Sensors and Materials, 3, 2 (1991) 111–125
MYU, Tokyo

S & M 0075

The Long-Term Reliability of a Switched-Capacitor Relative Humidity Sensor System

Maha A. S. Jaafar, Andrew R. K. Ralston and Denice D. Denton

Department of Electrical and Computer Engineering
and Materials Science Program
University of Wisconsin-Madison
1415 Johnson Drive
Madison, WI 53706, U.S.A.

(Received September 25, 1991; accepted October 17, 1991)

Key words: relative humidity, polyimide, switched-capacitor, reliability

The long-term reliability of a solid-state relative humidity (RH) sensor system is investigated. The polyimide capacitive sensor is described. The design, layout and performance of the switched-capacitor driving circuitry which was fabricated using the MOS implementation system (MOSIS) are discussed. The hysteresis, frequency response, temperature coefficient, dielectric stability and long-term reliability of the sensor system are determined experimentally. The experimental results indicate that the sensor device capacitance-RH characteristic changes as a function of exposure time in high-temperature and high-humidity environments (aging). The capacitance value at a given ambient RH increases after aging. In addition, the aged capacitor shows increased loss at low frequencies. The effect of this drift in device characteristics on the system output signal is simulated by means of simulation program for integrated circuit engineering (SPICE). The temperature coefficient is small over the range of 20°C to 65°C. Suggestions are made for maximizing system stability in the field.