

Miniature Fluxgate Sensing Element for High-Performance Integrated Silicon Magnetic Sensors

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In this paper, a miniature fluxgate sensing element for integrated silicon magnetic sensors is presented. The sensing element is composed of a thin-film ferromagnetic core and excitation and pick-up coils. The sensor core used is permalloy film formed by electrodeposition. The coils with the shape of solenoids are fabricated using the two-layered metallization process. The inductance of the element as an inductor device with a 50-turn coil and a 2- μm -thick 2-mm-long core was 0.36 μH at 10 kHz. The sensitivity of the element integrating both the pick-up coil (30 turns) and the excitation (20 turns) coil was 5.8 V/T at 100 kHz. Relatively high-sensitivity and low-offset characteristics were achieved compared with those of the conventional silicon magnetic sensors. The fabrication process for the sensing element is suitable for integrating the on-chip circuits creating an integrated fluxgate sensor.

1. Introduction

One of the attractive features of silicon sensors lies in the integration of the on-chip signal-conditioning circuits together with the sensing elements. However, the performance of the sensor depends on the material used, and silicon is not always