

Electrostatic Discharge Protection

Advances and Applications

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Electrostatic Discharge Protection Advances And Applications Devices Circuits And Systems

Steven Voldman



Electrostatic Discharge Protection Advances And Applications Devices Circuits And Systems:

Electrostatic Discharge Protection Juin J. Liou, 2017-07-26 Electrostatic discharge ESD is one of the most prevalent threats to electronic components In an ESD event a finite amount of charge is transferred from one object i e human body to another i e microchip This process can result in a very high current passing through the microchip within a very short period of time Thus more than 35 percent of single event chip damages can be attributed to ESD events and designing ESD structures to protect integrated circuits against the ESD stresses is a high priority in the semiconductor industry Electrostatic Discharge Protection Advances and Applications delivers timely coverage of component and system level ESD protection for semiconductor devices and integrated circuits Bringing together contributions from internationally respected researchers and engineers with expertise in ESD design optimization modeling simulation and characterization this book bridges the gap between theory and practice to offer valuable insight into the state of the art of ESD protection Amply illustrated with tables figures and case studies the text Instills a deeper understanding of ESD events and ESD protection design principles Examines vital processes including Si CMOS Si BCD Si SOI and GaN technologies Addresses important aspects pertinent to the modeling and simulation of ESD protection solutions Electrostatic Discharge Protection Advances and Applications provides a single source for cutting edge information vital to the research and development of effective robust ESD protection solutions for semiconductor devices and integrated circuits

Electrostatic Discharge Protection Juin J. Liou, 2017-12-19 Electrostatic discharge ESD is one of the most prevalent threats to electronic components In an ESD event a finite amount of charge is transferred from one object i e human body to another i e microchip This process can result in a very high current passing through the microchip within a very short period of time Thus more than 35 percent of single event chip damages can be attributed to ESD events and designing ESD structures to protect integrated circuits against the ESD stresses is a high priority in the semiconductor industry Electrostatic Discharge Protection Advances and Applications delivers timely coverage of component and system level ESD protection for semiconductor devices and integrated circuits Bringing together contributions from internationally respected researchers and engineers with expertise in ESD design optimization modeling simulation and characterization this book bridges the gap between theory and practice to offer valuable insight into the state of the art of ESD protection Amply illustrated with tables figures and case studies the text Instills a deeper understanding of ESD events and ESD protection design principles Examines vital processes including Si CMOS Si BCD Si SOI and GaN technologies Addresses important aspects pertinent to the modeling and simulation of ESD protection solutions Electrostatic Discharge Protection Advances and Applications provides a single source for cutting edge information vital to the research and development of effective robust ESD protection solutions for semiconductor devices and integrated circuits

ESD Protection Device and Circuit Design for Advanced CMOS Technologies Oleg Semenov, Hossein Sarbishaei, Manoj Sachdev, 2008-04-26 ESD Protection Device and Circuit Design for Advanced CMOS Technologies is

intended for practicing engineers working in the areas of circuit design VLSI reliability and testing domains As the problems associated with ESD failures and yield losses become significant in the modern semiconductor industry the demand for graduates with a basic knowledge of ESD is also increasing Today there is a significant demand to educate the circuits design and reliability teams on ESD issues This book makes an attempt to address the ESD design and implementation in a systematic manner A design procedure involving device simulators as well as circuit simulator is employed to optimize device and circuit parameters for optimal ESD as well as circuit performance This methodology described in ESD Protection Device and Circuit Design for Advanced CMOS Technologies has resulted in several successful ESD circuit design with excellent silicon results and demonstrates its strengths

Noise Coupling in System-on-Chip Thomas Noulis, 2018-01-09 Noise Coupling is the root cause of the majority of Systems on Chip SoC product fails The book discusses a breakthrough substrate coupling analysis flow and modelling toolset addressing the needs of the design community The flow provides capability to analyze noise components propagating through the substrate the parasitic interconnects and the package Using this book the reader can analyze and avoid complex noise coupling that degrades RF and mixed signal design performance while reducing the need for conservative design practices With chapters written by leading international experts in the field novel methodologies are provided to identify noise coupling in silicon It additionally features case studies that can be found in any modern CMOS SoC product for mobile communications automotive applications and readout front ends

