Abstracts

Microwave Performance of an Optically Controlled AIGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET (Dec. 1987 [T-MTT])

R.N. Simons. "Microwave Performance of an Optically Controlled AIGaAs/GaAs High Electron Mobility Transistor and GaAs MESFET (Dec. 1987 [T-MTT])." 1987 Transactions on Microwave Theory and Techniques 35.12 (Dec. 1987 [T-MTT] (1987 Symposium Issue)): 1444-1455.

This paper presents for the first time extensive experimental results which show the light-induced voltage, the increase in the drain current, the RF gain, and the change in the microwave scattering parameters of an AIGaAs/GaAs high electron mobility transistor (HEMT) under optical illumination of photon energy equal to or greater than the semiconductor band gap. From the de-embedded device scattering parameters, the change in the small-signal, lumped-element equivalent circuit model is computed. These results are compared and contrasted with those of a GaAs MESFET. Lastly, three potential applications of an optically controlled AIGaAs/GaAs HEMT are demonstrated: microwave amplifier gain control, detection, and mixing with an optically coupled local oscillator signal. Preliminary experiments on the optical control of a monolithic GaAs distributed amplifier are also presented. Measurements on a HEMT show that the tight-induced voltage is 0.57 V and the increase in the drain current is 5 mA under 1.7 mW optical power at 0.83 µm. Further, the increase in magnitude of S/sub 21/ with illumination ranges from 0.5 to 2.0 dB as V/sub gs/ takes discrete values between -0.5 and -0.95 V. However, the phase of S/sub 21/ is insensitive to optical illumination. The HEMT as a photodetector has an external quantum efficiency greater than 500 percent and a dark noise current of 27 pA//spl radic/Hz. Lastly, computations show that the response speed of the HEMT to an intensity-modulated optical signal is on the order of 11 ps.

❑ Return to main document.