

RESEARCH BULLETIN

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Revenue per Wafer Rising As Demand Grows for sub-7nm IC Processes *Despite high development costs, using smaller nodes yield larger revenue per wafer.*

The success and proliferation of integrated circuits has largely hinged on the ability of IC manufacturers to continue offering more performance and functionality for the money. Driving down the cost of ICs (on a per-function or per-performance basis) is inescapably tied to a growing arsenal of technologies and wafer-fab manufacturing disciplines as mainstream CMOS processes reach their theoretical, practical, and economic limits.

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Based on data presented in IC Insights' new edition of *The McClean Report* (released in January 2020), many IC companies are now designing high-performance microprocessors, application processors, and other advanced logic devices based on 10nm and 7nm process technology. Some of the current iterations from logic and foundry suppliers are shown in Figure 1.

Logic/Foundry Process Roadmaps (for Volume Production)

	2015	2016	2017	2018	2019	2020	2021
Intel		14nm+	10nm (limited) 14nm++		10nm	10nm+	7nm EUV 10nm++
Samsung	28nm FDSOI	10nm		8nm	7nm EUV 6nm EUV	18nm FDSOI 5nm	4nm
TSMC	16nm+ finFET	10nm	7nm 12nm		7nm+ EUV	5nm 6nm	5nm+
GlobalFoundries	14nm finFET			22nm FDSOI 12nm finFET		12nm FDSOI	12nm+ finFET
SMIC	28nm				14nm finFET	12nm finFET	
UMC			14nm finFET			22nm planar	

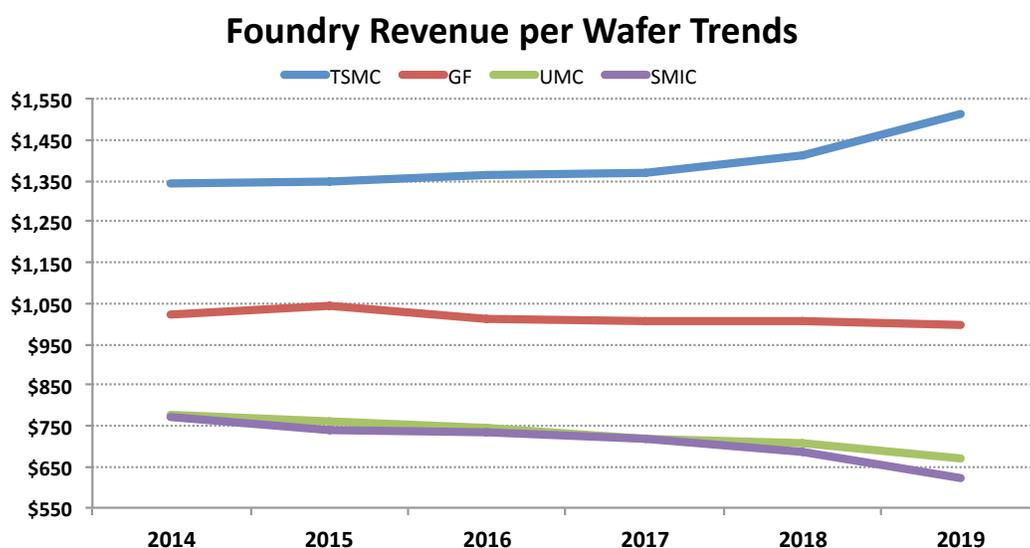
Note: What defines a process "generation" and the start of "volume" production varies from company to company, and may be influenced by marketing embellishments, so these points of transition should only be seen as very general guidelines.

Sources: Companies, conference reports, IC Insights

Figure 1

With more variety than ever among the processes that companies offer, it is challenging to compare them in a fair and useful way. Moreover, “plus” or derivative versions of each process generation and half steps between major nodes have become regular occurrences.

In the foundry world, manufacturing with leading-edge processes carries a distinct advantage. In 2019, TSMC was the only pure-play foundry manufacturing ICs using 7nm process technology. Not coincidentally, its overall revenue per wafer increased significantly as leading fabless IC suppliers lined up to have their newest designs manufactured on the 7nm process. TSMC was the only pure-play foundry that enjoyed higher revenue-per-wafer in 2019 (13%) compared to 2014. In contrast, 2019 revenue per wafer figures at GlobalFoundries, UMC, and SMIC—whose smallest process node is 12/14nm—were down by 2%, 14%, and 19% respectively, compared with 2014.



Source: Company reports, IC Insights

Figure 2

Besides foundry and logic IC manufacturing, memory suppliers like Samsung, Micron, SK Hynix, and Kioxia/WD are using advanced processes to make their DRAM and flash memory components. No matter the device type, the IC industry has evolved to the point where only a very small group of companies can develop leading-edge process technologies and fabricate leading edge ICs. Growing design and manufacturing challenges and costs have divided the integrated circuit world into the haves and have-nots. Marketshare makeup in various IC product segments has become “top heavy,” with increasing shares held by the top producers, leaving very little room for remaining competitors.

Report Details: *The 2020 McClean Report*

Additional details on other IC technology and market trends within the IC industry are provided in *The McClean Report—A Complete Analysis and Forecast of the Integrated Circuit Industry* (released in January 2020). A subscription to *The McClean Report* includes **free** monthly updates from March through

November (including a 200+ page *Mid-Year Update*), and **free** access to subscriber-only webinars throughout the year. An individual-user license to the 2020 edition of *The McClean Report* is priced at \$4,990 and includes an Internet access password. A multi-user worldwide corporate license is available for \$7,990.

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