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Simulation, Design and Fabrication of a Vertical Hall Device for Two-Dimensional Magnetic Field Sensing

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A silicon-based magnetic field sensor has been designed for two-dimensional detection of magnetic fields oriented parallel to the plane of the chip. This device is based on a vertically configured Hall plate structure and employs bulk micromachining as a post-processing step. The device has also been modeled using a two-dimensional finite-element scheme. This allows potential and current distributions to be determined within the device structure. Modeling results suggest a higher sensitivity for a micromachined device in comparison with a non-micromachined device. The experimental results confirm the modeling predictions.

1. Introduction

Micromachining technology is used extensively in the production of silicon-based microtransducers. The examples include pressure sensors,[1,2] accelerometers,[3,4] thermal sensors,[5] air-flow sensors,[6] miniaturized pumps,[7] and a myriad of other micromechanical structures. It is also becoming evident that microstructures can be fabricated easily by making use of the existing integrated circuit fabrication techniques, which leads to products with greater accuracy, higher speed and reliability, and allows the compensation of undesirable side effects.[5,6,8–10] Also, the merging of standard IC processing with micromachining can lead to improved character-