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SANTIAGO MIKAYLA

Microwaves & RF. McGraw Hill Professional
This book describes methods to design distributed amplifiers useful for performing circuit functions such as duplexing, paraphrase amplification, phase shifting power splitting and power combiner applications. A CMOS bidirectional distributed amplifier is presented that combines for the first time device-level with circuit-level linearization, suppressing the third-order intermodulation distortion. It is implemented in 0.13um RF CMOS technology for use in highly-linear, low-cost UWB Radio-over-Fiber communication systems.
Modeling and Design Techniques for RF Power Amplifiers Presses univ. de Louvain
This book presents the first comprehensive overview of the properties and fabrication methods of GaN-based power transistors, with contributions from the most active research groups in the field. It describes how gallium nitride has emerged as an excellent material for the fabrication of power transistors; thanks to the high energy gap, high breakdown field, and saturation velocity of GaN, these devices can reach breakdown voltages beyond the kV range, and very high switching frequencies, thus being suitable for application in power conversion systems. Based on GaN, switching-mode power converters with efficiency in excess of 99 % have been already demonstrated, thus clearing the way for massive adoption of GaN transistors in the power conversion market. This is expected to have important advantages at both the environmental and economic level, since power conversion losses account for 10 % of global electricity consumption. The first part of the book describes the properties and advantages of gallium nitride compared to conventional semiconductor materials. The second part of the book describes the techniques used for device fabrication, and the methods for GaN-on-Silicon mass production. Specific attention is paid to the three most advanced device

structures: lateral transistors, vertical power devices, and nanowire-based HEMTs. Other relevant topics covered by the book are the strategies for normally-off operation, and the problems related to device reliability. The last chapter reviews the switching characteristics of GaN HEMTs based on a systems level approach. This book is a unique reference for people working in the materials, device and power electronics fields; it provides interdisciplinary information on material growth, device fabrication, reliability issues and circuit-level switching investigation.

Charge-Based MOS Transistor Modeling Springer Science & Business Media

Achieve higher levels of performance, integration, compactness, and cost-effectiveness in the design and modeling of radio-frequency (RF) power amplifiers RF power amplifiers are important components of any wireless transmitter, but are often the limiting factors in achieving better performance and lower cost in a wireless communication system—presenting the RF IC design community with many challenges. The next-generation technological advances presented in this book are the result of cutting-edge research in the area of large-signal device modeling and RF power amplifier design at the Georgia Institute of Technology, and have the potential to significantly address issues of performance and cost-effectiveness in this area. Richly complemented with hundreds of figures and equations, Modeling and Design Techniques for RF Power Amplifiers introduces and explores the most important topics related to RF power amplifier design under one concise cover. With a focus on efficiency enhancement techniques and the latest advances in the field, coverage includes: Device modeling for CAD Empirical modeling of bipolar devices Scalable modeling of RF MOSFETs Power amplifier IC design Power amplifier design in silicon Efficiency enhancement of RF power amplifiers The description of state-of-the-art techniques makes this book a valuable and handy reference for practicing engineers and researchers, while the breadth of coverage makes it an ideal text for graduate- and advanced undergraduate-level courses in the area of RF power amplifier design and modeling.

EPAC 98 CRC Press

This is a rigorous tutorial on radio frequency and microwave power amplifier design, teaching the circuit design techniques that form the microelectronic backbones of modern wireless communications systems. Suitable for self-study, corporate training, or Senior/Graduate classroom use, the book combines analytical calculations and computer-aided design techniques to arm electronic engineers with every possible method to improve their designs and shorten their design time cycles.

Multiharmonic Tuning Behavior of MOSFET RF Power Amplifiers Springer

During the last decade many new concepts have been proposed for improving the performance of power MOSFETs. The results of this research are dispersed in the technical literature among journal articles and abstracts of conferences. Consequently, the information is not readily available to researchers and practicing engineers in the power device community. There is no cohesive treatment of the ideas to provide an assessment of the relative merits of the ideas. "Advanced Power MOSFET Concepts" provides an in-depth treatment of the physics of operation of

advanced power MOSFETs. Analytical models for explaining the operation of all the advanced power MOSFETs will be developed. The results of numerical simulations will be provided to give additional insight into the device physics and validate the analytical models. The results of two-dimensional simulations will be provided to corroborate the analytical models and give greater insight into the device operation.

