Fan-Out (FO) packages have found their niche applications in devices such as PMICs, audio codecs, connectivity modules, automotive radar, high-end application processors, and some RF transceiver applications. As FO packages are finding niche applications, Wafer Level Chip Scale Package (WLCSP) is becoming a new standard mainstream package for mobile/consumer market as it offers lowest package cost for many applications. Fueled by a strong semiconductor industry performance, FO package revenue reached $1.5B in 2018. TSMC remains the leader from a market-share standpoint, followed by ASE, JCET, and Amkor Technology. In 2019, Semco stepped away from its FO Panel Level Processing (PLP) business, which was subsequently acquired by Samsung Electronics. Meanwhile, PTI leads in Panel Level Processing (PLP) packaging expansion activities, with significant CapEx on the horizon and high hopes of winning business from the top Chinese OEMs. As performance requirements evolve, competition will remain fierce in the coming years amongst players and between various fan-out technologies with foundry players clearly winning in the High Density (HD) FO segment while OSATs continue struggling to catch up in this market. Top three OSATs, ASE, Amkor, and JCET continue to drive WLCSP to new heights as this form factor finds its place in switches, filters, serial flash, RF components, wireless charging and many more.

Yole Développement (Yole) will begin publishing, in quarterly instalments, a monitor containing world-class research, data, and insights pertaining to FO and WLCSP packaging markets. This monitor will analyse the Wafer Level Package (WLP) market's evolution in terms of revenue, shipments, capex, market pricing, capacity, application & process technology mix, and supplier market share. In the future, Yole will extend its coverage to Flip Chip packaging and 2.5D/3D packaging.

**WHAT ABOUT ADVANCED PACKAGING QUARTERLY MARKET MONITOR?**

A full package:
The Advanced Packaging Quarterly Market Monitor includes the following deliverables:
- Excel database with all historical and forecast data
- PDF slide deck with graphs and comments/analysis covering expected evolutions
- Direct access to a Yole Développement analyst for one year, providing an opportunity for on-demand Q&A and discussions regarding trends, analyses, forecasts, and breaking news

Frequency:
Receive every quarter the updated Market Monitor documents

Monitored platforms:
- Fan-Out and Fan-In (available from Q1 2020)
- Flip Chip and 2.5D/3D packaging (available from Q4 2020)

Get the sample of the monitor on www.i-Micronews.com

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**FAN-OUT PACKAGING CONTINUES TO GAIN ADOPTION IN HIGH-DENSITY APPLICATIONS AND HIGH-PERFORMANCE COMPUTING, WHILE WLCSP PACKAGE BECOMES MAINSTREAM FOR SMARTPHONE & CONSUMER APPLICATIONS**

FO packaging began several years ago with limited applications, but it has now found a critical role and rightful place in the high-end packaging sector as a mature, reliable package technology. In fact, TSMC’s InFO form-factors brought FO technology to new heights in 2015 as Apple launched its A10 with InFO-PoP approach. FO packages are primarily used in the mobile

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**ADVANCED PACKAGING QUARTERLY MARKET MONITOR**

Packaging Service - March 2020

Despite weak semiconductor demand, Wafer Level Packaging reaches new heights as Fan-Out package revenue to surpass $2B by 2025 and Wafer Level Chip Scale Packaging revenue to peak to $3B by 2025.
and consumer segments, with some proliferation in automotive radar. FO packaging is expected to gain wider adoption as 5G, AI, and autonomous driving take flight in the coming years - and revenue stemming from FO packaging is expected to reach $2B - $2.5B by 2025.

WLCSP market also found a new “M-series” product which provides side mold protection with greater board level reliability (BLR) performance as it is being adopted by a major customer. HDFO remains a key growth driver in the FO packaging market. TSMC clearly leads the HDFO segment with its InFO-PoP in mobile and consumer markets as it continues to expand its and InFO variants for networking and high performance computing applications. Meanwhile, Samsung Electronics has entered the market with its HD FO PLP line, to be utilized for the Galaxy watch and possible future implementation in Samsung’s Galaxy phone line-up. By 2021/2022 we expect another top Chinese phone OEM will adopt FO package for its application processor, where HDFO suppliers are predicted to be key winners with fast-growing FO packaging businesses.

