Abstracts

Analysis of Optically Controlled Microwave/Millimeter-Wave Device Structures

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Light-induced voltage and the change in the source-to-drain channel current under optical illumination higher than the semiconductor band gap for GaAs MESFET, InP MESFET, Al/sub 0.3/Ga/sub 0.7/As/GaAs high electron mobility transistor (HEMT), and GaAs permeable base transistor (PBT) are analytically obtained. The GaAs PBT and GaAs MESFET have higher sensitivity than the InP MESFET. However, the Al/sub 0.3/Ga/sub 0.7/As/ GaAs HEMT is observed to have the highest sensitivity. Variations in the small-signal parameters, such as channel conductance, gate-to-source capacitance, and transconductance, as well as transient parameters, such as switching time and power-delay product, of GaAs MESFET with illumination are computed. The computed capacitance and transconductance are compared with the experimentally obtained values and are found to be in fair agreement. Based on these results, the design considerations for an optically controlled MESFET switch are discussed. Finally, variation in device parameter due to optical illumination and its effect on the cutoff frequencies f/sub T/ and f/sub max/ are also investigated.

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