Abstracts

Microwave and Millimeter-Wave QWITT Diode Oscillators

V.P. Kesan, A. Mortazawi, D.R. Miller, V.K. Reddy, D.P. Neikirk and T. Itoh. "Microwave and Millimeter-Wave QWITT Diode Oscillators." 1989 Transactions on Microwave Theory and Techniques 37.12 (Dec. 1989 [T-MTT] (1989 Symposium Issue)): 1933-1941.

We present dc, microwave, and millimeter-wave characteristics of different quantum well injection transit time (QWITT) devices. Small-signal and Iarge-signal device models are used to provide physical device design parameters to maximize the output power density at any desired frequency of operation. A peak output power density of 3.5-5 kW/cm² in the frequency range of 5-8 GHz has been obtained from a planar QWITT oscillator. This is the highest output power density obtained from any quantum well oscillator at any frequency. This result also represents the first planar circuit implementation of a quantum well oscillator. Good qualitative agreement between dc and RF characteristics of QWITT devices and theoretical predictions based on small-signal and Iarge-signal analyses has been achieved. We also present results on improving device efficiency by optimizing the design of the drift region in the device through the use of a doping spike. By optimizing the doping concentration of the spike, an increase in efficiency from 3 to 5 percent has been obtained, without compromising the output power at X-band. Self-oscillating QWITT diode mixers have also been demonstrated at X-band in both waveguide and planar circuits. The self-oscillating mixer exhibits a conversion gain of about 10 dB in a narrow bandwidth and a conversion loss of about 5 dB if broad-band operation is desired. This is to our knowledge the first report of conversion gain obtained from a self-oscillating mixer using a quantum well device.

❑ Return to main document.