Press Release
May 31, 2021
LYON, France

FCCSP packaging market to rise to new heights driven by mobile & consumer

Advanced Packaging Quarterly Market Monitor – Q1, 2021

MARKET DYNAMICS

- Market trends:
  Top OSATs saw 15-20% increase in 2020 revenue compare to 2019 and 2021 is expected to shape up as a "Banner Year" for OSATs.
  Total advanced packaging revenue is expected to grow at 7.9% CAGR between 2020 and 2026.
  5G, automotive infotainment/ADAS, AI, Datacenter and wearable application megatrends continue to thrive the semiconductor eco-system.
- Special focus: FCCSP packaging
  This market segment will reach more than US$10 billion in 2026.
  Those packaging solutions are mainly used for baseband, RF transceivers, memory, and some PMIC applications.
  FCCSP packaging market share is controlled mainly by top OSATs such as ASE, Amkor, JCET, and memory suppliers such as Samsung, SK Hynix, and Micron.

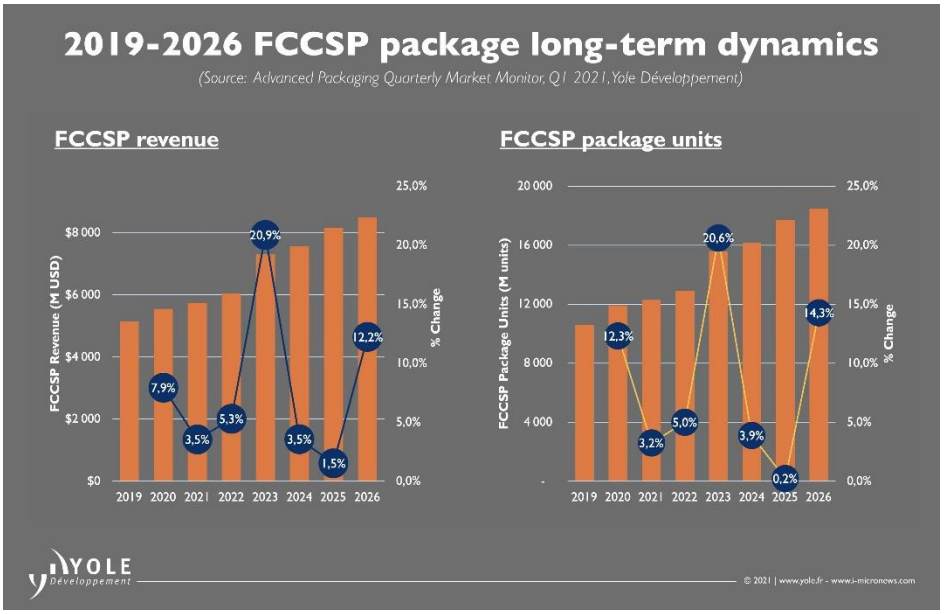
The semiconductor industry has enjoyed unprecedented growth in the last 15 years, fueled by smartphones, big data, 5G, and the AI revolution. As we look into the future, Moore's law as we know it will continue to slow down as Si transistor scaling continues to be very costly as only a few players remain able to invest in the capital infrastructure necessary. Intel's 7 nm delays are also evidence that only a select few players will remain as the technology node reduces to sub 5 nm.

