LYON, France – October 21, 2019: Yole Développement (Yole) power electronics team’s presents this year an optimistic analysis of the power electronics industry. The power device market is showing a comfortable 13.9% growth between 2018, compared to 2017. The market research & strategy consulting company points out a second consecutive high-growth year in this industry, after a couple of flat years...

Without doubt, both markets, power module and power module packaging take benefit of this momentum.

- As a key element in power converters and inverters, the power module market should reach about US$6 billion by 2024 with 6.6% CAGR between 2018 and 2024.
- In parallel, Yole announces a US$2.2 billion power module packaging market in 2024, in its latest power electronics report, Status of the Power Module Packaging Industry.

Beyond market figures, the most important point is probably the continuous growth showed by the EV/HEV sector. Electrification of the automotive industry directly impacts the market of power modules and related packaging...

Status of the Power Module Packaging Industry report from Yole is offering today a comprehensive update of the packaging industry for power applications. This analysis reveals key packaging trends and its ecosystem. This report also includes a special focus on focus on SiC and

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1 Source: Status of the Power Electronics Industry report, Yole Développement, 2019
2 CAGR: Compound Annual Growth Rate
3 EV/HEV: Electric and Hybrid Electric Vehicles
4 SiC: Silicon Carbide
Ga\textsuperscript{3} power device packaging as well as in-depth insights into power module substrates, technology trends, and supply chain. This report proposes also two dedicated sections on embedded die solutions and IPMs\textsuperscript{4}… “Power module packaging is clearly a very dynamic market with constantly reshaping supply chain”, comments Milan Rosina PhD, Principal Analyst, Power & Wireless / Batteries, at Yole. “Continuous innovations, materials’ enhancements, lot of R&D investments are part of the today’s power module landscape.”

What are the main market drivers? What are the latest technical innovations, especially at the packaging design and materials levels? Facing to the EV/HEV market demand, how will the supply chain evolve? Yole invites you to deep dive into the world of power module and technical innovations.

“In the past, packaging needs were driven by industrial applications, but today the market has changed and future will be different”, announces Shalu Agarwal, Power Electronics and Materials Analyst at Yole. “Indeed, EV/HEV will be the main player. At Yole, we think, EV/HEV will become the biggest power module market by 2024 and will represent a US$2.5 billion market in value”.

This market’s promising outlook proposed by the power electronics team at Yole, is clearly beneficial for the power module packaging material business. Therefore, the power module packaging material market will achieve a 7.8% CAGR between 2018 and 2024, reaching the US$2.17 billion business opportunity by 2024. Under this dynamic context, the material sector will represent more than one-third of the power module market.

In terms of innovative technologies and market forecasts, Yole’s report looks closely at substrates, baseplates, die-attach, substrate attach, encapsulation, interconnections, and TIM markets.

In 2018 the largest packaging material segment was baseplates, followed by substrates. The other 32% was represented by die-attach and substrate-attach materials. Thus, major technological choices in these segments can rapidly impact the overall power module packaging market. For example, the market share for silver sintering as a die-attach is increasing, driven especially by EV/HEV. This technology is pricier than more conventional soldering materials, and CAGR for the die-attach market is +10.8% between 2018 and 2024 – well higher than for other market segments.

The second-highest growth is for interconnections. Yole’s analysts announce 8.7% CAGR for the 2018 – 2024 period. This market segment is followed by substrates, with a 2018 – 2024 CAGR of 8.5%.

\textsuperscript{3} GaN : Gallium Nitride
\textsuperscript{4} IPM : Intelligent Power Modules

System Plus Consulting, sister company of Yole also collaborates with Yole’s analysts to identify and compare the current power module packaging technologies. Its report, \textit{Automotive Power Module...}
Packaging Comparison, confronts structures and costs of solutions today delivered by key automotive suppliers. System Plus Consulting' analysts point out the different technical choices selected by these companies.

“EV/HEVs progress pushes the electronic systems to meet new requirements to improve performance and reliability”, asserts Elena Barbarini, Head of Department Devices at System Plus Consulting. “Since the early stages of car electrification, power modules have been playing a key role, especially in the optimization of performances from inverters to bi-directional converters.”

Packaging these modules is today critical due to several technical aspects such as thermal efficiency and system integration. In addition, cost impact on the final solution becomes more and more stringent and lot of power electronics companies meets some issues to remain competitive in the open market.

