WHAT'S INSIDE

Process models unmask power device costs

System Plus Consulting can use physical samples to reveal critical information about device manufacturing methods, says Michel Allain, the company's general manager.

Michel Allain, General Manager, System Plus Consulting

In movies, how companies find out about each other's technology can be a matter of high intrigue, with industrial spies risking their lives for secrets. But in the power electronics industry Nantes, France's System Plus Consulting offers a much simpler way to get competitive information. Using data System Plus gains from analysing devices in its labs, it builds process and cost models that can help device buyers and rival manufacturers.

"Our customers can't normally go from what they see in a device to building a process," said Michel Allain, System Plus' general manager. "Manufacturers know their own processes, but sometimes they want help in order to know their competitors' processes. Maybe a customer from automotive or telecom doesn't have in-depth knowledge of power device technology, and so they are not always able to identify the process from a sample. We can help."

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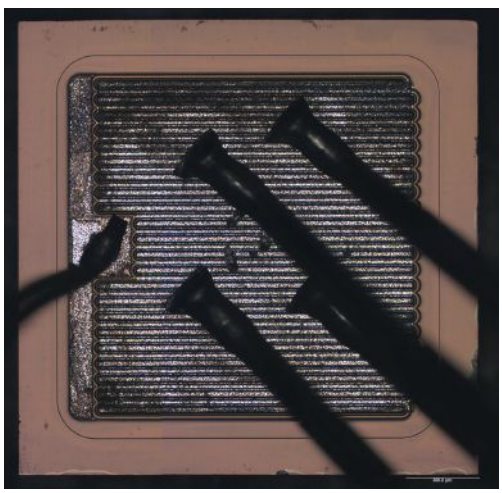
Though System Plus Consulting was founded to design semiconductors and integrated circuits, it started to analyse IC costs 20 years ago. After building cost models for its own use, it began offering costing services based on them, Allain explained. "We refined these cost models over the years, sold some tools and expanded the service outside ICs to systems, boards, transistors, LEDs and MEMs," he said.

Then, 10 years ago, System Plus was pulled into analysing power electronics by customers in the automotive sector, where such devices, along with controllers and sensors, were playing an increasingly important role. "These devices were taking a larger share in the electronic systems they had to implement in the cars," Allain explained. "The electronics themselves were also becoming a larger share of the cost of the car. They felt they needed to understand the cost structure to better negotiate with the electronics providers."



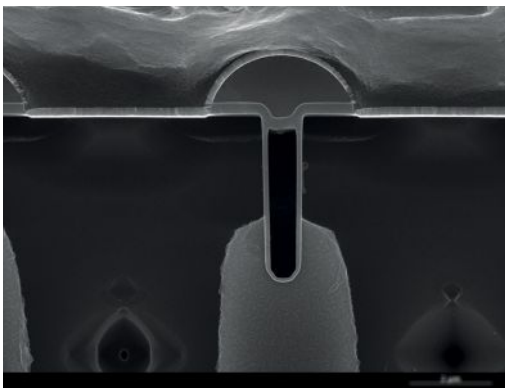
Hands-on experience: System Plus consulting has been producing cost analyses of SiC transistors based on physical analysis. (Courtesy of System Plus Consulting)

When requested to analyse unfamiliar discrete components or modules in this way, System Plus must build completely new cost models. "We collect data from several sources," Allain said. "First we investigate devices in our own laboratory to build and compare processes. We compare that to what's published by the manufacturer, or in its patents. Then we put it into our cost model flow-chart, where we can enter the process step-by-step. At each step we associate a piece of equipment, parameters and materials. We appraise the structure, build the process flow, and send back a report on the prospects of price reduction. Once we have established that for Infineon superjunction technology, for example, we can reuse it to analyse any type of transistor."

Thanks to such efforts System Plus developed the first widely-available cost model for power electronic devices. More recently, it has been exploiting this knowledge together with Lyon, France, based market analysts Yole Développement. "This business came from our customers first, because then there were no cost models on the market," Allain said. "Then we had the idea to use it to publish some reports on innovative devices like SiC transistors, JFETs, superjunction MOSFETs. And so we've been working with Yole Développement to define what the interesting, innovative devices are and to publish reports based on that."

Meanwhile, other power device makers have enlisted System Plus' help, including a tier-one EV/HEV automobile system manufacturer. "They are still using IGBTs, but have been thinking of using SiC for future generations," Allain said. "They asked us to analyse actual modules and simulate what could be the manufacturing cost using SiC diodes and MOSFETs instead of silicon."

But progress is slow in automotive compared to photovoltaic inverters, where System Plus has found SiC devices for at least four years. "We now have analysed a number of PV inverters, ranging



Gateway to better negotiations: Knowing device details, like this MOSFET gate structure, can put purchasers in a better position to negotiate price reductions. (Courtesy of System Plus Consulting)

from a few kW to over 20 kW," Allain said. "We can compare SiC to silicon solutions on cost and size reduction, rather than performance. SiC devices are increasingly used in PV inverters, where there is a lot of competition and investment. In automotive it seems it is not so easy. Car manufacturers are still thinking about it, but so far we haven't seen any active projects."

And while cost is always important Allain advises companies considering adopting new technologies, like wide-bandgap devices, to look at the bigger picture. "Cost is a major parameter in choosing between technologies, but it's only one," he said. "«It's also important to have an idea of how the technology can evolve in the future - what's the cost objective of a product or technology? If you start with low yield, there is much more possibility to decrease price. It's not so easy if you already have an optimised cost from the beginning. Market studies will give an approach in terms of quantity – if a product's successful then the cost will be reduced. Of course when the cost is reduced, the curve is not the same for different technologies. Knowing how quickly cost will be reduced isn't so easy."

www.systemplus.fr

Michel Allain, General Manager, System Plus Consulting
Michel Allain has been working for System Plus for more than 15 years, introducing cost simulation. Over the previous 15 years he held positions in ten different semiconductor industry companies, including startups, such as an IC design centre in Singapore. He holds a master's degree from the ENSEA graduate school of electrical engineering and computer science in Paris, France.