Diagnostic Devices with Microfluidics Francesco Piraino, Šeila Selimović, 2017-06-26 This book provides a current view of the research and commercial landscape of diagnostics devices particularly those that utilize microscale technologies intended for both patient and laboratory use Common diagnostic devices that are based on microfluidic principles include glucose sensors for diabetic patients and over the counter pregnancy tests Other diagnostic devices are being developed to quickly test a patient for bacterial and viral infections and other diseases The chapters written by experts from around the world discuss how to fabricate apply and market microfluidic diagnostic chips for lab and at home use Most importantly the book also contains a discussion of topics relevant to the private sector including patient focused market oriented development of diagnostics devices Chapter 9 of this book is freely available as a downloadable Open Access PDF at <http://www.taylorfrancis.com> under a Creative Commons Attribution CC BY 4.0 license

ESD Steven H. Voldman, 2015-04-24 ESD Circuits and Devices 2nd Edition provides a clear picture of layout and design of digital analog radio frequency RF and power applications for protection from electrostatic discharge ESD electrical overstress EOS and latchup phenomena from a generalist perspective and design synthesis practices providing optimum solutions in advanced technologies New features in the 2nd edition Expanded treatment of ESD and analog design of passive devices of resistors capacitors inductors and active devices of diodes bipolar junction transistors MOSFETs and FINFETs Increased focus on ESD power clamps for power rails for CMOS Bipolar and BiCMOS Co synthesizing of semiconductor chip architecture and floor planning with ESD design practices for

analog and mixed signal applications Illustrates the influence of analog design practices on ESD design circuitry from integration synthesis and layout to symmetry matching inter digitation and common centroid techniques Increased emphasis on system level testing conforming to IEC 61000 4 2 and IEC 61000 4 5 Improved coverage of low capacitance ESD scaling of devices and oxide scaling challenges ESD Circuits and Devices 2nd Edition is an essential reference to ESD circuit semiconductor engineers and quality reliability analysis engineers It is also useful for graduate and undergraduate students in electrical engineering semiconductor sciences microelectronics and IC design

ESD Protection Architecture in Integrated Circuits Pasquale De Marco, 2025-04-13 Electrostatic discharge ESD is a major threat to the reliability of integrated circuits ICs ESD can cause damage to ICs during manufacturing assembly testing and use As a result ESD protection is an essential part of IC design ESD Protection Architecture in Integrated Circuits provides a comprehensive overview of ESD protection for ICs This book covers all aspects of ESD protection from the basics to the latest advances The book is written by a team of experts in the field of ESD protection and it is intended for a wide audience including IC designers ESD engineers and researchers This book begins with an introduction to ESD and its effects on ICs It then discusses ESD protection standards and testing methods The book then covers the different types of ESD protection devices and their applications It also discusses ESD protection design techniques and failure analysis The book then moves on to more advanced topics such as ESD protection for advanced technologies 3D ICs high speed interfaces automotive applications and medical devices The book also discusses ESD protection in system design manufacturing and assembly Finally the book concludes with a discussion of future trends in ESD protection This includes emerging ESD threats and challenges advanced ESD protection technologies and ESD protection for next generation technologies ESD Protection Architecture in Integrated Circuits is an essential resource for anyone who is involved in the design manufacture or use of ICs It provides a comprehensive overview of ESD protection and the latest advances in the field

Key Features Comprehensive coverage of all aspects of ESD protection Written by a team of experts in the field of ESD protection Intended for a wide audience including IC designers ESD engineers and researchers Up to date coverage of the latest advances in ESD protection

Benefits Readers will gain a deep understanding of ESD protection Readers will be able to design and implement effective ESD protection measures Readers will be able to keep up with the latest advances in ESD protection If you like this book write a review on google books

