

Wide Bandgap Analog and Mixed-signal IC Design for Advanced Power Electronics

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Economy and performance are benefits that come with high power density power electronics, just as in the case of VLSI electronics. High density power electronics require the heterogeneous integration of disparate technologies including power semiconductor devices, driver, protection and control circuitry, passives and voltage isolation techniques into single modules. Such integration activity was central to the Google Little Box Challenge competition conducted last year. One of the keys to advancing power electronic integration has been the commercial reality of wide bandgap power semiconductor devices made from silicon carbide and gallium nitride. The ability to design and manufacture wide bandgap *integrated circuits* as drivers, controllers, and protection circuitry allows them to be packaged in close proximity to the power device die to minimize parasitics that would adversely impact system performance. These impacts include excessive ringing, noise generation, power loss, and, potentially, self-destruction. This talk will describe the state of the art in wide bandgap analog and mixed-signal IC design including example circuits such as amplifiers, data converters, controllers, and protection circuits and their integration into power electronic platforms. A synthesis tool under development for heterogeneous power circuit layout will be briefly described as a capstone to the application space descriptions.