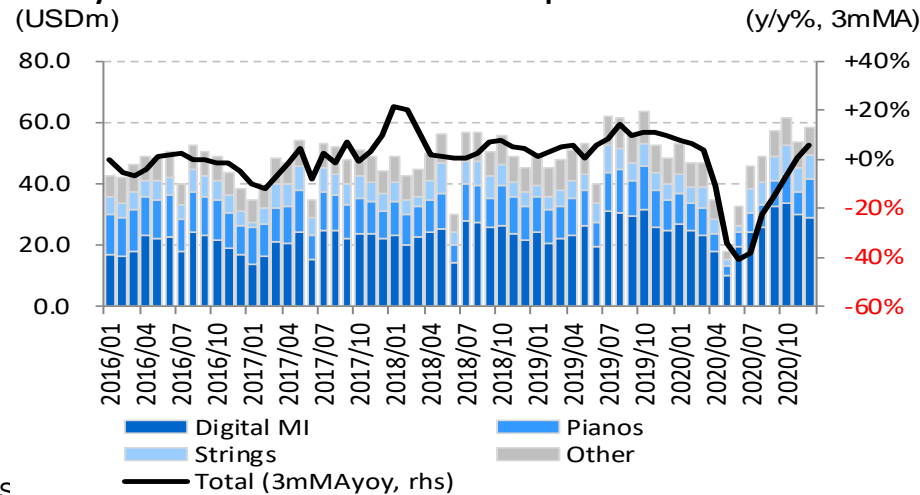
Monthly Japan musical instrument exports (total from Shimizu and Omaezaki customs)



Monthly China musical instrument exports



Monthly Indonesia musical instrument exports



Source: Mizuho Securities Equity Research from MOF, General Administration of Customs PR China and Statistics Indonesia

Yamaha > Earnings forecasts: Sales revenue (annual)

(JPY b)

	FY3/19	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21
(JPYb)			E	E	E	CoE
Exchange rate (average period) USD/JPY	111	109	106	105	105	106
Exchange rate (average period) EUR/JPY	128	121	123	125	125	123
Sales revenue	434.4	414.2	368.8	427.9	445.4	370.0
	-	-5%	-11%	+16%	+4%	-11%
Forex impact on revenue	-	-14.0	-3.5	1.6	0.0	-4.8
(LC y/y)	-	-2%	-10%	+16%	+4%	-10%
Musical Instruments	279.5	269.4	237.1	281.8	293.3	237.0
(y/y)	-	-4%	-12%	+19%	+4%	-12%
Yamaha Musical Instruments (Hardware)	229.4	224.4	200.7	239.0	251.9	
Pianos	56.0	53.0	50.8	60.1	62.6	51.4
Digital Musical Instruments	92.9	92.1	82.6	100.5	106.7	82.7
Winds, Strings / Percussion	53.1	50.7	37.8	47.1	49.5	38.0
Guitars	27.3	28.6	29.2	31.3	33.1	28.3
Japan	34.9	32.7	27.0	30.4	29.1	
North America	57.0	56.4	47.8	55.7	58.3	
Europe	49.1	48.4	44.6	51.9	52.8	
China	45.6	43.5	46.2	56.8	62.8	
Others	42.8	43.4	35.0	44.1	48.8	
Music Schools, etc.	50.1	45.0	36.4	42.8	41.4	
Audio Equipment	120.1	114.4	101.7	112.3	117.7	103.0
(y/y)	-	-5%	-11%	+10%	+5%	-10%
AV products	46.0	40.9	38.5	41.5	43.2	38.5
PA equipment	48.7	47.3	36.2	43.6	47.6	36.9
ICT devices	15.1	13.0	16.1	15.2	15.4	16.0
Others	10.3	13.2	10.9	12.0	11.5	11.6
Others	34.8	30.5	30.1	34.2	34.8	30.0
(y/y)	-	-12%	-1%	+14%	+2%	-2%
Elimination and adjustments	-0.3	-0.3	-0.3	-0.4	-0.4	0.0

Source: Mizuho Securities Equity Research

Yamaha > Earnings forecasts: Summary of P/L (annual, profit)

(JPY b)