Compressed Sensing for Engineers Angshul Majumdar, 2018-12-07 Compressed Sensing CS in theory deals with the problem of recovering a sparse signal from an under determined system of linear equations The topic is of immense practical significance since all naturally occurring signals can be sparsely represented in some domain In recent years CS has helped reduce scan time in Magnetic Resonance Imaging making scans more feasible for pediatric and geriatric subjects and has also helped reduce the health hazard in X Ray Computed CT This book is a valuable resource suitable for an engineering student in signal processing and requires a basic understanding of signal

processing and linear algebra Covers fundamental concepts of compressed sensing Makes subject matter accessible for engineers of various levels Focuses on algorithms including group sparsity and row sparsity as well as applications to computational imaging medical imaging biomedical signal processing and machine learning Includes MATLAB examples for further development Electrostatic Discharge Steven Voldman, 2019-10-02 As we enter the nanoelectronics era electrostatic discharge ESD phenomena is an important issue for everything from micro electronics to nanostructures This book provides insight into the operation and design of micro gaps and nanogenerators with chapters on low capacitance ESD design in advanced technologies electrical breakdown in micro gaps nanogenerators from ESD and theoretical prediction and optimization of triboelectric nanogenerators The information contained herein will prove useful for for engineers and scientists that have an interest in ESD physics and design **Optical Imaging Devices** Ajit Khosla, Dongsoo Kim, 2017-12-19 Optical Imaging Devices New Technologies and Applications delivers a comprehensive introduction to optical imaging and sensing from devices to system level applications Drawing upon the extensive academic and industrial experience of its prestigious editors and renowned chapter authors this authoritative text Explains the physical principles of optical imaging and sensing Covers topics such as silicon based imaging characteristics nanophotonic phased arrays thin film sensors label free DNA sensors and in vivo flow cytometry Presents the contributions of leading researchers real world examples from biomedicine recommendations for further reading and all measurements in SI units Optical Imaging Devices New Technologies and Applications provides an essential understanding of the design operation and practical applications of optical imaging and sensing systems making it a handy reference for students and practitioners alike Wireless Transceiver Circuits Woogeun Rhee, 2018-09-03 Modern transceiver systems require diversified design aspects as various radio and sensor applications have emerged Choosing the right architecture and understanding interference and linearity issues are important for multi standard cellular transceivers and software defined radios A millimeter wave complementary metal oxide semiconductor CMOS transceiver design for multi Gb/s data transmission is another challenging area Energy efficient short range radios for body area networks and sensor networks have recently received great attention To meet different design requirements gaining good system perspectives is important Wireless Transceiver Circuits System Perspectives and Design Aspects offers an in depth look at integrated circuit IC design for modern transceiver circuits and wireless systems Ranging in scope from system perspectives to practical circuit design for emerging wireless applications this cutting edge book Provides system design considerations in modern transceiver design Covers both systems and circuits for the millimeter wave transceiver design Introduces four energy efficient short range radios for biomedical and wireless connectivity applications Emphasizes key building blocks in modern transceivers and transmitters including frequency synthesizers and digital intensive phase modulators Featuring contributions from renowned international experts in industry and academia Wireless Transceiver Circuits System Perspectives and Design Aspects makes an ideal reference for engineers

