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Author

Tang AY. Stake J.

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Impact of Eddy Currents and Crowding Effects on High-Frequency Losses in Planar Schottky Diodes

Source

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Abstract

In this paper, we present the influence of eddy currents, skin and proximity effects on high-frequency losses in planar terahertz Schottky diodes. The high-frequency losses, particularly losses due to the spreading resistance, are analyzed as a function of the ohmic-contact mesa geometry for frequencies up to 600 GHz. A combination of 3-D electromagnetic (EM) simulations and parameter extraction based on lumped equivalent circuit is used for the analysis. The extracted low-frequency spreading resistance shows a good agreement with the results from electrostatic simulations and experimental data. By taking into consideration the EM field couplings, the analysis shows that the optimum ohmic-contact mesa thickness is approximately one-skin depth at the operating frequency. It is also shown that, for a typical diode, the onset of eddy current loss starts at similar to 200 GHz, and the onset of a mixture of skin and proximity effects occurs around similar to 400 GHz.