

Chapter 4 Cmos Cascode Amplifiers Shodhganga

Low Power UWB CMOS Radar Sensors deals with the problem of designing low cost CMOS radar sensors. The radar sensor uses UWB signals in order to obtain a reasonable target separation capability, while maintaining a maximum signal frequency below 2 GHz. This maximum frequency value is well within the reach of current CMOS technologies. The use of UWB signals means that most of the methodologies used in the design of circuits and systems that process narrow band signals, can no longer be applied. Low Power UWB CMOS Radar Sensors provides an analysis between the interaction of UWB signals, the antennas and the processing circuits. This analysis leads to some interesting conclusions on the types of antennas and types of circuits that should be used. A methodology to compare the noise performance of UWB processing circuits is also derived. This methodology is used to analyze and design the constituting circuits of the radar transceiver. In order to validate the design methodology a CMOS prototype is designed and experimentally evaluated.

CMOS operational amplifiers (Op Amps) are one of the most important building blocks in many of today's integrated circuits. This cutting-edge volume provides you with an analytical method for designing CMOS Op Amp circuits, placing emphasis on the practical aspects of the design process. This unique book takes an in-depth look at CMOS differential amplifiers, explaining how they are the main part of all Op Amps. The book presents important details and a design method for the different architectures of single ended Op Amps. You find complete chapters dedicated to the critical issues of CMOS output stages, fully differential Op Amps, and CMOS reference generators. This comprehensive book also includes an introduction to CMOS technology and the basics of the physical aspects of MOS transistors, providing you with the foundation needed to fully master the material.

Analog circuit design has grown in importance because so many circuits cannot be realized with digital techniques. Examples are receiver front-ends, particle detector circuits, etc. Actually, all circuits which require high precision, high speed and low power consumption need analog solutions. High precision also needs low noise. Much has been written already on low noise design and optimization for low noise. Very little is available however if the source is not resistive but capacitive or inductive as is the case with antennas or semiconductor detectors. This book provides design techniques for these types of optimization. This book is thus intended firstly for engineers on senior or graduate level who have already designed their first operational amplifiers and want to go further. It is especially for engineers who do not want just a circuit but the best circuit. Design techniques are given that lead to the best performance within a certain technology. Moreover, this is done for all important technologies such as bipolar, CMOS and BiCMOS. Secondly, this

book is intended for engineers who want to understand what they are doing. The design techniques are intended to provide insight. In this way, the design techniques can easily be extended to other circuits as well. Also, the design techniques form a first step towards design automation. Thirdly, this book is intended for analog design engineers who want to become familiar with both bipolar and CMOS technologies and who want to learn more about which transistor to choose in BiCMOS.

The purpose of this book is to provide a complete working knowledge of the Complementary Metal-Oxide Semiconductor (CMOS) analog and mixed-signal circuit design, which can be applied for System on Chip (SOC) or Application-Specific Standard Product (ASSP) development. It begins with an introduction to the CMOS analog and mixed-signal circuit design with further coverage of basic devices, such as the Metal-Oxide Semiconductor Field-Effect Transistor (MOSFET) with both long- and short-channel operations, photo devices, fitting ratio, etc. Seven chapters focus on the CMOS analog and mixed-signal circuit design of amplifiers, low power amplifiers, voltage regulator-reference, data converters, dynamic analog circuits, color and image sensors, and peripheral (oscillators and Input/Output [I/O]) circuits, and Integrated Circuit (IC) layout and packaging. Features: Provides practical knowledge of CMOS analog and mixed-signal circuit design Includes recent research in CMOS color and image sensor technology Discusses sub-blocks of typical analog and mixed-signal IC products Illustrates several design examples of analog circuits together with layout Describes integrating based CMOS color circuit

