Abstracts

Distributed MEMS true-time delay phase shifters and wide-band switches

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Wide-band switches and true-time delay (TTD) phase shifters have been developed using distributed microelectromechanical system (MEMS) transmission lines for applications in phased-array and communication systems. The design consists of a coplanar waveguide (CPW) transmission line (W=G=100 /spl mu/m) fabricated on a 500 /spl mu/m quartz substrate with fixed-fixed beam MEMS bridge capacitors placed periodically over the transmission line, thus creating a slow-wave structure. A single analog control voltage applied to the center conductor of the CPW line can vary the phase velocity of the loaded line by pulling down on the MEMS bridges to increase the distributed capacitive loading. The resulting change in the phase velocity yields a TTD phase shift. Alternatively, the control voltage can be increased beyond the pull-down voltage of the MEMS bridges such that the capacitive loading greatly increases and shorts the line to ground. The measured results demonstrate 0-60 GHz TTD phase shifters with 2 dB loss/118/spl deg/ phase shift at 60 GHz (/spl sim/4.5-ps TTD) and 1.8 dB loss/84/spl deg/ phase shift at 40 GHz. Also, switches have been demonstrated with an isolation of better than 40 dB from 21 to 40 and 40 to 60 GHz. In addition, a transmission-line model has been developed, which results in very close agreement with the measured data for both the phase shifters and switches. The pull-down voltage is 10-23 V, depending on the residual stress in the MEMS bridge. To our knowledge, this paper presents the first wide-band TTD MEMS phase shifters and wide-band switches to date.

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