# Design Of Microfabricated Inductors Power Electronics

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*Research in Progress: Microfabricated Inductors A deeper look at the approximate design of power inductors with gapped ferrite cores Power Electronics -Inductors*

Fundamentals of Power Electronics - Buck Converter Critical Inductance Value**ElectronicBits#22 - HF Power Inductor Design** *High frequency Power Inductor Design: DC \u0026 AC* ~~Power Electronics - 5.4.3 - Filter Inductor Design How INDUCTOR's work \u0026 How to make your own~~

Mod-04 Lec-05 Inductor~~Energy Stored in an Inductor~~ DIY 2400W SMPS Inductor Design: You can do this! 8.02x - Lect 20 - Inductance, RL Circuits, Magnetic Field Energy ~~Inductors and Inductance~~ Induction Heater - 6\" Coil vs. 1/2\" bar

How to making inductor part 2(Ferrite \u0026 Iron powder toroid cores) 8.02x - Lect 16 - Electromagnetic Induction, Faraday's Law, Lenz Law, SUPER DEMO *How Inductors Work Within a Circuit - Inductance* **SMPS Tutorial (5): Inductor Basics, Magnetic Circuits, Switched Mode Power Supplies**

#90: Measure Capacitors and Inductors with an Oscilloscope and some basic parts

Inductive spiking, and how to fix it!~~How to choose the right coil type (inductor)?! What is Inductance? The 3 Effects of Inductors - The 2-Minute Guru (s2e9)~~ *[Webinar] - Inductor Design for Power Electronics Applications Using EMS* ~~Coupled Inductor Basics~~ The \"Power-Inductor Checker\": A tester for power-inductors

Magic of Magnetism \u0026 Inductors (ElectroBOOM101-007) Basics of coupled inductors in power supplies How to decrease inductor size in a 10A DC/DC converter design How to Design a Coil for Specific Inductance **W ü rth Elektronik Webinar: How do I select the right inductor for a DC/DC converter design?**

Design Of Microfabricated Inductors Power

IEEE TRANSACTIONS ON POWER ELECTRONICS, VOL. 14, NO. 4, JULY 1999 709 Design of Microfabricated Inductors Luca Daniel, Student Member, IEEE, Charles R. Sullivan, Member, IEEE, and Seth R. Sanders, Member, IEEE Abstract—Possible con fi gurations for microfabricated induc-tors are considered. Inductance can be set by adjusting perme-

Design of microfabricated inductors - Power Electronics ...

603-646-2851 http://engineering.dartmouth.edu/inductor/ Abstract— Microfabricated inductor designs are proposed for convertersfor microprocessorpower delivery. The fabrication pro-cess uses anisotropic silicon etching to form V-grooves; granular metal/insulator nanoscale composite magnetic materials; and cop-per conductors.

Design of Microfabricated Inductors for Microprocessor ...

Design of Microfabricated Inductors for Microprocessor Power Delivery G J Mehas K D Coonley C R Sullivan Found in IEEE Applied Power Electronics Conference, Mar 1999, pp 1181 – 1187 ° c ···

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Design Of Microfabricated Inductors Power Electronics

Abstract: Possible configurations for microfabricated inductors are considered. Inductance can be set by adjusting permeability through control of anisotropy of a permalloy core or via a patterned quasi-distributed gap. A design methodology based on a simple model is proposed. A more accurate model and a numerical optimization are also developed.

Design of microfabricated inductors - IEEE Journals & Magazine
Design of microfabricated inductors for microprocessor power delivery by G J Mehas , K D Coonley , C R Sullivan , Gustavo J Mehas , Kip D Coonley , Charles R Sullivan - in IEEE Applied Power Electronics Conf. Proceedings , 1999

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CiteSeerX — Citation Query Design of Microfabricated Inductors
Abstract: Transformers and inductors fabricated with micron-scale magnetic-alloy and copper thin films are designed for high-frequency power conversion applications. Fine patterning produced by photolithography reduces eddy current losses, thus enabling very high power densities.

