Abstracts

A Physically Based Small-Signal Circuit Model for Heterostructure Acoustic Charge Transport Devices (Dec. 1993 [T-MTT])

J.S. Kenney and W.D. Hunt. "A Physically Based Small-Signal Circuit Model for Heterostructure Acoustic Charge Transport Devices (Dec. 1993 [T-MTT])." 1993 Transactions on Microwave Theory and Techniques 41.11 (Dec. 1993 [T-MTT] (1993 Symposium Issue)): 2218-2226.

A physically based small-signal circuit model for GaAs-AIGaAs Schottky gate heterostructure acoustic charge transport (HACT) devices is presented. Analytical expressions for the instantaneous and average channel current as a function of gate voltage are obtained from physical device parameters. The charge injection model is based on subthreshold current models for GaAs MESFET's. It is shown that the shape of the sampling aperture of the charge injection operation is approximately Gaussian. Good agreement is obtained between the measured dc channel current versus gate voltage and that predicted by the model. Equivalent circuits are also developed for the transfer and output sensing operations. Expressions for noise sources due to the physical processes that occur within the device are developed. Thermal noise, shot noise, and transfer noise are treated. The form of the analytic expressions for frequency response and noise figure allows easy implementation on commercially available CAE software. Simulations of both gain and noise figure performed on Libra™ are compared to measured data. Simulations agree with 10 percent of measured frequency response for a 160 tap HACT device. The predicted noise figure agrees within 1 dB of that measured for the same device.

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