

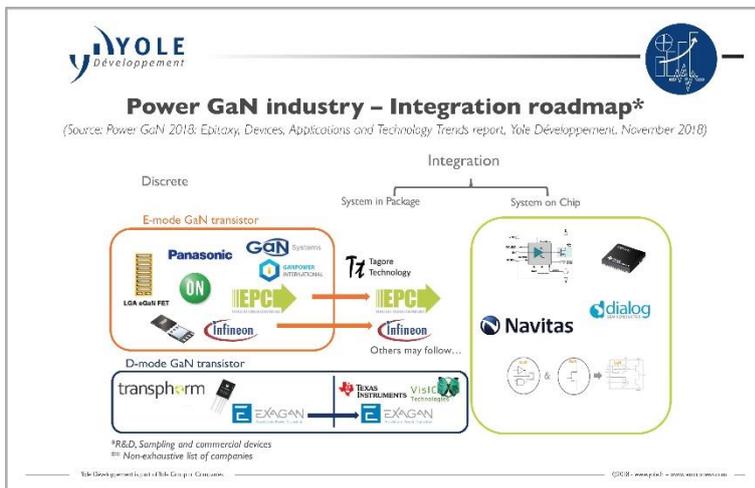


FOR IMMEDIATE RELEASE:

Would Apple change the power GaN world?

Extracted from: Power GaN: Epitaxy, Devices, Applications and Technology Trends report, Yole Développement | GaN Transistor Technology & Cost Comparison 2018 and Qorvo QPF4006 Power RF GaN FEM report from System Plus Consulting

LYON, France – December 19, 2018: Over a long period, industrial companies followed up at a distance the development of GaN-based solutions mainly managed by R&D institutes and laboratories. Today the context has changed. Under the updated of its annual report, [Power GaN: Epitaxy, Devices, Applications and Technology Trends](#), [Yole Développement \(Yole\)](#) identified, a lot of power electronics & compound semiconductor companies including leading players such as Infineon Technologies, STMicroelectronics... strongly engaged in significant projects of development. Some of them already introduce in their portfolio a GaN product. But it is not the majority. So what is the status of GaN technologies? Can we affirm a clear adoption of GaN products? What would be the main applications?... Business dream or reality, the power GaN industry has been deeply analyzed by the Power & Wireless team from Yole. The analysts propose you today to discover a snapshot of this industry.



Today, it is crystal-clear that, from theoretical point of view, GaN offers fantastic technical advantages over traditional Si MOSFETs; the technology is very appealing, and more and more players are entering; moreover the lowering of prices could make GaN devices a good competitor of the currently used Si-based power switching transistors. “Nevertheless the technical panorama is not clear yet; every manufacturer presents its solution on die design and

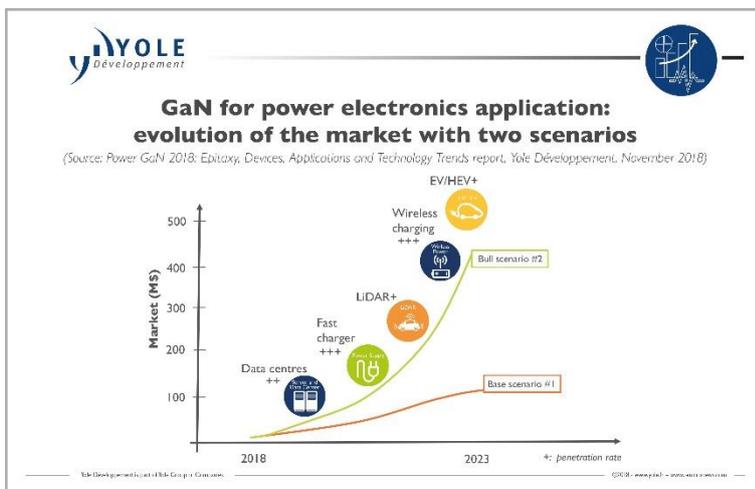
packaging integration. This brings to a strong competition which will accelerate technical innovations in terms of integration and better performances,” says **Elena Barbarini, PhD, Head of Department Semiconductors Devices at System Plus Consulting**

Even though the current GaN power market remains tiny compared to US\$32.8 billion silicon power market, GaN devices are penetrating confidently into different applications.

The biggest segment in the power GaN market is still power supply applications, i.e. fast charging for cellphones. This year, Navitas and Exagan introduced 45W fast-charging power adaptors with an integrated GaN solution.

Then, LiDAR applications are high-end solutions that take full benefit of high-frequency switching in GaN power devices.

And what about the EV/HEV¹ market? What is the status of GaN solutions in a market segment step by step dominated by SiC technology replacing Si IGBTs in main inverters? Therefore, Yole announces a US\$450 million SiC market in 2023 in its [Power SiC report](#).



“The accumulation of the market growth in various applicative markets, especially the power supply market segment which is the most important in that case, confirms our first scenario,” comments **Ana Villamor, PhD, Technology & Market Analyst at Yole**. *“Under this Base Case scenario, GaN market is expected to grow steadily. At Yole, we announce a GaN market to grow with 55% CAGR between 2017 and 2023”.*

However, this analysis is not the only way to see the tomorrow’s industry. Yole’s Power & Wireless team went further in their investigations. Is there any killer application that could cause the GaN power device market to explode? Yes possibly, Yole’s analysts said.

As matter of fact, several industrial players confirm that the leading smartphones manufacturer, Apple could consider the GaN technology for its wireless charging solution.

