

AUTOMOTIVE PACKAGING: MARKET AND TECHNOLOGIES TRENDS 2019

Market & Technology Report - November 2019

Vehicle autonomy and electrification are encouraging advanced packaging's growth in this industry.

WHAT'S NEW

- Detailed packaging forecast, by application; detailing the package by device for each application
- CIS packaging forecast, by CIS type
- LiDAR packaging forecast, by device type (laser, photodetector, μmirror)
- Radar and connectivity packaging forecast, by device type
- Automotive computing application (ADAS computing and AI for infotainment)
- Automotive memory (DRAM, NAND) applications
- IDMs and OSATs - 2018 packaging market share, and vision for 2024
- Supply chain changes - three different scenarios

KEY FEATURES

- Automotive market overview and trends
- Automotive packaging, trends, changes, challenges
- Multiple automotive applications: CIS / LiDAR / radar / connectivity / MEMS and sensors / memory / computing / power / LED
- Forecast (units and revenue) by packaging type for each application
- Supply chain and ecosystem by application
- IDMs and OSATs automotive packaging market share

THE AUTOMOTIVE INDUSTRY'S EVOLUTION, AND ITS IMPACT ON PACKAGING

Today's automotive industry is transforming in preparation for the vehicles of tomorrow. Vehicle autonomy and electrification trends, along with comfort and safety, are driving these changes, which are occurring on every front: supply chain, business models, players, and technologies, down to packaging and materials, etc.

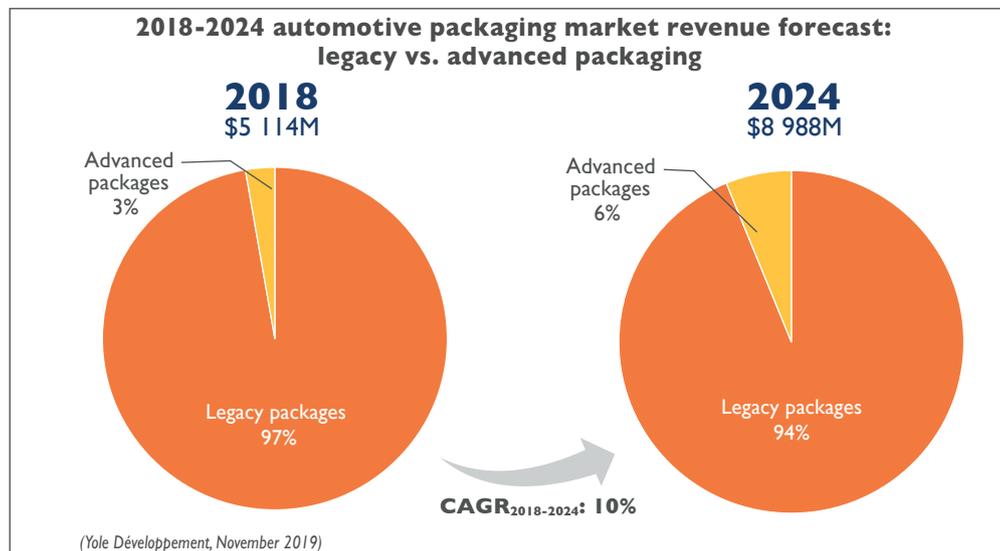
This report focuses on automotive packaging, presenting the different packages used by in-car applications. The total calculated packaging market will exhibit a +10% CAGR₂₀₁₈₋₂₀₂₄, growing from \$5.1B in 2018 to around \$9B in 2024.

Traditionally a conservative industry, automotive players have begun adapting their approach to today's quickened technology pace. Packaging is one of the fields where changes are manifesting, and affirming the growth of advanced packaging usage. In 2018, advanced packages accounted for only 3% of automotive packaging revenue: the other 97% was attributed to legacy packaging. But in 2024 advanced packaging will double its

share, reaching 6% of the total accessible market and accounting for \$550M (4x its 2018 revenue). Despite the obvious domination of legacy packaging, advanced platforms will continue their breakthrough into automotive - driven by autonomy applications like ADAS computing, along with vehicle electrification's need for new advanced packages, i.e. embedded die.

