Status of the Advanced Packaging Industry 2018
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Biography & contact

Santosh Kumar

Santosh Kumar is Director of Packaging, Assembly, and Substrates at Yole Korea. He is involved in the market, technology, and strategic analysis of microelectronic assembly and packaging technologies. His main interest areas are advanced IC packaging technology, including equipment and materials. He has also authored several reports on fan-out/fan-in WLP, flip chip, and 3D/2.5D packaging.

Santosh received a bachelor’s degree and master’s degree in Engineering from the Indian Institute of Technology (IIT) Roorkee and the University of Seoul, respectively. He has published more than 40 papers in peer-reviewed journals and has obtained two patents. Moreover, Santosh has presented and given talks at numerous conferences and technical symposiums related to advanced microelectronics packaging.

Contact: kumar@yole.fr
More than 100 companies cited in the report

(non-exhaustive list)

o Overview of Advanced Packaging in the new semiconductor era

- Short term and long term outlook, with roadmaps
- Impact of Front-End scaling on advanced packaging
- Analysis per package platform, forecasts and future development
- Competition, disruption and opportunities
- Complete overview of shifting business models
- Production splits per manufacturer
- Detailed financial analysis of TOP 25 OSATs
WHAT’S NEW IN THE ADVANCED PACKAGING TEAM?

Advanced Substrates and RF packaging activities

• From 2017, the Advanced Packaging team at Yole Développement is establishing “Advanced Substrates” and “RF Packaging” as standalone and separate activities, to allow deeper focus on these segments
• The “Advanced Substrate” activity is dedicated to exploring the market and technologies of PCBs, IC substrates and thin film RDLs
• The “RF Packaging” activity will deal with low power RF packaging as requirements for high frequency packages rise (5G)
• The objectives of these activities will be to:
  • Propose a common terminology framework
  • Identify and analyze competitive and overlapping technologies
  • Analyze the supply chain and business model shifts
  • Provide related market forecasts
  • Provide related technology roadmaps
  • Provide an outlook on market dynamics and disruptions
  • Identify market shares of involved players
  • Provide analysis on substrate and RF package - architectures, equipment and materials
SYSTEM INTEGRATION LEVELS

LEVEL 3: For Device/Equipment

LEVEL 2: Device/Equipment board

LEVEL 1: Semiconductor Packaging

LEVEL 0: Semiconductor Chip/Wafer

PACKAGING FAMILIES PLATFORMS

ADVANCED PACKAGING PLATFORMS

KEY TERM DEFINITIONS

NOTE:
- From a key technology point of view, the industry is divided into three main categories:
- In order of increasing complexity:
  - PCB (Printed Circuit Board)
  - Substrate: Wafer, BGA/CSP
  - T-Chip: FC, TSV, 3D IC, interposer, hybrid, etc.

BOARD VS. SUBSTRATE VS. THIN FILM RDL

- Multi-Die FC BGA
- Interposer
- Substrate
- 2.5D/3D IC on FC BGA
- Multi-Die Fan-Out WLP/PP
- Thin Film RDL
- Fan-Out WLP
Market Drivers and Dynamics
WHAT’S NEW ON THE MARKET?

Highest semiconductor market growth since 2010

- Semiconductor market grew whopping 22% YoY in 2017 to reach ~$412Bn
- It is expected to cross half trillion dollar mark by 2019/2020.

Global Semiconductor Market

2017 is year of Memory chips (DRAM & NAND)

SMARTPHONE GROWTH SLOWED DOWN

- The mobile market has now reached saturation level. Smartphone’s growth is lowered at +2.9% CAGR 2017-2023
- Although projections for future smartphone volumes beyond 2018 indicate moderate recovery, other market drivers are needed

Cell phone market segmentation as follow

- Luxury phones (~1000$)
- Smartphones high end (~600$)
- Smartphones (~180$)
- Feature phones (~60$)
- Basic phones (~50$)
WHAT’S NEW ON THE MARKET?

Moores Law has slowed down

Cost benefits of CMOS scaling have ceased

Time to market has slowed down

Transistor density relative to mini computer back in the 1970s (log scale)

WHAT’S NEW ON THE MARKET?