“It goes without saying that the potential adoption of GaN by Apple or another smartphone giant would completely change the market’s dynamics and finally provide a breath of life to the GaN power device industry,” comments **Ezgi Dogmus, PhD, Technology & Market Analyst and part of the Yole’s Power & Wireless team**. *“Indeed we imagine that after a company like Apple adopts GaN, numerous other companies would follow on the commercial electronics market.”*

What could be the added-value of GaN technology? Various players, such as EPC and Transphorm, have already obtained automotive qualification in preparation for GaN’s potential ramp-up. In addition BMW i Ventures’s investment in GaN Systems clearly demonstrates the automotive industry’s interest in GaN solutions for EV/HEV technology... Globally, Yole’s second scenario, named Bull Case

¹ EV/HEV: Electric Vehicle/Hybrid Electric Vehicle

Scenario is much more aggressive, conditioned by the adoption of GaN wireless charging solution by leading consumer manufacturers.

According to the market research, in this context, the GaN power business could reach around US\$423 million by 2023, with 93% CAGR² between 2017 and 2023.

The [Power GaN report, 2018 edition](#) conveys Yole's understanding of GaN implementation in different market segments. It delivers comprehensive market projections for GaN power discrete and the SoC/SiP³ market, and details Yole's understanding of the market's current dynamics and future evolution. This report also proposes an overview of the industry playground, covering the whole value chain: from epitaxy and device design, to device processing... A detailed description of Yole's technology & market report dedicated to the Power GaN industry is available on i-micronews.com, [power electronics section](#).

² CAGR : Compound Annual Growth Rate

³ SoC/SiP : System on Chip, System in Package

ABOUT THE REPORTS:

[Power GaN 2018: Epitaxy, Devices, Applications and Technology Trends](#)

GaN market growth is fed by Lidar, wireless charging and fast charging solutions. – Produced by Yole Développement (Yole).

Companies cited in the report:

Aixtron, Allos, Alpha&Omega, Amec, Amkor, Apple, ASE, AT&S, BMW, Coorstek, Delta electronics, Dialog Semiconductors, Dowa, Efficient Power Conversion, Egtronics, EpiGaN, Episil, Epistar, Evatran, Exagan, Fairchild, Finsix, Ford, Fuji Electric, GaN Systems, GaN Power, Imec, Infineon, IQE, LG electronics, Jedec, Kyma ...[Full list](#)

As well as:

▪ **[GaN Transistor Technology & Cost Comparison 2018](#)**

Dive deep into the technology and cost of GaN-on-silicon HEMTs from EPC, Transphorm, GaN Systems, Panasonic and Texas Instruments. - Produced by System Plus Consulting

▪ **[Qorvo QPF4006 Power RF GaN FEM](#)**

The first MMIC FEM targeting 5G base stations and terminals using a 0.15µm GaN-on-SiC process. - Produced by System Plus Consulting

Authors:

- **Ana Villamor**, PhD serves as a Technology & Market Analyst, Power Electronics & Compound Semiconductors. She is involved in many custom studies and reports focused on emerging power electronics technologies at Yole Développement, including device technology and reliability analysis (MOSFET, IGBT, HEMT, etc). . Previously Ana was involved in a high added value collaboration related to SJ Power MOSFETs, within the CNM research center for the leading power electronic company ON Semiconductor. During this partnership and after two years as Silicon Development Engineer, she acquired a relevant technical expertise and a deep knowledge of the power electronic industry. She holds an Electronics Engineering degree completed by a Master in micro and nano electronics, both from Universitat Autònoma de Barcelona (SP).
- As a Technology & Market Analyst, Compound Semiconductors, **Ezgi Dogmus**, PhD is daily contributing to the development of these activities with a dedicated collection of market & technology reports as well as custom consulting projects. Prior Yole, Ezgi was deeply involved in the development of GaN-based solutions at IEMN (Lille, France). Ezgi also participated in numerous international conferences and has authored or co-authored more than 12 papers. Upon graduating from University of Augsburg (Germany) and Grenoble Institute of Technology (France), Ezgi received her PhD in Microelectronics at IEMN (France).
- **Hong Lin**, PhD works as a Senior Technology and Market Analyst, Compound Semiconductors since 2013. She is specialized in compound semiconductors and provides technical and economic analysis. Before joining Yole Développement, she worked as R&D engineer at Newstep Technologies. She was in charge of the development of cold cathodes by PECVD for visible and UV lamp applications based on nanotechnologies. She holds a PhD in Physics and Chemistry of materials.
- As Head of Department Devices, **Elena Barbarini** is in charge of costing analyses for MEMS, IC and Power Semiconductors. She has a deep knowledge of Electronics R&D and Manufacturing environment. Elena holds a Master in Nanotechnologies and a PhD in PowerElectronics.
- **Yvon Le Goff** has joined System Plus Consulting in 2011, in order to setup the laboratory of System Plus Consulting. He previously worked during 25 years in Atmel Nantes Technological Analysis Laboratory as fab support in physical analysis, and 3 years at Hirex Engineering in Toulouse, in a DPA lab.
- **Véronique Le Troadec** has joined System Plus Consulting as a laboratory engineer. Coming from Atmel Nantes, she has extensive knowledge in failure analysis of components and in deprocessing of integrated circuits.

RELATED REPORTS

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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 and follow Yole on [LinkedIn](#) and [Twitter](#).

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