As the requirements for low power consumption and very small physical dimensions in portable, wearable and implantable medical devices are calling for integrated circuit design techniques using MOSFETs operating in the subthreshold regime, this book first revisits some well-known circuit techniques that use CMOS devices biased in subthreshold in order to establish nanopower integrated circuit designs. Based on these findings, this book shows the development of a class-AB current-mode sample-and-hold circuit with an order of magnitude improvement in its figure of merit compared to other state-of-the-art designs. Also, the concepts and design procedures of 1) single-branch filters 2) follower-integrator-based lowpass filters and 3) modular transconductance reduction techniques for very low frequency filters are presented. Finally, to serve the requirement of a very large signal swing in an energy-based action potential detector, a nanopower class-AB current-mode analog multiplier is designed to handle input current amplitudes of more than 10 times the bias current of the multiplier circuit. The invented filter circuits have been fabricated in a standard 0.18 μ CMOS process in order to verify our circuit concepts and design procedures. Their experimental results are reported. Institutional book, not really for bookstore catalogue The book contains valuable information structured to provide insight on how to design SC sigma-delta modulators. It presents architectures, circuits, models, methods and practical

considerations for the design of high-performance low-pass switched-capacitor (SC) sigma-delta A/D interfaces for mixed-signal CMOS ASICs. The main focus of the book is on cascade architectures. It differs from other books in the complete, in-depth coverage of SC circuit errors.

This book demonstrates how to design a wideband receiver operating in current mode, in which the noise and non-linearity are reduced, implemented in a low cost single chip, using standard CMOS technology. The authors present a solution to remove the transimpedance amplifier (TIA) block and connect directly the mixer's output to a passive second-order continuous-time ?? analog to digital converter (ADC), which operates in current-mode. These techniques enable the reduction of area, power consumption, and cost in modern CMOS receivers.

This book enables circuit designers to reduce the errors introduced by the fundamental limitations (noise, bandwidth, and signal power) and electromagnetic interference (EMI) in negative-feedback amplifiers. The authors describe a systematic design approach for application specific negative-feedback amplifiers, with specified signal-to-error ratio (SER). This approach enables designers to calculate noise, bandwidth, EMI, and the required bias parameters of the transistors used in application specific amplifiers in order to meet the SER requirements.

Compact Low-Voltage and High-Speed CMOS, BiCMOS and Bipolar Operational Amplifiers discusses the design of integrated operational amplifiers that approach the limits of low supply voltage or very high bandwidth. The resulting realizations span the whole field of applications from micro-power CMOS VLSI amplifiers to 1-GHz bipolar amplifiers. The book presents efficient circuit topologies in order to combine high performance with simple solutions. In total twelve amplifier realizations are discussed. Two bipolar amplifiers are discussed, a 1-GHz operational amplifier and an amplifier with a high ratio between the maximum output current and the quiescent current. Five amplifiers have been designed in CMOS technology, extremely compact circuits that can operate on supply voltages down to one gate-source voltage and two saturation voltages which equals about 1.4 V and, ultimate-low-voltage amplifiers that can operate on supply voltages down to one gate-source voltage and one saturation voltage which amounts to about 1.2 V. In BiCMOS technology five amplifiers have been designed. The first two amplifiers are based on a compact topology. Two other amplifiers are designed to operate on low supply voltages down to 1.3 V. The final amplifier has a unity-gain frequency of 200 MHz and can operate down to 2.5 V. Compact Low-Voltage and High-Speed CMOS, BiCMOS and Bipolar Operational Amplifiers is intended for the professional analog designer. Also, it is suitable as a text book for advanced courses in amplifier design.

Discover a fresh approach to efficient and insight-driven analog integrated circuit design in nanoscale-CMOS with this hands-on guide. Expert authors present a sizing methodology that employs SPICE-generated lookup tables, enabling

close agreement between hand analysis and simulation. This enables the exploration of analog circuit tradeoffs using the g_m/ID ratio as a central variable in script-based design flows, and eliminates time-consuming iterations in a circuit simulator. Supported by downloadable MATLAB code, and including over forty detailed worked examples, this book will provide professional analog circuit designers, researchers, and graduate students with the theoretical know-how and practical tools needed to acquire a systematic and re-use oriented design style for analog integrated circuits in modern CMOS.

Fuzzy logic is a computational paradigm capable of modelling the own uncertainty of human beings. This wide-ranging book focuses in-depth on the VLSI CMOS implementation and application of programmable analogue Fuzzy Logic Controllers following a mixed-signal philosophy.

