Abstracts

Characteristics of trenched coplanar waveguide for high-resistivity Si MMIC applications

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A novel low RF loss trenched coplanar waveguide (CPW) transmission-line structure fabricated using evaporated aluminum tracks on a high-resistivity (10-k/spl Omega/ cm) silicon (HRS) substrate is reported. By assuming that Schottky contact boundaries exist at the metal silicon substrate interface in the CPW line, the finite-element analysis method is used to determine the simulated behavior of the structure. The distributed capacitance, leakage conduction current, and dynamic shunt conductance for the line are shown to be a function of dc bias applied to the line, and also to reduce as a function of trench depth in the normal bias regime. Experimental results show: (1) the reduction of RF losses in comparison with conventional aluminum conductor CPW line structures may be as much as 0.5 dB/cm at 30 GHz; (2) by proper positive dc biasing of a CPW line on a p-type HRS substrate, a further reduction (0.2 dB/cm) in RF loss at 30 GHz can be achieved; (3) predicted trends in line leakage current, capacitance, and relative characteristics impedance are experimentally verified. The proposed waveguide structure may be utilized in a special fabrication process designed for RF/microwave applications.

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