Abstracts

Analysis of the High Frequency Series Impedance of GaAs Schottky Diodes by a Finite Difference Technique

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This paper describes a method to investigate the high frequency series impedance of GaAs Schottky barrier diodes. The analysis uses the finite difference technique to calculate the electromagnetic field within the diode chip based on a solution of Maxwell's equations, and includes high-frequency effects, such as the skin effect, charge carrier inertia, and dielectric relaxation. These effects are shown to greatly increase the series impedance at high frequencies. The finite difference technique is accurate for diode structures that incorporate an epitaxial layer of different doping than the substrate and a non-ideal ohmic contact on the bottom of the chip. An important feature of this analysis is an impedance calculation based on power considerations, rather than the electrostatic potential. The analysis is used to investigate the series impedance as a function of epilayer doping density, anode diameter, chip thickness and ohmic contact resistivity. It is shown that a proposed membrane diode, whose thickness is less than one skin depth, will have a series impedance 30 percent less than that of a comparable standard diode, provided that the ohmic contact has a specific contact resistivity of 10/sup-8/ Omega cm² or less.

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