China marching towards local integrated IC production goal

- China’s semiconductor production value surged 24.8% on year to CN¥51.12 billion in 2017, including CN¥188.97 billion contributed by the IC packaging and testing sector, up 20.8% on year.
- Fuelled by heavy government investment, IC packaging and testing in China generated US$29 billion in revenues in 2017, making China the world’s largest consumer of packaging equipment and materials.
- In 2017, China accounted for about 26% of the global packaging materials market, with China’s packaging materials revenue forecast to exceed US$5.2 billion in 2018.
- China assembly equipment market reached US$1.4 billion in revenues in 2017, remaining the world’s largest with 37% share.
- In 2017, assembly equipment manufactured in China (including assembly equipment made by foreign-owned companies and JVs) accounted for 17% of China’s assembly equipment market. And with the fast growth in the semiconductor packaging market, China’s domestic packaging materials suppliers are expanding with the industry and now starting to serve leading international packaging houses.
- Compared to other world regions, China’s investments in IC packaging and testing saw the fastest growth over the past decade, with domestic manufacturers securing strong support from both national and local governments to ramp capacity and technical capabilities.
- China’s National Integrated Circuit Industry Investment Fund (known as the Big Fund) has raised an estimated CN¥150-200 billion (US$22.8-30.4 billion) which will be spent for the second phase of its capital support for the country’s local IC companies.
SEMICONDUCTOR MARKET SHIFTS – APPLICATION DIVERSIFICATION

- The future brings no single leading driver, but a fragmented growing market!

IoT infrastructure – the connectivity and data processing backbone

Diversification

- IoT
- Autonomous driving
- Vehicle electrification
- AR&VR
- AI/ML
- Servers/Datacenters
- 5G connectivity
- Blockchain/Crypto currency

Mainframes

PCs

Smartphones

IoT

Servers/Datacenters

5G connectivity

Blockchain/Crypto currency

Vehicle electrification

Autonomous driving

AR&VR

IoT

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ELECTRONIC MEGATRENDS: 2021 MARKET VALUES

- **Mobile**: $500B (2021) market value, 2.5B units sold per year.
- **AR/VR**: $8.5B (2021) market value, 35M units (included VR/AR/MR untethered and tethered headsets).
- **Voice Processing**: $20B (2021) market value, includes microphone + audio IC + microspeaker.
- **AI/ML**: $12B (2021) hardware market value.
- **Hyperscale Data Centres**: $80B (2021) hardware value.
- **Smart Automotive**: $1,630B (2021) market value for 100M vehicles (incl. 25% Level 2 and more).
- **5G**: Bandwidth x100 compared to 4G latency /100.

Comparing 5G:
- Bandwidth: x100 compared to 4G
- Latency: /100 compared to 4G
ADVANCED SUBSTRATE TECHNOLOGY TRENDS

**Advanced substrate**

- SLP
  - Images courtesy: AT&S
- IC Substrate

**Traditional board**

**Product**

- PCB

**Technology**

- mSAP + Subtractive process
- mSAP / SAP
- Subtractive process

**Function**

- Replaces the final board in certain smartphones, first appear in 2017
- Serves as interconnection between the chip and the board, the package will be integrated on a final board
- The final piece of integration, where all components are mounted
Implications of Mega Trends on Advanced Packaging
MEGA TRENDS IMPLICATIONS

MEGA TRENDS

5G
Smart Automotive & Electrification
HPC/Hyperscale DC
AR/VR Voice processing
AI/ML

BUSINESS CHANGES

Technology Change
Units volume Change
Supply Chain Change

NEW OPPORTUNITIES

New Process
New Equipments

BUSINESS

New Customers or customers with new business models
ELECTRONIC MEGA TRENDS - REQUIREMENTS

- More computing power
- High speed
- More bandwidth
- Low latency
- Low Power
- More functionality
- System integration
- More sensors
- More memory
- Low cost
- Hardware-software compatibility
Advanced Packaging Technology
CURRENT TECHNOLOGY NODE DISTRIBUTION

- Device distribution per technology node:
  - 14nm/16nm to 28nm/20nm node: CPU/GPU, APP, DRAM, NAND require highest performance and are most progressive in technology.

TECHNOLOGY NODE ROADMAP

- Graph indicates approximate technology node transitions, based on announcements, current technology readiness and development projections. Customers may opt to skip a CMOS technology node, potentially opt for an alternative front-end technology (i.e. FD-SOI) or resort to boosting performance through advanced packaging (SiP – 2.5D, FO WLP, FC).

- DRAM controllers in servers can be 2 nodes ahead in certain cases.

