

Advanced
Packaging Current
Trends &
Challenges

ADVANCED PACKAGING PLATFORMS – Classification at System Integration Level

Level 1 - Die

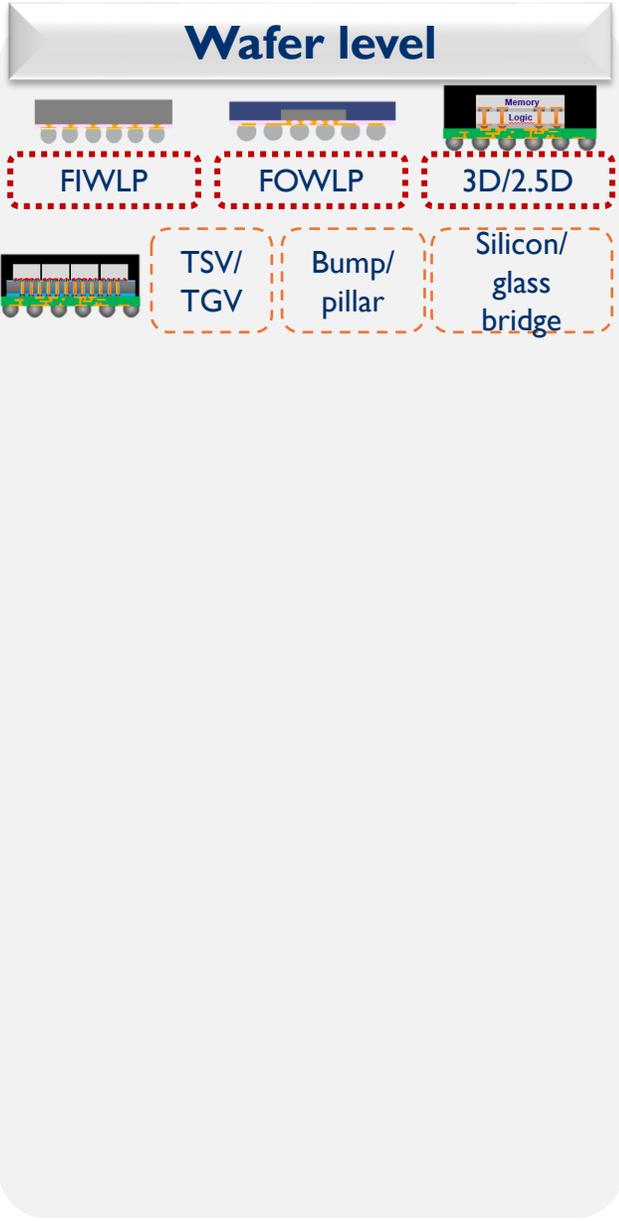
Interconnection

Substrate/
leadframe

Level 2 -
Packaging

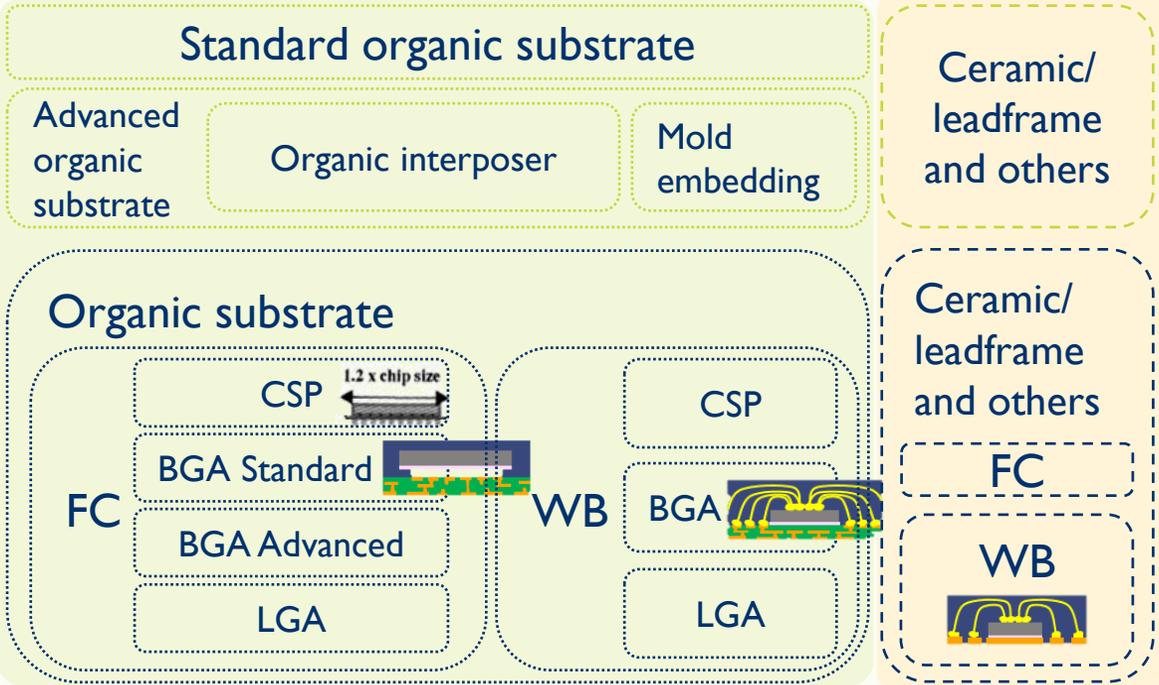
Module

Level 3 -
No SMT needed



Substrate/Strip level (Panel based)

Flip-chip, Wire-bond



SiP/PoP, etc.

AP platform

Panel level

FOPLP

RDL

Organic/
glass
substrate
etc.