		FY3/19	FY3/20	FY3/21	FY3/22	FY3/23	FY3/21
	(JPYb)			E	E	E	CoE
Exchange rate (settlement) USD/JPY		111	109	106	105	105	106
Exchange rate (settlement) EUR/JPY		131	122	121	125	125	121
Core OP		52.7	46.4	35.3	54.3	63.8	35.0
	(y/y)	-	-12%	-24%	+54%	+17%	-24%
	(margin)	12.1%	11.2%	9.6%	12.7%	14.3%	9.5%
Forex impact on revenue		-	-6.5	-0.7	1.9	0.0	-1.2
	(LC y/y)	-	+0%	-22%	+48%	+17%	-22%
Musical Instruments		40.8	37.8	27.9	44.9	51.2	28.0
	(margin)	14.6%	14.0%	11.8%	15.9%	17.5%	11.8%
Audio Equipment		9.6	8.6	6.2	7.5	10.4	6.0
	(margin)	8.0%	7.5%	6.1%	6.7%	8.8%	5.8%
Others		2.3	0.0	1.3	1.9	2.2	1.0
	(margin)	6.7%	0.1%	4.2%	5.6%	6.3%	3.3%
Other income/losses		0.1	-3.0	-2.3	0.0	0.0	-2.0
Operating profit		52.8	43.3	33.0	54.3	63.8	33.0
	(y/y)	-	-18%	-24%	+64%	+17%	-24%
	(margin)	12.2%	10.5%	9.0%	12.7%	14.3%	8.9%
Pretax profit		56.5	47.2	33.5	57.3	67.8	33.5
	(margin)	13.0%	11.4%	9.1%	13.4%	15.2%	9.1%
Net profit attributable to shareholders		40.3	34.6	24.5	42.1	49.8	24.0
	(margin)	9.3%	8.4%	6.6%	9.8%	11.2%	6.5%

Source: Mizuho Securities Equity Research

Yamaha > Earnings forecasts: Summary of P/L (quarterly)

(JPY b)