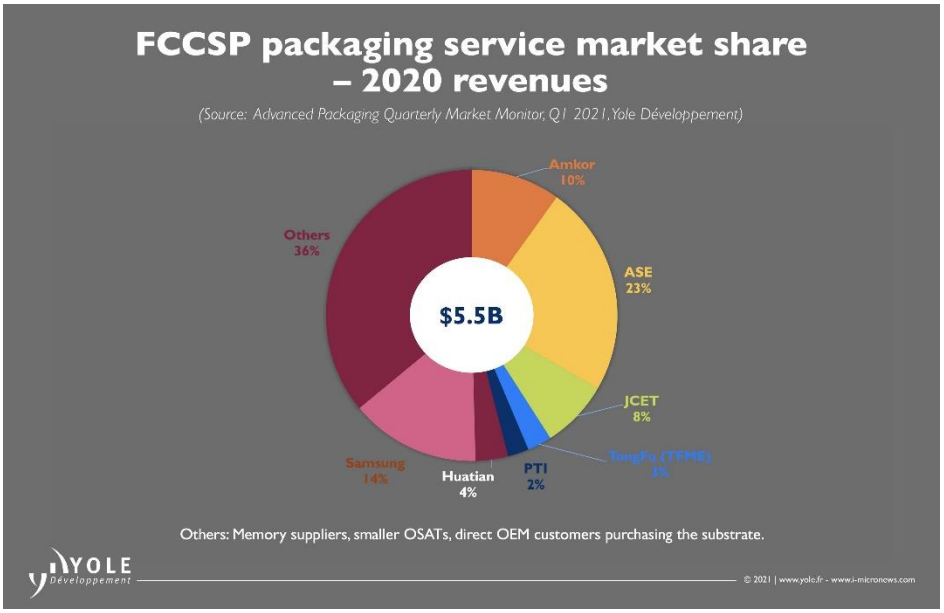
FCBGA PACKAGING REVENUE REACH NEW HEIGHTS AS DEMAND FOR SERVERS, AI, AND NETWORKING SKYROCKETS AMID GLOBAL CORONAVIRUS PANDEMIC

FCCSP packages are mainly used in baseband, RF transceivers, memory, and some PMIC applications.

Vaibhav Trivedi, Senior Technology & Market analyst, Semiconductor & Software division at Yole Développement (Yole) explains: *"Memory DRAM packages used in PC/Datacenter/Automobile are primarily FCCSP based manufactured by top memory makers such as Samsung, Micron, SK Hynix and Winbond."*

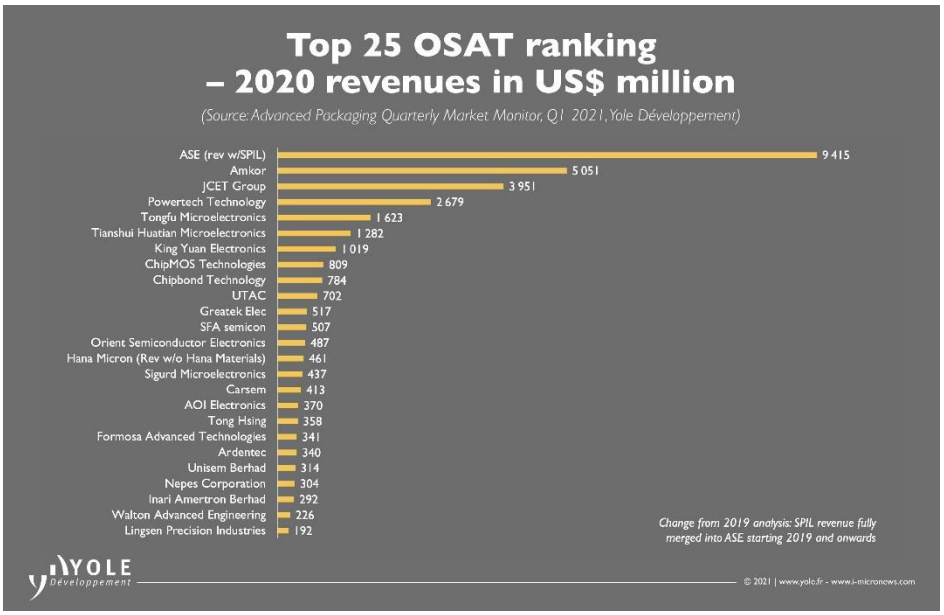
FCCSP packages find their place in mobile and consumer markets mainly in smartphone APUs, RF components and DRAM devices used in PC, servers, and automotive applications. FCCSP packages are well suited as they provide low cost and reliable solution like WLCSP without incurring higher cost of fan-out type packages. FCCSP are typically single die with few passive components with less than 13mm x 13 mm BD size and are typically over molded and use molded underfill for solder joint protection. FCCSP packaging market share is controlled mainly by top OSATs such as ASE, Amkor, JCET, and memory suppliers such as Samsung, SK Hynix, and Micron.