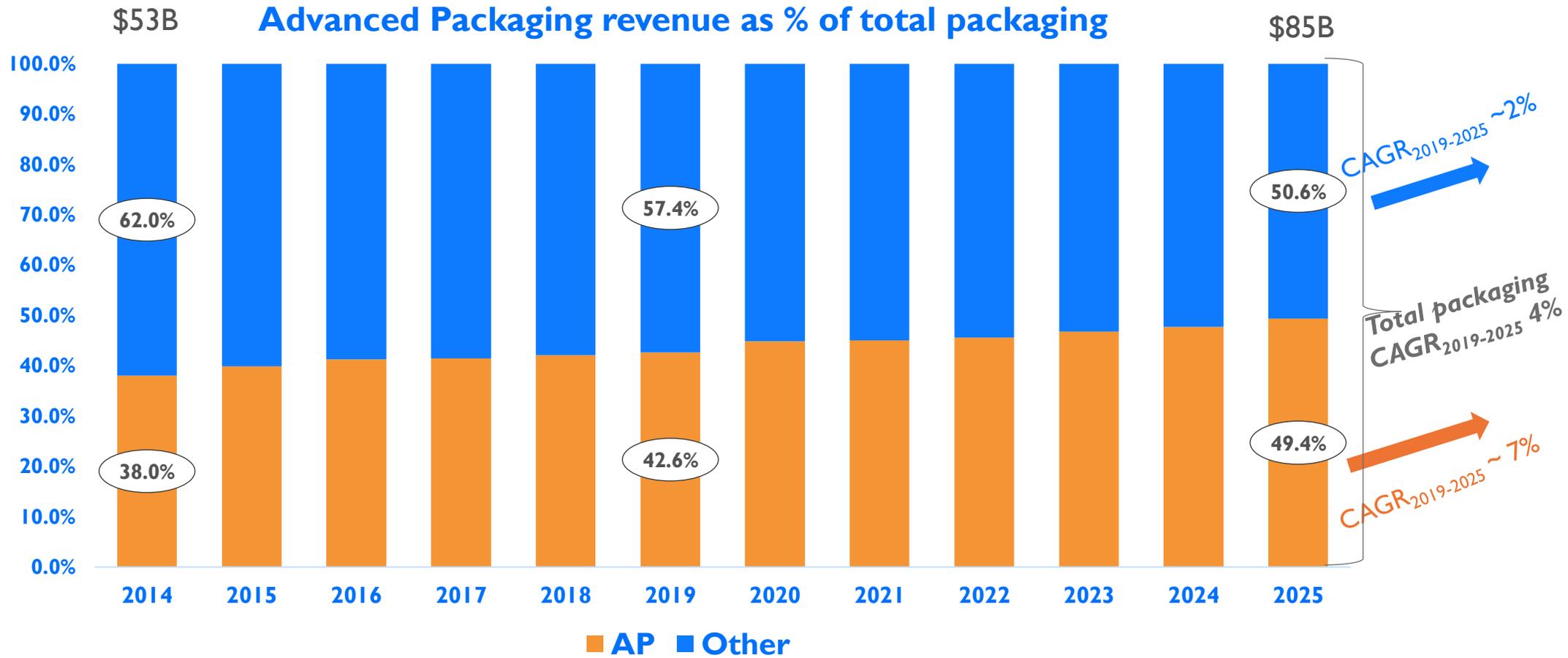
ED in
laminate

ED in PCB/Flex

ADVANCED PACKAGING MARKET SHARE EVOLUTION 2014-2025



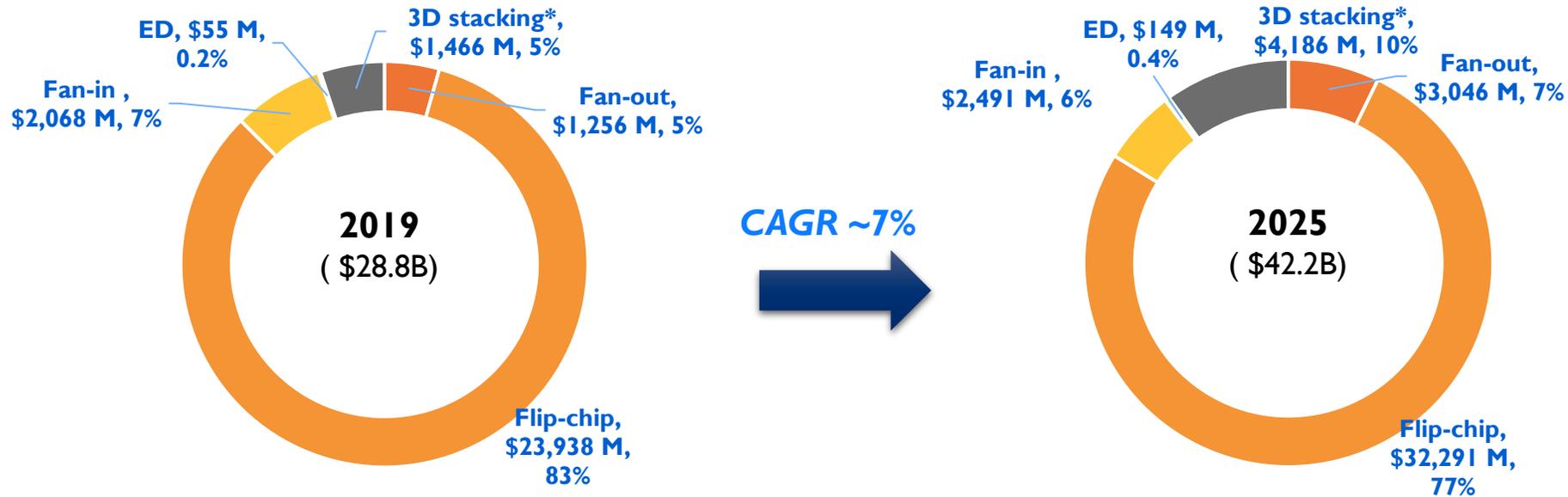
Advanced Packaging revenue will almost equal to traditional packaging revenue by 2025.



In 2019, the AP market share was 42.6%. Due to strong momentum in AP market driven by mega trends, the share of AP in the total semiconductor market is increasing continuously and will reach almost 50% of the market by 2025. In 2014, AP market share was 38% and there is strong possibility that in 2026, AP market share will exceed that of traditional packaging.

