The passive components market that Yole Développement covers in this report include capacitors, inductors and transformers, resistors and laminated busbars for power electronics. This market was worth $3.8B in 2015. The overall passive market is driven by a growing power converter market which will expand at a compound annual growth rate (CAGR) from 2015-2021 of around 6%. Electrification trends in transport, such as automotive and rail, together with the needs of renewable energy sources are making power electronics markets more stable. This is very positive for tier II passive component suppliers.

Electric and hybrid electric vehicles (EV/HEV) will undoubtedly be the main industry propelling growth in the passive components market 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.

This report will explore the EV/HEV market in detail, as well as the markets for PV inverters, wind turbines, rail traction, industrial motor drives and uninterruptible power supplies (UPS).

### INCREASING DEMAND FOR POWER CONVERTERS WILL DRIVE THE PASSIVE COMPONENTS MARKET TO $6B BY 2021

The passive components market that Yole Développement covers in this report include capacitors, inductors and transformers, resistors and laminated busbars for power electronics. This market was worth $3.8B in 2015. The overall passive market is driven by a growing power converter market which will expand at a compound annual growth rate (CAGR) from 2015-2021 of around 6%. Electrification trends in transport, such as automotive and rail, together with the needs of renewable energy sources are making power electronics markets more stable. This is very positive for tier II passive component suppliers.

![Capacitor and inductor markets will grow fastest, mainly driven by the upcoming EV/HEV expansion](image)

### MAJOR PASSIVE TECHNOLOGY INNOVATIONS ARE NEEDED TO MEET CHALLENGING SYSTEM LEVEL REQUIREMENTS

Emerging applications such as EV/HEV and renewable energy bring new technical requirements and trends in power converter design. 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 this report, Yole Développement will first explain the general trends that come from system or application level. These include large 1,500V direct current PV plants, high-voltage direct current (HVDC) line connections between offshore or isolated wind turbine farms and the grid and 48V mild hybrid vehicle launches in...

The passive component business is vast, and local and global players have niches, making it a very fragmented market. Yole Développement has analyzed which passive component companies are the leaders in facing the upcoming technology challenges posed by system level trends.

Magnetic and resistor markets are very fragmented, with hundreds of local players and few global market leaders. In resistors and standard capacitors, though, the use of local distribution and worldwide distribution channels is a common practice. While power magnetics and laminated busbars are highly customized products.

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 maximum temperature of the cooling system will be rated to 105°C, meaning that the close environment will be hotter. 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 capacitors. Film alternatives like PEN, PPS, and PTFE can attain higher temperatures, each with advantages and drawbacks, which Yole Développement has analyzed in this report.

New technologies are emerging to meet the more sophisticated needs of smaller, more efficient and more integrated converters, mostly in the Silicon Carbide (SiC) and Gallium Nitride (GaN) 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 illustrate the challenges. One of SiC and GaN’s benefits comes 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 5nH. Partnerships between capacitor and laminated busbar manufacturers could enable complete offerings that will better fulfill all and each of the new requirements.

Embedded magnetics

THE PASSIVE COMPONENT BUSINESS IS VAST, AND LOCAL AND GLOBAL PLAYERS HAVE NICHES, MAKING IT A VERY FRAGMENTED MARKET

Yole Développement has analyzed which passive component companies are the leaders in facing the upcoming technology challenges posed by system level trends.

In the power capacitor market Panasonic, TDK/Epcos and Vishay continue to be the leaders. These large companies are also present in other passive component markets as their strategy has been to expand horizontally in order to provide full solutions. System level trends and their technology demands clearly impact both active devices and passive components. This report describes that market evolution, how the main players are positioning themselves, the alternative future technologies and much more.
The main horizontally integrated passive component manufacturers

<table>
<thead>
<tr>
<th>Capacitors</th>
<th>Magnetics</th>
<th>Resistors</th>
<th>Fuses, MOV, etc.</th>
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(Info Développement, October 2016)

OBJECTIVES OF THE REPORT

- Access the market for passive components, namely capacitors, magnetics, resistors and laminated busbars
- Understand the market dynamics for the related power electronics applications
- Have a clear overview of current technologies for passive components
- Identify the key drivers that will shape the market in the future
- Understand the main challenges and proposed innovations

COMPANIES CITED IN THE REPORT (non exhaustive list)


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