Abstracts

Analysis and Improvement of Intermodulation Distortion in GaAs Power FET's

J.A. Higgins and R.L. Kuvas. "Analysis and Improvement of Intermodulation Distortion in GaAs Power FET's." 1980 Transactions on Microwave Theory and Techniques 28.1 (Jan. 1980 [T-MTT]): 9-17.

Tailoring of the doping profile is a powerful tool in reducing the intermodulation distortion (IMD) in GaAs power FET's. Reproducible and uniform preparation of the required profiles is a difficult task for epitaxial techniques. This shortcoming has motivated the present investigation of fabricating highly linear power FET's by ion implantation. An analytical device model was developed for exploring the relationship between the active layer profile and the IMD. These calculations revealed a complex behavior in the variation of the distortion levels due to partial correlation between the contributions arising from nonlinear transconductance and output conductance. The device model was used to identify implant doses and energies for approaching an optimum active layer profile. Based on the results, a deep Se implant followed by a shallow compensating Be implant to reduce the doping level close to the surface was used in the device fabrication. The IMD of the transistors was measured by the two-tone method. Conventional epitaxial FET's with a flat doping profile were evaluated for comparison purposes. This comparison demonstrated that a 4-dB increase in the intercept point for the third-order intermodulation product can be realized by using the tailored implanted profile. The experiments demonstrated that the tuning conditions for maximum output power and minimum IMD are virtually identical for the implanted transistors, in contrast to the behavior of conventional devices with flat doping profiles. These performance advantages, coupled with the high levels of uniformity and reproducibility of doping parameters, show ion implantation to be a powerful technique in the fabrication of highly linear power FET's.

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