	(JPYb)	FY3/20				FY3/21				FY3/22				FY3/23				
		1Q	2Q	3Q	4Q	1Q	2Q	3Q	4QE	1QE	2QE	3QE	4QE	1QE	2QE	3QE	4QE	
Exchange rate (average period) USD/JPY		110	107	109	109	108	106	105	105	105	105	105	105	105	105	105	105	105
Exchange rate (average period) EUR/JPY		123	119	120	120	119	124	125	125	125	125	125	125	125	125	125	125	125
Sales revenue		99.5	109.0	114.1	91.6	71.8	93.0	107.5	96.5	95.9	106.3	117.6	108.1	103.6	110.3	120.9	110.6	
	(y/y)	-5%	+0%	-4%	-11%	-28%	-15%	-6%	+5%	+34%	+14%	+9%	+12%	+8%	+4%	+3%	+2%	
Forex impact on revenue		-2.4	-4.3	-4.3	-2.9	-2.4	-0.3	-0.7	-0.1	+0.8	+0.5	+0.2	+0.0	+0.0	+0.0	+0.0	+0.0	
	(LC y/y)	-3%	+4%	-9%	-9%	-26%	-14%	-6%	+5%	+32%	+14%	+9%	+12%	+8%	+4%	+3%	+2%	
Musical Instruments		67.5	71.1	74.7	56.0	46.6	60.6	68.7	61.2	66.4	70.2	76.0	69.2	71.3	72.5	78.4	71.1	
	(y/y)	-1%	+3%	-1%	-15%	-31%	-15%	-8%	+9%	+42%	+16%	+11%	+13%	+7%	+3%	+3%	+3%	
Yamaha Musical Instruments (Hardware)		55.7	59.5	63.2	46.0	40.7	51.0	58.3	50.7	56.2	59.6	64.8	58.4	61.2	62.3	67.7	60.7	
Pianos		13.4	15.0	15.0	9.5	8.7	14.3	14.6	13.2	14.5	15.9	15.8	13.9	15.4	16.3	16.4	14.5	
Digital Musical Instruments		20.9	23.5	28.7	19.0	17.0	18.7	26.6	20.3	22.2	23.3	30.0	25.0	24.6	24.7	31.4	26.0	
Winds, Strings / Percussion		14.5	13.7	11.2	11.3	8.4	10.5	8.9	10.0	12.2	12.4	10.2	12.3	13.5	12.8	10.6	12.6	
Guitars		6.8	7.3	8.4	6.2	6.5	7.4	8.1	7.2	7.3	8.0	8.8	7.2	7.7	8.5	9.3	7.6	
Japan		9.8	8.8	6.3	7.8	5.8	6.6	6.7	7.9	8.4	7.2	7.0	7.8	8.1	6.9	6.7	7.4	
North America		12.5	15.0	15.7	13.2	10.3	11.7	12.8	13.0	12.1	13.1	15.0	15.5	13.3	13.6	15.4	16.0	
Europe		11.4	11.2	16.1	9.7	8.8	10.2	14.8	10.8	12.9	11.4	15.3	12.3	13.8	11.4	15.3	12.3	
China		12.2	13.2	12.4	5.7	9.5	13.4	13.2	10.1	14.2	15.4	14.8	12.4	16.0	16.8	16.3	13.7	
Others		9.7	11.2	12.8	9.7	6.3	9.0	10.8	8.9	8.5	12.5	12.7	10.4	10.1	13.5	14.0	11.2	
Music Schools, etc.		11.8	11.6	11.5	10.0	5.9	9.6	10.4	10.5	10.2	10.6	11.2	10.8	10.1	10.2	10.7	10.4	
Audio Equipment		24.8	29.7	31.7	28.2	19.5	25.7	29.6	26.9	22.0	28.0	32.6	29.7	24.3	29.5	33.5	30.4	
	(y/y)	-5%	-2%	-8%	-5%	-21%	-14%	-6%	-5%	+13%	+9%	+10%	+10%	+10%	+5%	+3%	+2%	
AV products		8.7	10.7	13.5	8.0	7.8	9.6	13.0	8.1	7.7	10.8	13.9	9.1	8.3	11.2	14.3	9.4	
PA equipment		12.3	12.0	12.7	10.3	7.1	8.8	10.5	9.8	8.5	10.9	12.4	11.8	10.3	12.1	12.9	12.3	
ICT devices		2.4	3.3	3.2	4.1	2.4	5.0	4.6	4.1	3.4	4.0	3.9	3.9	3.4	4.0	4.0	4.0	
Others		1.4	3.7	2.3	5.8	2.2	2.3	1.5	4.9	2.4	2.3	2.4	4.9	2.3	2.2	2.3	4.7	
Others		7.2	8.2	7.8	7.4	5.6	6.8	9.2	8.5	7.6	8.2	9.1	9.3	8.1	8.4	9.1	9.2	
	(y/y)	-28%	-12%	-12%	+8%	-22%	-17%	+19%	+15%	+35%	+21%	-1%	+9%	+7%	+2%	+0%	-1%	
Elimination and adjustments		-0.1	-0.1	-0.1	-0.1	-0.1	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
Exchange rate (settlement) USD/JPY		111	108	109	109	108	106	105	105	105	105	105	105	105	105	105	105	
Exchange rate (settlement) EUR/JPY		126	123.0	119	120	119	118.0	121	126	125	125	125	125	125	125	125	125	
Core OP		10.8	15.4	16.3	4.0	1.1	11.9	16.0	6.3	9.6	15.5	19.0	10.2	14.3	17.5	20.5	11.5	
	(y/y)	-13%	+8%	-10%	-50%	-89%	-23%	-2%	+59%	+744%	+30%	+19%	+62%	+49%	+13%	+8%	+13%	
	(margin)	10.8%	14.1%	14.2%	4.3%	1.6%	12.8%	14.9%	6.5%	10.0%	14.6%	16.2%	9.4%	13.8%	15.9%	17.0%	10.4%	
Forex impact on revenue		-1.1	-2.0	-2.1	-1.3	-0.7	-0.7	+0.1	+0.6	+0.7	+0.8	+0.4	-0.1	+0.0	+0.0	+0.0	+0.0	
	(LC y/y)	-4%	+22%	+1%	-33%	-83%	-18%	-2%	+45%	+683%	+24%	+16%	+63%	+49%	+13%	+8%	+13%	
Musical Instruments		9.8	12.4	12.5	2.9	2.5	9.2	11.3	4.9	9.7	12.8	14.3	8.1	12.1	14.3	15.6	9.2	
	(margin)	14.6%	17.5%	16.8%	5.3%	5.4%	15.2%	16.4%	8.0%	14.6%	18.2%	18.8%	11.7%	17.0%	19.7%	19.9%	12.9%	
Audio Equipment		0.9	2.8	3.5	1.4	-1.1	2.7	3.5	1.1	-0.5	2.2	4.0	1.8	1.7	2.6	4.2	1.9	
	(margin)	3.5%	9.4%	11.0%	5.1%	-5.5%	10.4%	11.8%	4.1%	-2.3%	7.9%	12.3%	6.1%	7.0%	8.8%	12.5%	6.3%	
Others		0.1	0.1	0.3	-0.4	-0.3	0.0	1.2	0.3	0.4	0.5	0.7	0.3	0.5	0.6	0.7	0.4	
	(margin)	0.9%	1.5%	3.5%	-5.8%	-5.3%	0.1%	13.5%	3.5%	5.3%	6.1%	7.7%	3.2%	6.2%	7.1%	7.7%	4.3%	
Other income/losses		0.3	1.1	0.2	-4.7	-2.6	0.4	-0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Operating profit		11.1	16.4	16.5	-0.7	-1.5	12.2	16.0	6.3	9.6	15.5	19.0	10.2	14.3	17.5	20.5	11.5	
	(y/y)	-8%	+14%	-12%	-	-	-25%	-3%	-	-	+27%	+19%	+62%	+49%	+13%	+8%	+13%	
	(margin)	11.2%	15.1%	14.4%	-0.8%	-2.1%	13.2%	14.9%	6.5%	10.0%	14.6%	16.2%	9.4%	13.8%	15.9%	17.0%	10.4%	