- TSMC entering 7nm production in 2018.
• Current interconnect coverage of board, semiconductor packaging and wafer processing technology
Competitive technology areas:

1. Substrate vs. board
2. Substrate vs. WLP
3. Organic WLP and dual damascene WLP vs. 2.5D IC
FLIP CHIP AND FAN OUT PACKAGING – VISION FOR 2030

Further scaling below L/S < 10/10 um and more multi die solutions (SiP/SiM)!

- By 2030, the gap between L/S 1/1 um and 10/10 um will be completely closed with both multi-die Fan-Out and Flip Chip CSP/BGA products in high volume.
- SiPs will take over the market, single die packages remain only where necessary/convenient.
- By 2030 High density Fan-Out is mature and in high volume taking further market share from FC CSP/BGA, possibly 2.5D/3D TSV.
- Cutting edge R&D transitions to developing packaging processes for technology nodes n < 3 nm and monolithic ICs (“true 3D”, front end stacking).

Low cost, high resolution multi die solutions

FOOTPRINT

3000mm²

2000mm²

1000mm²

20mm²

MOBILE / WIRELESS COMMUNICATION

CONSUMER

COMPUTING/ NETWORKING

2.5D/3D IC

55x55 mm

I/O

Fan-Out WLP <10x10 mm

Fan-Out SiP >20x20 mm

Fan-Out SiP >20x20 mm

FC CSP < 15x15 mm

FC BGA or FO type > 55x55 mm

FC BGA SiP > 20x20

HD Fan-Out in high volume, a variety of SiP architectures, development of n< 3nm and monolithic ICs, single dies only where necessary

Monolithic

2030

Die

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**ADVANCED PACKAGING ROADMAP**

**Applicative Packaging**  
Moving to high performance, low cost, application driven packaging techniques

**Advanced Packaging**  
Moving to high performance, high density, low cost, collective wafer-level packaging technique standards

- **1970s**  
  - DIP  
  - QFP  
  - LCC

- **1980s**  
  - PGA  
  - SOT / TSOP  
  - WB BGA

- **1990s**  
  - LED Packaging  
  - MEMS Packaging

- **2000s**  
  - Power module Packaging  
  - Camera module Packaging  
  - FC BGA / CSP  
  - WL CSP  
  - QFN  
  - Embedded SiP  
  - 3D WLP  
  - 2.5D interposer

- **2010s**  
  - PoP / PiP  
  - SiP  
  - 3DIC  
  - FO WLP  
  - FO PoP  
  - FO SiP

- **2020s**  
  - Moving to high-performance, low cost, application driven packaging techniques

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Players and Supply Chain
In order to expand the business and explore new areas, players in semiconductor supply chains are entering different business models.
SEMICONDUCTOR SUPPLY CHAIN - 2020

Semiconductor production chain

PCB and substrate component suppliers
Equipment/Materials suppliers
Passive components, connectors etc.

IDMs (Integrated Device Manufacturers)
Fab-light players (outsourcing + focused investment in manufacturing & critical IP)
Integrated wafer/package manufacturing foundries
WLP houses (no need for traditional substrates)
WSVs
Wafer Bumping houses
PCB houses with embedded die capability

FE related materials suppliers
BE Packaging materials suppliers
BE Packaging equipment suppliers
SMT material suppliers
SMT equipment suppliers
Passive components, connectors etc.

Substrate material suppliers
Package laminate suppliers
PCB suppliers
Sub-Module/Sub-systems Design & Assembly
System/Product

ODM/EMS/DMS
OSATs
OSATs with module/EMS capability

IDMs (Integrated Device Manufacturers)
Fab-light players (outsourcing + focused investment in manufacturing & critical IP)
Integrated wafer/package manufacturing foundries
WLP houses (no need for traditional substrates)
WSVs
Wafer Bumping houses
PCB houses with embedded die capability

FE related materials suppliers
BE Packaging materials suppliers
BE Packaging equipment suppliers
SMT material suppliers
SMT equipment suppliers
Passive components, connectors etc.

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ADVANCED PACKAGING 2017 WAFER SPLIT BY MANUFACTURER

2017 Advanced Packaging wafer split (300mm eq wspy)

OSATs accounts for XXX% of the AP wafer in 2017

Further increase of Cu pillar share from 59% to 66% from 2016 to 2022

TSMC leads the market share in Flip-chip wafer production due to emergence of InFO platform for mobile APs, networking & high-performance applications

NEPES increased its market share to 8% as compared to 2016, where its share was ~5%

