

# E-mobility: towards SiC adoption <sup>1</sup>

## OUTLINE:

- **Market forecasts:**  
Yole expects that the PHEV<sup>2</sup> and BEV<sup>3</sup> market will grow with 37.3% and 44% CAGR<sup>4</sup><sub>2020-2026</sub>.  
The converter market for xEV<sup>5</sup> will be worth more than US\$28.8 billion in 2026 with a CAGR<sub>2020-2026</sub> of 27.7%.  
The market value for semiconductor power electronic devices for xEVs will reach US\$5.6 billion in 2026 with a CAGR<sub>2020-2026</sub> of 25.7%.
- **Technology trends:**  
Strong electrification is required to avoid penalties.  
Optimal system integration is one of the ways to increase the efficiency of the power train.  
Modular systems and vehicle platforms have been announced by the main OEM<sup>6</sup>s.
- **Supply chain:**  
All players have to adapt their strategy to meet CO<sub>2</sub> emission reduction targets.  
OEMs are re-allocating the manufacturing production (xEV and ICE<sup>7</sup>) over their existing sites.  
China is still dominating BEV but there is a big push for PHEV in Europe
- **Latest news: Power SiC – Life in The Fast Lane as SiC Penetration Accelerates – Webcast on March 4, 2021. Register on [i-Micronews](#).**

*“There are basically three converter types in an electric car: the main inverter, DC/DC<sup>8</sup> and OBC<sup>9</sup>.” asserts **Ana Villamor, Technology & Market Analyst, Power Electronics at Yole Développement (Yole)**. “The main inverter is the largest market among the different converters due to the higher power levels, leading also to the highest content of power semiconductors.”*

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<sup>1</sup> Extracted from: [Power Electronics for E-Mobility 2021](#), Yole Développement

<sup>2</sup> PHEV: Plug-in Hybrid Electric Vehicles

<sup>3</sup> BEV: Battery Electric Vehicle

<sup>4</sup> CAGR: Compound Annual Growth Rate

<sup>5</sup> xEV: Any type of electrified vehicle (including MHEV, HEV, PHEV, BEV, FCEV)

<sup>6</sup> OEM: Original Equipment Manufacturer

<sup>7</sup> ICE: Internal Combustion Engine (thermal motor)

<sup>8</sup> DC/DC: Direct Current

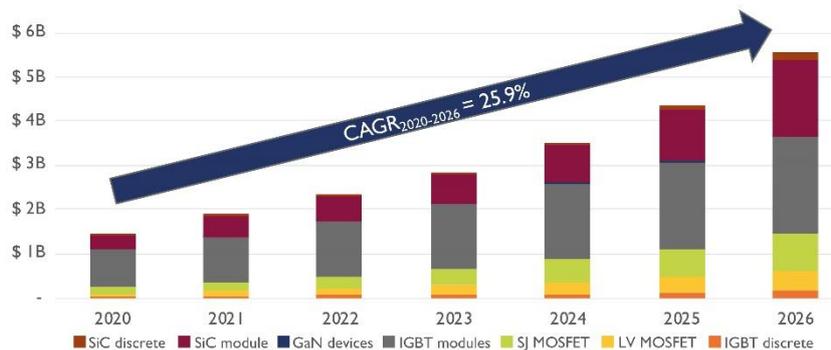
<sup>9</sup> OBC: Onboard Charger

Thus, the main inverter market is expected to reach US\$19.5 billion by 2026, representing 67% of the total EV/HEV converter market, with a CAGR of 26.9%.

Regarding the power semiconductor market, its value is expected to triple from 2020 to 2026, driven by a major technology battle between IGBT<sup>10</sup> and SiC<sup>11</sup> modules. Indeed, SiC modules are presently still about x3 the cost of a 650V IGBT module, but this difference will shrink when larger volumes are produced, with the transition to 8-inch wafers, and with the penetration of 1,200V devices for higher battery voltages.