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Possible configurations for microfabricated inductors are considered. Inductance can be set by adjusting permeability through control of anisotropy of a permalloy core, or via a patterned quasi-distributed gap. A design methodology based on a simple model is proposed. Analysis of secondary effects is also developed. A design example for a 5 MHz buck power converter application is presented.

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Design of microfabricated inductors | Semantic Scholar
Nov 2, 2012 - Contact mask layout for microfabricated inductors with thin-film magnetic cores. These magnetic components will be used for high-efficiency integrated power converters in LED lighting systems. Image courtesy of Ph.D. candidate Dan Harburg, working under advisor Professor Victor Petrenko. Submitted as part of the …

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Microfabricated inductors | Inductors, Power converters ...
Transformers and inductors fabricated with micronscale magnetic-alloy and copper thin films are designed for high-frequency power conversion applications. Fine patterning produced by photolithography reduces eddy current losses, thus enabling very high power densities. Calculated design graphs and ...

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Design Of Microfabricated Inductors Power Electronics
We are developing high-frequency (8 MHz) power inductors fabricated by thin-film deposition and photolithography. They are described in " Design of Microfabricated Inductors for Microprocessor Power Delivery " and " Converter and Inductor Design for Fast-Response Microprocessor Power Delivery ", and in the first and second papers titled "Fabrication of Thin-Film V-Groove Inductors Using Composite Magnetic Materials."

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Publications from Dartmouth Magnetic Component and Power ...
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Design of microfabricated inductors for microprocessor ...
Design equations and closed-form expressions for losses are presented. Special design considerations for the key dynamic voltage scaling enabler, called the dynamic DC-DC converter are given. The focus throughout is on low-power

portable applications, where small size, low cost, and high energy efficiency are the primary design objectives.

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Design of microfabricated transformers and inductors for ...
Nov 14, 2012 - Contact mask layout for microfabricated inductors with thin-film magnetic cores. These magnetic components will be used for high-efficiency integrated power converters in LED lighting systems. Image courtesy of Ph.D. candidate Dan Harburg, working under advisor and Professor

Trends in the miniaturisation of electronic products, especially in the portable products area, has sparked considerable interest in the miniaturisation of the energy processing electronics i.e. the power conversion circuits such as the switched mode power supply (SMPS). Unlike digital electronics which have benefited from miniaturisation and integration in microelectronics, power conversion electronics have not significantly reduced in size. This is directly due to the fact that power conversion requires energy storage components such as inductors and capacitors. The value of the inductors and capacitors required can be reduced if the switching frequency of the power converter is increased. In order to miniaturise the power converter, the switching frequency must be increased so that passive components can be miniaturised and integrated. Traditionally the inductive components have been difficult to integrate on chip. This work focused on the design and fabrication of integrated inductors-on-silicon for very high frequency power conversion (20 {u2013} 100 MHz). Initially an analytical model for micro-inductors which was developed in previous work was used to design inductors for operation up to 20 MHz. The designs selected for fabrication had a footprint area between 5 {u2013} 9 mm2 and a predicted device efficiency of 90% and above. These models were validated by finite element analysis before fabrication. The fabricated prototypes displayed a low loss of inductance to 20 MHz and current handling ability to 0.5 A. The micro-inductors were then interfaced with a high frequency dc-dc converter (20 {u2013} 100 MHz) developed by NXP Semiconductor, and achieved an inductor efficiency of 93% at 20 MHz. The maximum converter efficiency with the micro-inductor was measured to be 78.5%, which to date is highest quoted inductor-on-silicon device efficiency in a converter application at 20 MHz. Circuit equivalent lumped-element models of the micro-inductor for use in circuit simulation software were also developed. This equivalent circuit model includes elements such as capacitance, which are not accounted for in the previously developed analytical model. The initial micro-inductor devices performance was found to be comparable to commercial chip inductors for inductor efficiency when used in a converter. However, if the micro-inductor technology is to compete as a viable alternative to commercial devices, it needed to reduce its footprint area dramatically. This was achieved by using an optimisation software engine to find the inductor designs with maximum efficiency for a given footprint area. The footprint of these optimised devices ranged from 0.5 {u2013} 2.5 mm2 for a range of inductances to 200 nH. A range of optimised devices were fabricated and the measured optimised devices displayed a low loss of inductance to tens of MHz and good current handling capability. However, measured dc resistance was found to be substantially higher than design, due to issues in the fabrication process. The fabricated inductors also highlighted the trade-offs that are introduced in micro-inductor performance vs. footprint area. This design trade-off was also reflected in micro-inductor performance in a converter. An optimised 2.5 mm2 area device was tested in a dc-dc converter at 20 MHz, which resulted in a slightly lower peak micro-inductor efficiency of 90.5% than the previous larger devices. The fabricated optimised micro-inductors achieve an inductance density (inductance per unit area) ranging from 66 - 110 nH/mm2 and display current handling ability of 500mA for the 2.5 mm2, 250mA for the 1.3 mm2 and 150mA for the 0.5 mm2 area device. For inductors aimed at power conversion applications, this work shows a significant improvement to what is reported in literature - in high frequency operation to tens of MHz, inductance density and current handling.

