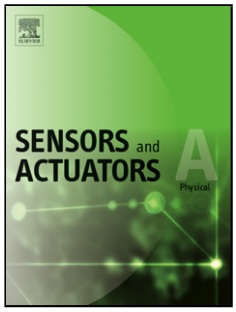

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Fabrication and Characterization of a Ni-Fe-W Core Microtransformer for High-Frequency Power Applications

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Highlights

- We fabricate a planar microtransformer with Ni-Fe-W alloy core for high-frequency power applications.
- We characterize the properties with respect to frequencies.
- The Ni-Fe alloy core and Ni-Fe-W alloy core microtransformer are compared.

Abstract

This paper presents the fabrication and characterization of a microtransformer device for high-frequency power applications using electroplating and photolithography techniques. These devices are realized on an oxidized silicon wafer. They have the identical geometry on the primary and the secondary side combined with a core thickness value of 6 µm. The device consists of six coils (three coils on the primary side and three coils on the secondary side) and each coil has nine numbers of turns. The copper coil winding and the Ni-Fe-W alloy magnetic core are fabricated by electroplating. The fabricated microtransformer has an inductance ranging from 25 nH to 74 nH. An optimum quality factor of 4.5 is obtained at 70 MHz.

1. INTRODUCTION

Nowadays, integrated inductors and the transformers are used in DC-DC converters and have many potential advantages such as high-frequency operation, efficiency, quality, low cost, and low power loss [1]. The planar transformers are one of the significant devices in these converters due to its high efficiency and reliability [2, 3]. Today, many researchers realize several planar transformers to meet these requirements [4-9]. Dinulovic et al. [4] have fabricated planar transformers with 2.5 mm X 2 mm in size, with a maximum inductance of 37 nH at 1 MHz and a quality factor of 3 at 20 MHz using Ni45Fe55 magnetic core. With the same design, this transformer shows a maximum inductance of 33 nH with a quality factor of 3 at 20 MHz using Fe-Co magnetic core [5]. In another planar transformer design, they [6] have reported an inductance of 50 nH with very good performance up to higher frequencies.

However, development of the new materials is required to further increase the performance of the planar transformer. The new magnetic material core must have a higher resistivity, higher saturation flux (B_S),