### 2020–2026 semiconductor power device market for xEV in \$B

(Source: Power Electronics for E-Mobility 2021 report, Yole Développement, 2021)



In this context, Yole investigates disruptive technologies and related markets in depth, to point out the latest innovations and underline the business opportunities.

Released today, the [Power Electronics for E-Mobility 2021 report](#) provides an overview of the main global drivers for vehicle electrification as well as drivers for each vehicle electrification approach. It also analyzes the changes in business models, synergies with other EV/HEV<sup>12</sup> business segments and other applications outside of EV/HEV. Including market trends and forecasts, supply chain, technology trends, technical insights and analysis, take away and outlook, this study delivers an in-depth understanding of the ecosystem and main players' strategies.

What are the economic and technological challenges of the EV/HEV industry? What are the key drivers? Who are the suppliers to watch, and what innovative technologies are they working on? What are the key technology trends that will influence the power electronic system and component choice in the future? What are the impacts of the COVID-19 crisis on the EV/HEV industry?

Yole presents today its vision of the power electronics for e-mobility industry.

<sup>10</sup> IGBT: Insulated Gate Bipolar Transistor

<sup>11</sup> SiC: Silicon Carbide

<sup>12</sup> EV/HEV: Electric Vehicle/ Hybrid Electric Vehicle

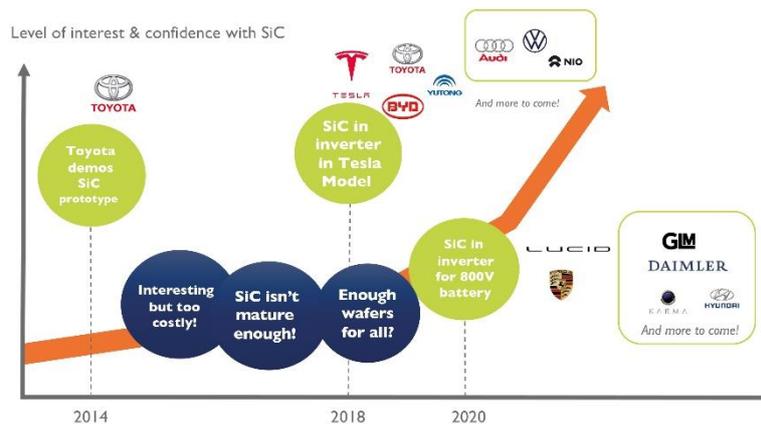
As analyzed by Yole’s team in the new Power Electronics for E-Mobility 2021 report, the EV/HEV supply chain continues to be impacted by the increased demand and technology trends. Although the leading semiconductor manufacturers for EV/HEV remain the same as for other power applications. It includes Infineon Technologies, STMicroelectronics, Hitachi, Mitsubishi Electric, ON Semiconductor. Other companies, Tier 1s, OEMs, power semiconductor manufacturers, and pure module newcomers, are now offering power modules for EV/HEV. A similar situation occurs with the battery design and manufacturing, where OEMs such as Tesla and GM are further trying to control their supply chains.

According to **Milan Rosina, Principal Analyst, Power Electronics & Batteries at Yole:** *“Competition at OEM level has also opened two main fronts: on the one hand, there are the traditional OEMs with established markets and known brands that are transforming their business towards electric vehicles. On the other hand, pure EV OEMs are popping up in the different regions of the world (such as NIO, Rivian, Rimac, Xpeng, and Hozon), some of which are rapidly increasing their volumes year after year (lead by Tesla)”.*

The new car models being launched often offer better performance/cost ratio, and this has led to a continuous reshaping of the top 10 vehicle sales.