ADVANCED PACKAGING REVENUE FORECAST 2019-2025

Advanced Packaging REVENUE SPLIT by packaging platform



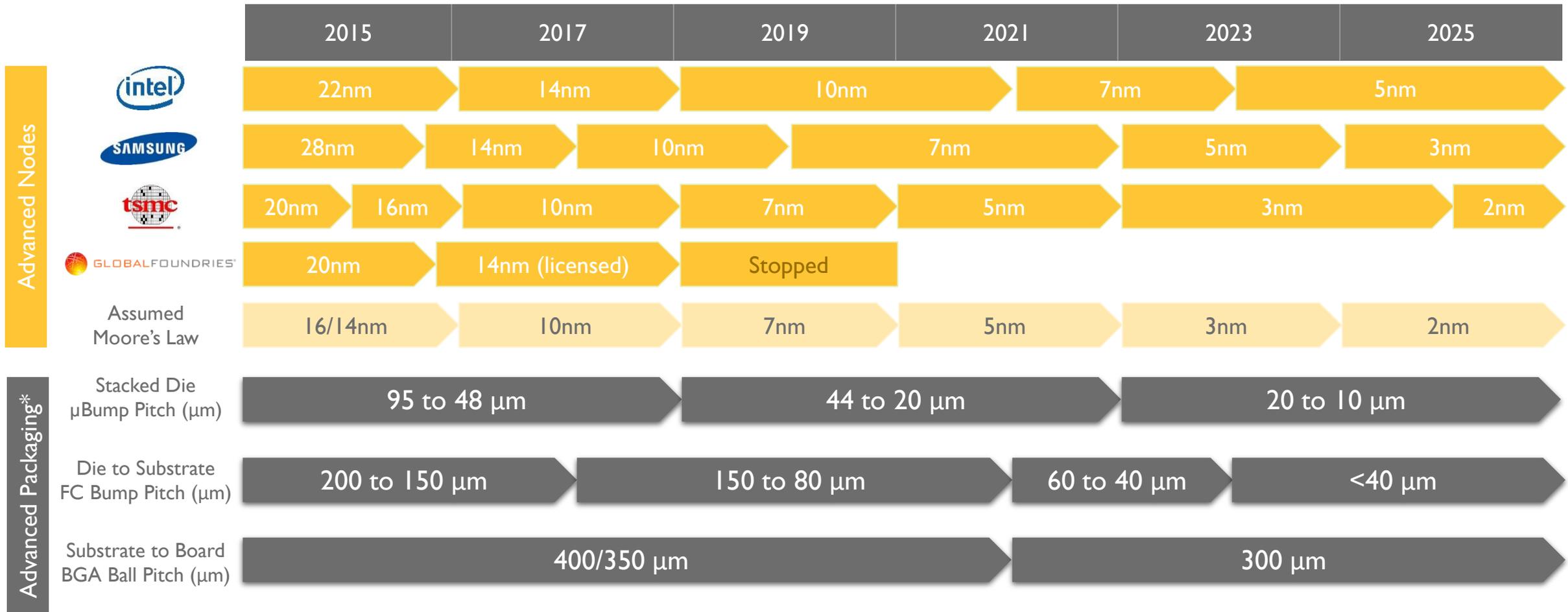
Flip-chip	CAGR ₂₀₁₈₋₂₀₂₅ ~ 5.9%
Fan-out	CAGR ₂₀₁₈₋₂₀₂₅ ~ 16%
Fan-in WLP	CAGR ₂₀₁₈₋₂₀₂₅ ~ 3.2%
3D Stacking	CAGR ₂₀₁₈₋₂₀₂₅ ~ 21.3%
Embedded Die	CAGR ₂₀₁₈₋₂₀₂₅ ~ 18%

• **NOTE:**

- Values represent packaging services (assembly and test) and do not include FEOL Si die processing
- TSV* includes portion of package revenue not included in Flip-chip or fan-in

- The Advanced Packaging market was worth ~\$28.8B in 2019. It is expected to grow at ~ 7% CAGR₂₀₁₉₋₂₀₂₅ to reach ~\$42.2B in 2025.
- Highest revenue CAGR expected from 2.5D / 3D stacking IC, ED (in laminate substrate) and Fan-Out, 21%, 18% and 16%, respectively, as high volume products further penetrate the market: FO in mobile, networking, automotive; 2.5D/3D TSV in AI/ML, HPC, datacenters, CIS, MEMS/sensors; ED in automotive and medical.

TECHNOLOGY ROADMAP: FROM NANO-SCALE TO MICRO-SCALE..

