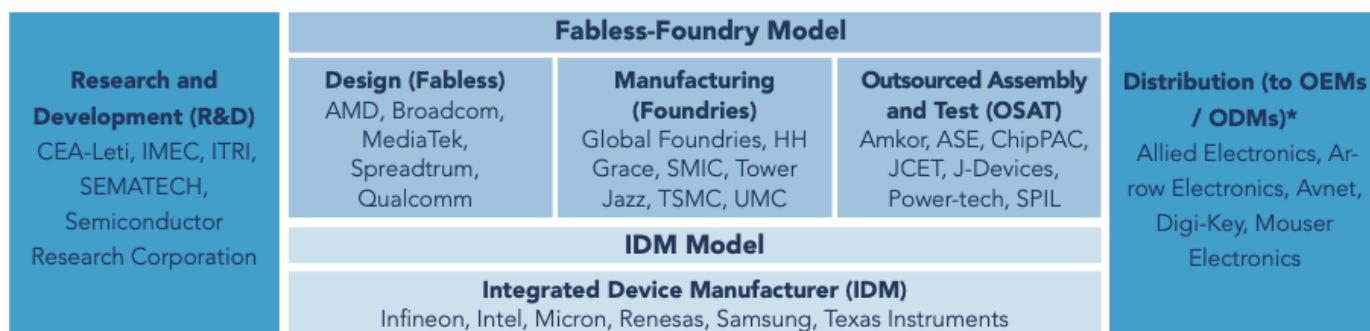


Semiconductor Industry Overview - Top Mark Capital

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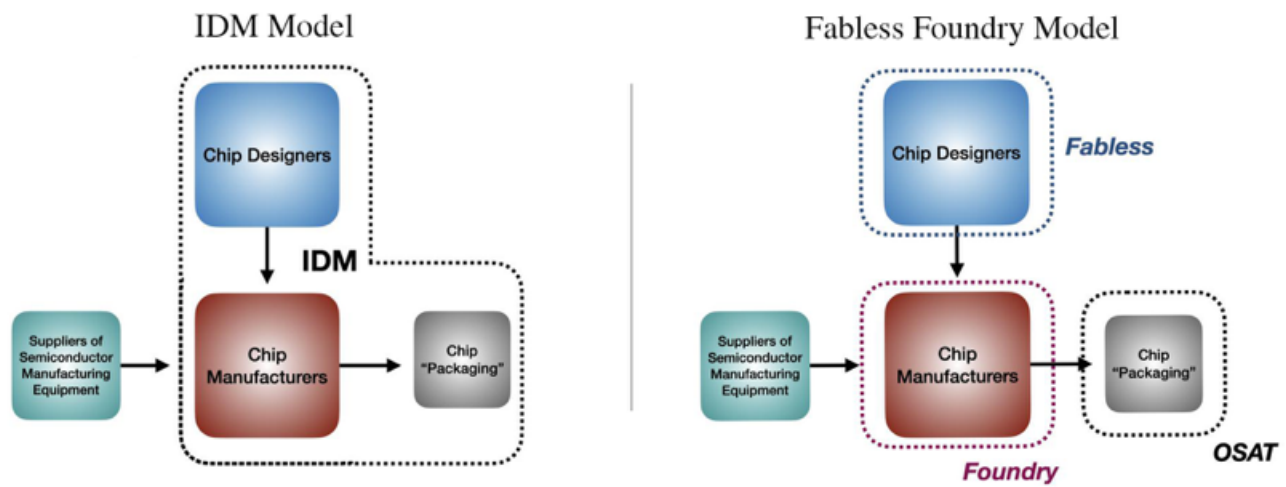
Version	Date	Notes
v1.0	September 29, 2020	Initial release

In the 1950s, individual semiconductor companies tended to engage in all stages of production and operated in one country. Companies still employing this model are known as the Integrated Device Manufacturers (IDMs). Today we see an ever-diversifying range of business models and relationships crossing national and regional boundaries, driven by technological advances and competition^[1]. There are two general models pursued in chip making - the *Fabless-Foundry Model* and the *IDM Model*.



