LYON, France – November 7, 2016: The overall inverter market in 2015 exceeded US$ 47 billion driven by many market segments including EV/HEV\(^1\), PV inverters, rail traction, wind turbines and more. “With an impressive 6% CAGR until 2021\(^2\), the power converter is clearly driving the power passive components market”, announces the “More than Moore” market research and strategy consulting company, Yole Développement (Yole). Under its new power electronics report titled “Passive Component Technologies & Market Trends for Power Converters” Yole’s analysts detail this market evolution and propose a comprehensive overview of the latest technology trends. According to Mattin Grao Txapartegi, Power Electronics Analyst at Yole, CAGR\(^3\) between 2015 and 2021 of the power capacitor market reaches +10%. In parallel, during the same period, power inductor market CAGR is showing 8% growth.

Those figures are not the only results of Yole’s power electronics technology & market report. Indeed this analysis proposes as well a detailed description of related technologies. Moreover the consulting company is offering a comprehensive understanding of market dynamics for the following applications: EV/HEV, PV inverters, wind turbines, rail traction, UPS and industrial motor drives. For each market segments, key drivers have been identified and analyzed. And a technical roadmap is also detailed in this report.

Pushed by the power converter market, industrial companies are asking for more and more innovations, especially within the EV/HEV and renewable energy sectors. Those industrial sectors are showing new trends in power converter design and asking for new technical requirements.

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\(^1\) EV/HEV: Electric Vehicle/Hybrid Electric Vehicle

\(^2\) Source: Inverter Technology Trends and Market Expectations, Yole Développement, May 2016

\(^3\) CAGR: Compound Annual Growth Rate
Showing impressive market figures and asking for disruptive technologies, what is the status of the passive component industry for power converter applications? Yole is analyzing for you this dynamic ecosystem…

The passive components market including capacitors, inductors and transformers, resistors and laminated busbars for power electronics was worth US$3.8 billion in 2015. Electrification trends in transport, such as automotive and rail, together with the needs of renewable energy sources are making power electronics markets more and more stable. And this trend is very positive for tier II passive component suppliers.

In parallel, EV/HEV is undoubtedly the central market segment for such power devices. “The passive component market will follow the EV/HEV market evolution,” explains Mattin Grao Txapartegi from Yole. “At Yole, we forecast a strong growth for the next decade”. The automotive industry will grow from 17% of power capacitor demand in 2015 to 37% in 2021 and from 6% to 19% of inductor and transformer demand over the same period.

Yole’s report explores the EV/HEV market in detail, as well as the markets for PV inverters, wind turbines, rail traction, industrial motor drives and UPS.

Major power converter challenges can be defined as follow. Switching frequencies are rising, semiconductor junction temperatures increasing and systems shrinking. These three factors impact the required features of passive components directly or indirectly.

In the passive component report, Yole’s analysts explain the general trends that come from system or application level. These include large 1,500V direct current PV plants, HVDC line connections between off-shore or isolated wind turbine farms and the grid and 48V mild hybrid vehicle launches in Europe.

They also detail the current passive component technologies and the function that they perform in EV/HEV, photovoltaic, wind turbine, rail traction, industrial motor drives and UPS. For instance, while wirewound and steel grid resistors can be used for braking, pre-charge or energy dumping in general, thick film resistors are used for precision as snubber resistors.

In power applications, polypropylene film capacitors are becoming widespread, and have replaced electrolytic aluminum capacitors in many cases. But a coming automotive industry trend could still change the situation. Mild hybrid vehicles may adopt a single cooling loop in the next 2-3 years that would challenge converter designers. The

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4 UPS : Uninterruptible Power Supplies
5 HVDC : High-Voltage Direct Current
maximum temperature of the cooling system will be rated to 105°C, meaning temperature junction of the IGBTs will increase. Consequently, the DC link capacitors or laminated busbars will need to handle a temperature close to 120°C. The immediate effect would be the replacement of polypropylene DC link capacitors by polyester film or new material capacitors. Film alternatives like PEN\(^6\), PPS\(^7\), and PTFE\(^8\) can attain higher temperatures, each with advantages and drawbacks, which Yole has also analyzed. As well as identifying the companies that are working on new products for high temperature solutions.

New technologies are emerging to meet the more sophisticated needs of smaller, more efficient and more integrated converters, mostly in the SiC\(^9\) and GaN\(^10\) semiconductor fields, and in power packaging materials and techniques. Now passive component manufacturers also need to propose solutions that converter designers will be ready to implement.

Magnetic components also illustrate the challenges. One of SiC and GaN’s benefits come when driven at high frequencies, from hundreds of kilohertz to megahertz, which means magnetic core materials and designs need to be rethought. Capacitor manufacturers are proposing new design approaches to minimize inductance below 5\(\mu\)H. Partnerships between capacitor and laminated busbar manufacturers could enable complete offerings that will better fulfill all and each of the new requirements.

A detailed presentation of passive components report for power converter applications is available on i-micronews.com, power electronics reports section.

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6 PEN : Polyethylene Naphtalate  
7 PPS : Polyphenylene Sulfide  
8 PTFE : Polytetrafluoroethylene  
9 SiC : Silicon Carbide  
10 GaN : Gallium Nitride
New power converter trends require enhanced passive component technology solutions.

About Passive Components Technologies & Market Trends for Power Converters 2016 report

About the author:
Mattin Grao Txapartegi is a Power Electronics Analyst at Yole Développement. He is in charge of inverter architecture evolution and passive components, from capacitors to protection devices. Previously, he was an intern at the French car maker Renault, designing power converters for electric car chargers. He graduated from Grenoble INP with an Engineering degree in Electrical Systems, followed by a specialization in embedded systems for transportation. He then earned an advanced master’s degree in Aeronautics Engineering from Arts et Métiers ParisTech. During this time, he oversaw managerial, financial, and marketing fields within the aeronautics industry.

Companies cited in the report:

For more information about this report, please contact David Jourdan - Phone: +33 472 83 01 90

Founded in 1998, Yole Développement has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole Développement group has expanded to include more than 50 collaborators worldwide covering MEMS, Compound Semiconductors, LED, Image Sensors, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Nanomaterials, Power Electronics, Batteries & Energy Management and Displays.
The “More than Moore” company Yole, along with its partners System Plus Consulting, Blumorpho and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business.

Consulting & Financial Services: Jean-Christophe Eloy (eloy@yole.fr)
Reports: David Jourdan (jourdan@yole.fr)
Press Relations & Corporate Communication: Sandrine Leroy (leroy@yole.fr)

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