Source: Mizuho Securities Equity Research

Yamaha > Earnings forecasts: Balance sheet (IFRS)

(JPYm)

Consolidated Balance sheet (IFRS)	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Cash and cash equivalent	95,815	92,671	109,125	134,818	170,838
Trade and other receivables	65,346	58,067	51,531	59,789	62,234
Inventories	101,003	100,054	92,959	103,165	103,723
Other	20,655	19,397	19,198	21,102	21,965
Total current assets	282,819	270,189	272,813	318,873	358,761
Property, plant and equipment	91,326	97,106	100,106	99,606	99,106
Right-of-use assets	29,579	24,480	24,480	24,480	24,480
Goodwill	161	158	158	158	158
Intangible assets	1,321	1,736	1,736	1,736	1,736
Financial assets	101,093	67,817	67,817	67,817	67,817
Other	9,625	12,547	12,544	12,544	12,544
Total noncurrent assets	233,105	203,844	206,841	206,341	205,841
Total assets	515,924	474,034	479,654	525,214	564,602
Trade and other payables	59,525	52,982	48,500	53,927	56,133
Short-term interest-bearing debt	8,936	10,830	11,125	15,528	14,292
Lease liabilities	5,730	5,365	3,966	4,225	4,418
Other	26,252	29,972	27,155	31,354	32,910
Total current liabilities	100,443	99,149	90,745	105,034	107,754
Long-term interest-bearing debt	-	-	-	-	-
Lease liabilities	18,258	15,864	16,898	17,674	18,255
Other	38,215	32,570	32,570	32,570	32,570
Total noncurrent liabilities	56,473	48,434	49,468	50,244	50,825
Total liabilities	156,917	147,584	140,213	155,278	158,579
Capital stock	28,534	28,534	28,534	28,534	28,534
Capital surplus	21,568	21,277	21,277	21,277	21,277
Retained earnings	293,547	316,899	329,816	360,312	396,398
Treasury stock	-42,533	-65,093	-65,093	-65,093	-65,093
Other components of equity	56,820	23,792	23,788	23,788	23,788
Equity attributable to owners of the parent	357,936	325,409	338,322	368,818	404,904
Non-controlling interest	1,070	1,040	1,119	1,119	1,119
Total equity	359,007	326,450	339,441	369,937	406,023
Total liabilities and equity	515,924	474,034	479,654	525,214	564,602

Source: Mizuho Securities Equity Research

Yamaha > Earnings forecasts: CF, Financial indicators (IFRS)

(JPYm)

Cash flow statement (IFRS)	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Net income before income taxes	56,471	47,225	33,467	57,300	67,800
Depreciation and amortization	16,553	17,322	17,000	17,500	17,500
Incr/decr in inventory assets	-6,244	-2,841	7,095	-10,206	-558
Incr/decr in trade receivables	987	3,282	6,536	-8,257	-2,445
Incr/decr in purchase obligation	-1,392	-4,887	-4,482	5,427	2,205
Other	-30,855	-2,939	-11,487	-12,904	-17,307
Cash flow from operating activities	35,520	57,162	48,129	48,859	67,195
Purchase of tangible fixed assets	-20,192	-20,473	-15,000	-12,000	-12,000
Other	-2,909	-594	-	-	-
Cash flow from investing activities	-23,101	-21,067	-15,000	-12,000	-12,000
Change in interest-bearing debt	-2,566	2,120	295	4,404	-1,236
Repayment of lease obligations	-5,606	-5,871	-5,365	-3,966	-4,225
Purchase of treasury stock	-11,948	-21,312	-	-	-
Payment amount of dividends	-10,547	-11,274	-11,604	-11,604	-13,714
Other	-3,326	-85	-	-	-
Cash flow from financing activities	-33,993	-36,422	-16,675	-11,166	-19,175
Forex conversion, consolidation change, etc.	-14	-2,817	-	-	-
Cash and cash equivalents at end of period	95,815	92,671	109,125	134,818	170,838
(Financial indicators)	FY3/19	FY3/20	FY3/21E	FY3/22E	FY3/23E
Net worth	357,936	325,409	338,322	368,818	404,904
Equity ratio	69.4%	68.6%	70.5%	70.2%	71.7%
FCF	12,419	36,095	33,129	36,859	55,195
EBITDA	69,368	60,655	50,016	71,800	81,300
Interest-bearing debt (incl. lease liabilities)	32,924	32,059	31,989	37,426	36,966
Net debt (incl. lease liabilities)	-62,891	-60,612	-77,137	-97,391	-133,873
D/E ratio	0.09	0.10	0.09	0.10	0.09
Net D/E ratio	-0.18	-0.19	-0.23	-0.26	-0.33

