Abstracts

InGaAs Microwave Switch Transistors for Phase Shifter Circuits

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A new InGaAs insulated-Gate FET (IGFET) with 1 µm gate length and three different gate widths have been designed, fabricated and characterized as switch devices for microwave control applications in phase shifter circuits. The devices employed a plasma deposited silicon dioxide gate insulator and had multiple air bridged source regions. The details of the DC current-voltage (I-V) characteristics and small signal S-parameter measurements up to 20 GHz are presented. The switch IGFET's had a drain saturation current density of 300 mA/mm gate width with breakdown voltages of higher than 35 V. An insertion loss of 1.0, 0.6, and 0.4 dB at 10 GHz and 1.4, 0.8, and 0.4 dB at 20 GHz have been measured for the 300, 600, and 1200 µm gate width IGFET's, respectively. Equivalent circuit models fitted to the measured S-parameters for IGFET's yielded on-state resistances from 10.7 to 3.3 Omega, off-state resistances from 734.4 to 186.8 Omega and off-state capacitances from 0.084 to 0.3 pF as the gate width is increased from 300 to 1200 µm. The simulation results using IGFET models for the phase shifter circuits indicated a maximum phase error of 0.11°, 0.26°, and 0.47° with 0.74, 0.96, and 1.49 dB maximum insertion loss and greater than 33, 26, and 19 dB return loss for the 11.25°, 22.5°, and 45° phase bits, respectively, over the 9.5-10.5 GHz frequency band.

❑ Return to main document.