Abstracts

The effects of C/sub bc/ on the linearity of AlGaAs/GaAs power HBTs

Woonyun Kim, Sanghoon Kang, Kyungho Lee, Minchul Chung, Youngoo Yang and Bumman Kim. "The effects of C/sub bc/ on the linearity of AlGaAs/GaAs power HBTs." 2001 Transactions on Microwave Theory and Techniques 49.7 (Jul. 2001 [T-MTT]): 1270-1276.

It is well known that C/sub bc/ is the dominant nonlinear element in heterojunction bipolar transistors (HBTs). To study its behavior, an analytical nonlinear HBT equivalent-circuit model has been developed. The present model includes the effect of the ionized donor charge in the depleted collector region compensated by the injected mobile charge. The model-based simulation shows that, at a small-signal range, the third-order intermodulation (IM3) of the normal HBT has the normal 3:1 gain slope generated by the nonlinearity of C/sub bc/. At a large-signal level, the load line passes through some regions with constant C/sub bc/ because its collector is fully depleted by the injected free carriers, and the growth rate of the IM3 is decreased. The punch-through collector HBT has constant C/sub bc/ during the whole RF cycle, and the IM3, which is generated by g/sub m/ nonlinearity, has the normal 3:1 gain slope for the all input signal level. Therefore, the IM3 level is significantly lower for the punch-through HBT at a low-power level, but the IM3s of both devices are comparable at a high-power level. The experiment supports our proposed model.

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