Abstracts

Phase Shifts in Single- and Dual-Gate GaAs MESFET's for 2-4-GHz Quadrature Phase Shifters

J.P. Mondal, A.G. Milnes, J.G. Oakes and S.-K. Wang. "Phase Shifts in Single- and Dual-Gate GaAs MESFET's for 2-4-GHz Quadrature Phase Shifters." 1984 Transactions on Microwave Theory and Techniques 32.10 (Oct. 1984 [T-MTT]): 1280-1288.

The variation of transmission phase for single- and dual-gate GaAs MESFET's with bias change and its probable effects on the performance of an active phase shifter have been studied for the frequency range 2 to 4 GHz. from measured S-parameter values for single- and dual-gate transistors, the element values of the equivalent circuits were fitted by using the computer-aided design program SUPER COMPACT. For the normal full-gate voltage range 0 to -2 V at V/sub DS/= 4 V, the single-gate MESFET varies in transmission phase from 142° to 149° at 2 GHz, and from 109° to 119° at 4 GHz. However, with drain voltage varied from 0.3 to 4 V and a constant gate-voltage bias of 0 V, the phase shifts are much larger, 105° to 145° at 2 GHz and 78° to 112° at 4 GHz. this suggests that large phase shifts may be expected in a dual-gate device and this is found to be so. With V/sub DS/= 4 Vand V/sub GS1/= - 1.0 V, variation of control (second) gate bias from 0 to - 1.75 V for the NE463 GaAs MESFET produces a transmission phase variation from 95° to 132° at 2 GHz and 41° to 88° at 4 GHz. Such phase shifts cause both amplitude and phase errors in phase-shifter circuits of the kind where signals from two FET channels are combined in quadrature with their gate voltages controlled to provide 0° to 90° phase control with constant amplitude. For the single-gate FET examined, the expected amplitude and phase errors are 0.30 dB and 6° at 2 GHz, and 0.36 dB and 10° at 4 GHz. If dual-gate FET's are used in similar circuits, the distribution of errors is different. For NE463 devices, the corresponding figures are 0.56 dB and 2° at 2 GHz and 1.2 dB and 3° at 4 GHz. the advantage of the dual-gate configuration is that the input impedance conditions are more constant than for the single-gate configuration.

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