Following 2017’s trend, SiC transistors are clearly being adopted, penetrating smoothly into different applications. Yole Développement’s (Yole) forecast for the value of the SiC power semiconductor market is about $1.4B by 2023 with a compound annual growth rate (CAGR) of 29% for 2017-2023. Today the market is still being driven by diodes used in power factor correction (PFC) and photovoltaic (PV) applications. However Yole expects that in five years from now the main SiC device market driver will be transistors, with an impressive 50% CAGR for 2017-2023. This adoption is partially thanks to the improvement of the transistor performance and reliability compared to the first generation of products, which gives confidence to customers for implementation.

One of the topics that has been discussed in all Yole’s exchanges with industrial players is SiC adoption for automotive applications over the next 5-10 years. Its implementation rate differs depending on where SiC is being used. That could be in the main inverter, in the on-board-charger (OBC) or in the DC/DC converter. By 2018, more than 20 automotive companies are already using SiC Schottky barrier diodes (SBDs) or SiC MOSFET transistors for the OBC, which will lead to 44% CAGR through to 2023. Yole expects SiC adoption in the main inverter by some pioneers, with an inspiring 108% market CAGR for 2017-2023. This will be possible because nearly all carmakers have projects to implement SiC in the main inverter in coming years. In particular, Chinese automotive players are strongly considering the adoption of SiC.

PV has also caught our attention during recent months. China claimed almost the half of the world’s installations in the last year. This segment could have therefore helped grow the SiC device market, but new governmental regulations mean Yole has lowered its expectation for the segment.

System manufacturers are interested in implementing cost effective systems which are reliable, without taking into account if the power devices are silicon or SiC based. Therefore, even if it’s certified that SiC performs better than silicon, system manufacturers still get questions about long term reliability and the total cost of the SiC inverter.

This report gives an overview of SiC power device markets, including electric and hybrid electric vehicles (EV/HEV), charging...
Automotive-grade SiC power device

*Example: Tesla & STMicroelectronics*

A fast-evolving market is seeing plenty of activity from its participants, with several important events in 2017-2018. In February 2018, Cree announced a 180° turnaround in its strategy on its investor day, after the abortive sale of its Wolfspeed business to Infineon. The company decided to instead focus on Wolfspeed which, despite being Cree's smallest business, is the market leader in both the SiC wafer and SiC power device markets as of 2017. This strategy pivot will allow Cree to invest more into its SiC activities, expanding wafer, epiwafer and device capacity and prepare for market growth. On the other side of the abortive acquisition, Infineon has also developed its SiC power business. The company signed a long term SiC wafer supply agreement with Cree and began to actively promote its CoolSiC™ MOSFETs at different power electronic tradeshows and conferences in 2018.

Meanwhile, excitement surrounds Tesla’s adoption of SiC MOSFETs in its electric vehicles. This had been rumoured since 2016, but without detailed information about whether it would be in the OBC and/or main inverters. Confirmation came through reverse engineering, which shows that the Model 3 uses STMicroelectronics’ 1-in-1 top lead frame module, containing two SiC MOSFETs.
A foundry model is clearly forming which facilitates fabless and fab-lite companies to launch SiC products and make the technology more accessible. But there was also short supply of foundry services in 2017. A new 6" wafer foundry, Clas-SiC Wafer Fab Limited (6") was founded in 2017, with the entire SiC team from Raytheon, which has stopped its SiC activities. Taiwanese foundry Episil is also now active.

This report provides an overview of the SiC power industry, covering the value chain from material to epitaxy to module. It also outlines Yole’s understanding of the market’s current dynamics and future evolution.

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### OBJECTIVES OF THE REPORT

- Provide a clear understanding of the SiC power industry, covering markets from wafer to discrete and module level, with valuations in units and $M.
- Analyze the market drivers and bottlenecks of the SiC power industry by studying SiC adoption by different end applications and supply chains.
- Understand the status of SiC power device technology
- Describe the industry landscape

### RELATED REPORTS

- Cree-Wolfspeed
- Tesla Model 3 Inverter with SiC Power Module from STMicroelectronics
- UnitedSiC UJN1205K 1200V SiC JFET

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