FLIP CHIP CAPACITY SHARE BY MANUFACTURER

2017 Flip Chip Bumping capacity share by players (K wspy, 300mm eq)

FAN-OUT PRODUCTION SHARE BY MANUFACTURER

2017 Fan-out wafer production by players (K wspy, 300mm eq)

FAN-IN PRODUCTION SHARE BY PLAYER BY MANUFACTURER

2017 Fan-in wafer production by player (K wspy, 300 mm eq)

NOTE:
- Fan-In WLP is less as compared to total production wafer capacity
NOTE:
- Flip Chip values are entered as total capacity, not production (production values not available per customer)
- Average global Flip Chip production is at ~85% of capacity
- Fan-In and Fan-Out WLP are entered as total production, not capacity
Financial section
## TOP 25 OSATS

### Summary

- Ranked by 2017 revenue

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>BM</th>
<th>Location</th>
<th>2017 Revenue</th>
<th>YoY growth</th>
<th>2017 R&amp;D</th>
<th>R&amp;D %</th>
<th>2017 CapEx</th>
<th>CapEx %</th>
<th>2017 Gross Profit</th>
<th>Gross Profit %</th>
<th>2017 Net Income</th>
<th>Net Income %</th>
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<tr>
<td>1</td>
<td>ASE (with USI) only revenue w/o USI</td>
<td>OSAT</td>
<td>Taiwan</td>
<td>9,557 / 5,157</td>
<td>12.0%</td>
<td>306</td>
<td>5.0%</td>
<td>779</td>
<td>2.0%</td>
<td>1,735</td>
<td>1.5%</td>
<td>811</td>
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<td>2</td>
<td>Amkor</td>
<td>OSAT</td>
<td>US</td>
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<td>167</td>
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<td>609</td>
<td>2.4%</td>
<td>717</td>
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<td>3</td>
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<td>OSAT</td>
<td>China</td>
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<td>834</td>
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<td>127</td>
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<td>Taiwan</td>
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<td>57</td>
<td>7.6%</td>
<td>613</td>
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<td>428</td>
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<td>854</td>
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<td>329</td>
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<td>100</td>
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<td>457</td>
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<td>86</td>
<td>20.0%</td>
<td>6</td>
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<td>6.0%</td>
<td>25</td>
<td>0.6%</td>
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<td>1</td>
<td>3.0%</td>
<td>69</td>
<td>2.2%</td>
<td>34</td>
<td>0.3%</td>
<td>9</td>
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<td>312</td>
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<tr>
<td>16</td>
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<td>359</td>
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<td>17</td>
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<td>32</td>
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<td>1.0%</td>
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<td>OSAT</td>
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<td>42</td>
<td>1.0%</td>
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<td>62</td>
<td>1.0%</td>
<td>37</td>
<td>1.0%</td>
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</table>

**TOTAL:**

### Notes:

- ASE Group values include contribution of USI for all parameters (unless otherwise directly noted and only in case of revenue comparison)
- TSMC is estimated to fit between 5th and 10th position in packaging, compared to OSATs (and rising)
- Carsem revenue corresponds to that of parent company Malaysian Pacific Industries Berhard (“MPI”)
- AOI Electronics have a fiscal year from March 2017 to March 2018
TOP 25 OSATS

YoY Growth

* 2016 financial values of UTAC was only partially available, starting from 2017, financial data of UTAC (2016 and 2017) are up to date.
Market Forecasts
Advanced Packaging revenue will be ~47.4% of total packaging market by 2023.

Total packaging market grow by 5.2% whereas AP market grow by 7.5%
The advanced packaging market was ~$22.4B in 2017 and is expected to grow at 8% CAGR (2017-2023) to $37.2B in 2023.

- TSV is represented separately in the graph for visualization/comparison purposes as the high end of TSV is represented in FC and some low end TSV is part of Fan-out.

NOTES:
- Values represent packaging services (assembly and test) and do not include FEOL Si die processing.
- This TSV category includes packaging revenue from high end (3D TSV memory, 2.5D interposer & 3D SoC), middle end (CIS) and low end (MEMS/sensors).
- TSV is represented separately in the graph for visualization/comparison purposes as the high end of TSV is represented in FC and some low end TSV is part of Fan-out.
**STATUS OF THE ADVANCED PACKAGING INDUSTRY 2018**

**Market & Technology report - September 2018**

*In the era of a slowing Moore’s Law, advanced packaging has emerged as the savior of future semiconductor development.*

**ADVANCED PACKAGING IS ESSENTIAL FOR DRIVING SEMICONDUCTOR INNOVATION**

The semiconductor industry is in the midst of a big transition, and entering a disruptive phase where mobile and other emerging mega-drivers, such as big data, AI, 5G, high-performance computing (HPC), Internet-of-Things (IoT) (including industrial IoT), smart automotive, industry 4.0, and data centers will significantly impact business dynamics and create tremendous opportunity across the supply chain.