Source: Mizuho Securities Equity Research

Largan Precision (3008.TT; PO TWD3,600): remain positive on 2H21 recovery

Investment Rating..... Buy
 Price Objective..... TWD3,600
 Valuation method18X 2021E EPS

Largan – financial summary, 2017-2021

YE:	Dec 17	Dec 18	Dec 19	Dec 20	Dec 21E
Revenue (TWDm)	53,128	49,952	60,745	55,944	57,060
Net profit to comm on shareholders (TWDm)	25,976	24,376	28,263	24,528	26,868
Basic EPS (TWD)	193.6	181.7	210.7	182.9	200.3
EPS vs consensus					(3.24%)
EPS growth	14.26%	(6.16%)	15.95%	(13.21%)	9.54%
P/E (x)	15.65	16.67	14.38	16.57	15.13
BPS (TWD)	689	802	934	1,038	1,153
P/B (x)	4.40	3.78	3.24	2.92	2.63
ROAE	30.70%	24.38%	24.27%	18.55%	18.29%
Dividend yield	2.39%	2.24%	2.61%	2.61%	2.81%

■ Share Price Drivers

- Stronger iPhone demand
- Share gains on China OEMs (OVX)
- VCM order wins in next iPhones
- Camera upgrade acceleration
- Better product mix to improve margins

ACT: While Largan's YoY sales decline would persist in 1H21 due to Huawei's loss in 2020, we expect Largan to resume its growth from 2H21 driven by Honor (new Huawei), iPhone 13 cycle, and the upside from VCM order wins likely in new iPhones. Our new PO is set at TWD3,600, based on 18x 2021E EPS.

4Q20 recap: Largan reported 4Q20 EPS at TWD51.8. Largan commented the shortage from semi components had modest negative impacts on its sales in Dec 20, and guided sequential decline of both sales in Jan-Feb 21. According to the management regarding VCM development, Largan's integrated solution of lens with VCM offers thinner form factors to potential customers, as it has built the technology know-how in the past few years. Largan also highlighted improving demand of high-end camera specs in early 2021, despite limited near-term order visibility from OEMs. .