and researchers in the area of wireless systems and circuits Solid-State Radiation Detectors Salah Awadalla,2017-12-19 Integrating aspects of engineering application physics and medical science Solid State Radiation Detectors Technology and Applications offers a comprehensive review of new and emerging solid state materials based technologies for radiation detection Each chapter is structured to address the current advantages and challenges of each material and technology presented as well as to discuss novel research and applications Featuring contributions from leading experts in industry and academia this authoritative text Covers modern semiconductors used for radiation monitoring Examines CdZnTe and CdTe technology for imaging applications including three dimensional capability detectors Highlights interconnect technology for current pixel detectors Describes hybrid pixel detectors and their characterizations Tackles the integrated analog signal processing read out front ends for particle detectors Considers new organic materials with direct bandgap for direct energy detection Summarizes recent developments involving lanthanum halide and cerium bromide scintillators Analyzes the potential of recent progress in the field of crystallogenes quantum dots and photonics crystals toward a new concept of x and gamma ray detectors based on metamaterials Explores position sensitivity photomultipliers and silicon photomultipliers for scintillation crystals Solid State Radiation Detectors Technology and Applications provides a valuable reference for engineers and scientists looking to enhance the performance of radiation detector technology for medical imaging and other applications *Advances in Solid State Circuit Technologies* Paul Chu,2010-04-01 This book brings together contributions from experts in the fields to describe the current status of important topics in solid state circuit technologies It consists of 20 chapters which are grouped under the following categories general information circuits and devices materials and characterization techniques These chapters have been written by renowned experts in the respective fields making this book valuable to the integrated circuits and materials science communities It is intended for a diverse readership including electrical engineers and material scientists in the industry and academic institutions Readers will be able to familiarize themselves with the latest technologies in the various fields **Organic Solar Cells** Qiquan Qiao,2017-12-19 Current energy consumption mainly depends on fossil fuels that are limited and can cause environmental issues such as greenhouse gas emissions and global warming These factors have stimulated the search for alternate clean and renewable energy sources Solar cells are some of the most promising clean and readily available energy sources Plus the successful utilization of solar energy can help reduce the dependence on fossil fuels Recently organic solar cells have gained extensive attention as a next generation photovoltaic technology due to their light weight mechanical flexibility and solution based cost effective processing Organic Solar Cells Materials Devices Interfaces and Modeling provides an in depth understanding of the current state of the art of organic solar cell technology Encompassing the full spectrum of organic solar cell materials modeling and simulation and device physics and engineering this comprehensive text Discusses active layer interfacial and transparent electrode materials Explains how to relate synthesis parameters to morphology of the photoactive layer using molecular

dynamics simulations Offers insight into coupling morphology and interfaces with charge transport in organic solar cells Explores photoexcited carrier dynamics defect states interface engineering and nanophase separation Covers inorganic organic hybrids tandem structure and graphene based polymer solar cells Organic Solar Cells Materials Devices Interfaces and Modeling makes an ideal reference for scientists and engineers as well as researchers and students entering the field from broad disciplines including chemistry material science and engineering physics nanotechnology nanoscience and electrical engineering

Soft Errors Jean-Luc Autran, Daniela Munteanu, 2017-12-19 Soft errors are a multifaceted issue at the crossroads of applied physics and engineering sciences Soft errors are by nature multiscale and multiphysics problems that combine not only nuclear and semiconductor physics material sciences circuit design and chip architecture and operation but also cosmic ray physics natural radioactivity issues particle detection and related instrumentation Soft Errors From Particles to Circuits addresses the problem of soft errors in digital integrated circuits subjected to the terrestrial natural radiation environment one of the most important primary limits for modern digital electronic reliability Covering the fundamentals of soft errors as well as engineering considerations and technological aspects this robust text Discusses the basics of the natural radiation environment particle interactions with matter and soft error mechanisms Details instrumentation developments in the fields of environment characterization particle detection and real time and accelerated tests Describes the latest computational developments modeling and simulation strategies for the soft error rate estimation in digital circuits Explores trends for future technological nodes and emerging devices Soft Errors From Particles to Circuits presents the state of the art of this complex subject providing comprehensive knowledge of the complete chain of the physics of soft errors The book makes an ideal text for introductory graduate level courses offers academic researchers a specialized overview and serves as a practical guide for semiconductor industry engineers or application engineers

Laser-Based Optical Detection of Explosives Paul M. Pellegrino, Ellen L. Holthoff, Mikella E. Farrell, 2018-09-03 Laser Based Optical Detection of Explosives offers a comprehensive review of past present and emerging laser based methods for the detection of a variety of explosives This book Considers laser propagation safety and explains standard test material preparation for standoff optical based detection system evaluation Explores explosives detection using deep ultraviolet native fluorescence Raman spectroscopy laser induced breakdown spectroscopy reflectometry and hyperspectral imaging Examines photodissociation followed by laser induced fluorescence photothermal methods cavity enhanced absorption spectrometry and short pulse laser based techniques Describes the detection and recognition of explosives using terahertz frequency spectroscopic techniques Each chapter is authored by a leading expert on the respective technology and is structured to supply historical perspective address current advantages and challenges and discuss novel research and applications Readers are left with an in depth understanding and appreciation of each technology s capabilities and potential for standoff hazard detection