The electronic hardware needed to support these new mega-trends requires high computing power, high speed, more bandwidth, lower latency, low power, more functionality, more memory, system-level integration, a variety of sensors, and most importantly, a low cost. These new trends will create business opportunities amongst various packaging platforms, and advanced packaging technologies are ideal for fulfilling the various performance requirements and complex heterogeneous integration needs. Thus, advanced packaging will account for the bulk of the assembly business.

Handling the large data generated by new applications will be crucial, and therefore improved data processing performance will remain one of the drivers for semiconductors. Semiconductor scaling will continue, but without the previous cost/performance benefits with every technology-node generation. Advanced semiconductor packaging could increase the value of a semiconductor product by adding functionality and maintaining/increasing performance, while lowering cost. A variety of multi-die packaging (system-in-packages) solutions are in development for high- and low-end, as well as for consumer, performance, and specialized applications. This places immense pressure on package suppliers, given the increasing degree of customization required for each individual customer.

From 2017 - 2023, the total packaging market’s revenue will grow at a CAGR of 5.2%, and the advanced packaging market will grow at a CAGR of 7%, reaching $39B in 2023. On the other hand, the traditional packaging market will grow at a lower CAGR of 3.3%. Of the different advanced packaging platforms, 3D TSV and fan-out will grow at rates of 29% and 15%, respectively. Flip-chip, which constitutes the majority of the advanced packaging market, will grow at a ~ 7% CAGR. Meanwhile, fan-in WLP will grow at a CAGR of 7% from 2017 - 2023, led mainly by mobile.

Advanced packages will continue their important role of addressing high-end logic and memory in computing and telecom, with further penetration in analog and RF in high-end consumer/mobile segments. All of this while eyeing opportunities in the growing automotive and industrial segments.

This report explores the advanced packaging field and serves as an annual overview of the latest market and technology developments. We begin by summarizing the drivers for advanced packaging along with the latest market dynamics, and then analyse packaging technology evolution, complete with short- and long-term roadmaps. This report also provides an extensive supply chain analysis, including player positioning and strategy, along with production per player (revenue, wafers). This analysis also includes a thorough financial analysis of the top 25 OSATs. The report concludes by providing revenue, wafer, and unit forecasts per packaging platform, along with an analysis of future production and developments over the 2017 - 2023 timeframe.

### 2017 - 2023 advanced packaging revenue forecast, by packaging platform in $B

<table>
<thead>
<tr>
<th>Year</th>
<th>Flip-chip (FC)</th>
<th>Fan-in (Fi)</th>
<th>Fan-out (FO)</th>
<th>Embedded die (ED)</th>
<th>Through silicon via (TSV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>15</td>
<td>10</td>
<td>5</td>
<td>10</td>
<td>10</td>
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<td>10</td>
<td>15</td>
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<td>2023</td>
<td>21</td>
<td>16</td>
<td>11</td>
<td>16</td>
<td>16</td>
</tr>
</tbody>
</table>

**CAGR 2017-2023**

- ED ~22%
- FO ~15%
- FC ~7%
- TSV ~29%

(Yole Développement, September 2018)
**ADVANCED PACKAGING’S SUCCESS REQUIRES CONSTANT TECHNOLOGICAL INNOVATION, INCLUDING EQUIPMENT & MATERIALS**

To fulfil next-generation hardware performance requirements, advanced packaging must press for innovations in process, materials, and equipment. Indeed, advanced packaging has accelerated the need for breakthrough technologies in substrate manufacturing, package assembly, and test engineering. Investments in next-gen manufacturing tool developments, i.e. thermo compression bonding (TCB), panel-level tools, and substrate UV via formation, are required in order to fuel advanced packaging’s overall growth.

As for materials, there is a desire to develop new dielectric materials, mold compounds, underfill, solder interconnects, and thermal interface materials (TIMs) for fulfilling the stringent performance and reliability requirements demanded by next-generation hardware. Also, the need for breakthroughs in package feature-scaling requires a sense of urgency from key suppliers to the semiconductor packaging industry.

This report covers the trends and challenges specific to advanced packaging technology, and includes detailed roadmaps for various packaging platforms. This report also goes into more detail concerning the competition between advanced flip chip (FC) substrate and wafer level packaging (WLP) up to L/S 5/5 μm, as well as WLP vs. 2.5D/3D technology below L/S 5/5 μm. Furthermore, a long-term outlook is projected to 2030.