GaN Transistors for Efficient Power Conversion World Scientific

This dissertation focuses on the design of CMOS power amplifiers for modern wireless handsets, where stringent linearity requirements and high power efficiency are difficult to achieve simultaneously. CMOS technology has been an attractive technology for research in fully-integrated transceivers due to its low cost and high-integration capability, as well as its continuously improving high-frequency performance. Its advantages, however, come at the cost of continuously reduced breakdown voltages, low isolation and high power loss in the substrate. To address these limitations, a stacked-FET design technique is first developed to systematically divide the voltage stress among several transistors connected in series, allowing the use of a larger supply voltage. The voltage swing of each stacked device is added in phase to provide a larger output power to the load without the requirement of a large impedance transformation. To investigate this technique, a fully-integrated 20 dBm RF power amplifier is first implemented using 0.25-[mu]m silicon-on-sapphire MOSFETs. By using triple-stacked FETs, the optimum load impedance for a 20 dBm power amplifier increases to 50 [Omega] so impedance transformation is not required at the output. Measurement of a single-stage linear power amplifier shows a small-signal gain of 17.1 dB and a saturated output power of 21.0 dBm with a power added efficiency (PAE) of 44.0% at 1.88 GHz. With an IS-95 code division multiple access (CDMA) modulated signal, the power amplifier shows average output power of 16.3 dBm and PAE of 18.7% with ACPR below -42 dBc. The concept is then further demonstrated at higher voltage and power level. A single-stage quadruple-stacked-FET linear power amplifier is presented using 0.28-[mu]m 2.5-V standard I/O FETs in a 0.13- & mu;m silicon-on-insulator (SOI) CMOS technology. The PA is designed to withstand up to 9 V of supply voltage before reaching its breakdown limit. The measured PA achieves a small-signal gain of 14.6 dB, a saturated output power of 32.4 dBm, and a PAE of 47% at 1.9 GHz with a 6.5-V supply. Using a reverse-link IS-95 CDMA modulated signal, the PA shows an average output power of up to 28.7 dBm with a PAE of 41.2% while meeting the adjacent channel power ratio requirement. The PA also shows an average output power of up to 29.4 dBm with a PAE of 41.4% while meeting the adjacent channel leakage ratio requirement of an uplink wideband code division multiple access (WCDMA) modulated signal. These performances are comparable to those of GaAs-based power amplifiers. To fully exploit the advantages of higher-speed CMOS technology and the availability of co-integrated digital circuitry, a digital-intensive transceiver architecture is explored as an alternative in the second part of the dissertation. A single-ended digitally-modulated power amplifier (DPA) is demonstrated in a 0.13-[mu]m 1.2-V SOI CMOS technology, to be used in a multi-standard RF polar transmitter. The amplitude modulation is done by digitally controlling the number of activated unit amplifiers

whose currents are summed at the output. The DPA is designed for multi-mode multi-band functionality by avoiding frequency-selective components, except for the final-stage output matching network. The measured DPA delivers a 24.9-dBm peak output power at 900 MHz with a maximum power efficiency of 62.7%. Similar high-efficiency performance is also exhibited at 1.92 GHz with a reconfigured matching network. By employing a digital pre-distortion technique, the DPA could meet linearity requirements for both the enhanced data rate for GSM evolution (EDGE) and WCDMA standards.

