LYON, France – April 13, 2017: As development of packaging technologies intensifies, in order to accommodate further front-end scaling trends and multi-die integration, advanced FO RDL\(^3\) and FC\(^4\) substrates represent the key interconnect components. The competition between FO and FC packages and the features of their interconnect components is resulting in an abundance of new package architectures that are crucial in enabling future products and markets. For this reason, the “More than Moore” market research and strategy consulting company Yole Développement (Yole) has established a stand-alone dedicated advanced substrate activity, focused on exploring the market, technologies and competition between thin film RDLs, and package substrates and its impact on PCBs. This activity is part of the Advanced Packaging & Semiconductor Manufacturing business unit and starts with the release of a dedicated report titled Advanced Substrates Overview: From IC Package to Board.

How and where does FO compete with FC substrates? Why will further PCB scaling impact the FC substrate manufacturing and supply chain? Yole’s Advanced Packaging & Semiconductor Manufacturing team offers you today a comprehensive overview of the latest technology and market trends.

Advanced substrate solutions are fueling tomorrow’s market. The FO WLP platform is the advanced packaging platform with the highest growth, boasting revenue CAGR\(^5\) of 49% from 2015 to 2021. The FO platform is forecasted to exceed US$2.5 billion in packaging services revenue by 2021.

In parallel FC packaging platform holds 85% of the advanced packaging

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1. FO: Fan-Out
2. PCB: Printed Circuit Board
3. RDL: Redistribution Layers
4. FC: Flip Chip
5. CAGR: Compound Annual Growth Rate
market, but regardless of its solid 5% CAGR, it is losing market share to FO WLP resulting in a drop to 76% by 2021. The fast-rising FO WLP platform is ambitiously developing higher density solutions while at the same time facing more competition from advanced FC and hybrid FC solutions. Though the FC substrate market exhibited a dip in 2016 due to further adoption of FO lead by TSMC InFO, it is expected to bounce back with mild growth at a 1.6% revenue CAGR. This can be split into a 3.6% FC CSP\(^6\) CAGR and a stagnating 0.6% FC BGA\(^7\) CAGR. Overall, FC substrate revenue is expected to exceed US$8 billion by 2021.

Today’s advanced substrates in volume are FC substrates, 2.5D/3D TSV\(^8\) assemblies, and thin-film RDLs (FO WLP) below a L/S resolution of 15/15 um and with transition below L/S < 10/10 um. These interconnects are traditionally linked to higher-end logic (CPUs\(^9\)/GPUs\(^10\), DSPs\(^11\), etc.) driven by ICs\(^12\) in the latest technology nodes in the computing, networking, mobile, and high-end consumer market segments (gaming, HD\(^13\)/Smart TV). However, due to additional form factor and low power demands, WLP and advanced FC substrates are also widespread in majority of smartphone functions: application processors, baseband, transceivers, filters, amplifiers, WiFi modules, drivers, codecs, power management, etc.

Future higher-end products will require package substrates with L/S < 10/10 um and boards with L/S < 30/30 um. These demands have given rise to three distinct competition areas:

- Board vs. FC substrate
- FC substrate vs. FO WLP
- FO WLP vs. 2.5D/3D packaging

The competitive areas of boards, substrates, and thin-film RDLs are directly linked to the underlying technologies used. Board
manufacturers are representatives of the subtractive process, which is hard to scale beyond L/S 30/30 µm. Meanwhile, substrate manufacturers have experience with SAP\textsuperscript{14} and mSAP processes that can lead to larger substrates and potentially “substrate-like PCBs”, but at higher cost. On the other side, when competing with FO WLP, FC substrates have a cost advantage but FO WLP scales faster.

Yole’s report compares the main processes and technologies used, discusses the limitations, advantages, and opportunities for each process, and provides roadmaps for thin-film RDLs (FO WLP) and FC substrates.

Furthermore, under this new report, Yole’s team proposes a common terminology for diverse substrate architectures and provides an advanced substrate segmentation, followed by in-depth analysis of advanced substrate drivers, markets and dynamics, the three competition areas, current and future FO and FC architectures, supply chain, player positioning, business model shifts, and advanced substrate market forecasts during the 2015 – 2021 period.

What type of FO and FC substrate solutions are in development? Which markets and applications will require advanced RDL and substrates below L/S 10/10 µm? How does this also affect boards? What are the limitations and advantages of FO RDL, FC substrates and board technology, which players are taking charge of which solution, and how is the supply chain changing?...

A detailed description of this technology & market report is available on [i-micronews.com, advanced packaging report section]().

\textsuperscript{14} SAP: Semi-Additive Process
About Advanced Substrates Overview: From IC Package to Board report

How can advanced substrates and boards bridge the gap created by front-end scaling?

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Companies cited in the report:


Founded in 1998, Yole Développement has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole Développement group has expanded to include more than 50 collaborators worldwide covering MEMS, Compound Semiconductors, LED, Displays, Image Sensors, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Nanomaterials, Power Electronics and Batteries & Energy Management.

The “More than Moore” company Yole, along with its partners System Plus Consulting, Blumorpho and KnowMade, support 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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