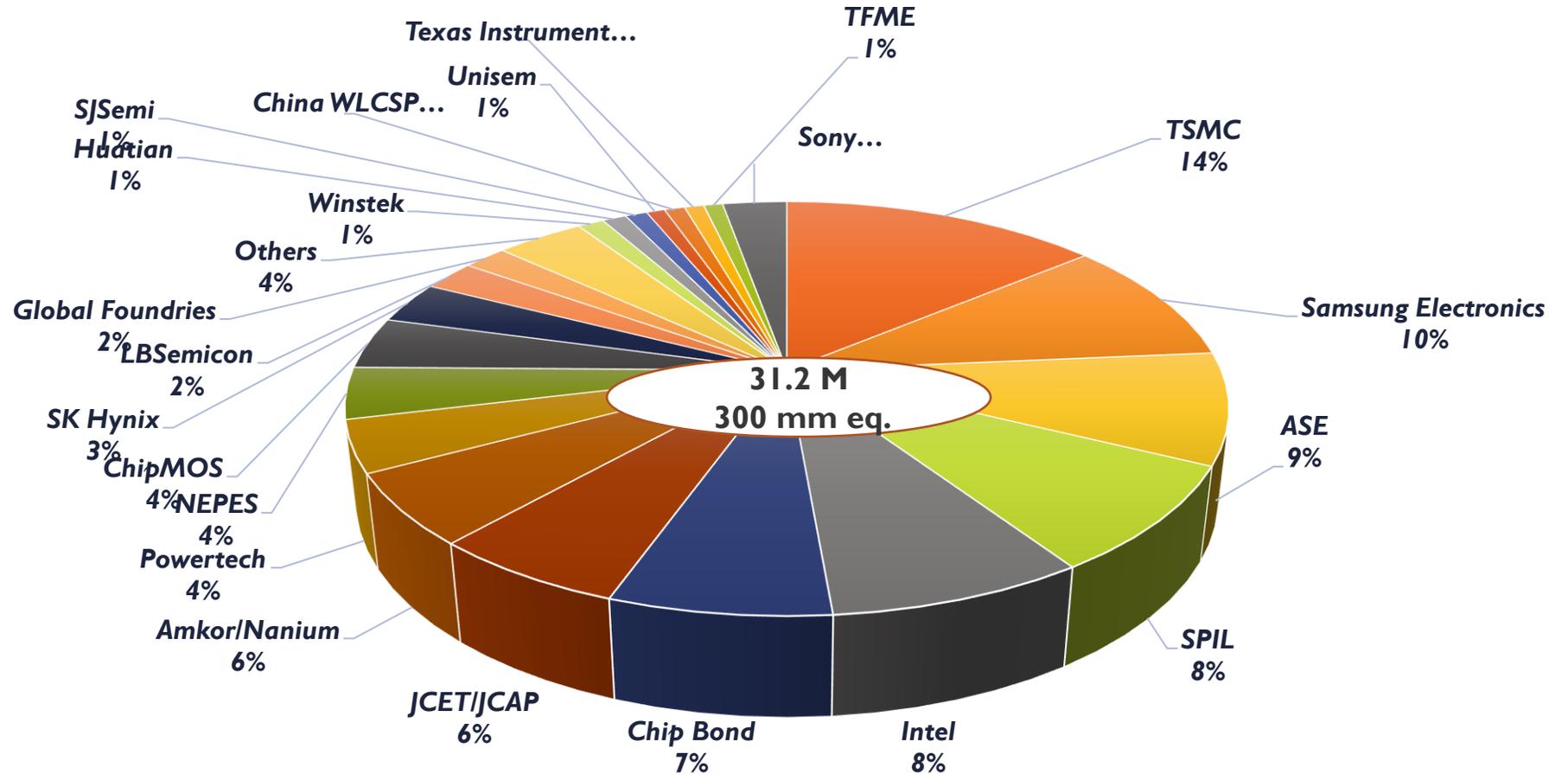


Industry is looking into the growing importance of functional roadmap

Advanced Packaging is essential to bridge the scale-gap between die and PCB



2019 ADVANCED PACKAGING WAFER SPLIT (300MM EQ WSPY)



TEN players, which includes 2 IDMs (Intel, Samsung), a foundry (TSMC), the top 5 global OSATs (ASE, SPIL, Amkor, PTI, JCET) together with Nepes and Chipbond, process approximately 75% of Advanced Packaging wafers.

NOTE:

- This pie chart represents superpositions of all Advanced Packaging platforms (Fan-in/Fan-out WLP, Flip-chip including 2.5D/3D and embedded die).
- Flip-chip values are entered as **total capacity**, fan-in, fan-out, 3D stacking and embedded die as **total production**.
- Flip-chip production values were not available by customer – global utilization is at ~85-90% of capacity.

FINANCIAL OVERVIEW FOR TOP 25 OSATS

Revenue in 2019

TOP 25 OSAT ranking by 2019 revenue [﻿M]



Large OSATs were separated from the rest.