Although they are some of the main components in the design of power electronic converters, the design of inductors and transformers is often still a trial-and-error process due to a long working-in time for these components. Inductors and Transformers for Power Electronics takes the guesswork out of the design and testing of these systems and provides a broad overview of all aspects of design. Inductors and Transformers for Power Electronics uses classical methods and numerical tools such as the finite element method to provide an overview of the basics and technological aspects of design. The authors present a fast approximation method useful in the early design as well as a more detailed analysis. They address design aspects such as the magnetic core and winding, eddy currents, insulation, thermal design, parasitic effects, and measurements. The text contains suggestions for improving designs in specific cases, models of thermal behavior with various levels of complexity, and several loss and thermal measurement techniques. This book offers in a single reference a concise representation of the large body of literature on the subject and supplies tools that designers desperately need to improve the accuracy and performance of their designs by eliminating trial-and-error.

Based on the fundamentals of electromagnetics, this clear and concise text explains basic and applied principles of transformer and inductor design for power electronic applications. It details both the theory and practice of inductors and transformers employed to filter currents, store electromagnetic energy, provide physical isolation between circuits, and perform stepping up and down of DC and AC voltages. The authors present a broad range of applications from modern power conversion systems. They provide rigorous design guidelines based on a robust methodology for inductor and transformer design. They offer real design examples, informed by proven and working field examples. Key features include: emphasis on high frequency design, including optimisation of the winding layout and treatment of non-sinusoidal waveforms a chapter on planar magnetic with analytical models and descriptions of the processing technologies analysis of the role of variable inductors, and their applications for power factor correction and solar power unique coverage on the measurements of inductance and transformer capacitance, as well as tests for core losses at high frequency worked examples in MATLAB, end-of-chapter problems, and an accompanying website containing solutions, a full set of instructors ' presentations, and copies of all the figures. Covering the basics of the magnetic components of power electronic converters, this book is a comprehensive reference for students and professional engineers dealing with specialised inductor and transformer design. It is especially useful for senior undergraduate and graduate students in electrical engineering and electrical energy systems, and engineers working with power supplies and energy conversion systems who want to update their knowledge on a field that has progressed considerably in recent years.

This book describes the structured design and optimization of efficient, energy processing integrated circuits. The approach is multidisciplinary, covering the monolithic integration of IC design techniques, power electronics and control theory. In particular, this book enables readers to conceive, synthesize, design and implement integrated circuits with high-density high-efficiency on-chip switching power regulators. Topics covered encompass the structured design of the on-chip power supply, efficiency optimization, IC-compatible power inductors and capacitors, power MOSFET switches and efficient switch drivers in standard CMOS technologies.