JJAP Elsevier

This thesis investigates multiharmonic tuning of RF power amplifiers using power MOSFETs implemented in bulk silicon CMOS technology. The use of this technique may lead to the low-cost implementation of the RF power amplifier integrated on the same chip as the rest of the wireless transceiver. The work proposes a complete classification of multiharmonic tuning into four basic modes: both odd/even harmonics SHORT (SS), odd harmonics SHORT and even harmonics OPEN (SO), odd harmonics OPEN and even harmonics SHORT (OS), and both odd/even harmonics OPEN (OO). Conventional power amplifiers can then be characterized using these modes of operation in so far as multiharmonic tuning is concerned. A systematic multiharmonic tuning optimization procedure is introduced to find the optimal harmonic terminations. The newly proposed OO mode features a sinusoidal drain current waveform containing no harmonics, resulting in little or no energy wasted at harmonic frequencies and yielding high efficiency. To study the multiharmonic tuning behavior of MOSFET RF power amplifiers, power MOSFETs were implemented in a 0.25[mu]m silicon CMOS process. For power amplifiers using these MOSFETs, at 1.88GHz, the OO mode yields the highest efficiency (PAE = 61%) with a 23.3dBm output power at a 12dBm input power and at a 2.0V supply voltage.

Silicon RF Power MOSFETS Springer

This new resource presents readers with all relevant information and comprehensive design methodology of wideband amplifiers. This book specifically focuses on distributed amplifiers and their main components, and presents numerous RF and microwave applications including well-known historical and recent architectures, theoretical approaches, circuit simulation, and practical implementation techniques. A great resource for practicing designers and engineers, this book contains numerous well-known and novel practical circuits, architectures, and theoretical approaches with detailed description of their operational principles.

Radio Frequency Transistors Artech House

Silicon-on-Insulator Technology: Materials to VLSI, Third Edition, retraces the evolution of SOI materials, devices and circuits over a period of roughly twenty years. Twenty years of progress, research and development during which SOI material fabrication techniques have been born and abandoned, devices have been invented and forgotten, but, most importantly, twenty years during which SOI Technology has little by little proven it could outperform bulk silicon in every possible way. The turn of the century turned out to be a milestone for the semiconductor industry, as high-quality SOI wafers suddenly became available in large quantities. From then on, it took only a few years to witness the use of SOI technology in a wealth of applications ranging from

audio amplifiers and wristwatches to 64-bit microprocessors. This book presents a complete and state-of-the-art review of SOI materials, devices and circuits. SOI fabrication and characterization techniques, SOI CMOS processing, and the physics of the SOI MOSFET receive an in-depth analysis. Silicon-on-Insulator Technology: Materials to VLSI, Third Edition, also describes the properties of other SOI devices, such as multiple gate MOSFETs, dynamic threshold devices and power MOSFETs. The advantages and performance of SOI circuits used in both niche and mainstream applications are discussed in detail. The SOI specialist will find this book invaluable as a source of compiled references covering the different aspects of SOI technology. For the non-specialist, the book serves an excellent introduction to the topic with detailed, yet simple and clear explanations. Silicon-on-Insulator Technology: Materials to VLSI, Third Edition is recommended for use as a textbook for classes on semiconductor device processing and physics at the graduate level.

Power GaN Devices Institute of Physics Publishing (GB)

There is not a single industry which will not be transformed by machine learning and Internet of Things (IoT). IoT and machine learning have altogether changed the technological scenario by letting the user monitor and control things based on the prediction made by machine learning algorithms. There has been substantial progress in the usage of platforms, technologies and applications that are based on these technologies. These breakthrough technologies affect not just the software perspective of the industry, but they cut across areas like smart cities, smart healthcare, smart retail, smart monitoring, control, and others. Because of these “game changers,” governments, along with top companies around the world, are investing heavily in its research and development. Keeping pace with the latest trends, endless research, and new developments is paramount to innovate systems that are not only user-friendly but also speak to the growing needs and demands of society. This volume is focused on saving energy at different levels of design and automation including the concept of machine learning automation and prediction modeling. It also deals with the design and analysis for IoT-enabled systems including energy saving aspects at different level of operation. The editors and contributors also cover the fundamental concepts of IoT and machine learning, including the latest research, technological developments, and practical applications. Valuable as a learning tool for beginners in this area as well as a daily reference for engineers and scientists working in the area of IoT and machine technology, this is a must-have for any library.