Top 8 OSATs continued with heavy investment in CapEx and R&D.

Players not within the Top 8 rankings need to catch up. Otherwise, they risk being acquired or incurring losses in business.

Top OSATs with heavy investments were creating a disparity with the rest of the pack.

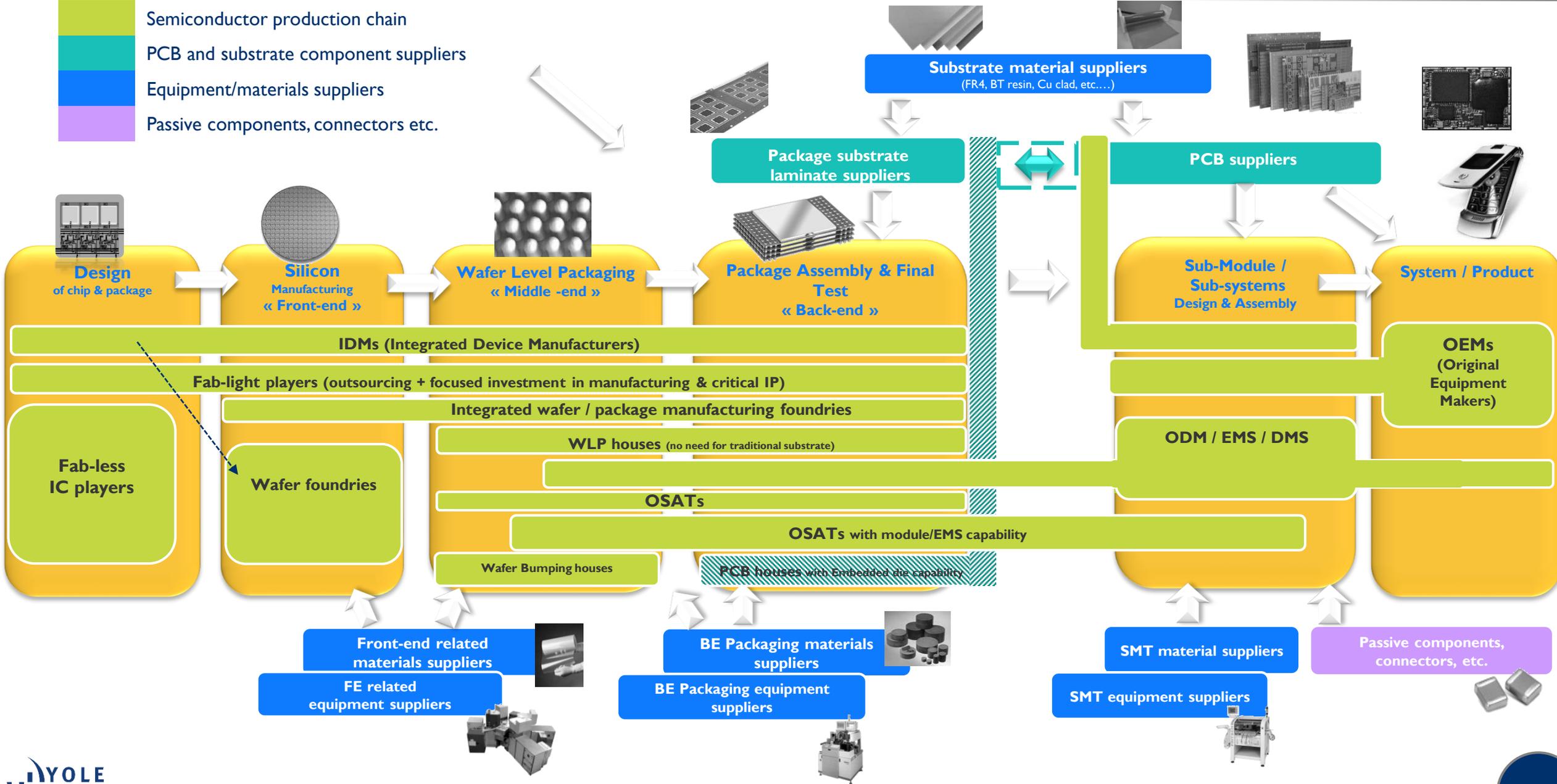
Top 8 OSATs now include 3 manufacturer HQ-ed in China. UTAC maintained its 8th spot.