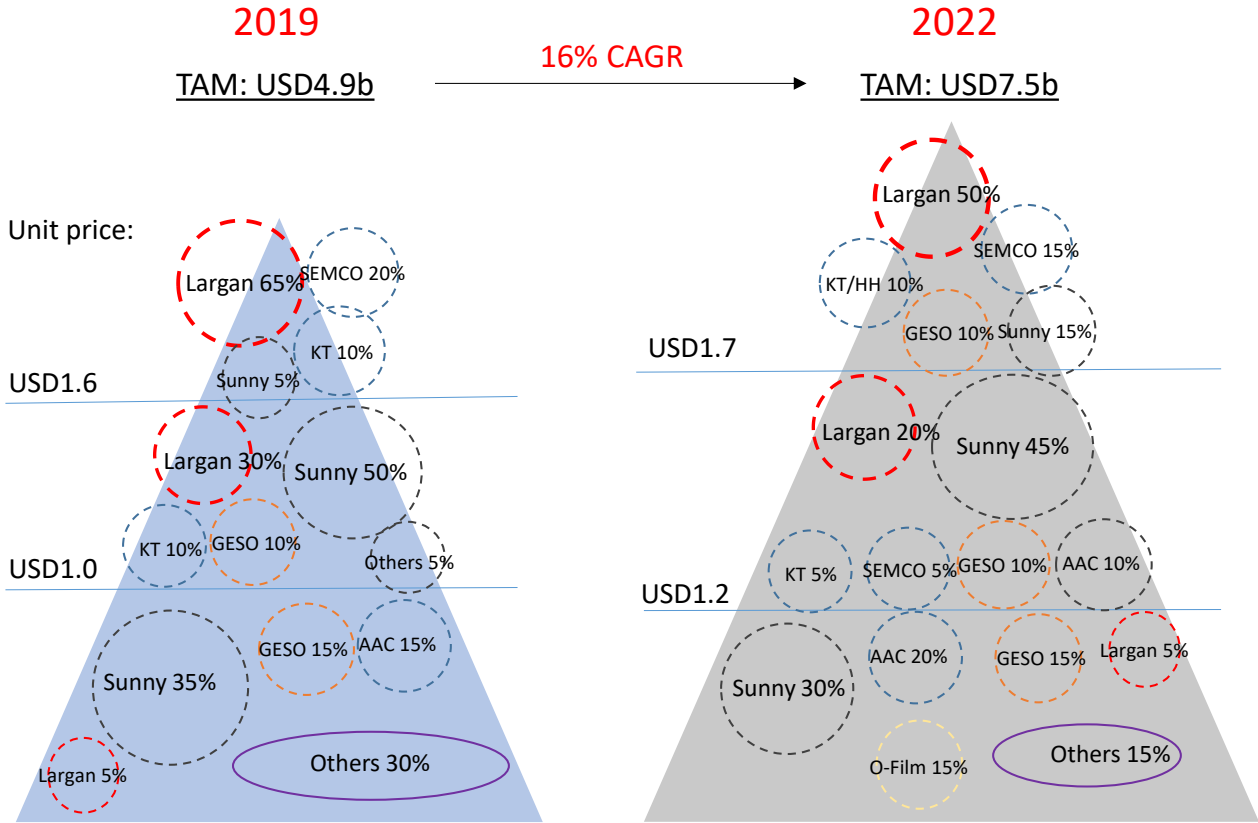
FY 2021 outlook: We expected the growth of multiple camera penetration, especially the quad-cameras, is likely to slow down in 2021 due to high bases in China OEMs and cost pressure from 5G semi components. However, we do not take it incrementally negative to Largan, since it is more focus on the main camera with intact demand for higher resolutions and more pieces of lens (7P/8P). The critical factor, in our view, is the sales momentum of Honor brand succeeding the optical R&D forces from Huawei. Without factoring in VCM orders, conservatively, we expect Largan to post mid-single digit YoY sales growth in 2021, with EPS at TWD200.

Source: Mizuho Securities Equity Research

Largan Precision: focus on high-end SP camera lens

We estimate the market size (in dollars) will grow at 16% annually from 2019 to 2022, reaching USD7.5b. On the other hand, the competition is more intensified. Largan remains the leader in high-end segment but the shares decline gradually, unless it competes shares by lowering margins.

Global smartphone camera lens - market size and competitions



Source: Mizuho Securities Equity Research

Smartphone camera lens: Multi-camera penetration to slowdown in 2021

WATCH: While global smartphone camera unit still grows at double-digits YoY in 2021, the adoption rate of triple/quad cameras (ex-iPhone) has reached at a high level and OEMs are more focus on the quality of the camera performance such as higher resolution, larger CIS size and better optical zooming.

Global smartphone camera lens shipment (updated in Jan 21)

TAM by units (millions)	2020					YoY (%)	2021					YoY (%)
	set volume	dual cam	triple cam	quad cam	lens units		set volume	dual cam	triple cam	quad cam	lens units	
1) Rear camera lens												
China smartphone	630	26%	28%	37%	2001	43%	690	14%	41%	39%	2332	17%
iPhone	200	46%	36%	0%	469	25%	230	42%	46%	0%	583	24%
Samsung	260	21%	38%	33%	834	29%	300	12%	40%	45%	1059	27%
Others - global (LG, Sony, Moto, etc.)	74	35%	20%	15%	173	-6%	68	16%	47%	21%	199	15%
Others - white box	125	45%	15%	5%	249	-14%	80	25%	40%	10%	200	-20%
% of dual/triple cam		30%	30%	26%				19%	42%	31%		
total volume	3726					29%	4373					17%
2) Front camera lens												
% of multi cam	24%						32%					
total volume	1598					1%	1806					13%
3) 3D sensing -SL and ToF												
% of penetration	19%						19%					
total volume	245					42%	260					6%
total lens volume (with 3D sensing)	5570					20%	6438					16%
total lens volume (w/o 3D sensing)	5325					19%	6178					16%

Source: Mizuho Securities Equity Research

Smartphone camera lens: iPhone's roadmap in 6P/7P, triple cams, and ToF/3D sensing

WATCH: We believe Apple's periscope telephoto camera project has been push out beyond 2022. Thus, the from factor of its triple camera upgrade is limited in 2020/21.