The classical approach to analog circuit analysis is a daunting prospect to many students, requiring tedious enumeration of contributing factors and lengthy calculations. Most textbooks apply this cumbersome approach to small-signal amplifiers, which becomes even more difficult as the number of components increases. Analysis of Bipolar and CMOS Amplifiers offers students an alternative that enables quick and intuitive analysis and design: the analysis-by-inspection method. This practical and student-friendly text demonstrates how to achieve approximate results that fall within an acceptable range of accuracy and are based on sound scientific principles. Working from the basics of amplifiers and transistors to biasing, single- and multistage amplifiers, current sources and mirrors, and analysis at midband, low, and high frequencies, the author demonstrates the interrelationship between behavior in both the time and frequency domains and balances the discussion between bipolar and CMOS circuits. Each chapter closes with a set of simulation examples in SPICE and MATLAB® that give students hands-on experience applying the concepts and methods using industry-standard tools. Building a practical working knowledge around a solid theoretical framework, Analysis of Bipolar and CMOS Amplifiers prepares your students to meet the challenges of quick and accurate approximations and software-based analysis awaiting them in the workplace.

Structured Analog CMOS Design describes a structured analog design approach that makes it possible to simplify complex analog design problems and develop a design strategy that can be used for the design of large number of analog cells. It intentionally avoids treating the analog design as a mathematical problem, developing a design procedure based on the understanding of device physics and approximations that give insight into parameter interdependences. The basic design concept consists in analog cell partitioning into the basic analog structures and sizing of these basic analog structures in a predefined procedural design sequence. The procedural design sequence ensures the correct propagation of design specifications, the verification of parameter limits and the local optimization loops. The proposed

design procedure is also implemented as a CAD tool that follows this book.

The essentials of analog circuit design with a unique all-region MOSFET modeling approach.

Fundamentals of Microelectronics, 2nd Edition is designed to build a strong foundation in both design and analysis of electronic circuits this text offers conceptual understanding and mastery of the material by using modern examples to motivate and prepare readers for advanced courses and their careers. The book's unique problem-solving framework enables readers to deconstruct complex problems into components that they are familiar with which builds the confidence and intuitive skills needed for success. CMOS: Front-End Electronics for Radiation Sensors offers a comprehensive introduction to integrated front-end electronics for radiation detectors, focusing on devices that capture individual particles or photons and are used in nuclear and high energy physics, space instrumentation, medical physics, homeland security, and related fields. Emphasizing practical design and implementation, this book: Covers the fundamental principles of signal processing for radiation detectors Discusses the relevant analog building blocks used in the front-end electronics Employs systematically weak and moderate inversion regimes in circuit analysis Makes complex topics such as noise and circuit-weighting functions more accessible Includes numerical examples where appropriate CMOS: Front-End Electronics for Radiation Sensors provides specialized knowledge previously obtained only through the study of multiple technical and scientific papers. It is an ideal text for students of physics and electronics engineering, as well as a useful reference for experienced practitioners.

This book is the first standalone book that combines research into low-noise amplifiers (LNAs) with research into millimeter-wave circuits. In compiling this book, the authors have set two research objectives. The first is to bring together the research context behind millimeter-wave circuit operation and the theory of low-noise amplification. The second is to present new research in this multi-disciplinary field by dividing the common LNA configurations and typical specifications into subsystems, which are then optimized separately to suggest improvements in the current state-of-the-art designs. To achieve the second research objective, the state-of-the-art LNA configurations are discussed and the weaknesses of state-of-the-art configurations are considered, thus identifying research gaps. Such research gaps, among others, point towards optimization – at a systems and microelectronics level. Optimization topics include the influence of short wavelength, layout and crosstalk on LNA performance. Advanced fabrication technologies used to decrease the parasitics of passive and active devices are also explored, together with packaging technologies such as silicon-on-chip and silicon-on-package, which are proposed as alternatives to traditional IC implementation. This research outcome builds through innovation. Innovative ideas for LNA construction are explored, and alternative design methodologies are deployed, including LNA/antenna co-design or utilization of the electronic design automation in the research flow. The book also offers the authors' proposal for streamlined automated LNA design flow, which focuses on LNA as a collection of highly optimized subsystems.

This comprehensive treatment of the challenges in low-power RF CMOS design deals with the design and implementation of low-power wireless transceivers in a standard digital CMOS process. It addresses trade-offs and techniques that improve

performance, from the component level to the architectural level.

A comprehensive study of silicon-based distributed architectures in wideband circuits are presented in this book. Novel circuit architectures for ultra-wideband (UWB) wireless technologies are described. The book begins with an introduction of several transceiver architectures for UWB. The discussion then focuses on RF front-end of the UWB radio. Therefore, the book will be of interest to RF circuit designers and students.

