



INDUSTRY TRENDS: POWER DEVICES

The power electronics market is definitely in excellent health

The power electronics industry is enabling mega trends and will reach almost US\$41.5 billion in 2023. This market showed impressive general growth in 2018 to achieve US\$34.4 billion revenue at the end of the year. To be more precise, the discrete device market and the power IC¹ market will grow with a CAGR² 2017-2023 of 2.7% and 4.6% respectively, whereas the power module market will have a CAGR³ 2017-2023 of almost 8%³.

There are several reasons for this growth, but as confirmed by the 18% increase in 2017 in year-on-year global IGBT⁴ module sales, the major drive comes from dynamic EV/HEV⁵ power market⁶. Currently EV/HEV represents 29% of IGBT modules consumption, while by 2023 Yole Développement estimates it will represent over 43%. A similar situation is found in MOSFETs⁷ for EV/HEV applications, with a 5.9% market increase in 2017 over 2016. MOSFETs are widely used in various EV/HEV converters, in battery chargers handling roughly 3 to 6 kW, in 48V DC/DC⁸ converters and in micro-inverters for the stop-start function⁹. Power ICs for automotive is forecast to reach US\$2 billion by 2023 with a CAGR of 6.2% from 2018 to 2023. This is possible not only because of the expected increase in power trains to cater for the increase of EV/HEV sales, but also due to the addition of ADAS¹⁰ which is the predominant safety product offered both by luxury automobile makers such as Audi, BMW, Mercedes-Benz, Tesla, etc. and for mass market

passenger vehicles such as those offered by VW, Toyota, Honda, Ford, etc.

For a long time, the semiconductor industry also profited from the growth of the PV¹¹ segment, in part due to an accelerated installation boom in China, but today the status of this industry is different and future growth will be partially dependent on Chinese government subsidies. However, the growth of the PV market in other geographical regions will also lead to an increasing market for the forecast period. Motor drives is another big segment pushing the growth of the IGBT module market due to aggressive regulation targets. In fact, Yole Développement forecasts a CAGR of 4.6% for motor drives from 2017 to 2023.

The computing and storage market, including laptops and data servers is the second biggest market for MOSFETs, which is expected to achieve \$1.7B by 2023. The network and telecommunications market will get a boost thanks to the arrival of new communications technology such as 5G, with a CAGR²⁰¹⁷⁻²⁰²³ of 7.8%. Yole Développement forecasts Power ICs will benefit from multiple key end markets to deliver a 4.6% CAGR²⁰¹⁷⁻²⁰²³, in line with the general trend of the overall semiconductor industry.

New directions in power electronics driven by the new requirements of EV/HEV are just a few examples of how technology is evolving. There are still several issues with cost, product

