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Evaluation and simulation of MEMS cantilever relays[1] JASON WILLIAMS, Texas State University, CASEY SMITH, SEMATECH, Inc., ANUP BANDYOPADHYAY, GREGORY SPENCER, Texas State University — Electrostatically-actuated MEMS cantilevers were fabricated for testing as a potential replacement for nanoscale circuit components in low power applications like spacecraft. These cantilevers are operated in a horizontal plane by applying a voltage to side electrodes. The polysilicon cantilevers were fabricated at SEMATECH with a range of beam lengths (from 2 to 14 μm) and electrode gap spacings (from 110 nm to 140 nm). The cantilevers were tested to determine the voltage required to bring the beam into contact with the collector. This pull-in voltage was measured as a function of device dimensions. To simulate the device operation, a model was created in MEMS simulation software. Simulations of pull-in voltage and time were compared to the data to validate the model and estimate the frequency response of the devices. Variations of model device parameters such as beam thickness, height, gap size, and Young's modulus were used to define a design space based on power requirements. SEM images were obtained to study failure mechanisms of some tested devices. This work is systematically evaluating the effects of device dimensions on the operation and failure mechanisms of nanoscale cantilevers for low power applications.

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