Abstracts

Low-frequency noise characterization of self-aligned AlGaAs-GaAs heterojunction bipolar transistors with a noise corner frequency below 3 kHz

J.-H. Shin, J. Kim, Y. Chung, J. Lee, Y. Suh, K.H. Ahn and B. Kim. "Low-frequency noise characterization of self-aligned AlGaAs-GaAs heterojunction bipolar transistors with a noise corner frequency below 3 kHz." 1998 Transactions on Microwave Theory and Techniques 46.11 (Nov. 1998, Part I [T-MTT]): 1604-1613.

To find dominant 1/f noise sources, generalized noise analyses have been performed for self-aligned AlGaAs/GaAs heterojunction bipolar transistors (HBT's). For shorted base-emitter condition, the resistance fluctuation 1/f noise is dominant, while for open base-emitter condition, the base-emitter current 1/f noise is dominant. The collector-emitter 1/f current noise, though generally considered an important noise source, is negligible. The resistance 1/f noise stems mainly from the emitter resistance fluctuation. Our noise-reduction work is focused on the reduction of the base-emitter current 1/f noise. We have investigated the base-emitter-current noise properties as a function of emitter-base structure and surface passivation condition. It is found that the surface-recombination 1/f noise can be significantly reduced by the heterojunction launcher of the abrupt junction with 30% aluminum mole fraction emitter. The depleted AlGaAs ledge surface passivation further suppresses the surface-recombination currents. Consequently, we have achieved a very low 1/f noise corner frequency of 2.8 kHz at the collector current density of 10 kA/cm/sup 2/. The dominant noise source of the HBT is not a surface-recombination current, but a bulk current noise. This is the lowest 1/f noise corner frequency among the III-V compound semiconductor transistors, and is comparable to those of low-noise Si bipolar junction transistors (BJTs).

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