Power electronics industry: China is playing a new role

OUTLINE:

- The global power electronics market accounts for US$17.5 billion, with a 4.3% CAGR between 2019 and 2025.
- In this industry, Yole Développement identifies three different major driving components: IGBT modules, silicon MOSFETs and SiC devices.
- The automotive market segment is the strongest market driver of this industry.
- The largest share of the power devices market is for silicon MOSFET devices. This segment accounts for 45% of the total power electronics market value.
- Chinese players are playing a key role within the today’s power electronics ecosystem.
- According to Yole Développement’s analysis, the supply chain reshaping will continue. Although big players continue to grow, the position of the top players is unlikely to change significantly.

“China is the leader in systems for several power electronics applications segments” asserts Anna Villamor, PhD. Technology & Market Analyst, Power Electronics & Compound Semiconductors within the Power & Wireless division at Yole Développement (Yole). Chinese companies such as BYD, Huawei, CRRC and Sungrow are amongst the leading players worldwide. However, in power electronic device manufacturing, China still strongly depends on foreign suppliers, which include Infineon Technologies, Fuji Electric and Mitsubishi Electric.

And Milan Rosina, PhD. Principal Analyst at Yole affirms: “Indeed, although China is the biggest market for electric and hybrid electric vehicles, foreign suppliers still provide a big proportion of power modules integrated into systems in China”.

In this context, both partners, Yole and System Plus Consulting investigate the power electronics industry and related disruptive technologies in depth. Their aim is to point out the latest innovations and underline the business opportunities.

Released today, the Status of the Power Electronic Industry 2020 report is one of the annual bestsellers proposed by the market research & consulting company Yole. This report delivers

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1 Extracted from: Status of the Power Electronic Industry 2020 report, Yole Développement, 2020
2 StarPower GD820HTX75P6H Tri-Pack IGBT Module, System Plus Consulting, 2020
3 CAGR: Compound Annual Growth Rate
Press Release

a detailed analysis of the power electronics industry, its latest market challenges and technical issues.

“The power electronics industry is showing a significant shift in 2020,” comments Ana Villamor from Yole. “In this report, we consider the numerous facts that have been happened since one year: the impact of the COVID-19 outbreak, the deep supply chain reorganization, the move towards 300mm wafers started few years ago, the China’s growing competence in power electronic devices manufacturing, the country’s efforts toward Made-in-China power electronics.”

Yole’s power electronics study gives detailed insights into global and China-specific supply chains, market trends and forecasts, player ranking and technology trends. This new report aims to closely examine the status of the entire power market, explore the market shares of the different device types and materials and much more...

In parallel, System Plus Consulting provides a full reverse engineering and costing study of the StarPower module GD820HTX75P6H. This Tri-Pack power module, in a P6 package from StarPower, drives 820 A with a voltage rating of 750 V. It uses copper pinfin dissipation structure for direct liquid cooling. Supported by a full teardown of the module’s components and housing, this report reveals StarPower’s packaging technological choices as well as the designs of the IGBT and diode dies used. System Plus Consulting’s report provides insights about technology data, manufacturing cost and the selling price of the module. It includes an estimated manufacturing cost of all the module’s components.

StarPower module GD820HTX75P6H - tilted optical view

What is the status of the power electronics industry? What are the key drivers of this industry? What are the impacts of the COVID-19 on the different power electronics market segments? Who are the key players to watch and their market positioning? What are the latest innovations? Yole and System Plus Consulting present today their vision of the power electronics industry.
Today, the largest share of the power device market is for silicon MOSFET devices, which accounts for 45% of the total value. The major application segments for silicon MOSFETs are automotive, portable & wireless, computing & storage and industrial. “They are pushed by needs for higher efficiency and increasing global communications”, explains Abdoulaye Ly, Technology & Market Analyst specializing in Electronic Power Systems at Yole. Despite the decrease of automotive and consumer end-system sales due to COVID-19 in the first half of 2020, there is an expected 1.4% CAGR between 2019 and 2025.

The other major part of the power electronics devices industry is the IGBT modules. This segment represents US$3.7 billion in 2019 and is traditionally dedicated to applications such as industrial and renewable energy converters. As detailed in Yole’ power electronics’ report, these applications are today driven by efficiency regulations or increase of clean energy goals, and they account for 46% of the total IGBT module market. Nevertheless, the key application for power IGBT modules is undoubtedly EV/HEV\(^3\), with an expected growth of 18% from 2019 to 2025, reaching US$5.4 billion by 2025. Indeed, EV/HEVs are being pushed by many countries, with subsidies to allow fast electrification of the passenger car fleet.

At the end, the SiC MOSFET market is also expected to be driven by EV/HEVs, as SiC-based modules keep being adopted by several players, such as Tesla and BYD, and competing directly with IGBT modules in the main inverter for more compact and efficient designs. Moreover, SiC discrete transistors are directly competing with Silicon MOSFETs in OBC\(^4\) systems for higher efficiency systems.

In this dynamic context, Yole’s report points out the key role of the Chinese market. Indeed, Chinese power semiconductor companies and the Chinese government are trying hard to change the situation in favour of domestic production of power electronic devices. Local players want to expand their manufacturing capacities in order to capture more added value in local markets and conquer new markets abroad.

For example, Wingtech raised US$818 million for Nexperia China to introduce high-power MOSFET production line, for both semiconductor and packaging.

