Abstracts

X- and Ku-band amplifiers based on Si/SiGe HBT's and micromachined lumped components

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A double mesa-structure Si/SiGe heterojunction bipolar transistor (HBT) and novel micromachined lumped passive components have been developed and successfully applied to the fabrication of X- and Ku-band monolithic amplifiers. The fabricated 5/spl times/5 /spl mu/m/sup 2/ emitter-size Si/SiGe HBT exhibited a DC-current gain /spl beta/ of 109, and f/sub T/ and f/sub max/ of 28 and 52 GHz, respectively. Micromachined spiral inductors demonstrated resonance frequency of 20 GHz up to 4 nH, which is higher than that of conventional spiral inductors by a factor of two. Single-, dual-, and three-stage X-band amplifiers have been designed, based on the extracted active- and passive-device model parameters. A single-stage amplifier exhibited a peak gain of 4.0 dB at 10.0 GHz, while dual- and three-stage versions showed peak gains of 5.7 dB at 10.0 GHz and 12.6 dB at 11.1 GHz, respectively. A Ku-band single-stage amplifier has also been designed and fabricated, showing a peak gain of 1.4 dB at 16.6 GHz. Matching circuits for all these amplifiers were implemented by lumped components, leading to a much smaller chip size compared to those employing distributed components as matching elements.

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