* Original Equipment Manufacturers (OEMs)/Original Design Manufacturers (ODMs) buy semiconductors to integrate into consumer end-products

Beginning in the 80s, a new trend developed, separating the IDM business into three separate, specialized businesses: designers, manufacturers, and packagingforbes-idm. This business model evolution was an efficient division of labor due to the scale requirements to operate a successful foundry, and the increasing specialization required to design the latest and greatest chipsets. It also was a boon for global trade as many countries were able to participate meaningfully in the supply chain by focusing on their relative competitive advantages.



Designers focus on design of chips. From a business model perspective this is an 'asset light' model and outperformance is dependent on the firm's ability to recruit and retain talent. This explains the rather short and well compensated tenures of *rockstar* chip designers like Jim Keller at various employers^[2]. The Fabless model creates 2 to 4 times more shareholder value per dollar of earnings-per-share than the asset-heavy foundries and IDMs. Various designers have been successful in building competitive moats by specialization, monetization, or other practices that go beyond the scope of this report. Notable Designers include:

- [Qualcomm](#)
- Broadcom
- [Nvidia](#)
- [AMD](#)
- [Xilinx](#)
- Hi-Silicon (Chinese, sub of Huawei)

Manufacturers (aka fabs) focus strictly on the manufacturing of the chips. Setting up a new advanced technology fabrication facility can cost between US \$5-10+ billion and take 1–2 years to complete. Additionally, to stay competitive, the fab is likely to need retooling every 2 to 3 years, again involving significant costs. As a result of these constraints, few companies build their own chip plants^[1-1]. Notable manufacturers include:

- [Taiwan Semiconductor](#)
- Global Foundries
- SMIC (Chinese)

Packaging companies, known as OSAT (outsourced assembly and test). Firms in this segment are comparatively small, competition is high, margins are low, and the business is very cyclical^[3].

- ASE Technology Holding Co Ltd (Taiwan) (Ticker: ASX)
- Amkor Technology Inc (US) (Ticker: AMKR)

Suppliers of Semi Mfg Equipment. Notable companies include^[4]...

- [Lam Research](#) Corp (US) (Ticker: LRCX)
- Advantest (Japanese)
- [Teradyne](#) Inc (US) (TER)
- [ASML](#) Holding NV (Netherlands)
- ASM Pacific Technology (Hongkong)
- [Applied Materials](#) (US) (AMAT)

The semiconductor industry is a truly global industry and recent world trade skirmishes have highlighted the interdependence of the supply chain. Trade restrictions and/or deleveraging could lead to overcapacity and undercapacity for certain fabs, siloed (and therefore slower) evolution of technologies, and increasing costs. However, the interdependence of these companies and their relative bargaining strength will likely determine who wins and who loses if and when sanctions are imposed.

Strengthening market position of the fab?: The US undoubtedly dominates the design portion of the fabless model and, in most cases, the fab market is relatively competitive, which leaves the US in a strong comparative position as trade takes center stage in the political arena. However, the most interesting scenario in the current environment is the accelerated advancement of TSMC as the worlds leading fab. It appears that

the other fabs are struggling to keep pace with TSMC's manufacturing abilities. As a result, more of the designers (Apple, AMD, Nvidia, and even Intel) are moving more of their production to TSMC, and a higher percentage of that production is on technologies which other fabs (Samsung, Global Foundries, etc) lack competing capabilities (sub 14nm). If TSMC is able to sustain this advantage, one could suppose that they will be in a strong position to capture significant margin from the designers.

Value in IDMs? Contrary to the financial market's current perspective, there may be a case for optimism for the IDMs. If trade wars and deleveraging persist, IDMs like Intel may be in a unique strategic position to capitalize on the fab side of the market as designers seek fabs outside of China.

1. <https://www.semiconductors.org/wp-content/uploads/2018/06/SIA-Beyond-Borders-Report-FINAL-June-7.pdf> ↩↩
2. https://en.wikipedia.org/wiki/Jim_Keller_%28engineer%29 ↩
3. [Calhooun, Intel, Nvidia, Et Al., And American Semiconductor Hegemony, Forbes, April 2020](#) ↩
4. <https://www.vlsiresearch.com/customer-satisfaction-survey/best-semiconductor-equipment-supplier-&-manufacturer-of-2020> ↩