This book helps engineers to grasp fundamental theories and design principles by presenting physical and intuitive explanations of switched-capacitor circuits. Numerous circuit examples are discussed and the author emphasizes the most important and fundamental principles involved in implementing state-of-the-art switched-capacitor circuits for analog signal processing and power management applications. Throughout the book, the author presents numerous step-by-step tutorials and gives practical design examples. While some quantitative analysis is necessary to understand underlying concepts, tedious mathematical equations and formal proofs are avoided. An intuitive appreciation for switched-capacitor circuits is achieved. Much of the existing information on contemporary switched-capacitor circuit applications is in the form of applications notes and data sheets for various switched-capacitor ICs. This book compiles such information in a single volume and coherently organizes and structures it. The author has his own website at www.mingliangliu.com * Step-by-step tutorials which emphasize the most fundamental principals of switched-capacitor circuits * Few tedious mathematical equations * The first easy-to-understand compilation on this subject--most information available is not very cohesive

Today, most, if not all microelectronic circuit design is performed with the aid of a computer-aided circuit analysis program. SPICE has become the industry standard software for computer-aided circuit analysis for microelectronic circuits. This text is ideal as a companion to Sedra and Smith's Microelectronic Circuits, Third Edition, but is also a very effective stand-alone tutorial text on computer-aided circuit analysis using SPICE.

The book covers the CMOS-based millimeter wave circuits and devices and presents methods and design techniques to use CMOS technology for circuits operating beyond 100 GHz. Coverage includes a detailed description of both active and passive devices, including modeling techniques and performance optimization. Various mm-wave circuit blocks are discussed, emphasizing their design distinctions from low-frequency design methodologies. This book also covers a device-oriented circuit design technique that is essential for ultra high speed circuits and gives some examples of device/circuit co-design that can be used for mm-wave technology.

One of the main trends of microelectronics is toward design for integrated systems, i.e., system-on-a-chip (SoC) or system-on-silicon (SoS). Due to this development, design techniques for mixed-signal circuits become more important than before. Among other devices, analog-to-digital and digital-to-analog converters are the two bridges between the analog and the digital worlds. Besides, low-power design technique is one of the main issues for embedded systems, especially for hand-held applications. Modular Low-Power, High-Speed CMOS Analog-to-Digital Converter for Embedded Systems aims at design techniques for low-

power, high-speed analog-to-digital converter processed by the standard CMOS technology. Additionally this book covers physical integration issues of A/D converter integrated in SoC, i.e., substrate crosstalk and reference voltage network design.

This book presents high-/mixed-voltage analog and radio frequency (RF) circuit techniques for developing low-cost multistandard wireless receivers in nm-length CMOS processes. Key benefits of high-/mixed-voltage RF and analog CMOS circuits are explained, state-of-the-art examples are studied, and circuit solutions before and after voltage-conscious design are compared. Three real design examples are included, which demonstrate the feasibility of high-/mixed-voltage circuit techniques. Provides a valuable summary and real case studies of the state-of-the-art in high-/mixed-voltage circuits and systems; Includes novel high-/mixed-voltage analog and RF circuit techniques – from concept to practice; Describes the first high-voltage-enabled mobile-TVRF front-end in 90nm CMOS and the first mixed-voltage full-band mobile-TV Receiver in 65nm CMOS; Demonstrates the feasibility of high-/mixed-voltage circuit techniques with real design examples.