Companies in the tail are at a higher risk if there is no differentiated technology or IP for merger and acquisition as an exit strategy.

SEMICONDUCTOR SUPPLY CHAIN - 2020

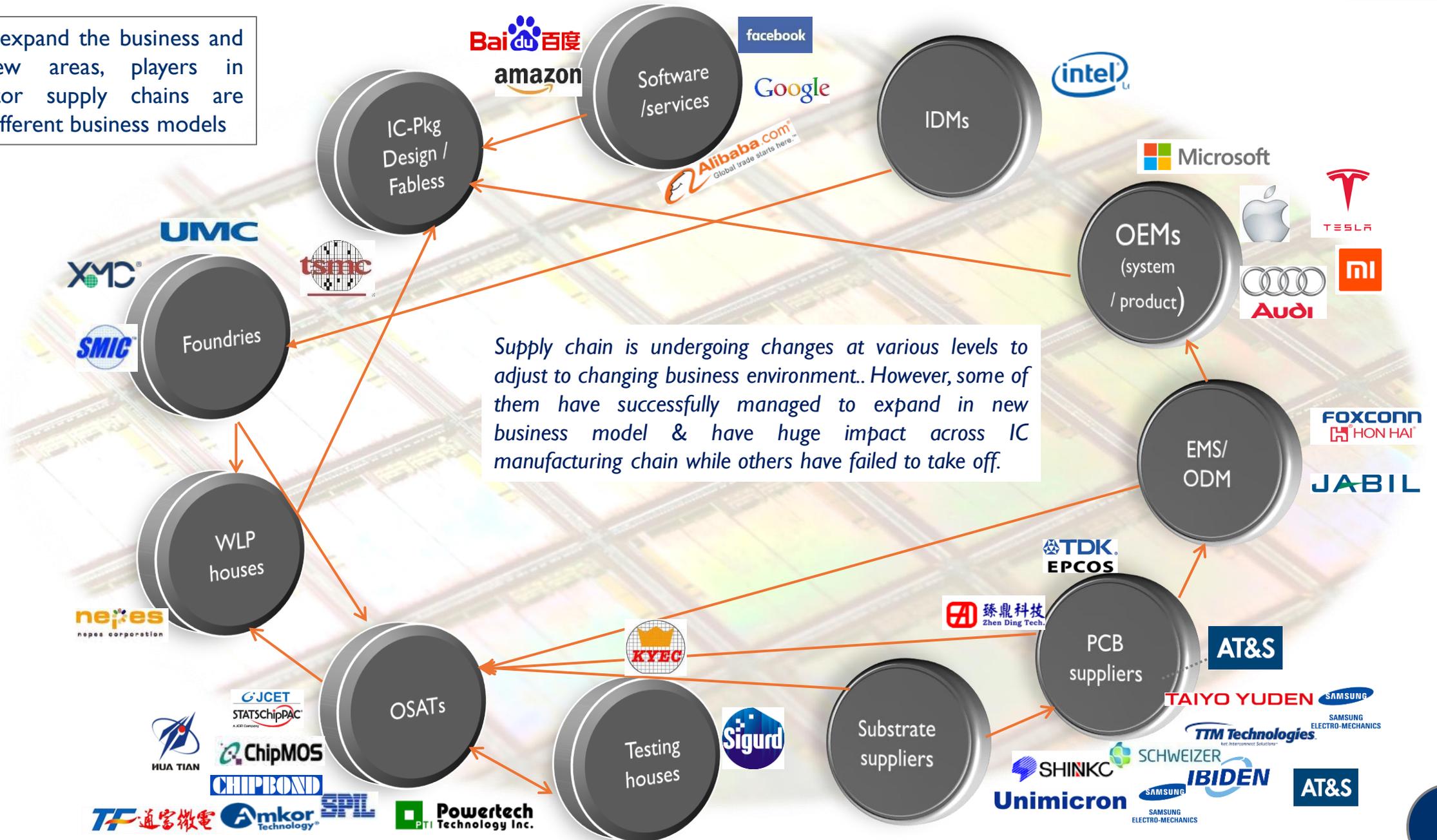


- Semiconductor production chain
- PCB and substrate component suppliers
- Equipment/materials suppliers
- Passive components, connectors etc.