Elena Barbarini from System Plus Consulting comments: “Power electronics companies offer various innovative solutions, from integrated heatsink to die attach, for both discretes and modules. Moreover the request of cost saving during the integration steps pushes design companies to move forward single and more flexible structures, such as 1-in-1 commutation cells or embedded discretes.”

As a direct consequence, the power module packaging supply chain is showing strong changes. Indeed, two main factors will impact its reshaping in the coming years. Yole announces, the evolution of packaging technologies, and the EV/HEV industry’s specific requirements:

- The evolution of packaging technologies towards innovative solutions (low-inductance interconnections, silver-sintering die-attach material, Si3N4 AMB ceramic substrates, etc.) will benefit the suppliers offering these solutions. For example; MacDermid Alpha, Rogers, and Toshiba Materials.

Besides the materials suppliers, packaging equipment manufacturers (i.e. wire bonders, sintering machines, reflow ovens, cleaning equipment) will also be positively or negatively impacted by these changes. The power module makers that adopt innovative packaging solutions early on can secure a better market position, as seen in the example of STMicroelectronics’ SiC power module used in the Tesla Model 3’s main inverter.
Suppliers of packaging solutions for EV/HEV power modules must adapt their strategy, product portfolio, and manufacturing capacities to satisfy strong requirements in terms of costs, manufactured volume, and product reliability. This is a very challenging task, especially because many players are targeting opportunities offered via rapidly-growing EV/HEV demand. To succeed in this competitive environment, new mergers and acquisitions as well as partnerships are necessary to help capture new technologies/new customers quickly, and increase production capacity. To reduce cost pressure, some companies have already moved or are planning to move at least part of their production capacity to countries with lower production costs (i.e. China, Romania, and Vietnam).

A detailed description of the overall power electronics reports’ collection is available on i-Micronews.com.

In this innovative and dynamic industry Yole and System Plus Consulting are organizing their first EV/HEV Techday: “EV/HEV cost vs. performance trade-off: a battle on multiple fronts for Power Electronics” on December 12 in Germany.

Aim of this one-day conference is provide a complete overview of the ecosystem and disruptive technologies. It includes amongst others power device packaging, batteries and new semiconductor materials. Yole & System Plus Consulting Techday is a unique opportunity to meet the automotive professionals from the overall segments of the supply chain: from material and equipment suppliers to power electronic device manufacturer, including system integrators, car makers and more…

Make sure to be at the right place at the right time to discuss technical challenges, market issues, business opportunities and timelines for this growing EV/HEV market.

For more info. about the Yole & System Plus Consulting Techday, please contact: Camille Veyrier, MarCom Director.
ABOUT THE REPORTS:  

**Status of the Power Module Packaging Industry**  
Major evolutions in substrate, interconnection, and die-attach technologies, driven by EV/HEV, are transforming the power module packaging supply chain – Performed by Yole Développement (Yole)  

Companies cited in the report:  

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As well as:  
- **Status of the Power Electronics Industry**  
Long term growth of the power electronics market is driving 300mm wafer-based production. - Performed by Yole Développement (Yole)  
- **Automotive Power Module Packaging Comparison 2018**  
A cost-oriented review of power module packaging technologies for the automotive market. - Structure, process and cost report from System Plus Consulting  

ABOUT YOLE GROUP OF COMPANIES  

System Plus Consulting specializes in the cost analysis of electronics, from semiconductor devices to electronic systems. Created more than 20 years ago, System Plus Consulting has developed a complete range of services, costing tools and reports to deliver in-depth production cost studies and estimate the objective selling price of a product. System Plus Consulting engineers are experts in Integrated Circuits - Power Devices & Modules - MEMS & Sensors - Photonics – LED - Imaging – Display - Packaging - Electronic Boards & Systems. Through hundreds of analyses performed each year, System Plus Consulting offers deep added-value reports to help its customers understand their production processes and determine production costs. Based on System Plus Consulting’s results, manufacturers are able to compare their production costs to those of competitors. System Plus Consulting is a sister company of Yole Développement. More info on [www.systemplus.fr](http://www.systemplus.fr) and on [LinkedIn](https://www.linkedin.com) and [Twitter](https://twitter.com).
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 covering MEMS & Sensors - Imaging - Medical Technologies - Compound Semiconductors - RF Electronics - Solid State Lighting - Displays - Photonics - Power Electronics - Batteries & Energy Management - Advanced Packaging - Semiconductor Manufacturing - Software & Computing - Memory and more...

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. For more information, visit [www.yole.fr](http://www.yole.fr) and follow Yole on [LinkedIn](http://www.linkedin.com) and [Twitter](http://www.twitter.com).

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