Abstracts

Optimum Noise Measure of IMPATT Diodes

H.A. Haus, H. Statz and R.A. Pucel. "Optimum Noise Measure of IMPATT Diodes." 1971 Transactions on Microwave Theory and Techniques 19.10 (Oct. 1971 [T-MTT]): 801-813.

An attempt is made to determine some of the factors responsible for the noise performance of avalanche diodes. In particular we are interested whether there are any lower lids in the noise measure. We derive a theorem which shows that there is a lower limit M/sub opt/ = (½)(q/alpha'/kT) for an IMPATT diode which has a constant value of a', where M/sub opt/ is the optimum noise measure, q is the electronic charge, a' is the derivative with respect to the electric field of the carrier generation rate, k is Boltzmann's constant, and T is the standard absolute temperature. Even though the optimum noise measure is derived for a diode with constant a' in extensive numerical calculations of structures with sections of different a', we never found cases where the overall diode noise figure was lower than calculated by the above formula using the largest value of a'. Detailed calculations show that the lowest noise measure is achieved for carrier transit angles near 2 pi. The negative real part of the impedance becomes rather small when both the transit angle is near 2 pi and when a' is made large. In practical cases it is therefore often not possible to reach noise measures close to M/sub opt/. The paper also investigates how the amplifier noise determines amplitude and frequency noise of the corresponding avalanche oscillators.

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