Silicon-on-Insulator Technology: Materials to VLSI John Wiley & Sons

The book summarizes and compares recent advancements in the development of novel lateral power transistors (LDMOS devices) for integrated circuits in power electronic applications. In its first part, the book motivates the necessity for lateral power transistors by a top-down approach: First, it presents typical energy conversion applications in modern industrial, automotive and consumer electronics. Next, it introduces common circuit topologies suitable for these applications, and discusses the feasibility for monolithic integration. Finally, the combination of power and logic functionality on a single chip is motivated and

the requirements and limitations for the power semiconductor devices are deduced. The second part describes the evolution of lateral power transistors over the past decades from the simple pin-type concept to double-acting RESURF topologies. It describes the principle of operation for these LDMOS devices and discusses limitations of lateral power devices. Moreover, figures-of-merit are presented which can be used to evaluate the performance of the novel lateral power transistors described in this book with respect to the LDMOS devices. In the last part, [..] the fundamental physical concepts including charge compensation and trench gate topologies are discussed. Also, the status of research in LDMOS devices on silicon carbide is presented. Advantages and drawbacks for each of these integration approaches are summarized, and the feasibility with respect to power electronic applications is evaluated.

Proceedings of the ... International Symposium on Power Semiconductor Devices and ICs Springer Science & Business Media

Easily design today's wireless systems and circuits Design an entire radio system from the ground up instead of relying on a simple plug-in selection of circuits to be modified. Avoid an arduous trek through theory and mathematical derivations. Cotter Sayre's Complete Wireless Design covers wireless hardware design more thoroughly than any other handbook —and does it without burying you in math. This new guide from today's bestselling wireless author gives you all the skills you need to design wireless systems and circuits. If you want to climb the learning curve with grace, and start designing what you need immediately, this reasonably priced resource is your best choice. It's certain to be the most-used reference in your wireless arsenal for designing cutting-edge filters, amplifiers, RF switches, oscillators, and more. You get: Simplified calculations for impedance matching, analysis of wireless links, and completing a frequency plan Real-world examples of designing with RFIC's and MMIC's Full circuit and electromagnetic software simulations More

Silicon RF Power MOSFETS Springer Science & Business Media

Fully-depleted SOI CMOS Circuits and Technology for Ultralow-Power Applications addresses the problem of reducing the supply voltage of conventional circuits for ultralow-power operation and explains power-efficient MTCMOS circuit design for FD-SOI devices at a supply voltage of 0.5 V. The topics include the minimum required knowledge of the fabrication of SOI substrates; FD-SOI devices and the latest developments in device and process technologies; and ultralow-voltage circuits, such as digital circuits, analog/RF circuits, and DC-DC converters. Each ultra-low-power technique related to devices and circuits is fully explained using figures to help understanding.

IEICE Transactions on Electronics John Wiley & Sons

This book describes the n and p-channel Silicon Nanowire Transistor (SNT) designs with single and dual-work functions, emphasizing low static and dynamic power consumption. The authors describe a process flow for fabrication and generate SPICE models for building various digital and analog circuits. These include an SRAM, a baseband spread spectrum transmitter, a neuron cell and a Field Programmable Gate Array (FPGA) platform in the digital domain, as well as high bandwidth single-stage and operational amplifiers, RF communication

circuits in the analog domain, in order to show this technology’s true potential for the next generation VLSI.

Distributed Power Amplifiers for RF and Microwave Communications John Wiley & Sons

Offering a single volume reference for high frequency semiconductor devices, this handbook covers basic material characteristics, system level concerns and constraints, simulation and modeling of devices, and packaging. Individual chapters detail the properties and characteristics of each semiconductor device type, including: Varactors, Schottky diodes, transit-time devices, BJTs, HBTs, MOSFETs, MESFETs, and HEMTs. Written by leading researchers in the field, the RF and Microwave Semiconductor Device Handbook provides an excellent starting point for programs involving development, technology comparison, or acquisition of RF and wireless semiconductor devices.

