LYON, France – September 19, 2019: The power electronics industry is showing an healthy growth for several years now. According to its latest power electronics reports, Status of the Power Electronics Industry and Status of the Inverter Industry, Yole Développement (Yole) announces, in 2018, a US$53.4 billion inverter market as well as a US$17.5 billion for power semiconductor devices market segment.

“Key driving factors include electrical power conversion optimization and expansion, driven by electrification trends in transportation, CO₂ emission reduction goals, the development of clean electricity sources, and industrialization”, details Ana Villamor, Technology & Market Analyst at Yole.

“The biggest increase will be seen in IGBT modules, which is still driven by the requirement for high power efficiency and density from the main power applications”, adds Elena Barbarini, Head of Department Devices at System Plus Consulting. “Today, modules still represent 23% of the total market.”

The expected increase in the CAGR² of IGBTs during the coming years is directly linked with the current investments in manufacturing lines from various players. Indeed, some of the big players are preparing for 300mm production…

Yole Group of Companies, including Yole and System Plus Consulting investigates the power electronics world for a while. The Group publishes all year long a multiple collection of technology, market, reverse engineering and costing reports focused on the power electronic markets and related products. Both companies combine their technical expertise and market knowledge to deliver valuable and comprehensive analyses.

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1 IGBT: Insulated-Gate Bipolar Transistor
2 CAGR: Compound Annual Growth Rate
Among its numerous reverse engineering and costing analyses, System Plus Consulting also proposes in-depth technical & cost comparisons. Aim of these reports is to present the state of the art of the technology, highlight similarities and differences in design and manufacturing processes, measure the impact at the device level and evaluate the production cost. These reports are useful to evaluate a technology, compare it with competitive solutions and select the most relevant one for its own project. SiC MOSFET Comparison, GaN-Based Wall Charger Comparison and Automotive Power Module Packaging Comparison are the most well-known. But the company proposes additional topics including RF, MEMS, optics…

“The main driving application with a huge market potential and technological innovation is, without doubts, EV/HEVs,” explains Ana Villamor from Yole. “But let’s not forget that there are other applications that are boosted by electrification needs and by EV/HEVs…”

This is the case in renewable energy, which is boosted by clean driving trends and growing electricity consumption. More grid lines also need to be deployed to sustain greater amounts of required energy. Similarly, more energy storage systems need to be deployed for better distribution of the energy to the grid. The grid must also reach newly installed EV charging stations outside cities, enabling many cars to be plugged in at the same time with an acceptable charging time. Moreover, if we take into account automated driving and long term V2X communication, more data centers could be required, more LiDAR systems, along with other supporting technology.

The power electronics industry is so experiencing a shift in its dynamics. The shift comes from the increase of demand predicted for coming years, which translates into a move for 300mm waferbased production. In 2018 there was saturation of 200mm wafer demand, leading to wafer price rise instead of wafer supply. As of today, more than seven power electronics players have announced investments in new fabrication
capabilities, to be in production from 2021.

- Infineon has invested US$1.9 billion in Villach to build a second fab for power devices on 300mm wafers.\(^9\)
- STMicroelectronics has also started the expansion of its Agrate site for 300mm production, for Bipolar CMOS-DMOS, power MOSFETs and IGBTs.\(^10\)
- Another example is Bosch, which has also started building its 300mm fab in Dresden, preparing for the imminent increase in volumes for both automotive and IoT applications.\(^11\)
- Chinese players have also started the expansion to 300mm, like Silan Microelectronics or GTA Semiconductors, the latter having confirmed that it is working on its automotive-grade IGBT production line…

The need for increasing performance as well as the introduction of new materials with different technical properties have pushed manufacturers to find new solutions, not only at the silicon level, but also in packaging… Obviously, all innovations have a cost, thus the improvements by manufacturers must take this factor into account.

“A bigger power module can have a higher cost by itself, but we always have to consider the final impact on the integration and the flexibility of assembling”, explains Elena Barbarini from System Plus Consulting. “The fast evolution of technology on all design levels and the cost of modules are the two factors that in recent years eliminated the presence of a standard in power module design, and we will expect even more innovation in the future.”

Yole Group of Companies is planning a EV/HEV event in Germany, by the end of the year. Batteries, charging, WBG technologies, packaging solutions and more will be part of this program.

Detailed agenda & logistics will come soon on i-Micronews.com (Contact: Léonor Martin, Yole Développement).

Stay tuned!

\(^9\) Source: i-Micronews.com, May 2018
\(^10\) Source: EENewsAnalog article, January 2019
\(^11\) Source: i-Micronews.com, June 2017
\(^12\) IoT: Internet of Things
ABOUT THE REPORTS:

**Status of the Power Electronics Industry**
Long term growth of the power electronics market is driving 300mm wafer-based production. – Powered by Yole Développement (Yole).

Companies cited:
ABB, Alpha and Omega Semiconductor (AOS), Alstom, Amkor, Analog Devices, ASE Group, Bosch, BYD, Continental, Cree, CRRC, Danfoss, Denso, Incorporated, Diotec semiconductor, Episil, EXAGAN, Fuji Electric, GaN Systems, General Electric, Global Wafers, GTA semiconductor, HHGrace, Hitachi, Honda, Huawei, Infineon, Ingeteam, Littelfuse, MACMIC, Magnachip, Maxim Integrated, Microchip, Mitsubishi Electric, Monolithic Power Systems, Navitas, Nexperia… and more

**Status of the Inverter Industry**
Motor drive still powers the inverter market, with EV/HEV positively impacting overall market dynamics. – Powered by Yole Développement (Yole).

Companies cited:

**SiC MOSFET Comparison**
Discover and compare the state of the art: 22 SiC MOSFETs from Cree/Wolfspeed, Rohm, STMicroelectronics, Littelfuse, and Infineon. – Powered by System Plus Consulting

**GaN-Based Wall Charger Comparison**
The first wall chargers based on GaN technology from RAVPower, Aukey, Made in Mind, and Anker. - Powered by System Plus Consulting

**Automotive Power Module Packaging Comparison**
A cost-oriented review of power module packaging technologies for the automotive market. – Powered by System Plus Consulting

Authors of these reports:
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He received his PhD degree from Grenoble Institute of Technology (Grenoble INP) in France.

**Ana Villamor**, PhD serves as a Technology & Market Analyst, Power Electronics & Compound Semiconductors within the Power & Wireless division at Yole Développement (Yole). 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). In addition, Ana is leading the quarterly power management market updates released in 2017.

She holds an Electronics Engineering degree completed by a Master and PhD. in micro and nano electronics from Universitat Autonoma de Barcelona (SP).

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**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.
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 and on LinkedIn and Twitter.

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 and follow Yole on LinkedIn and Twitter.

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