Abstracts

A Novel Monolithic HBT-p-i-n-HEMT Integrated Circuit with HBT Active Feedback and p-i-n Diode Variable Gain Control

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We report the world's first functional MMIC circuit integrating HBT's, HEMT's, and vertical p-i-n diodes on a single III-V substrate. The 1-10 GHz variable gain amplifier monolithically integrates HEMT, HBT, and vertical p-i-n diode devices has been fabricated using selective MBE and a merged processing technology. The VGA offers low-noise figure, wideband gain performance, and good gain flatness over a wide gain control range. A noise figure below 4 dB was achieved using a HEMT transistor for the amplifier stage and a wide bandwidth of 10 GHz. A nominal gain of 10 dB was achieved by incorporating HBT active feedback techniques and 12 dB of gain control range was obtained using a vertical p-i-n diode as a varistor, all integrated into a compact 1.5 x 0.76 mm^2 MMIC. The capability of monolithically integrating HBT's, HEMT's, and p-i-n's in a merged process will stimulate the development of new monolithic circuit techniques for achieving optimal performance as well as provide a foundation for high performance mixed-mode multi-functional MMIC chips.

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