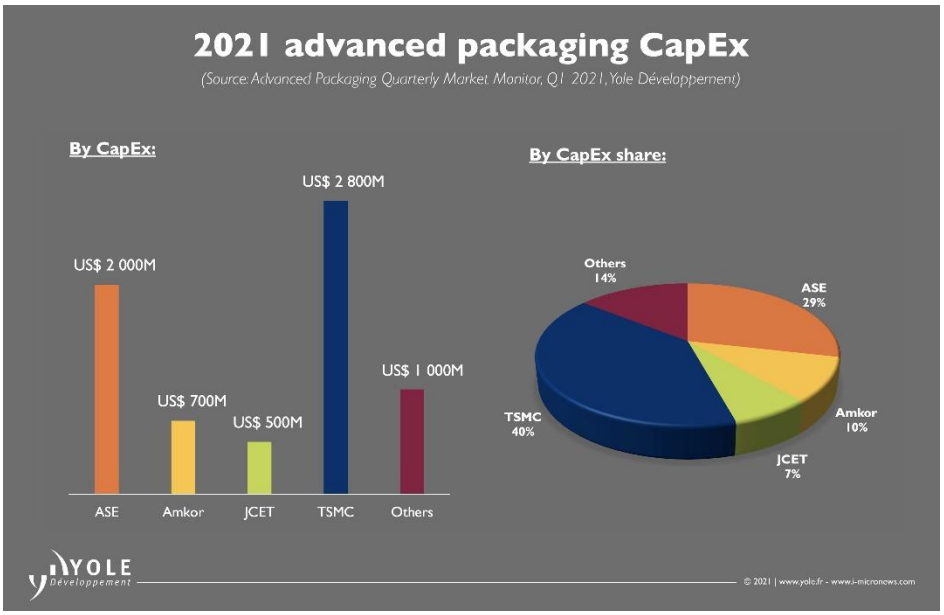
RISING CAPEX IN 2021 BY TOP OSATS IN ADVANCED PACKAGING

The semiconductor industry in 2020 was resilient and experienced strong growth as the top OSATs showed unprecedented growth in Q4 2020 and, in fact, throughout 2020 as the global pandemic took shape. Many OSATs, IDMs, and OEMs experienced +15-20% growth in revenue and increased gross margins compared to 2019…



In the race for heterogeneous integration, key players, such as ASE (w/SPIL & USI), TSMC, Intel, Amkor, and JCET, have announced unprecedented CapEx investment in 2021:

- TSMC is planning to spend an estimated US$2.5-US$2.8 billion CapEx in 2021 to gear up new advanced packaging factories with InFO based devices, CoWoS, and SoIC-based product lines. TSMC generated an estimated $3.6 billion revenue through its advanced packaging offering in 2021 and is poised to reach new heights in the cluster of top OSATs.
- ASE has also announced an estimated US$2 billion CapEx investing specifically in the booming system-in-package business through EMS activities, as well as its wafer-level packaging business. ASE remains a top OSAT after the acquisition of SPIL and USI…
- Finally, Intel has recently announced that it will invest ~US$20 billion in building new fabs in Arizona. It will also invest in advanced packaging collaborations as it expands its Foveros/EMIB "hybrid" packaging manufacturing in its Arizona and Oregon factories…



For more information, discover Vaibhav Trivedi's article: Advanced Packaging CapEx to exceed US$5 billion in 2021 as top OSATs and foundries continue to crank on all cylinders, on i-Micronews.

Yole's Advanced Packaging Monitor is published every beginning of March (Q1), June (Q2), September (Q3) and December (Q4)... Aim of these services is to provide an in-depth coverage of rapidly changing market dynamics and main players' status and strategy. This monitor subscription provides quarterly updates on unit shipments, wafer production, and revenue on near-term and long-term basis. It provides capacity, CapEx, and supply chain insights into emerging markets and growth rates in mature markets in addition to providing package level forecast:

- *Module I: Fan-Out Package Monitor – Wafer & Panel level (2019 Q4 released)*
- *Module II: WLCSP / Fan-In Package Monitor (2020 Q1 released)*
- *Module III: 2.5D/3D Stacked Package (2020 Q3 released)*
- *Module IV: FCBGA Package (2020 Q4 released)*
- *Module V: FCCSP Package (2021 Q1)* ***NEW***

In addition, the market research and strategy consulting company Yole releases dedicated advanced packaging reports:

- *5G Packaging Trends for Smartphones*
- *WLCSP/ Fan-In Packaging Technologies and Market*
- *High-End Performance Packaging: 3D/2.5D Integration 2020*
- *Status of the Advanced Packaging Industry*

Stay tuned to i-Micronews to get further information about our Advanced Packaging, Semiconductor Manufacturing & Memory activities!