CMOS DC-DC Converters aims to provide a comprehensive dissertation on the matter of monolithic inductive Direct-Current to Direct-Current (DC-DC) converters. For this purpose seven chapters are defined which will allow the designer to gain specific knowledge on the design and implementation of monolithic inductive DC-DC converters, starting from the very basics.

This book deals with energy delivery challenges of the power processing unit of modern computer microprocessors. It describes in detail the consequences of current trends in miniaturization and clock frequency increase, upon the power delivery unit, referred to as voltage regulator. This is an invaluable reference for anybody needing to understand the key performance limitations and opportunities for improvement, from both a circuit and systems perspective, of state-of-the-art power solutions for next generation CPUs.

Power Management Integrated Circuits and Technologies delivers a modern treatise on mixed-signal integrated circuit design for power management. Comprised of chapters authored by leading researchers from industry and academia, this definitive text: Describes circuit- and architectural-level innovations that meet advanced power and speed capabilities Explores hybrid inductive-capacitive converters for wide-range dynamic voltage scaling Presents innovative control techniques for single inductor dual output (SIDO) and single inductor multiple output (SIMO) converters Discusses cutting-edge design techniques including switching converters for analog/RF loads Compares the use of GaAs pHEMTs to CMOS devices for efficient high-frequency switching converters Thus, Power Management Integrated Circuits and Technologies provides comprehensive, state-of-the-art coverage of this exciting and emerging field of engineering.

Metallic films play an important role in modern technologies such as integrated circuits, information storage, displays, sensors, and coatings. Metallic Films for Electronic, Optical and Magnetic Applications reviews the structure, processing and properties of metallic films. Part one explores the structure of metallic films using characterization methods such as x-ray diffraction and transmission electron microscopy. This part also encompasses the processing of metallic films, including structure formation during deposition and post-deposition reactions and phase transformations. Chapters in part two focus on the properties of metallic films, including mechanical, electrical, magnetic, optical, and thermal properties. Metallic Films for Electronic, Optical and Magnetic Applications is a technical resource for electronics components manufacturers, scientists, and engineers working in the semiconductor industry, product developers of sensors, displays, and other optoelectronic devices, and academics working in the field. Explores the structure of metallic films using characterization methods such as x-ray diffraction and transmission electron microscopy Discusses processing of metallic films, including structure formation during deposition and post-deposition reactions and phase transformations Focuses on the properties of metallic films, including mechanical, electrical, magnetic, optical, and thermal properties

Recent catastrophic blackouts have exposed major vulnerabilities in the existing generation, transmission, and distribution systems of transformers widely used for energy transfer, measurement, protection, and signal coupling. As a result, the reliability of the entire power system is now uncertain, and many blame severe underinvestment, aging technology, and a conservative approach to innovation. Composed of contributions from noted industry experts around the world, Transformers: Analysis, Design, and Measurement offers invaluable information to help designers and users overcome these and other challenges associated with the design, construction, application, and analysis of transformers. This book is divided into three sections to address contemporary economic, design, diagnostic, and maintenance aspects associated with power, instrument, and high-frequency transformers. Topics covered include: Design considerations Capability to withstand short circuits Insulation problems Stray losses, screening, and local excessive heating hazard Shell type and superconducting transformers Links between design and maintenance Component-related diagnostics and reliability Economics of life-cycle cost, design review, and risk-management methods Parameter measurement and prediction This book is an essential tool for understanding and implementing solutions that will ensure improvements in the development, maintenance, and life-cycle management of optimized transformers. This will lead to enhanced safety and reliability and lower costs for the electrical supply. Illustrating the need for close cooperation between users and manufacturers of transformers, this book outlines ways to achieve many crucial power objectives. Among these, the authors focus on the growing demand for transformer miniaturization, increased transmitted power density, and use of advanced materials to meet the requirements of power materials running under higher operational frequencies. Suggesting ways to redirect resources and exploit new technologies—such as computational modeling software—this book presents relatively inexpensive, simple, ready-to-implement strategies to advance transformers, improve power system integrity, reduce environmental impact, and much more.