Automotive packaging is application-dependent. In areas like MEMS, low-power, and most CIS, legacy packaging is sufficient - whereas other applications, i.e. computing, require advanced packaging. In fact, advanced packaging's growth in automotive is directly linked to advancements in autonomy levels, vehicle electrification, and their adoption.

This report details the packages used for various applications: CIS, LiDAR, radar, connectivity, MEMS and sensors, LED lighting, computing, memory, and power devices.



THE AUTOMOTIVE PACKAGING LANDSCAPE: AN "IDM VS. OSAT" BUSINESS

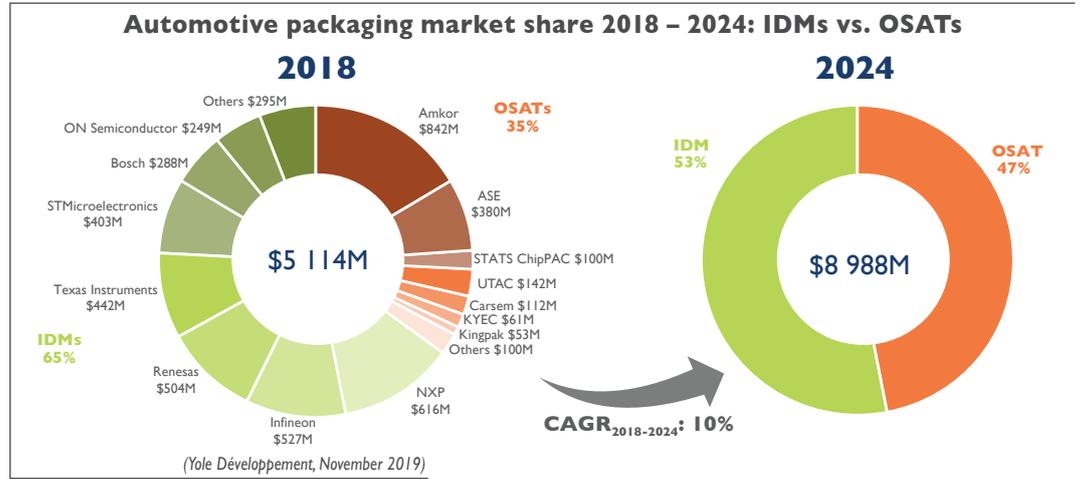
The automotive industry of the future will require more in-vehicle electronics systems, implying higher packaging volumes. Historically, automotive packaging was mostly done in-house by IDMs. Today however, with higher volumes and OSATs' extensive packaging expertise, IDMs are more frequently subcontracting packaging to OSATs, or at the very least producing part of their legacy package needs in-house and subcontracting the rest.

Most IDMs are not willing to invest in new packaging lines - especially not for automotive advanced packaging, which requires a substantial investment in terms of tools, qualification, and workforce. In 2018, 65% of the \$5.1B total calculated for automotive packaging was generated by IDMs, led by NXP and followed by Infineon and Renesas. In the future, Infineon, due to its acquisition of Cypress, may challenge NXP's leading position.

OSATs accounted for \$1.79B (or 35%) of the automotive packaging market. The unquestioned leader is AMKOR with 47% market share, with ASE far behind at 21%. AMKOR reached the summit in part because of its 2015 acquisition of J-Devices. If AMKOR’s competitors are willing to mount a challenge, the fastest way to do so is by imitating AMKOR’s approach to M&A. Without

such an effort, AMKOR’s domination will only grow stronger: a scenario in which there is one major player and then “the rest”.

Yole Développement expects OSAT market share to increase in the next five years. A potential scenario by 2024 is one where both business models have similar automotive packaging market share.



AUTOMOTIVE SUPPLY CHAIN CHANGES

Automotive trends, the introduction of new systems like high-performance computing units and the need for higher in-car cyber security, are few reasons behind potential supply chain changes in the future. Conventional car makers like Audi, Toyota, and Volkswagen will lead the consumer automotive business, while so-called “service providers” like Uber, Lyft, Waymo, and Baidu will spearhead the robotic vehicle supply chain.