Press Release

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About the advanced packaging team at Yole Développement

Favier Shoo is a Technology and Market Analyst in the Semiconductor, Memory and Computing Division at Yole Développement, part of Yole Group of Companies. Based in Singapore, Favier is engaged in the development of technology & market reports as well as the production of custom consulting reports. During 7 years at Applied Materials as a Customer Application Technologist in the advanced packaging marketspace, Favier developed an in-depth understanding of the supply chain and core business values. As an acknowledged expert in this field, Favier has provided training and held numerous technical review sessions with industry players. In addition, he has obtained 2 patents. Prior to that, Favier worked at REC Solar as a Manufacturing Engineer to maximize production capacity. Favier holds a Bachelor's in Materials Engineering (Hons) and a Minor in Entrepreneurship from Nanyang Technological University (NTU) (Singapore). Favier was also the co-founder of a startup company where he formulated business goals, revenue models and marketing plans.

Vaibhav Trivedi is a Senior Technology & Market analyst at Yole Développement (Yole) working with the Semiconductor & Software division. Based in the US, he is a member of Yole's advanced packaging team and contributes to analysis of ever-changing advanced packaging technologies. Vaibhav has 17+ years of field experience in semiconductor processing and semiconductor supply chain, specifically on memory and thermal component sourcing and advanced packaging such as SiP and WLP. Vaibhav has held multiple technical and commercial lead roles at various semiconductor corporations prior to joining Yole. Vaibhav holds a Bachelor of Science in Chemical Engineering, and Master of Science of Material Science from University of Florida in addition to an MBA from Arizona State University.

Santosh Kumar is currently working as Principal Analyst and Director Packaging, Assembly & Substrates for Yole Développement's activities in Korea. Based in Seoul, Santosh is involved in the market, technology and strategic analyses of the microelectronic assembly and packaging technologies. His main interest areas are advanced IC packaging technology including equipment & materials. He is the author of several reports on fan-out / fan-in WLP, flip chip, and 3D/2.5D packaging. Santosh Kumar received the Bachelor's and Master's Degree in Engineering from the Indian Institute of Technology (IIT), Roorkee and University of Seoul respectively. He has published more than 40 papers in peer reviewed journals and has obtained 2 patents. He has presented and given talks at numerous conferences and technical symposiums related to advanced microelectronics packaging.

Stefan Chitoraga is a Technology and Market Analyst specializing in Packaging and Assembly at Yole Développement (Yole). As part of the Semiconductor, Memory & Computing division at Yole, Stefan is focused on advanced packaging platforms and processes, substrates, and PCBs. He is involved daily in the production of technology & market reports and custom consulting projects.
Prior to Yole, Stefan served as a Package Design Engineer at Teledyne E2V for 4 years, where he was in charge of the ceramic package and glass lid development for image sensors, developing mechanical design, routing, electrical and thermal simulations.
Stefan holds a Bachelor's in Electronics and Computer Science for Industry Applications from the Polytech Grenoble (France).

Emilie Jolivet is Director of the Semiconductor & Software Division at Yole Développement, part of Yole Group of Companies, where her specific interests cover package & assembly, semiconductor manufacturing, memory and software & computing fields. Based on her valuable experience in the semiconductor industry, Emilie manages the expansion of the technical and market expertise of the Semiconductor and Software Team. The team interacts daily with leading companies allowing semiconductor & software analysts to collect a large amount of data and integrate their understanding of the evolution of the market with technology breakthroughs. In addition, Emilie's mission focusses on the management of business relationships with semiconductor leaders and the development of market research and strategy consulting activities inside the Yole group. Emilie Jolivet holds a Master's degree in Applied Physics specializing in Microelectronics from INSA (Toulouse, France). After an internship in failure analysis at Freescale (France), she was an R&D engineer for seven years in the photovoltaic business where she co-authored several scientific articles. Enriched by this experience, she graduated with an

MBA from IAE Lyon and then joined EV Group (Austria) as a business development manager in 3D & Advanced Packaging before joining Yole Développement in 2016.

About Yole Développement

Founded in 1998, Yole Développement (Yole) has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide… More

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