

SPICE Modeling of Neutron Displacement Damage in Bipolar Amplifier

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Abstract

SPICE modeling method of neutron displacement degradation in bipolar amplifier was developed based on the neutron displacement effects model library for elementary bipolar transistors from PDK. The neutron displacement effects model library was built according to the Gummel-Poon (GP) SPICE model framework, and the model parameters were extracted from the experimental data of neutron displacement effects in the elementary bipolar transistors exposed to the reactor neutrons with different neutron fluence. To verify the correctness of the SPICE modeling method, the simulation was carried out on two types of bipolar amplifiers LM158L and LM158V with lateral and substrate PNP input transistors respectively, and the SPICE simulation results well predicts the degradation performance under neutron irradiation experiments. The RMS error between SPICE simulation and experimental results for input bias current degradation of bipolar amplifiers is within 16.4%.