This book presents the challenges and solutions of designing power amplifiers at RF and mm-Wave frequencies in a silicon-based process technology. It covers practical power amplifier design methodologies, energy- and spectrum-efficient power amplifier design examples in the RF frequency for cellular and wireless connectivity applications, and power amplifier and power generation designs for enabling new communication and sensing applications in the mm-Wave and THz frequencies. With this book you will learn: Power amplifier design fundamentals and methodologies Latest advances in silicon-based RF power amplifier architectures and designs and their integration in wireless communication systems State-of-the-art mm-Wave/THz power amplifier and power generation circuits and systems in silicon Extensive coverage from fundamentals to advanced design topics, focusing on various layers of abstraction: from device modeling and circuit design strategy to advanced digital and mixed-signal architectures for highly efficient and linear power amplifiers New architectures for power amplifiers in the cellular and wireless connectivity covering detailed design methodologies and state-of-the-art performances Detailed design techniques, trade-off analysis and design examples for efficiency enhancement at power back-off and linear amplification for spectrally-efficient non-constant envelope modulations Extensive coverage of mm-Wave power-generation techniques from the early days of the 60 GHz research to current state-of-the-art reconfigurable, digital mm-Wave PA architectures Detailed analysis of power generation challenges in the higher mm-Wave and THz frequencies and novel technical solutions for a wide range for potential applications, including ultrafast wireless communication to sensing, imaging and spectroscopy Contributions from the world-class experts from both academia and industry The work establishes the design flow for the optimization of linear CMOS power amplifiers from the first steps of the design to the final IC implementation and tests. The authors also focuses on design guidelines of the inductor's geometrical characteristics for power applications and covers their measurement and characterization. Additionally, a model is proposed which would facilitate designs in terms of transistor sizing, required inductor quality factors or minimum supply voltage. The model considers limitations that CMOS processes can impose on implementation. The book also provides different techniques and architectures that allow for optimization.

Integrated circuits (ICs) don't always work the first time. Many things can and do go wrong in analog circuit designs. There are a number of common errors that often require costly chip redesign and refabrication, all of which can be avoided when designers are aware of the pitfalls. To realize success, IC designers need a complete toolbox—a toolbox filled not only with a solid background in electronics, design concepts and analysis skills, but also with the most valuable tool of all: experience. Analog BiCMOS Design offers IC design engineers the learning equivalent to decades of practical experience. Culled from the careers of practicing engineers, it presents the most effective methods and the pitfalls most frequently encountered in the design of biCMOS integrated circuits. Accessible to anyone who has taken a course in electronics, this book covers the basic design of bandgap voltage references, current mirrors, amplifiers, and comparators. It reviews common design errors often overlooked and offers design techniques used to remedy those problems. With its complete coverage of basic circuit building blocks, full details of common design pitfalls, and a compendium of design and layout problems and solutions, Analog BiCMOS Design is the perfect reference for IC designers and engineers, fledgling and experienced alike. Read it to reinforce your background, browse it for ideas on avoiding pitfalls, and when you run into a problem, use it to find a solution.

Low-Voltage CMOS Operational Amplifiers: Theory, Design and Implementation discusses both single and two-stage architectures. Opamps with constant-gm input stage are designed and their excellent performance over the rail-to-rail input common mode range is demonstrated. The first set of CMOS constant-gm input stages was introduced by a group from Technische Universiteit, Delft and Universiteit Twente, the Netherlands. These earlier versions of circuits are discussed, along with new circuits developed at the Ohio State University. The design, fabrication (MOSIS Tiny Chips), and characterization of the new circuits are now complete. Basic analog integrated circuit design concepts should be understood in order to fully appreciate the work presented. However, the topics are presented in a logical order and the circuits are explained in great detail, so that Low-Voltage CMOS Operational Amplifiers can be read and enjoyed by those without much experience in analog circuit design. It is an invaluable reference book, and may be used as a text for advanced courses on the subject.

????????????????, ???CMOS????????????, ???MOS????????????.

This book tackles both high efficiency and high linearity power amplifier (PA) design in low-voltage CMOS. With its emphasis on theory, design and implementation, the book offers a guide for those actively involved in the design of fully integrated CMOS wireless transceivers. Offering mathematical background, as well as intuitive insight, the book is essential reading for RF design engineers and researchers and is also suitable as a text book.

The book comprehends the latest Anna University syllabus on the course Electronic Circuits J which is designed for the third year ECE students of Anna University. The book has a perfect blend of focused content coverage and solved Anna University question papers which will be extremely helpful to the students. Salient features - Crisp content presentation in line with the latest Anna University syllabus of Electronic Circuits I, (Regulation 2013) - Previous Anna University solved

questions are appropriately incorporated as; • Long Questions: Tagged with text • Short Questions: End o/the chapter - Rich exam-oriented pedagogy: • Solved Examples: 85 • Solved 1Wo Marks Questions: 52 • Review Questions: 111 • Illustrations: 195