	2019			2020E				2021E			
Model	iPhone 11	iPhone 11 Pro	iPhone Pro Max	iPhone 12	iPhone 12 Max	iPhone 12 Pro	iPhone 12 Pro Max	iPhone 13	iPhone 13 Max	iPhone 13 Pro	iPhone 13 Pro Max
Display size	6.06"	5.85"	6.46"	5.42	6.06"	6.06	6.67"	5.42	6.06	6.06"	6.67"
Display panel	LTPS LCD	OLED	OLED	OLED	OLED	OLED	OLED	OLED	OLED	OLED	OLED
Rear cam											
Number of cameras	dual	triple	triple	dual	dual	triple	triple	triple	triple	triple	triple
Resolution	12MP (wide angle) 12MP (telephoto)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto)	12MP (wide angle) 12MP (telephoto)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)	12MP (wide angle) 12MP (telephoto) 12MP (superwide)
CMOS size	1/2.4" (wide angle) 1/2.8" (telephoto)	1/2.4" (wide angle) 1/2.8" (SW+telephoto)	1/2.4" (wide angle) 1/2.8" (SW+telephoto)	1/2.4" (wide angle) 1/2.8" (telephoto)	1/2.4" (wide angle) 1/2.8" (telephoto)	1/2.4" (wide angle) 1/2.8" (SW+telephoto)	1/2.4" (wide angle) 1/2.8" (SW+telephoto)	1/2.0" (wide angle) 1/2.0" (wide angle)	1/2.0" (wide angle) 1/2.0" (wide angle)	1/1.7" (wide angle)	1/1.7" (wide angle)
Aperture	f/1.8 (wide angle) f/2.0 (telephoto)	f/1.8 (wide angle) f/2.0 (telephoto) f/2.4 (superwide)	f/1.8 (wide angle) f/2.0 (telephoto) f/2.4 (superwide)	f/1.8 (wide angle) n/a	f/1.8 (wide angle) n/a	f/1.4 (wide angle) n/a	f/1.4 (wide angle) n/a	n/a n/a n/a	n/a n/a n/a	n/a n/a n/a	n/a n/a n/a
Lens (main/sub/sub)	6P/6P	6P/6P/5P	6P/6P/5P	6P/6P	6P/6P	7P/6P/5P	7P/6P/5P	7P/6P/5P	7P/6P/5P	7P/6P/5P	7P/6P/5P
OIS #	2	2	2	2	2	2	2	2	2	2	2
Digital zoom	5x	5x	5x	5x	5x	5x	5x	5x	5x	5x	5x
Optical zoom	2x	2x	4x	2x	2x	4x	4x	4x	4x	4x	4x
ASP (USD)	1.4 (wide angle) 1.6 (telephoto)	1.4 (wide angle) 1.6 (telephoto) 1.8 (superwide)	1.4 (wide angle) 1.6 (telephoto) 1.8 (superwide)	1.4 (wide angle) 1.5 (telephoto)	1.4 (wide angle) 1.5 (telephoto)	2.1 (wide angle) 1.5 (telephoto) 1.7 (superwide)	2.1 (wide angle) 1.5 (telephoto) 1.7 (superwide)	n/a n/a n/a	n/a n/a n/a	n/a n/a n/a	n/a n/a n/a
Front cam											
Resolution	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP	12MP
CMOS size	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"	1/3.5"
Lens (main/sub/sub)	5P	5P	5P	5P	5P	5P	5P	5P	5P	5P	5P
ASP (USD)	1.0	1.0	1.0	0.9	0.9	0.9	0.9	n/a	n/a	n/a	n/a
Front - structured light											
Tx -											
Lens	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO	WLO
Suppliers	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon	AMS/Heptagon
ASP (USD)	3.2	3.2	3.2	3.0	3.0	3.0	3.0	2.7	2.7	2.7	2.7
Rx -											
Lens	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P	4P
Suppliers	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO
ASP (USD)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
Rear - ToF											
Tx -											
CMOS						Sony	Sony	Sony	Sony	Sony	Sony
Lens						5P	5P	5P	5P	5P	5P
Suppliers						Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO	Largan/GESO
ASP (USD)						2.0	2.0	1.6	1.6	1.6	1.6
Dollar content (USD) on opticals	7.6	9.3	9.3	7.2	7.2	9.4	12.3				

Source: Mizuho Securities Equity Research

Smartphone camera lens: competition highlights on iPhone

We highlight the current supply status on iPhone 12 (2020) and iPhone 13 (2021)

- **Genious Optical (GESO):** GESO wins 20-30% of final allocation on 7P main lens (WI) in iPhone 12. On superwide, Largan might be the major supplier in Pro models (with VCM bundled) and GESO still supplies the majority of other two.
- **Kantatsu (KT):** KT has 6m/month capacity in Lianyungang China. It will supply both 6P on rear and tele in iPhone 12, plus the upside of 7P on high-end rear cam. In addition to in-house production, KT has +10m/month outsourcing capacity to Foxconn.
- **SEMCO:** SEMCO will join to supply 6P tele in iPhone 12, while the volume is only 2-3m/month committed to Apple. It is qualifying 7P for iPhone 13.
- **Sunny:** We expect Sunny to supply front-cam and/or tele from 2H of 2021 as the earliest.