Besides car makers, if we descend the supply chain pyramid we find system makers that can also be module makers - for example, Denso and Delphi. Component and module makers, which include companies like Infineon, NXP, Bosch, and others, are the next link in the supply chain, following companies offering manufacturing and packaging services: TSMC, Amkor, ASE, and UTAC.

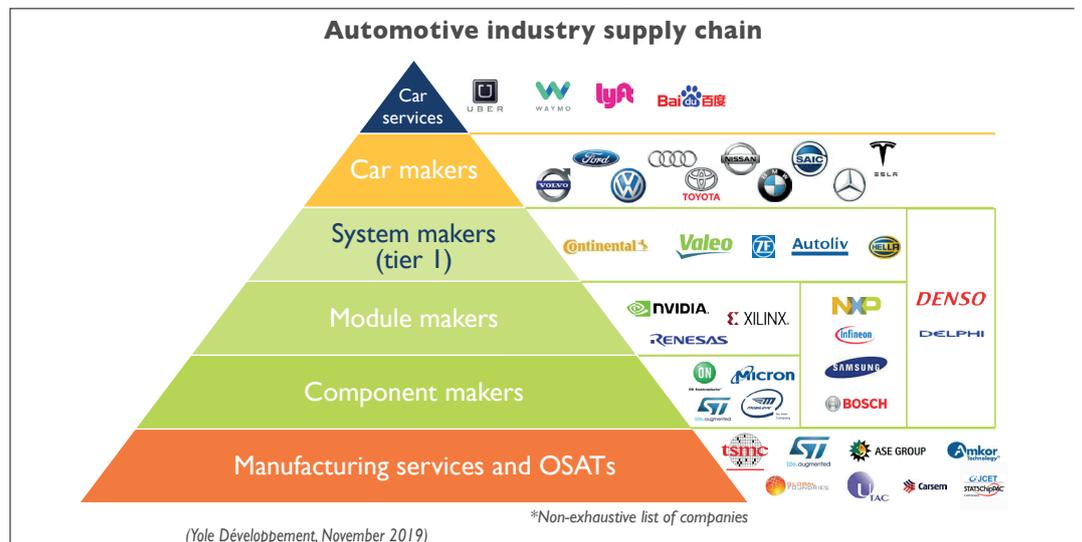
Different supply chain scenarios are possible. Manufacturing and service companies will be less impacted, since car makers will continue relying on them. One possible mid-term scenario calls for

expanded involvement of car makers in the supply chain, bypassing system makers and working directly with component and module makers. This scenario is supported by the need for a smaller supply chain, with higher engagement in developing the hardware for specific applications directly linked to vehicle security. This is similar to what Toyota is doing with Denso, and what Audi is researching.

Another approach is one where the car maker integrates the entire supply chain in-house, with the exception of manufacturing and packaging. Tesla is trying to create this scenario by internally developing some of the hardware and software for its cars. This path is risky and costly, and should only be attempted either through very close partnerships and/or M&A.

In the short-term, the automotive supply chain will not change drastically - but we should become more aware of some business models than others, based on future activities.

More details are provided in this report, along with an analysis of ecosystems, by application.



REPORT OBJECTIVES

- Offer a global overview of the automotive market and trends
- Show the impact of automotive mega-trends, and trends in the automotive semiconductor ecosystem
- Provide an overview of automotive electronics and packaging
- Furnish updated market data & forecasts for different automotive applications, and their packaging (units and revenue): CIS / LiDAR / radar / connectivity / MEMS and sensors / memory / computing / power / LED
- Identify the key players and their automotive ecosystems
- Discuss the possible scenarios for the automotive supply chain's future evolution
- Compare the packaging market share of IDMs vs. OSATs

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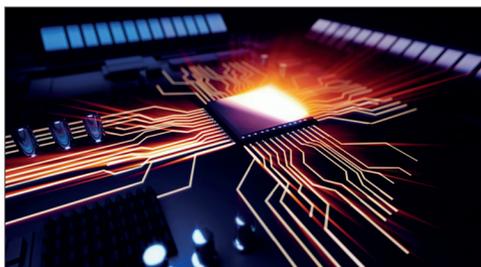


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