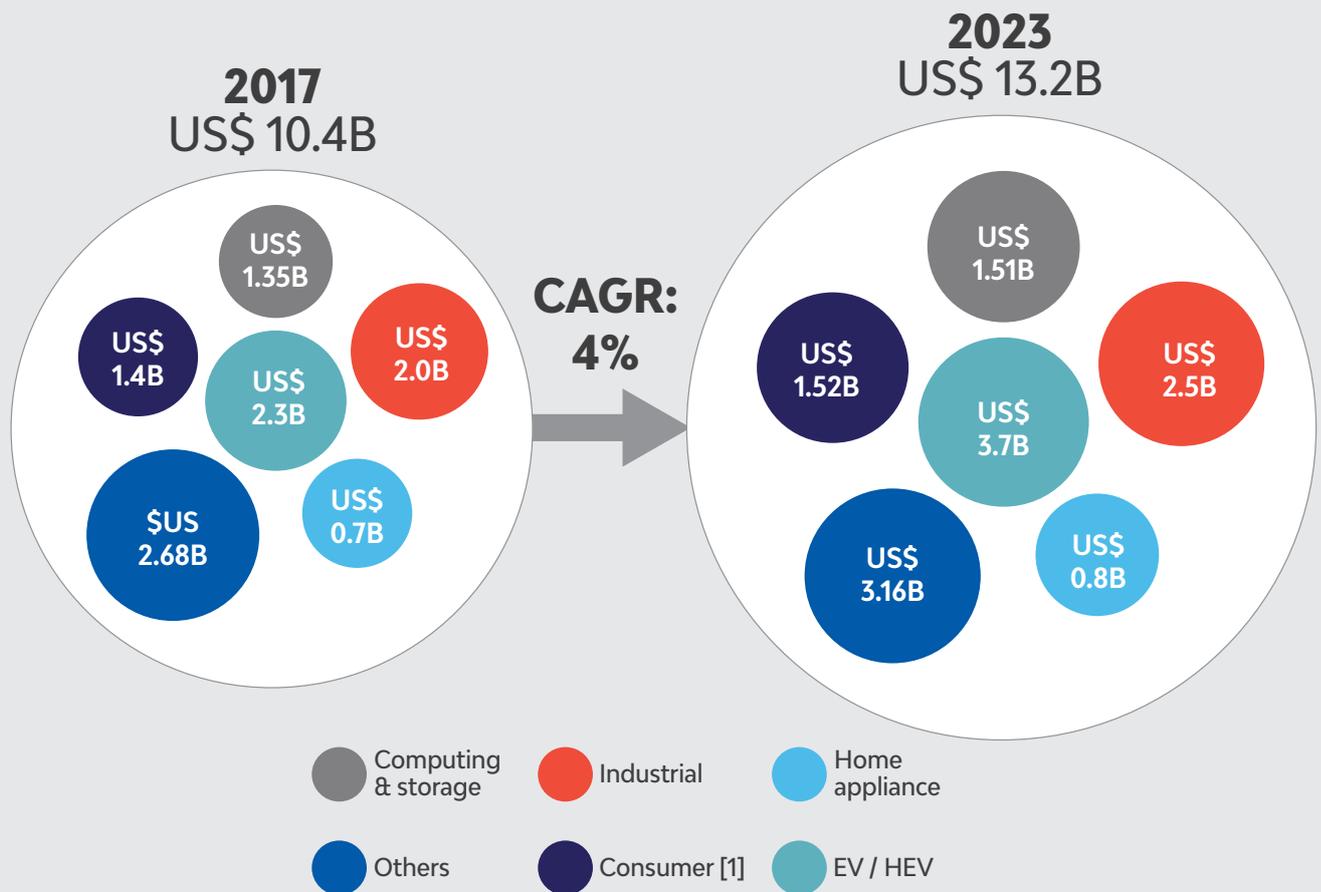
shortage, integration and reliability, but step by step the supply chain is stabilizing, passive components and drivers are being developed, and automotive qualification is starting.

It is still too early today to say how mainstream module technology will look like in an electric car in 10 years. However innovations are accelerating the evolution of power electronics, and other industries will no doubt be able to take advantage of these cost-effective emerging technologies. The power electronics industry, which represents a large ecosystem from semiconductor to packaging material suppliers and from passive components to converter system designers, is definitely in excellent health.

1. IC: Integrated Circuit
2. CAGR: Compound Annual Growth Rate
3. Source: Status of the Power Electronics Industry report, Yole Développement, 2018 and Introduction to the power IC market 2018 report, Yole Développement, 2018
4. IGBT: Insulated-Gate Bipolar Transistor
5. EV/HEV: Electric and Hybrid Vehicles
6. Source: IGBT Market and Technology Trends 2017 report, Yole Développement, 2017
7. MOSFET: Metal Oxide Semiconductor Field-Effect Transistor
8. DC: Direct Current
9. Source: Power MOSFET 2017: Market and Technology Trends report, Yole Développement, 2018
10. ADAS: Advanced Driver Assistance Systems
11. PV: Photovoltaic

2017 – 2023 power electronics driving application evolution Discrete and module IGBTs & MOSFETs markets

Source: Status of Power Electronics Industry report, Yole Développement, 2018



[1] Consumer segment includes Portable & wireless and Audio & Image applications

Dr. Ana Villamor serves as a Technology & Market Analyst, Power Electronics at Yole Développement. She is involved in many custom studies and reports focused on emerging power electronics technologies, including device technology and reliability analysis (MOSFET, IGBT, HEMT, etc.). In addition, Previously Ana was involved in a high-added value collaboration on 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 extensive relevant technical expertise and a deep knowledge of the power electronics industry. Dr. Villamor is author and co-author of several papers as well as a patent.