iPhone - market share assumptions on major vendors, 2018-2021

	model	Size	Rear - main	Rear - superwide	Rear - telephoto	Front
2018	iPhone XR	6.06"	Largan (90%);GESO (10%)			GESO (60%);Largan (40%)
	iPhone XS	5.85"	Largan (90%);GESO (10%)		Largan (70%);KT (30%)	GESO (60%);Largan (40%)
	iPhone XS Max	6.46"	Largan (95%);GESO (5%)		Largan (70%);KT (30%)	GESO (60%);Largan (40%)
2019	iPhone 11	6.06"	Largan (70%);KT (15%);GESO (15%)		Largan (70%);KT (30%)	GESO (70%);Largan (30%)
	iPhone 11 Pro	5.85"	Largan (70%);KT (15%);GESO (15%)	Largan (20%);GESO (80%)	Largan (70%);KT (30%)	GESO (70%);Largan (30%)
	iPhone Pro Max	6.46"	Largan (90%);KT (10%)	Largan (20%);GESO (80%)	Largan (70%);KT (30%)	GESO (70%);Largan (30%)
2020E	iPhone 12 mini	5.42"	Largan (60%);KT (30%);GESO (10%)		Largan (70%);KT (25%);SEM CO (5%)	GESO (70%);Largan (30%)
	iPhone 12 Max	6.06"	Largan (60%);KT (30%);GESO (10%)		Largan (70%);KT (25%);SEM CO (5%)	GESO (70%);Largan (30%)
	iPhone 12 Pro	6.06"	Largan (80%);GESO (20%)	Largan (20%);GESO (80%)	Largan (70%);KT (25%);SEM CO (5%)	GESO (70%);Largan (30%)
	iPhone 12 Pro Max	6.67"	Largan (80%);GESO (20%)	Largan (20%);GESO (80%)	Largan (70%);KT (25%);SEM CO (5%)	GESO (70%);Largan (30%)
2021E	iPhone 13	5.42"	Largan (65%);GESO (25%);KT (10%)	Largan (20%);GESO (80%)	Largan (50%);KTHH (30%),SEM CO (20%)	GESO (70%);Largan (30%)
	iPhone 13 Max	6.06"	Largan (65%);GESO (25%);KT (10%)	Largan (20%);GESO (80%)	Largan (50%);KTHH (30%),SEM CO (20%)	GESO (70%);Largan (30%)
	iPhone 13 Pro	6.06"	Largan (70%);GESO (30%)	Largan (100%)	Largan (65%);KTHH (25%),SEM CO (10%)	GESO (70%);Largan (30%)
	iPhone 13 Pro Max	6.67"	Largan (70%);GESO (30%)	Largan (100%)	Largan (65%);KTHH (25%),SEM CO (10%)	GESO (70%);Largan (30%)

Source: Mizuho Securities Equity Research

Companies Mentioned

Code	Company Name	Recommendation	Price (17/3)
6740	JAPAN DISPLAY	NR	¥50
6752	Panasonic	Neutral	¥1,379.5
6753	Sharp	Neutral	¥1,851
6758	Sony	Buy	¥11,575
6839	Funai Electric	Neutral	¥727
6875	Megachips	Neutral	¥3,360
7731	Nikon	Underperform	¥947
7951	Yamaha	Buy	¥6,400
2317 TT	Hon Hai	Neutral	NA
2409 TT	AU Optronics	Neutral	NA
3008 TT	Largan Precision	Buy	NA
3481 TT	Innolux	NR	NA
1070 HK	TCL Multimedia Technology	NR	NA
981 HK	SMIC	Underperform	NA
751 HK	SKYWORTH DIGITAL TECHNOLOGY	NR	NA
732 HK	Truly International	NR	NA
005930 KS	Samsung Electronics	Buy	NA
034220 KS	LG Display	Neutral	NA
000050 CH	Tianma Microelectronics	NR	NA
000725 CH	BOE Technology	NR	NA
300750 CH	Contemporary Amperex Technology	NR	NA
AAPL US	Apple	NR	NA
OLED US	UDC	NR	NA
TSLA US	Tesla	NR	NA
QCOM US	Qualcomm	Buy	NA

Note: NR = Not Rated, Source: Mizuho Securities Equity Research

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