

## Pseudomorphic HEMT Manufacturing Technology for Multifunctional Ka-Band MMIC Applications

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C.S. Wu, C.K. Pao, W. Yau, H. Kanber, M. Hu, S.X. Bar, A. Kurdoghlian, Z. Bardai, D. Bosch, C. Seashore and M. Gawronski. "Pseudomorphic HEMT Manufacturing Technology for Multifunctional Ka-Band MMIC Applications." 1995 Transactions on Microwave Theory and Techniques 43.2 (Feb. 1995 [T-MTT]): 257-266.

We have demonstrated very good performance, high yield Ka-Band multifunctional MMIC results using our recently developed 0.25- $\mu\text{m}$  gate length pseudomorphic HEMT (PHEMT) manufacturing technology. Four types of MMIC transceiver components--low noise amplifiers, power amplifiers, mixers, and voltage controlled oscillators--were processed on the same PHEMT wafer, and all were fabricated using a common gate recess process. High performance and high producibility for all four MMIC components was achieved through the optimization of the device epitaxial structure, a process with wide margins for critical process steps and circuit designs that allow for anticipated process variations, resulting in significant performance margins. We obtained excellent results for the Ka-band power amplifier: greater than 26 dBm output power at center frequency with 4.0% standard deviation over the 3-in. wafer, 2-GHz bandwidth, greater than 20 percent power-added efficiency, over 8 dB associated gain, and over 10 dB linear gain. The best performance for the Ka-band LNA was over 17 dB gain and 3.5 dB noise figure at Ka-band. In this paper, we report our device, process, and circuit approach to achieve the state-of-the-art performance and producibility of our MMIC chips.

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