Additionally, some key packaging market dynamics are brought into perspective, such as: impact of longer front-end scaling cycles; competing platforms and technologies in the scaling roadmap below L/S 10/10 μm (package substrates vs WLP; WLP vs 2.5/3D); transition from wire-bond to FC packages; and panel-level packaging.

**THE SEMICONDUCTOR SUPPLY CHAIN IS TRANSITIONING AT VARIOUS LEVELS**

In order to expand their business, explore new areas, and guard against future uncertainty, players across semiconductor supply chains are embracing different business models. Some integrated-device-manufacturings (IDMs) are entering the foundry business to leverage their front-end technology expertise and create additional revenue streams by utilizing their excess capacity. Meanwhile, original equipment manufacturers (OEMs) and software/services companies are designing their own chips and controlling the related supply chain of equipment and materials.

In betting on mega-trends like AI, some outsourced assembly and testing (OSATs) are expanding into the fablite business model. Pure play foundries are entering the high-end packaging business to provide their customers with turnkey solutions. Other OSATs are directing considerable efforts towards developing advanced wafer-level and 3D IC packaging capability in order to support scaling and density requirements. Meanwhile, certain OSATs are expanding their testing expertise, and traditional pure-test players are investing in assembly/packaging capabilities.

Substrate manufacturers are penetrating the advanced packaging area with panel-level fan-out packaging and embedded die in organic laminate. Electronics manufacturing service (EMS) companies are developing assembly/packaging capability and expanding into the OSAT business domain. The packaging market as a whole is differentiated by players in several categories: large volume with advanced and mature technologies combined; smaller volume but specific advanced technology; and numerous mature technology suppliers.

Supply chain shifts and their implications, as well as the production dynamics of >25 major packaging suppliers per advanced packaging platform, are summarized and analysed in this report.

**NEW GROWTH PLAYERS REVEALED VIA IN-DEPTH FINANCIAL OBSERVATIONS OF OSATs**

A deeper look into financial performance allows creation of a link between technology evolution, supply chain shifts, and the overall success of individual players in this changing landscape. The top 25 OSATs are examined by revenue, R&D investment, CapEx, gross profit/margin, and net income. Of these top 25, Taiwan-based OSATs account for more than half of total revenue, followed by China, the US, and Korea. Except for OSE and Formosa Advanced Technologies, every OSAT showed YoY growth in 2016 and 2017.

Eight large OSATs are separating from the pack. As these firms continue their heavy investment in CapEx and R&D, the rest must catch up, lest they are acquired or fade away. Three China-based manufacturers are now among the top eight OSATs. UTAC dropped to #8, replaced by Tianshui Huatian and Nantong Fujitsu. JCET, Tianshui Huatian, Nantong Fujitsu, and King...
MARKET & TECHNOLOGY REPORT

Yuan continue growing. ChipMOS’ revenue is up again after a three-year decline, and STS is on the upswing again after four years of negative growth.

This report offers deeper insight into the 2013 - 2017 financial evolution of the top 25 OSATs.

COMPANIES CITED IN THE REPORT (non exhaustive list)

OBJECTIVES OF THE REPORT
Advanced Packaging Market overview
- Drivers and dynamics
- Future applications
- Disruptions and opportunities

Technology trends and forecasts
- Revenue, wafer and unit forecasts per platform
- Future development per platform
- Impact of front end scaling
- Scaling and functional roadmaps

Supply chain analysis
- Overview of production per player (IDM, OSAT, foundry)
- Shifting business models
- Financial analysis of TOP 25 OSATs

Santosh Kumar is Director of Packaging, Assembly, and Substrates at Yole Korea. He is involved in the market, technology, and strategic analysis of microelectronic assembly and packaging technologies. His main interest areas are advanced IC packaging technology, including equipment and materials. He has also authored several reports on fan-out/fan-in WLP, flip chip, and 3D/2.5D packaging. Santosh received a bachelor's degree and master’s degree in Engineering from the Indian Institute of Technology (IIT) Roorkee and the University of Seoul, respectively. He has published more than 40 papers in peer-reviewed journals and has obtained two patents. Moreover, Santosh has presented and given talks at numerous conferences and technical symposiums related to advanced microelectronics packaging.

AUTHOR

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**Status of the Advanced Packaging Industry 2018**

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- Low

- High
- Low
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