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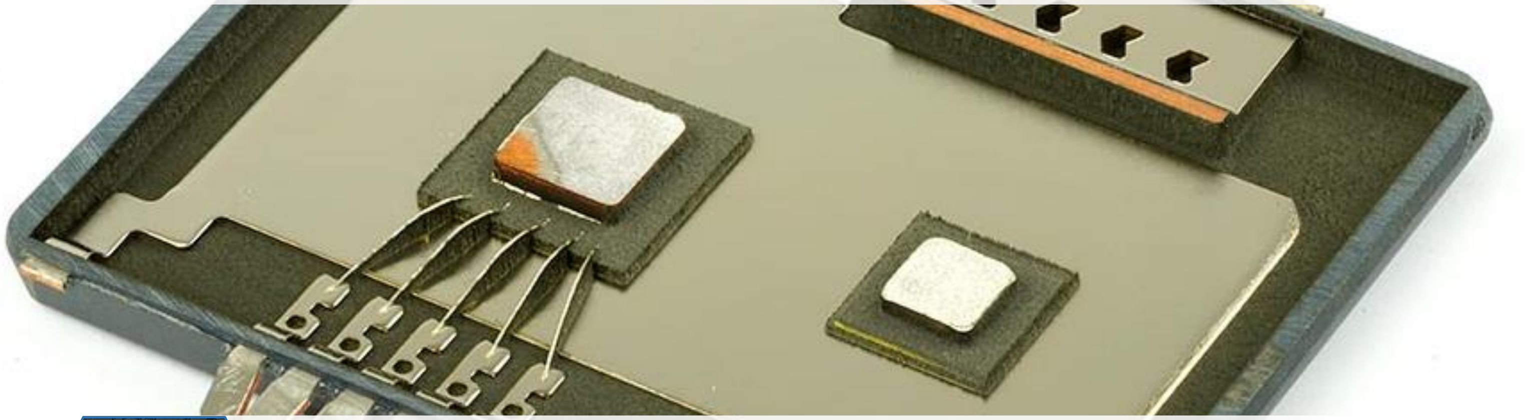
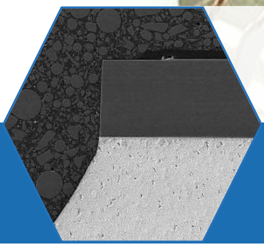
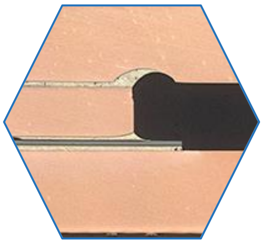
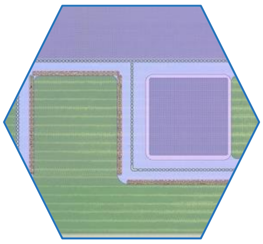




DENSO SiC Power Module in the Toyota Mirai II

Discover the technology, design, and cost analysis of DENSO's SiC module, the first to be used in fuel cell electric vehicles.





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The new environmental regulations to reduce average CO2 emissions, along with automotive trends, play in favor of greater vehicle electrification and faster deployment of electric vehicles/hybrid electric vehicles (EV/HEVs). Yole Développement expects the EV/HEV market to reach 41 million vehicles by 2026 according to the Power Electronics for E-Mobility 2021 report.

Numerous carmakers continue qualifying SiC devices in main inverters, OBC, and DC/DC converters for their next-generation models. Toyota is one of the pioneers in integrating SiC dies in their vehicles and, now it is the first car maker using a SiC MOSFETs in fuel cell electric vehicle (FCEV). In fact, the Toyota Mirai II integrates a SiC based power module in the boost converter.

In this context, System Plus Consulting provides a full reverse costing study of the DENSO SiC Power Module in the Toyota Mirai II.

Supported by a full teardown of the module, this report reveals DENSO's technology choices in its SiC MOSFET, as well as the design of the module's packaging and diode chip. The module is assembled with the standard molding technology of Denso and uses spacer for better thermal dissipation. The two dies are assembled with clips and wire bonding.

Detailed optical and SEM images with precise measurements show the structure of the transistor and the diode. Then a complete analysis of the supply chain is performed, and the dies process flow is described step-by-step.

This report provides insights into technology data, manufacturing cost, and selling price of the module. Also furnished is an estimated manufacturing cost of all the module's components, as well as a selling price analysis.

COMPLETE TEARDOWN WITH:

- Detailed optical and SEM photos
- Precise measurements
- Manufacturing process flow
- Supply chain evaluation
- Manufacturing cost analysis
- Estimated selling price

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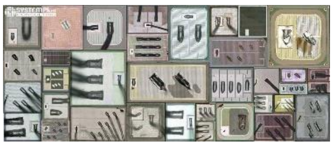

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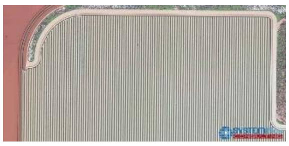

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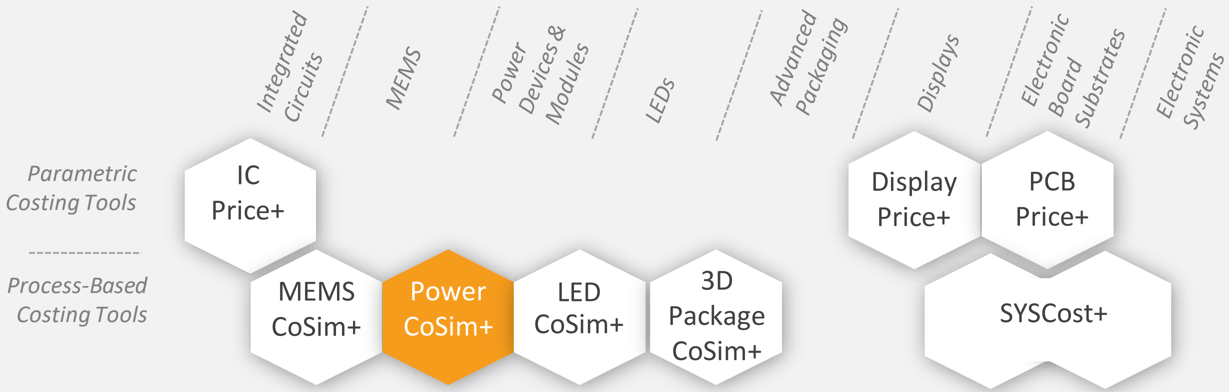

Our analysis is performed with our costing tool Power CoSim+.

System Plus Consulting offers powerful costing tools to evaluate the production cost and selling price from single chip to complex structures.

Power CoSim+

Cost simulation tool to evaluate the cost of any Power Electronics process or device from single chip to complex structures.

WHAT IS A REVERSE COSTING®?

Reverse Costing® is the process of disassembling a device (or a system) in order to identify its technology and calculate its manufacturing cost, using in-house models and tools.

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System Plus Consulting is specialized in the cost analysis of electronics from semiconductor devices to electronic systems.
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