Advanced packaging: OSATs, foundries, and IDMs all want to be part of the game

OUTLINE:

- Advanced packaging was a US$38 billion market in 2019. It is expected to grow at 6.6% CAGR between 2019 and 2025.
- Due to strong momentum driven by slowing Moore’s Law and heterogeneous integration, along with the megatrends 5G, AI, HPC, IoTs, etc., the share of the advanced packaging market segment within the total semiconductor market is continuously increasing. It will reach almost 50% of the total market by 2025.
- Technology status:
  Advanced packaging is moving from package substrates to silicon platforms. This trend is offering huge opportunities for TSMC, Intel, and Samsung.
- Competitive landscape:
  Advanced packaging activities at TSMC has become a fully-fledged business in itself. With an expected US$2.8 billion revenue from advanced packaging activities in 2019, TSMC will achieve the #4 position in the 2019 OSAT rankings.
- COVID-19 impact:
  Semiconductor business will decline in 2020 due to COVID-19 pandemic. According to Yole Développement, it is expected to recover in 2021.
  The advanced packaging market will decrease by 7% in 2020, while the traditional packaging market will decrease by 15%.

“Once the traditional, exclusive domain of OSATs and IDMs, today a paradigm shift is occurring in the assembly / packaging segment of the semiconductor manufacturing supply chain”, asserts Santosh Kumar, Principal Analyst and Director Packaging, Assembly & Substrates, Yole Korea, part of Yole Développement (Yole). “Players from different
business models, including foundries, substrate/PCB\(^8\) suppliers, EMS\(^9\)/ODMs\(^{10}\), are entering this market and cannibalizing OSATs’ share.”

Without doubt, advanced packaging is today moving from a package substrate platform to silicon, a significant shift that is providing huge opportunities for giants like TSMC, Intel, and Samsung. These leading players can now flex their muscles in the advanced packaging market segment and emerge as key innovators of new advanced packaging technology.

In this dynamic and attractive context, Yole presents today its annual advanced packaging report, *Status of the Advanced Packaging Industry*. Compiled by the advanced packaging team at Yole, this analysis follows the evolution of the industry and offers an understanding of the market and key strategies of the leading advanced packaging companies. This report presents updated forecasts of the semiconductor\(^{11}\) and the advanced packaging markets. It also points out the impact of COVID-19 on all market figures. In addition, the advanced packaging study highlights the US-China trade war and the related changes within the semiconductor business and supply chain.

In this 2020 edition of the report, Yole’s experts offer an impressive financial analysis of the top 25 OSATs. They combine different parameters to analyze the market positionings and strategies of each of the leading companies, including revenue, YoY\(^{12}\) growth, R&D, CapEx, gross profit, gross margin, net income, etc.… They also consider mergers and acquisitions and deliver possible scenarios for their evolution. The market research and strategy consulting company Yole presents today one of its most strategic reports.

In addition to a huge collection of advanced packaging reports and a dedicated quarterly market monitor, the company is covering the advanced packaging industry with its annual advanced packaging conference taking place in Wuxi, China on September 15: SYNAPS. After a successful edition with more than 140 attendees in 2019, Yole and its partner NCAP China, offer this year again an attractive program with leading advanced packaging companies, including Besi, Camtek, Corning, Evatec, HiSilicon, JCET, SPTS Technologies, Tianshi Huatian Electronic, Xiamen Sky Semi., XMC…” And strategic topics including glass substrate, fan-out, high-performance applications… For one day, this both digital & onsite event will cover the overall advanced packaging industry. Be sure to be part of it and register today!

What is the status of the semiconductor industry? How has the advanced packaging industry evolved since last year? What are today’s key market drivers? Who are the advanced packaging players to watch, and what innovative platforms are they working on? What are the economic…

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8 PCB: Printed Circuit Board
9 EMS: Electronics Manufacturing Services
10 ODM: Original Design Manufacturer
11 Including memory and non-memory components as well as key system level demand: mobile, consumer, automotive, telecom and infrastructure.
12 YoY: Year to Year
and technological challenges, after the COVID-19 outbreak? What is the ranking of the top OSATs: who are the winners? ...Yole presents today a comprehensive overview of the advanced packaging industry.