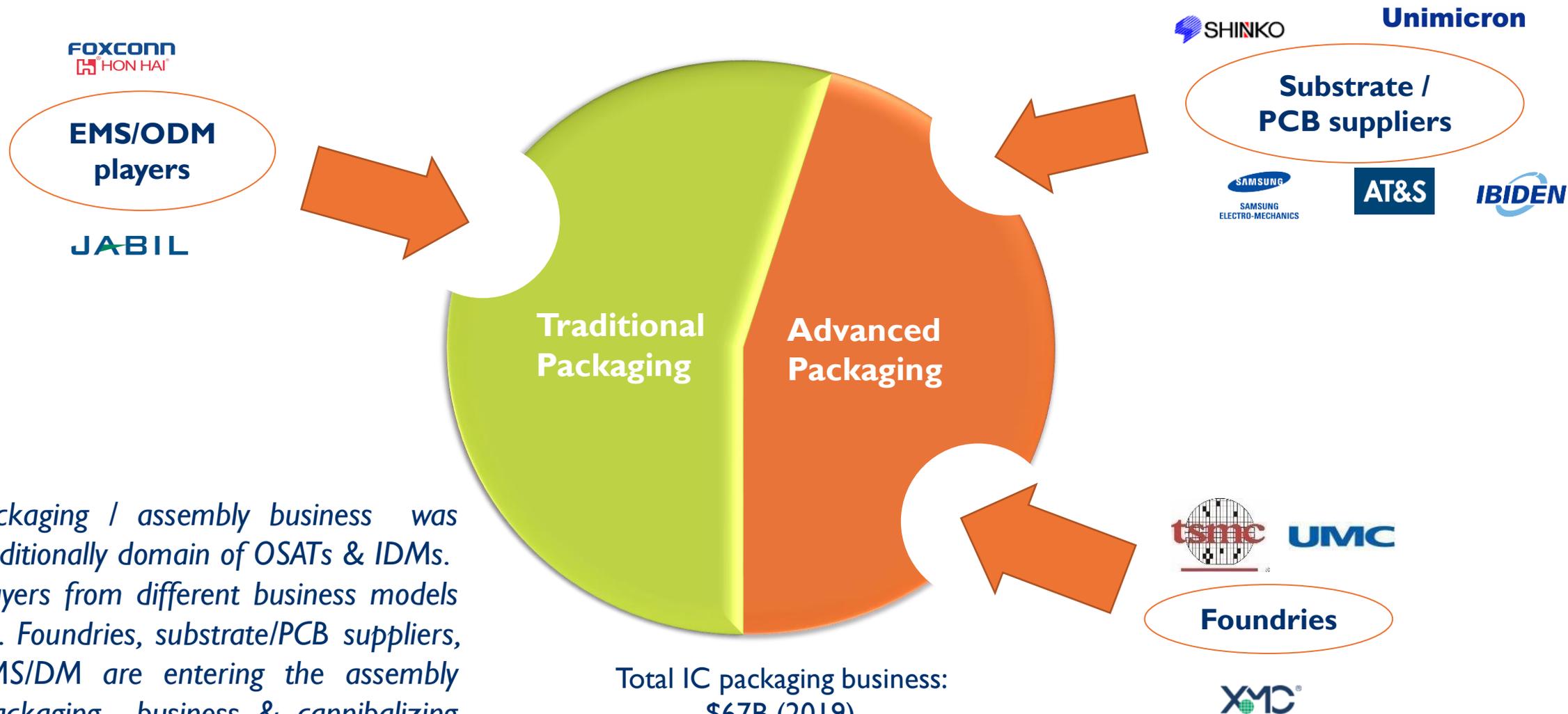
MOBILITY ACROSS SEMICONDUCTOR SUPPLY CHAIN AT VARIOUS LEVELS

In order to expand the business and explore new areas, players in semiconductor supply chains are moving to different business models



Supply chain is undergoing changes at various levels to adjust to changing business environment.. However, some of them have successfully managed to expand in new business model & have huge impact across IC manufacturing chain while others have failed to take off.

OSATS PACKAGING BUSINESS CANNIBALIZATION TREND



- Packaging / assembly business was traditionally domain of OSATs & IDMs.
- Players from different business models viz. Foundries, substrate/PCB suppliers, EMS/DM are entering the assembly /packaging business & cannibalizing the OSAT business.

Thank you!