A step-by-step guide to the design and analysis of CMOS operational amplifiers and comparators This volume is a comprehensive text that offers a detailed treatment of the analysis and design principles of two of the most important components of analog metal oxide semiconductor (MOS) circuits, namely operational amplifiers (op-amps) and comparators. The book covers the physical operation of these components, their design procedures, and applications to analog MOS circuits-particularly those involving switched-capacitor circuits, and analog-to-digital (A/D) and digital-to-analog (D/A) converters. Roubik Gregorian, a leading authority in the field, gives circuit designers the technical knowledge they need to design high-performance op-amps and comparators suitable for most analog circuit applications. In this self-contained treatment, which is loosely based on his well-received 1986 book, Analog MOS Integrated Circuits for Signal Processing (coauthored with Gabor C. Temes), Gregorian reviews the required basics before advancing to state-of-the-art topics and problem-solving techniques. This valuable guide: * Clearly explains configuration and performance limitation issues affecting the operation of CMOS op-amps and comparators * Details advanced design procedures to improve performance * Provides practical design examples suitable for a broad range of analog circuit applications * Incorporates hundreds of illustrations into the text * Concludes each chapter with problems and references to advanced topics, useful in textbook adoptions Introduction to CMOS Op-Amps and Comparators is invaluable for analog and mixed-signal designers, for senior and graduate students in electrical engineering, and for anyone who would like to keep up with this essential technology.

This book addresses the need for energy-efficient amplifiers, providing gain enhancement strategies, suitable to run in parallel with lower supply voltages, by introducing a new family of single-stage cascode-free amplifiers, with proper design, optimization, fabrication and experimental evaluation. The authors describe several topologies, using the UMC 130 nm CMOS technology node with standard-VT devices, for proof-of-concept, achieving results far beyond what is achievable with a classic single-stage folded-cascode amplifier. Readers will learn about a new family of circuits with a broad range of applications, together with the familiarization with a state-of-the-art electronic design automation methodology used to explore the design space of the proposed circuit family.

CMOS Current Amplifiers; Speed versus Nonlinearity is intended as a current-amplifier cookbook containing an extensive review of different current amplifier topologies realisable with modern CMOS integration technologies. The seldom-discussed issue of high-frequency distortion performance is derived for all reviewed amplifier topologies using as simple

and intuitive mathematical methods as possible. The topologies discussed are also useful as building blocks for high-performance voltage-mode amplifiers. So the reader can apply the discussed techniques to both voltage- and current-mode analogue integrated circuit design. For the most popular open-loop current-mode amplifier, the second-generation current-conveyor (CCII), a macro model is derived that, unlike other reported macromodels, can accurately predict the common-mode behaviour in differential applications. Similarly, this model is used to describe the nonidealities of several other current-mode amplifiers. With modern low-voltage CMOS-technologies, the current-mode operational amplifier and the high-gain current-conveyor (CCIIINFINITY perform better than various open-loop current-amplifiers. Similarly, unlike with conventional voltage-mode operational amplifiers, the large-signal settling behaviour of these two amplifier types does not degrade as CMOS-processes are scaled down. This book contains application examples with experimental results in three different fields: instrumentation amplifiers, continuous-time analogue filters and logarithmic amplifiers. The instrumentation amplifier example shows that using unmatched off-the-self components very high CMRR can be reached even at relatively high frequencies. As a filter application, two 1 MHz 3rd-order low-pass continuous-time filters are realised with a 1.2 μm CMOS-process. These filters use a differential CCIIINFINITY with linearised, dynamically biased output stages resulting in outstanding performance when compared to most OTA-C filter realisations reported. As an application example of nonlinear circuits, two logarithmic amplifier chips are designed and fabricated. The first circuit, implemented with a 1.2 μm BiCMOS-process, uses again a CCII8 and a pn-junction as a logarithmic feedback element. With a CCII8 the constant gain-bandwidth product, typical of voltage-mode operational amplifiers, is avoided resulting in a constant 1 MHz bandwidth within a 60 dB signal amplitude range. The second current-mode logarithmic amplifier, realised in a 1.2 μm CMOS-process, is based on piece-wise linear approximation of the logarithmic function. In this logarithmic amplifier, using limiting current amplifiers instead of limiting voltage amplifiers results in exceptionally low temperature dependency of the logarithmic output signal. Additionally, along with this logarithmic amplifier a new current peak detector is developed.

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