Abstracts

Picosecond Pulse Propagation on Coplanar Striplines Fabricated on Lossy Semiconductor Substrates: Modeling and Experiments

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A simple model for the propagation of high-frequency signals on coplanar striplines with lossy semiconductor substrates is proposed and demonstrated. This model incorporates the effect of a conductive substrate through the loss tangent in a distributed-circuit analysis extended to high frequencies. Very strong attenuation and dispersion due to the substrate are observed even when the GaAs conductance is only 1 mho/cm, corresponding to a doping density of around 10/sup 15/ cm/sup-3/. The accuracy of this model is tested with a direct comparison to experimental data, of picosecond pulse propagation on a doped-GaAs coplanar stripline (CPS) measured in the time domain using the electro-optic (EO) sampling technique. Good agreement is found in terms of the attenuation and phase velocity of the distorted pulses at four propagation distances up to 300 μm. The pulse propagation on a multiple modulation-doped layer is also studied experimentally as a prototype of high-frequency signal propagation on the gate of a modulation-doped field-effect transistor (MODFET). The attenuation shows linear frequency dependence up to 1.0 THz, contrary to the cubic or quadratic dependence of coplanar transmission lines on low-loss substrates.

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