Another good example is StarPower, one of the major power module manufacturers in China. That is the reason why System Plus Consulting’s team decided to deeply analyze one of StarPower’s IGBT, the StarPower module GD820HTX75P6H.

Amine Allouche, Technology & Cost Analyst within System Plus Consulting’s Power Electronics and Compound Semiconductors team comments: “Although China is the biggest market for electric and hybrid electric vehicles, foreign suppliers still provide a big proportion of power modules integrated into systems in China. However, the share of Chinese power module and die makers is increasing and the quality and performance of these devices is continuously increasing.”

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\(^3\) EV/HEV: Electric and Hybrid Electric Vehicle  
\(^4\) OBC: On Board Charger
improving. For sure, one of the most important power module manufacturers in China is today StarPower.”

Other new local companies are directly building 300mm foundries with power discrete and power IC\(^5\) capabilities like HHGrace or SiEn. There are growing trends for big Chinese companies to go public, such as CR Micro or BYD Semiconductor.

**Components supply chain in Greater China**

(Source: Status of the Power Electronics Industry 2020 report, Yole Development, 2020)

According to **Milan Rosina, PhD, Principal Analyst, Power Electronics and Batteries, at Yole**: “These companies have achieved a “mature and consolidated” status and they want to further expand, so an IPO\(^6\) is a good way to raise money relatively quickly.”

US-China technology and trade wars are giving more momentum to develop domestic manufacturing. Nevertheless, these US-China tensions have not impacted all power electronics segments in the same way. For instance, it is more critical to buy/sell components for defense and telecom market segments compared to motor drives. Some of the semiconductor manufacturers have not felt the difference before and after the trade. Although some leading power electronic players from outside of China are sceptical about China’s capability to develop and master challenging power electronic device technologies, China has shown in the past that it is able to overcome very difficult challenges.

All year long, Yole Développement and System Plus Consulting publish numerous reports and monitors. In addition, experts realize various key presentations and organize key conferences.

In this regard, Yole and CITC invite you to take part in two collaborative online forums covering power packaging and RF packaging: The Power and RF Packaging Virtual Forums on November 24 & December 1, 2020. Register on i-Micronews.

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\(^5\) IC : Integrated Circuit  
\(^6\) IPO : Initial Public Offering
In addition, do not miss **Semicon Europa** on November 10th, Munich, Germany and **PCIM Asia 2020** on November 16th, Shanghai, Germany. Stay tuned on **i-Micronews**!

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About our analysts

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. 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. Ana is author and co-author of several papers as well as a patent. She holds an Electronics Engineering degree completed by a Master and PhD. in micro and nano electronics from Universitat Autonoma de Barcelona (SP).

Milan Rosina, PhD, is Principal Analyst, Power Electronics and Batteries, at Yole Développement (Yole), within the Power & Wireless division. He is engaged in the development of the market, technology and strategic analyses dedicated to innovative materials, devices and systems. His main areas of interest are EV/HEV, renewable energy, power electronic packaging and batteries. Milan has 20 years of scientific, industrial and managerial experience involving equipment and process development, due diligence, technology, and market surveys in the fields of renewable energies, EV/HEV, energy storage, batteries, power electronics, thermal management, and innovative materials and devices. He received his PhD degree from Grenoble Institute of Technology (Grenoble INP) in France. Milan Rosina previously worked for the Institute of Electrical Engineering in Slovakia, Centritherm in Germany, Fraunhofer IWS in Germany, CEA LETI in France, and utility company ENGIE in France.

Abdoulaye Ly is a Technology & Market Analyst specializing in Electronic Power Systems at Yole Développement (Yole). As part of the Power Electronics & Wireless division at Yole, Abdoulaye’s expertise is focused on power electronics system design. Prior to Yole, Abdoulaye served as an electrical engineer and power electronics system engineer at Centum Adetel Transportation Solution for 3 years, where he was in charge of converter design. He also performed simulations for catenary free tramways, tested qualifying Auxiliary Power Supplies (APS) for railway applications and managed a team developing a new battery cooling system. Abdoulaye graduated with a technical degree in 2014 from Bethune University Institute of Technology and in 2017 received an electrical engineering degree from Grenoble Institute of Technology.

Amine Allouche is part of System Plus Consulting’s Power Electronics and Compound Semiconductors team. Amine holds a Master’s degree focused on Micro and Nanotechnologies for integrated Systems.

Guillaume Chevalier has joined System Plus Consulting in early 2018 to perform physical analyses. He holds a two-year university degree in technology of physical measurements and instrumentation technics.

About the reports

Status of the Power Electronic Industry 2020

China is reshaping the power electronic industry. – Performed by Yole Développement

Companies cited:

StarPower GD820HTX75P6H Tri-Pack IGBT Module
Tri-Pack power module from StarPower with direct liquid cooling pin-fin structure. – Performed by System Plus Consulting

Related reports:
- Power Electronics for Electric & Hybrid Electric Vehicles 2020
- Industrial Power Module Packaging Comparison 2020
- Compound Semiconductor Quarterly Market Monitor, Q2 2020
- Innoscience’s 650V GaN-on-Si Transistor
- Power SiC 2019: Materials, Devices, and Applications

About Yole Développement
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 as 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… More

About System Plus Consulting
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… More

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