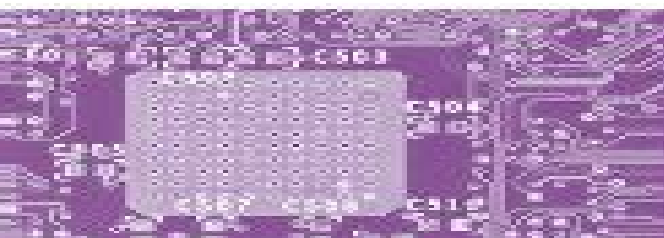




# ESD

ANALOG CIRCUITS AND DESIGN

STEVEN H. VOLDMAN



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# Esd Design For Analog Circuits

**Vladislav A. Vashchenko, Andrei  
Shibkov**



## **Esd Design For Analog Circuits:**

**ESD** Steven H. Voldman, 2014-07-30 A comprehensive and in depth review of analog circuit layout schematic architecture device power network and ESD design This book will provide a balanced overview of analog circuit design layout analog circuit schematic development architecture of chips and ESD design It will start at an introductory level and will bring the reader right up to the state of the art Two critical design aspects for analog and power integrated circuits are combined The first design aspect covers analog circuit design techniques to achieve the desired circuit performance The second and main aspect presents the additional challenges associated with the design of adequate and effective ESD protection elements and schemes A comprehensive list of practical application examples is used to demonstrate the successful combination of both techniques and any potential design trade offs Chapter One looks at analog design discipline including layout and analog matching and analog layout design practices Chapter Two discusses analog design with circuits examining single transistor amplifiers multi transistor amplifiers active loads and more The third chapter covers analog design layout also MOSFET layout before Chapters Four and Five discuss analog design synthesis The next chapters introduce the reader to analog digital mixed signal design synthesis analog signal pin ESD networks and analog ESD power clamps Chapter Nine the last chapter covers ESD design in analog applications Clearly describes analog design fundamentals circuit fundamentals as well as outlining the various ESD implications Covers a large breadth of subjects and technologies such as CMOS LDMOS BCD SOI and thick body SOI Establishes an ESD analog design discipline that distinguishes itself from the alternative ESD digital design focus Focuses on circuit and circuit design applications Assessable with the artwork and tutorial style of the ESD book series PowerPoint slides are available for university faculty members Even in the world of digital circuits analog and power circuits are two very important but under addressed topics especially from the ESD aspect Dr Voldman's new book will serve as an essential and practical guide to the greater IC community With high practical and academic values this book is a bible for professionals graduate students device and circuit designers for investigating the physics of ESD and for product designs and testing

*ESD Design for Analog Circuits* Vladislav A. Vashchenko, Andrei Shibkov, 2010-07-27 This Book and Simulation Software Bundle Project Dear Reader this book project brings to you a unique study tool for ESD protection solutions used in analog integrated circuit IC design Quick start learning is combined with in depth understanding for the whole spectrum of cross disciplinary knowledge required to excel in the ESD field The chapters cover technical material from elementary semiconductor structure and device levels up to complex analog circuit design examples and case studies The book project provides two different options for learning the material The printed material can be studied as any regular technical textbook At the same time another option adds parallel exercise using the trial version of a complementary commercial simulation tool with prepared simulation examples Combination of the textbook material with numerical simulation experience presents a unique opportunity to gain a level of expertise that is hard to achieve otherwise The book is bundled with simplified trial

version of commercial mixed TM mode simulation software from Angstrom Design Automation The DECIMM Device Circuit Mixed Mode simulator tool and complementary to the book's simulation examples can be downloaded from [www.analogesd.com](http://www.analogesd.com) The simulation examples prepared by the authors support the specific examples discussed across the book chapters A key idea behind this project is to provide an opportunity to not only study the book material but also gain a much deeper understanding of the subject by direct experience through practical simulation examples

**The ESD Handbook** Steven H. Voldman, 2021-04-12 A practical and comprehensive reference that explores Electrostatic Discharge ESD in semiconductor components and electronic systems The ESD Handbook offers a comprehensive reference that explores topics relevant to ESD design in semiconductor components and explores ESD in various systems Electrostatic discharge is a common problem in the semiconductor environment and this reference fills a gap in the literature by discussing ESD protection Written by a noted expert on the topic the text offers a topic by topic reference that includes illustrative figures discussions and drawings The handbook covers a wide range of topics including ESD in manufacturing garments wrist straps and shoes ESD Testing ESD device physics ESD semiconductor process effects ESD failure mechanisms ESD circuits in different technologies CMOS Bipolar etc ESD circuit types Pin Power Pin to Pin etc and much more In addition the text includes a glossary index tables illustrations and a variety of case studies Contains a well organized reference that provides a quick review on a range of ESD topics Fills the gap in the current literature by providing information from purely scientific and physical aspects to practical applications Offers information in clear and accessible terms Written by the accomplished author of the popular ESD book series Written for technicians operators engineers circuit designers and failure analysis engineers The ESD Handbook contains an accessible reference to ESD design and ESD systems