ISPSD'04 Springer Science & Business Media

There are many semiconductors with nominally superior electronic properties compared to silicon. However, silicon became the material of choice for MOSFETs due to its robust native oxide. With Moore's observation as a guiding principle, the semiconductor industry has come a long way in scaling the silicon MOSFETs to smaller dimensions every generation with engineering ingenuity and technological innovation. As per the 2012 International Technology Roadmap for Semiconductors (ITRS), the MOSFET is expected to be scaled to near 6 nm gate length by 2025. However, materials, design and fabrication capabilities aside, basic physical considerations such as source to drain quantum mechanical tunneling, channel to gate tunneling, and thermionic emission over the channel barrier suggest an end to the roadmap for CMOS is on the horizon. The semiconductor industry is already aggressively looking for the next switch which can replace the silicon FET in the long term. My Ph.D. research is part of the quest for the next switch. The promises of process compatibility with existing CMOS technologies, fast carriers with high mobilities, and symmetric conduction and valence bands have led to graphene being considered as a possible alternative to silicon. This work looks at three devices based on graphene using first principles atomistic transport simulations and compact models capturing essential physics: the large-area graphene RF FET, the Bilayer pseudoSpin FET, and the double electron layer resonant tunneling transistor. The characteristics and performance of each device is explored with a combination of SPICE simulations and atomistic quasi static transport simulations. The BiSFET device was found to be a promising alternative to CMOS due to extremely low power dissipation. Finally, I have presented formalism for efficient simulation of time dependent transport in graphene for beyond quasi static performance analysis of the graphene based devices explored in this work.

Fully-Depleted SOI CMOS Circuits and Technology for Ultralow-Power Applications Springer

An up-to-date, practical guide on upgrading from silicon to GaN, and how to use GaN transistors in power conversion systems design This updated, third edition of a popular book on GaN transistors for efficient power conversion has been substantially expanded to keep students and practicing power conversion engineers ahead of the learning curve in GaN technology

advancements. Acknowledging that GaN transistors are not one-to-one replacements for the current MOSFET technology, this book serves as a practical guide for understanding basic GaN transistor construction, characteristics, and applications. Included are discussions on the fundamental physics of these power semiconductors, layout, and other circuit design considerations, as well as specific application examples demonstrating design techniques when employing GaN devices. GaN Transistors for Efficient Power Conversion, 3rd Edition brings key updates to the chapters of Driving GaN Transistors; Modeling, Simulation, and Measurement of GaN Transistors; DC-DC Power Conversion; Envelope Tracking; and Highly Resonant Wireless Energy Transfer. It also offers new chapters on Thermal Management, Multilevel Converters, and Lidar, and revises many others throughout. Written by leaders in the power semiconductor field and industry pioneers in GaN power transistor technology and applications Updated with 35% new material, including three new chapters on Thermal Management, Multilevel Converters, Wireless Power, and Lidar Features practical guidance on formulating specific circuit designs when constructing power conversion systems using GaN transistors A valuable resource for professional engineers, systems designers, and electrical engineering students who need to fully understand the state-of-the-art GaN Transistors for Efficient Power Conversion, 3rd Edition is an essential learning tool and reference guide that enables power conversion engineers to design energy-efficient, smaller, and more cost-effective products using GaN transistors.

