

High Performance GaN HEMTs for mmWave Applications

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GaN/AlGaN HEMTs offer a unique combination of high electron velocity and breakdown fields making them the prime candidate for the highest performance mmWave solid-state power amplifiers. GaN-based solid-state power amplifiers offer compact, low-cost, reliable alternatives to traveling wave tube technology. Significant research has resulted in unprecedented advances in the performance and uniformity of GaN HEMT epilayers, with demonstrations of near-theoretical power performance from L- to Q-band. Rockwell Scientific (RSC) has developed novel metalization schemes, with sub-quarter-micron gates and unique epitaxial designs that permit high-performance devices without sacrificing yield. Leveraging these advancements, we demonstrated GaN HEMTs with the world's highest power density of any solid-state device at 40 GHz. However, considerable challenges remain in improving gain, efficiency, device uniformity, MMIC performance, and above all, reliability. Present status of RSC's GaN technology, and our approaches to address the challenges facing GaN HEMT technology will be discussed.