

A Small-Signal Linear Equivalent Circuit of HEMT's Fabricated on GaAs-on-Si Wafers

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A new small-signal linear equivalent circuit for high electron mobility transistors (HEMT's) fabricated on GaAs-on-Si wafers, HEMT's-on-Si, has been proposed. The new equivalent circuit describes the microwave characteristics of HEMT's-on-Si much better than the conventional metal-semiconductor field-effect transistor (MESFET) equivalent circuit does. Influences of the pads, the GaAs-Si interface, and the Si substrate on the microwave characteristics are included in the circuit. It also has a great advantage in that it can separately analyze the intrinsic device characteristics and influences of Si substrate and GaAs-Si interface. Analyses using the new equivalent circuit show that the crucial problem of HEMT's-on-Si is the larger values of the pad capacitances and the drain-source capacitances than those of HEMT's fabricated on GaAs bulk wafers, HEMT's-on-GaAs, and that the substrate resistivity is not an important factor for microwave performances of HEMT's-on-Si. The microwave performance was improved by the reduction of the pad capacitances.

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