In this highly competitive domain, TSMC especially has emerged as the leader in terms of developing an innovative advanced packaging platform from fan-out, namely InFO, to 2.5D Si interposer, CoWoS, to 3D SoIC. Based on current packaging revenue rankings, TSMC is #4 among the OSATs.

Meanwhile, other top OSATs such as ASE/SPIL, Amkor, and JCET are investing in various advanced SiP\(^{13}\) and fan-out technologies to increase their competition and their share of the advanced packaging market. IC\(^{14}\) substrate & PCB manufacturers, EMS companies, and display industry players are also entering the advanced packaging arena via panel-level fan-out packages, SiPs, and embedded dies (and passives) in organic substrates. This trend will continue in 2020 and beyond.

### Top 25 OSATs: 2019 revenue (in M$) (Source: Status of the Advanced Packaging Industry 2020 report, Yole Développement, 2020)

<table>
<thead>
<tr>
<th>OSAT/Group</th>
<th>Revenue (M$)</th>
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<tbody>
<tr>
<td>ASE (rev w/SPIL &amp; w/o USI)</td>
<td>8,456</td>
</tr>
<tr>
<td>Amkor</td>
<td>4,053</td>
</tr>
<tr>
<td>JCET Group</td>
<td>3,285</td>
</tr>
<tr>
<td>PowerTech Technology</td>
<td>2,209</td>
</tr>
<tr>
<td>Tonghai Microelectronics</td>
<td>1,169</td>
</tr>
<tr>
<td>Tianhai Huatian Microelectronics</td>
<td>1,096</td>
</tr>
<tr>
<td>King Yuan Electronics</td>
<td>948</td>
</tr>
<tr>
<td>UTAC</td>
<td>710</td>
</tr>
<tr>
<td>Chipbond Technology</td>
<td>679</td>
</tr>
<tr>
<td>ChipMOS Technologies</td>
<td>673</td>
</tr>
<tr>
<td>China Semiconductor Electronics</td>
<td>582</td>
</tr>
<tr>
<td>APA semicon</td>
<td>484</td>
</tr>
<tr>
<td>Hans Micron (Rev w/o Hans Materials)</td>
<td>465</td>
</tr>
<tr>
<td>Greatk Inc</td>
<td>399</td>
</tr>
<tr>
<td>AOL Electronics</td>
<td>388</td>
</tr>
<tr>
<td>Cencor</td>
<td>319</td>
</tr>
<tr>
<td>Sigma Microelectronics</td>
<td>297</td>
</tr>
<tr>
<td>Formosa Advanced Technologies</td>
<td>214</td>
</tr>
<tr>
<td>Naps Corporation</td>
<td>289</td>
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<tr>
<td>Uniyen</td>
<td>286</td>
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<tr>
<td>Avontec</td>
<td>267</td>
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<tr>
<td>Insta America</td>
<td>264</td>
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<tr>
<td>Tong Hsing</td>
<td>247</td>
</tr>
<tr>
<td>Wison Advanced Engineering</td>
<td>223</td>
</tr>
<tr>
<td>Linsen Precision Industries</td>
<td>157</td>
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</tbody>
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If counted separately, SPIL\(^{13}\) revenue in 2019 is $2.88B, which will place it as 4th rank among global OSATs.

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All these supply chain shifts and their related implications, as well as a production overview of more than 25 major packaging suppliers per advanced packaging platform, are summarized and analyzed in Yole’s advanced packaging report. “Deeper insight into financial performance enables us to create a link between technology evolution, supply chain shifts, and the overall success of individual players in this changing landscape,” explains Santosh Kumar from Yole.

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\(^{13}\) SiP : System in Package

\(^{14}\) IC : Integrated Circuit
In 2019 the total IC packaging market was worth US$68 billion. Advanced packaging accounted for US$29 billion and is expected to grow at a 6.6% CAGR between 2019 and 2025, reaching US$42 billion in value in 2025. At the same time, the traditional packaging market will grow at a 1.9% CAGR. And the total packaging market will grow at 4% CAGR from US$43 billion to US$85 billion in value.

