Docket #: S04-112

High Q Inductor

This invention is an efficient and very small high frequency inductor developed by Stanford researchers and made on an active substrate, such as silicon. It is designed to be integrated into a chip and was specifically created for DC to DC voltage step down converters (known as 'buck converters'). The inductor includes a magnetic core made of a single layer of magnetic material, and its design is very effective in terms of the area it occupies and its low electrical resistance. Because of the active substrate the inductor is built on, it achieves a much higher quality factor than current inductors, which means that it works significantly better at high frequencies and suffers lower losses from electrical resistance. This inductor is ideal for providing output voltages to integrated chips, particularly VLSI (very large scale integration) chips, and it reduces power consumption and significantly reduces system size and cost.

In demonstration devices inductances of greater than 70 nano-Henries with electrical resistance of less than 1 ohm has been shown for devices under 1 square millimeter in size. The inductances achieved are more than 30 times what has been achieved with similar air core inductors and the quality factors are 5 times higher than similar air core inductors. Inductance densities of over 200 nano-Henries per square millimeter have been achieved, and the results have followed analytical models quite well.

Applications

- Integrated electronics chips and packages
- Applications requiring simple, small, efficient inductors (particularly in integrated circuis)
- System on chip and system in package designs, where integrated inductors are key
- Higher performance and lower power consumption chips

Advantages

- Greatly reduced system and component sized (compared to standard passive components)
- Decreased power consumption (both because of reduced component resistance and elimination of interconnects required for standard soldered-on inductors)
- Lower production costs
- High inductance, low electrical resistance and high quality factors compared to standard passive components
- Low ohmic losses due to low resistance
- Reduced interference with surrounding components

Publications

- US Published Patent Application 20090201113, "Integrated Inductor Structure and Method of Fabrication"
- D. W. Lee, K.-P. Hwang and S. X. Wang, "Fabrication and Analysis of High-Performance Integrated Solenoid Inductor With Magnetic Core," *IEEE Trans. Mag.*, 44, 4089-95, 2008.
- D. W. Lee, L. Li, S. X. Wang, Jiongxin Lu, C. P. Wong, Swapan K. Bhattacharya, and John Papapolymerou, Embedded Passives, book chapter in Materials for Advanced Packaging, Daniel Lu, CP Wong, Eds., Springer, 2008.

Patents

- Published Application: 20090201113
- Published Application: 20070069333
- Issued: 9,153,547 (USA)

Innovators

- Shan Wang
- Ankur Mohan Crawford
- Gilroy Vandentop

- Raj Nair
- Henning Braunisch

Licensing Contact

David Mallin

Licensing Manager, Physical Sciences

Email