**ESD** Steven H. Voldman, 2006-02-03 The scaling of semiconductor devices from sub micron to nanometer dimensions is driving the need for understanding the design of electrostatic discharge ESD circuits and the response of these integrated circuits IC to ESD phenomena ESD Circuits and Devices provides a clear insight into the layout and design of circuitry for protection against electrical overstress EOS and ESD With an emphasis on examples this text explains ESD buffering ballasting current distribution design segmentation feedback coupling and decoupling ESD design methods outlines the fundamental analytical models and experimental results for the ESD design of MOSFETs and diode semiconductor device elements with a focus on CMOS silicon on insulator SOI and Silicon Germanium SiGe technology focuses on the ESD design optimization integration and synthesis of these elements and concepts into ESD networks as well as applying within the off chip driver networks and on chip receivers and highlights state of the art ESD input circuits as well as ESD power clamps networks Continuing the author's series of books on ESD this book will be an invaluable reference for the professional semiconductor chip and system ESD engineer Semiconductor device and process development quality reliability and failure analysis engineers will also find it an essential tool In addition both senior undergraduate and graduate students in microelectronics and IC design will find its numerous examples useful

**System**

**Level ESD Protection** Vladislav Vashchenko, Mirko Scholz, 2014-03-21 This book addresses key aspects of analog integrated circuits and systems design related to system level electrostatic discharge ESD protection It is an invaluable reference for anyone developing systems on chip SoC and systems on package SoP integrated with system level ESD protection The book focuses on both the design of semiconductor integrated circuit IC components with embedded on chip system level protection and IC system co design The readers will be enabled to bring the system level ESD protection solutions to the level of integrated circuits thereby reducing or completely eliminating the need for additional discrete components on the printed circuit board PCB and meeting system level ESD requirements The authors take a systematic approach based on IC system ESD protection co design A detailed description of the available IC level ESD testing methods is provided together with a discussion of the correlation between IC level and system level ESD testing methods The IC level ESD protection design is demonstrated with representative case studies which are analyzed with various numerical simulations and ESD testing The overall methodology for IC system ESD co design is presented as a step by step procedure that involves both ESD testing and numerical simulations     **1997 International Symposium on VLSI Technology, Systems, and Applications** ,1997     **IEEE Transactions on Circuits and Systems** ,2006     **ESD** Steven H. Voldman, 2006-11-02 With the growth of high speed telecommunications and wireless technology it is becoming increasingly important for engineers to understand radio frequency RF applications and their sensitivity to electrostatic discharge ESD phenomena This enables the development of ESD design methods for RF technology leading to increased protection against electrical overstress EOS and ESD ESD RF Technology and Circuits Presents methods for co synthesizing ESD networks for RF applications to achieve improved performance and ESD protection of semiconductor chips discusses RF ESD design methods of capacitance load transformation matching network co synthesis capacitance shunts inductive shunts impedance isolation load cancellation methods distributed loads emitter degeneration buffering and ballasting examines ESD protection and design of active and passive elements in RF complementary metal oxide semiconductor CMOS RF laterally diffused metal oxide semiconductor LDMOS RF BiCMOS Silicon Germanium SiGe RF BiCMOS Silicon Germanium Carbon SiGeC and Gallium Arsenide technology gives information on RF ESD testing methodologies RF degradation effects and failure mechanisms for devices circuits and systems highlights RF ESD mixed signal design integration of digital analog and RF circuitry sets out examples of RF ESD design computer aided design methodologies covers state of the art RF ESD input circuits as well as voltage triggered to RC triggered ESD power clamps networks in RF technologies as well as off chip protection concepts Following the authors series of books on ESD this book will be a thorough overview of ESD in RF technology for RF semiconductor chip and ESD engineers Device and circuit engineers working in the RF domain and quality reliability and failure analysis engineers will also find it a valuable reference in the rapidly growing area of RF ESD design In addition it will appeal to graduate students in RF microwave technology and RF circuit design     **EDN, Electrical Design News** ,2000     Printed Circuit Board Design

Techniques for EMC Compliance Mark I. Montrose, IEEE Electromagnetic Compatibility Society, 1996 Presents simple techniques for designing and laying out circuits that meet the most stringent domestic and international regulations on electromagnetic compatibility for high technology products Includes sample designs in every stage of the product development cycle information on the latest suppression techniques and a checklist of layout techniques Annotation copyrighted by Book News Inc Portland OR

**Electrical Overstress/Electrostatic Discharge Symposium Proceedings**, 2004

Proceedings of Technical Papers, 1999

**Nano-CMOS Circuit and Physical Design** Ban Wong, 2005 Based on the authors expansive collection of notes taken over the years Nano CMOS Circuit and Physical Design bridges the gap between physical and circuit design and fabrication processing manufacturability and yield This innovative book covers process technology including sub wavelength optical lithography impact of process scaling on circuit and physical implementation and low power with leaky transistors and DFM yield and the impact of physical implementation

Proceedings, 2001

**Proceedings of the ... European Symposium on Reliability of Electron Devices, Failure Physics and Analyses**, 1996

**ESD** Steven H. Voldman, 2006

**IEEE 2000 First International Symposium on Quality Electronic Design**, 2000

Basic ESD and I/O Design Sanjay Dabral, Timothy Maloney, 1998 This volume presents an integrated treatment of ESD I O and process parameter interactions that both I O designers and process designers can use It examines key factors in I O and ESD design and testing and helps the reader consider ESD and reliability issues up front when making I O choices Emphasizing clarity and simplicity this book focuses on design principles that can be applied widely as this dynamic field continues to evolve

**Electronic Engineering and Information Science** Jing Hua Yin, Bo Su, Dong Xing Wang, 2014-07-08 Selected peer reviewed papers from the 2014 International Conference on Electronic Engineering and Information Science ICEEIS 2014 June 21 22 2014 Harbin China

*Ultra Low Power Transmitters for Wireless Sensor Networks* Yuen Hui Chee, 2006

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