FO technology’s future promises to be far more dynamic and complex than its past, as multiple foundry and OSAT players race to win HDFO business while simultaneously growing their core FO products. WLCSP packages are gaining strong momentum in smartphone and consumer applications. Yole’s quarterly market monitor will answer the pressing questions facing this industry, including:

- Will the two primary HDFO suppliers (TSMC and Samsung Electronics) continue to manage supply, or will there be a new entrant to support HDFO’s growing demand?
- Will the FO PLP business significantly increase in the coming years as ASE and PTI increase capex by bringing additional PLP capacity online?
- Will WLCSP packages find new adoption in IoT/consumer applications and how WLCSP package market share will change for automotive applications?
- Will the IoT/consumer market grow significantly, and drive the need for thinner, faster Systems on Chip (SOCs)?
- Will 5G spur additional WLP package growth with new RF designs?
- Will WLP package capex continue increasing, or will it stabilize at a certain level?

With its Packaging Research Quarterly Market Monitor, Yole provides opinions and answers to all of these questions, every quarter.
WHAT DO THE UPCOMING QUARTERS HOLD?

2019 second half results especially a strong Q4 shows demand recovery for advanced packaging market. 2020 remains healthy besides few macroeconomic conditions affecting global markets such as the coronavirus outbreak and will have temporary effect on the world economies. After a low Q1, the FO packaging market faces ASP erosion - especially in the core FO area, where OSATs are under pressure to reduce price with lower demand and their factories filling up. However, WLCSP revenue grew slightly in 2019 despite weak semiconductor market. This clearly shows the dominance of WLCSP packages in mobile/consumer segment as they offer practical/lowest cost solution to OEMs. OSAT capacity for FO packages far exceeds customer demand for core FO devices, but thankfully other WLP products can fill this capacity, ensuring higher factory utilization. The outlook for FO packages remains positive: in the range of 4% growth YoY over the long-term, heading towards $2.5B revenue by 2025.

The HDFO market remains a key driver that can propel the FO packaging market to new heights as a possible inflection point in 2021. IoT/wearables can also drive incremental growth.

ADVANCED PACKAGING QUARTERLY MARKET MONITOR - CONTENT

The Advanced Packaging Quarterly Market Monitor contains all of the data related to FO and Fan-In/WLCSP package revenue per quarter, shipments, near and long-term revenue, market share per quarter, capex per company, and market demand/supply forecasts. Also included is a complete analysis of demand breakdown across key segments such as mobile, consumer, automotive, and medical. For top players (TSMC, Samsung Electronics, Amkor, JCET, ASE/Deca, PTI, SPIL, Nepes, Huatian), the Advanced Packaging Quarterly Market Monitor, furnishes a detailed analysis of capex, shipments, market share, and capacity, along with the expected impact of changes in FO/WLCSP process technologies and the application mix.

COMPANIES MONITORED IN THE PRODUCT

Amkor, ASE, Deca, Huatian, JCET, Nepes, PTI, Samsung Electronics, Semco, SPIL, TSMC, TI, China WLCSP

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RELATED REPORTS, MONITORS & TRACKS

- Equipment and Materials for Fan-Out Packaging 2019
- Fan-Out Packaging: Technologies and Market Trends 2019
- NAND & DRAM Quarterly Market Monitors
- Application Processor Quarterly Market Monitor
- Teardown Tracks - by System Plus Consulting

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ABOUT YOLE DEVELOPPEMENT

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 120 collaborators worldwide covering MEMS and image sensors, Compound semiconductors, RF Electronics, Solid-state lighting, Displays, Software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Power Electronics, Batteries & Energy Management and Memory.

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and Blumorpho, supports industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business.

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   HSBC, 1 place de la Bourse 69002 Lyon France

   Bank code: 30056

   BIC or SWIFT code: CCFRFRPP

   Account n°: 0710 020 1565 87

   IBAN: FR76 3005 6001 7001 0716 0156 587

   To secure the payments due to the Seller, the Seller reserves the right to request down payments from the Buyer. In such case, the full price for a license of the Product or the use of the information, will be delayed by a down payment will be managed on the corresponding order.

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4. The Seller publications (reports, monitors, tracks...) are due for delivery only after receipt by the Seller of any payment due by the Buyer prior to delivery.

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