Abstracts

Large-Signal Silicon and Germanium Avalanche-Diode Characteristics

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A technique for measurement of the large-signal single-frequency microwave amplifier admittance of avalanche diodes is described, and results are presented for silicon and germanium avalanche diodes. Single-frequency amplifier operation can provide a unique characterization of diode-admittance variation with RF drive for diodes operated near the optimum transit angle (the case in which all harmonic voltages are negligibly small compared to the fundamental). Such characterization is useful for predicting diode performance for circuits in which the harmonic voltages are not large enough to have an appreciable effect on the diode admittance at the fundamental frequency. A process of matching quadratic forms to the above admittance data which may be used for calculation of diode terminal admittance and power output is discussed. The usefulness of the measurement technique is illustrated by the agreement of the calculated maximum power output with the measured power output in a single-transformer coaxial circuit. The corresponding circuit admittance may be used for circuit-design purposes and for evaluating variations in diode-assembly techniques. The ability to obtain the diode equivalent circuit as a function of incident power allows studies in the design of the associated semiconductor device. For example, one has the capability of obtaining an accurate single-frequency large-signal model near the optimum transit angle, a model which can be studied without building a circuit. With this model it is possible to carry out optimization procedures at considerable savings of time and money.

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