Modeling of Graphene-based FETs for Low Power Digital Logic and Radio Frequency Applications John Wiley & Sons

A comprehensive one-volume reference on current JLFET methods, techniques, and research Advancements in transistor technology have driven the modern smart-device revolution—many cell phones, watches, home appliances, and numerous other devices of everyday usage now surpass the performance of the room-filling supercomputers of the past. Electronic devices are continuing to become more mobile, powerful, and versatile in this era of internet-of-things (IoT) due in large part to the scaling of metal-oxide semiconductor field-effect transistors (MOSFETs). Incessant scaling of the conventional MOSFETs to cater to consumer needs without incurring performance degradation requires costly and complex fabrication process owing to the presence of metallurgical junctions. Unlike conventional MOSFETs, junctionless field-effect transistors (JLFETs) contain no metallurgical junctions, so they are simpler to process and less costly to manufacture.JLFETs utilize a gated semiconductor film to control its resistance and the current flowing through it. Junctionless Field-Effect Transistors: Design, Modeling, and Simulation is an inclusive, one-stop referenceon the study and research on JLFETs This timely book covers the fundamental physics underlying JLFET operation, emerging architectures, modeling and simulation methods, comparative analyses of JLFET performance metrics, and several other interesting facts related to JLFETs. A calibrated simulation framework, including guidance on SentaurusTCAD software, enables researchers to investigate JLFETs, develop new architectures, and improve performance. This valuable resource: Addresses the design and architecture challenges faced by JLFET as a replacement for MOSFET Examines various approaches for

analytical and compact modeling of JLFETs in circuit design and simulation Explains how to use Technology Computer-Aided Design software (TCAD) to produce numerical simulations of JLFETs Suggests research directions and potential applications of JLFETs Junctionless Field-Effect Transistors: Design, Modeling, and Simulation is an essential resource for CMOS device design researchers and advanced students in the field of physics and semiconductor devices.

RF and Microwave Semiconductor Device Handbook John Wiley & Sons

The boom of mobile communications leads to an increasing request of low cost and low power mixed mode integrated circuits. Maturity of SOI technology, and recent progresses of MOSFET's microwave performances, explain the success of silicon as compared to III-V technologies for low-cost multigigahertz analog applications. The design of efficient circuits requires accurate, wide-band models for both active and passive elements. Within this frame, passive and active components fabricated in SOI technologies have been studied. Various topologies of integrated transmission lines, like Coplanar Waveguides or thin film microstrip lines, have been analyzed. Also, a new physical model of integrated inductors has been developed. This model, based on a coupled line analysis of square spiral inductors, is scalable and independent of the technology used. Inductors with various spacing between strips, conductor widths, or number of turns can be simulated on different multi-layered substrates. Each layer that composes the substrate is defined using its electrical properties (permittivity, permeability, conductivity). The performances of integrated sub-micron MOSFETs are analyzed. New alternative structures of transistor (the Graded Channel MOSFET and the Dynamic Threshold MOSFET) are proposed to increase the performances of a CMOS technology for for analog, low power, low voltage, and microwave applications. They are studied from Low to High frequency. The graded channel MOSFET is an asymmetric doped channel MOSFET's which bring solutions for the problems of premature drain break-down, hot carrier effects, and threshold voltage (Vth) roll-off issues in deep submicrometer devices. The GCMOS processing is fully compatible with the conventional SOI MOSFET process flow, with no additional steps needed. The dynamic threshold voltage MOS is a MOS transistor for which the gate and the body channel are tied together. All DTMOS electrical properties can be deduced from standard MOS theory by introducing Vbs = Vgs. The main advantage of DTMOS over conventional MOS is its higher drive current at low bias conditions. To keep the body to source current as low as possible, the body bias voltage must be kept lower than 0.7 V. It seems obvious that the DTMOS transistor is an attractive component for low voltage applications.

Characterization and Modeling of SOI RF Integrated Components John Wiley & Sons

Cellular telephones, satellite communications and radar systems are adding to the increasing demand for radio frequency circuit design principles. At the same time, several generations of digitally-oriented graduates are missing the essential RF skills. This book contains a wealth of valuable design information difficult to find elsewhere. It's a complete 'tool kit' for successful RF circuit design. Written by experienced RF design engineers

from Motorola's semiconductors product section. Book covers design examples of circuits (e.g. amplifiers; oscillators; switches; pulsed power; modular systems; wiring state-of-the-art devices; design techniques).