“With a 6.1% CAGR between 2014 and 2015, the advanced packaging market is expected to more than double its revenue,” asserts Favier Shoo, Technology & Market Analyst at Yole. “At Yole we think this market should grow from US$20 billion in 2014 to about US$42 billion in 2025. This is almost triple the expected growth for the traditional packaging market, estimated at a 2.2% CAGR during the same timeframe.”

And Yole’s analysts do not stop their analysis there. They analyze in-depth the COVID-19 outbreak and its impact on the semiconductor industry, including the advanced packaging market. Indeed, due to the impact of COVID-19, the segment is expected to decrease by 6.8% YoY in 2020. However, Yole explains in its 2020 advanced packaging report that this market should rebound in 2021, with about 14% YoY growth. The highest CAGR revenue is expected from 2.5D / 3D TSV\textsuperscript{15} IC, ED\textsuperscript{16} in laminate substrate, and fan-out (21.3%, 18%, and 16%, respectively), as high-volume products further penetrate the market.

“We see many examples: fan-out in mobile, networking, and automotive; 3D stacking in AI/ML, HPC, datacenters, CIS\textsuperscript{17}, and 3D NAND; and ED in automotive, mobile, and base stations,” details Vaibhav Trivedi, Senior Technology & Market Analyst at Yole. And he adds: “In revenue, the mobile & consumer market segment constituted 85% of total advanced package revenue in 2019, and it will grow at a 5.5% CAGR to constitute 80% of advanced packaging revenue by 2025. Telecom & infrastructure is in revenue the fastest-growing segment with 13% growth between 2019 and 2025. At Yole, we estimate, this will constitute 14% by 2025 against 10% in 2019.” Vaibhav oversees the development of Yole’s Advanced Packaging Quarterly Market Monitor. He compiles and analyzes all market figures related to this industry. The analysis is not complete without taking into account the automotive & transportation market segment. In terms of revenue, Yole’s report indicates a 10.6% CAGR during the 2019 – 2025 timeframe. This market will reach almost US$1.9 billion in 2025, according to Yole.

Status of the Advanced Packaging Industry report and Advanced Packaging Quarterly Market Monitor, both explore in-depth the field of advanced packaging. In parallel, SYNAPS is the annual place to be to get a comprehensive yearly prospectus of the latest market updates and technology developments. Make sure to get a relevant understanding of this industry and follow us on i-Micronews.com.

\textsuperscript{15} TSV: Through Silicon Via
\textsuperscript{16} ED: Embedded Die
\textsuperscript{17} CIS: CMOS Image Sensor
The LIVE MARKET BRIEFING – Advanced Packaging Landscape in Post COVID Economy, dedicated to the advanced packaging industry is still available on i-Micronews.com. Take few minutes to register and watch the recorded version!

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About our analyst

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.

Favier Shoo is a Technology and Market Analyst in the Semiconductor & Software 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 a deep 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 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.

About the report

Status of the Advanced Packaging Industry

OSATs, foundries, and IDMs all want to impact the growing advanced packaging market. – Performed by Yole Développement

Companies cited:
Amkor, Analog Devices, Ardentec, Atmel, AOI Electronics, Apple, ARM, ASE, Avago, Bitmain, Broadcom, Carsem, China WLCSP, Chipbond, ChipMOS, Cisco, Cypress Semiconductor, Deca Technologies, Greatek, IC Interconnect, Fairchild, Facebook, Flip Chip International, Formosa, Freescale, Fujitsu, GlobalFoundries, Google, Hana Micron, Huawei, Inari Berhad, Intel, Intersil, J-Devices, JCET, King Yuan, Linear Technology, LB Semicon, Linsen Precision, Maxim, MaximLinear, MediaTek, Microchip, Micron, Microsemi, Movidius, Nantong-Fujitsu, Nanium, Nepes, Nvidia, NXP, ON Semiconductor, OptoPAC and more...

Related reports
• Advanced Packaging Quarterly Market Monitor, Q1, 2020, Yole Développement
• Fan-Out Packaging Processes Comparison 2020
• Equipment and Materials for Fan-Out Packaging

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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