

Foundry TAM will increase due to Intel abandon in-house advanced node manufacturing, TSMC CAPEX will be used for advanced technology capacity expansion



July, 31st, 2020

Kingdom Wide Corp Research

FOUNDRY TAM, CAPEX and TSMC CAPACITY EXPANSION UPDATE

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- Intel announcement of outsourcing advanced technology nodes might give overall foundry TAM (5nm beyond) increase from 16.2% to 34.7%.
- Foundries with leading edge technologies (i.e. 5/4/3nm) will have opportunities to win Intel outsourcing business.
- TSMC announced to increase \$1B for expansion of advanced technology nodes, e.g. 5/3 nm.

Intel cost of goods sold (COGS) is currently \$33B, or about 40% of sales. Removing: (a) \$1.5B for the memory part (of which the manufacturing would have typically to be picked up by another IDM); and (b) \$1B in the system part (coming from ~\$3B in Intel's non-semiconductor revenue), Intel's non-memory semiconductor COGS ends up being about \$31.5B. Taking 70% outsourcing assumption, the foundry market TAM could balloon \$20~\$22B (mostly leading-edge technology nodes).

Technology Nodes	2018	2019	2020F	2021F	2022F	2022F
≤5nm	0.0%	0.0%	6.6%	12.3%	16.2%	34.7%
7/6nm	5.7%	17.1%	16.0%	14.4%	13.4%	10.5%
10nm	8.4%	3.0%	2.3%	2.0%	1.7%	1.3%
16/14/12nm	17.7%	16.3%	14.6%	13.4%	12.8%	10.0%
28/22/20/18nm	15.9%	13.8%	13.2%	12.8%	12.5%	9.8%
45/40nm	11.9%	11.3%	10.7%	10.0%	9.6%	7.5%
65/55nm	10.5%	10.4%	9.6%	9.0%	8.4%	6.5%
90/80nm	3.1%	1.9%	1.5%	1.3%	1.2%	0.9%
0.13/0.11μm	7.7%	7.3%	6.9%	6.6%	6.4%	5.0%
0.18/0.15μm	10.3%	10.2%	9.9%	9.7%	9.5%	7.4%
≥0.25μm	8.7%	8.8%	8.8%	8.6%	8.4%	6.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*The assumption is Intel abandon advanced node manufacturing for Notebook/PC/ IoT CPUs and Data center/ Gaming GPUs.

Table1: Foundry TAM forecast and breakdown by technology nodes

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TSMC has announced to increase \$1B for expansion of advanced technology nodes, e.g. 5/3 nm for HPC and mobile phone applications. TSMC's announcing that this year they will grow their revenue by more than 20% y/y, associated with UMC's expected 10% and SMIC 20% y/y growth, is a sign that the foundry business is healthy, and for many nodes. Already by Q4 2020, TSMC will have almost half of its revenue coming from 7nm and 5nm. According to Kingdom Wide Corp Research forecast, in 2021 major foundry market share shouldn't change significantly, as TSMC top customers are likely to be migrating from 16nm to 12nm and 7 to 5nm, but not as much from 12nm into 7nm. From Table 3, TSMC will spend CAPEX in expensing 5nm and 3nm manufacturing capacity, to be noticed that, TSMC will increase 5nm manufacturing capacity ~ 1.6x by 2021 (compared to 2020 manufacturing capacity) which will give TSMC significant revenue growth momentum on 2021. Kingdom Wide Corp Research believes that TSMC will enlarge the difference of market share to Samsung foundry.

Company (\$B)	2018	2019	2020F
Samsung	21.3	19.6	19.0
Intel	15.2	16.2	17.0
TSMC	10.5	14.9	16.5
SMIC	1.8	2.0	3.1
UMC	0.7	0.6	1.0
Globalfoundries	0.5	0.7	0.8

*TSMC announced to increase \$1B CAPEX for advanced nodes.

Table2: 2018~2020 Intel and major foundries' CAPEX reference table

Node	2018				2019				2020				2021			
	1Q'18	2Q'18	3Q'18	4Q'18	1Q'19	2Q'19	3Q'19F	4Q'19F	1Q'20	2Q'20	3Q'20F	4Q'20F	1Q'21F	2Q'21F	3Q'21F	4Q'21F
3nm	-	-	-	-	-	-	-	-	-	-	-	1.0	1.0	2.0	3.3	3.3
5nm	-	-	-	1.0	3.0	4.5	7.5	7.5	12.3	33.0	37.5	41.3	41.3	48.8	53.8	56.3
7nm/ 6nm	1.0	4.2	6.5	6.7	7.0	7.3	7.3	8.1	8.8	9.3	9.7	9.7	9.7	9.7	9.7	9.7
10nm	1.0	0.3	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16/12nm	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.4	1.4	1.6	1.6	1.6	1.6

*Capacity expansion normalized to 1Q'17, leading edge technologies (7/5/3 nm) normalized to risk production capacity.

Table3: 2018~2021 TSMC manufacturing capacity expansion by technology nodes reference table

Kingdom Wide Corp Research foundry capacity estimation model description

To achieve trustable foundry Fab capacity estimation and capacity expansions which requires analyst to make their predictions with monitoring critical semiconductor equipment for advanced nodes, material consumption rates, bottleneck process wafer per day throughput and adjusting estimate CAPEX/ capacity with analysts' work experiences in foundry operations, R&D and tool installation/ verification cycle time. Kingdom Wide Corp Research has innovated multiple tracking methods which we believe providing insights into foundry capacity expansion trends at various fabs. By analyzing and cross tracking multiple supplies of tool installation/ qualification cycle time, machine throughput (i.e. EUV, epitaxy, etcher, CMP) and critical/ bottleneck semiconductor process materials (such as CMP slurry, lithography photoresist, developers, solvents, epitaxy gases, etchants, etc.) that are dispensed on wafer basis, our analysts have created internal analysis methods/ models that we have confidence in making best guesses of foundry Fab capacity estimation and capacity expansions trends for multiple Fabs and technologies mentioned.

To be notice that the assumptions to be considered in our analysis is not only the semiconductor material consumption depending on the manufacturing technology nodes, product application and must-have process equipment, but also semiconductor tool shipment, installation, qualification cycle time, semiconductor materials different expiration date and safe day of inventory for critical semiconductor materials. Furthermore, the different technology nodes with their own manufacturing qualification cycle time, such as inline, electrical, yield, final test performances by different process equipment, customer product level qualifications and etc., will all impact on the foundry Fab capacity estimation and capacity expansions trends. Our analysts can help our customers to have in depth analysis and provide more accreted research information/ reports.

Kingdom Wide Corp Research is open to discuss our foundry Fab capacity estimation and capacity expansions trends model and assumptions with customers interested in more detail about our analysis.

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