### SiC adoption by xEV - Tesla and 800V effects in 2021

(Source: Power Electronics for E-Mobility 2021 report, Yole Développement, 2021)



SiC is now walking the EV/HEV red carpet. Over the last couple of years (and especially since Tesla introduced SiC in their Model 3 main inverter), there has been much noise around SiC adoption in EV/HEV. But not all converters or all types of electrification are suitable for this expensive material. Without a doubt, BEV is the winner due to the requirements of a long driving range and fast charging time (km driven by charge time). Therefore, the increased cost of the converter is repaid, as the efficiency of the converter will improve, allowing battery savings. It is no surprise then that the use of SiC in the main inverter has become a common goal for the leading OEMs, with players such as Daimler and Hyundai soon including it in their main inverters. Who will be next?

Today, there is already a good portfolio of SiC devices with SiC dies coming from Infineon Technologies, Cree (Wolfspeed), and STMicroelectronics. Many semiconductor players are targeting SiC modules for EV applications, and the SiC module market is expected to reach 32% of the total EV/HEV semiconductor market by 2026.



In this context, Yole, its partner System Plus Consulting and Wolfspeed bring together valuable speakers for the Power SiC – Life in The Fast Lane as SiC Penetration Accelerates – Webcast on March 4, 2021. This event will be presented by Dieter Liesabeth, Director Strategic Business Development Automotive at Wolfspeed, Amine Allouche, Technology and Cost Analyst at System Plus Consulting and Ezgi Dogmus PhD, Team Lead Analyst in Compound Semiconductor & Emerging Substrates in the Power

& Wireless Division at Yole.

“Wolfspeed is tirelessly working to implement an ecosystem around SiC based products for the electronic power industry,” explains **Dieter Liesabeth from Wolfspeed**. “We are delighted to help create a cleaner planet by enabling efficient renewable energy systems and electrical vehicles with more range and lower consumption to reduce energy waste. I’m looking forward to sharing our view of the future with the audience.”

Register on [i-Micronews](#).

All year long, Yole Développement publishes numerous power electronics-related reports and monitors. In addition, experts realize various key presentations and organize key conferences.

Make sure to be aware of the latest news coming from the industry and get an overview of our activities, including interviews with leading companies and more on [i-Micronews](#). Stay tuned!

### Press contacts

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### About our power electronics 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 Autònoma 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, Centrotherm in Germany, Fraunhofer IWS in Germany, CEA LETI in France, and utility company ENGIE in France.

### About the report

#### **Power Electronics for E-Mobility 2021**

*Strict CO2 targets will push EV/HEV share to 38% of all passenger vehicles in 2026, representing a large market opportunity for various semiconductor technologies and power devices.* – Performed by Yole Développement

#### **Companies cited:**

Ankai, Aptiv, Audi, BAIC, BMW, BMW-Brilliance, BorgWarner, Bosch, Broad-Ocean, Brusa, BYD, CATL, Continental, CRRC, Daimler, Dana, Danfoss, Delphi, Delta Electronics, Denso, FAW, FCA, Ford, Fuji Electric, Geely, GKN, GM, Hella, Hitachi, Honda, Huayu, Hyundai, Infineon, Isuzu, JAC, Jaguar Land Rover, LiAuto, Kia, LG Chem, Macmic, Mahle, Mahindra, Mazda, Mitsubishi Electric, Mitsubishi Motors, Nichicon, Nidec, NIO, Nissan, Panasonic, Porsche, Proterra, PSA, Renault, Ricardo, SAIC, Samsung SDI, Scania, Schaeffler, Shinry, Siemens-Valeo, Solaris, Starpower, Tesla, Subaru, Tata Motors, Toshiba, Toyota, UAES, Valeo, Volkswagen, Volvo, Yutong, Xpeng and more...

### Related reports:

- [Status of the Power Electronics Industry 2020](#)
- [Status of the Power Module Packaging Industry 2020](#)
- [Li-ion Battery Packs for Automotive and Stationary Storage Applications 2020](#)
- [Power SiC: Materials, Devices and Applications 2020](#)
- [SiC Transistor Comparison 2020](#)
- [Silicon IGBT Comparison 2021](#)

### 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 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](#)

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