Design of 3D Integrated Circuits and Systems Rohit Sharma, 2018-09-03 Three dimensional 3D

integration of microsystems and subsystems has become essential to the future of semiconductor technology development 3D integration requires a greater understanding of several interconnected systems stacked over each other While this vertical growth profoundly increases the system functionality it also exponentially increases the design complexity Design of 3D Integrated Circuits and Systems tackles all aspects of 3D integration including 3D circuit and system design new processes and simulation techniques alternative communication schemes for 3D circuits and systems application of novel materials for 3D systems and the thermal challenges to restrict power dissipation and improve performance of 3D systems Containing contributions from experts in industry as well as academia this authoritative text Illustrates different 3D integration approaches such as die to die die to wafer and wafer to wafer Discusses the use of interposer technology and the role of Through Silicon Vias TSVs Presents the latest improvements in three major fields of thermal management for multiprocessor systems on chip MPSoCs Explores ThruChip Interface TCI NAND flash memory stacking and emerging applications Describes large scale integration testing and state of the art low power testing solutions Complete with experimental results of chip level 3D integration schemes tested at IBM and case studies on advanced complementary metal oxide semiconductor CMOS integration for 3D integrated circuits ICs Design of 3D Integrated Circuits and Systems is a practical reference that not only covers a wealth of design issues encountered in 3D integration but also demonstrates their impact on the efficiency of 3D systems Electrical Overstress (EOS) Steven H. Voldman, 2013-08-27 Electrical Overstress EOS continues to impact semiconductor manufacturing semiconductor components and systems as technologies scale from micro to nano electronics This book teaches the fundamentals of electrical overstress and how to minimize and mitigate EOS failures The text provides a clear picture of EOS phenomena EOS origins EOS sources EOS physics EOS failure mechanisms and EOS on chip and system design It provides an illuminating insight into the sources of EOS in manufacturing integration of on chip and system level EOS protection networks followed by examples in specific technologies circuits and chips The book is unique in covering the EOS manufacturing issues from on chip design and electronic design automation to factory level EOS program management in today's modern world Look inside for extensive coverage on Fundamentals of electrical overstress from EOS physics EOS time scales safe operating area SOA to physical models for EOS phenomena EOS sources in today's semiconductor manufacturing environment and EOS program management handling and EOS auditing processing to avoid EOS failures EOS failures in both semiconductor devices circuits and system Discussion of how to distinguish between EOS events and electrostatic discharge ESD events e.g. such as human body model HBM charged device model CDM cable discharge events CDM charged board events CBE to system level IEC 61000 4 2 test events EOS protection on chip design practices and how they differ from ESD protection networks and solutions Discussion of EOS system level concerns in printed circuit boards PCB and manufacturing equipment Examples of EOS issues in state of the art digital analog and power technologies including CMOS LDMOS and BCD EOS design rule checking DRC LVS and ERC electronic design automation

EDA and how it is distinct from ESD EDA systems EOS testing and qualification techniques and Practical off chip ESD protection and system level solutions to provide more robust systems Electrical Overstress EOS Devices Circuits and Systems is a continuation of the author's series of books on ESD protection It is an essential reference and a useful insight into the issues that confront modern technology as we enter the nano electronic era

Radiation Detectors for Medical Imaging Jan S. Iwanczyk, 2015-10-16 Radiation Detectors for Medical Imaging discusses the current state of the art and future prospects of photon counting detectors for medical imaging applications Featuring contributions from leading experts and pioneers in their respective fields this book Describes x ray spectral imaging detectors based on cadmium zinc telluride CdZnTe and cad

The ESD Handbook Steven H. Voldman, 2021-03-02 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

The Top Books of the Year Electrostatic Discharge Protection Advances And Applications Devices Circuits And Systems The year 2023 has witnessed a remarkable surge in literary brilliance, with numerous compelling novels captivating the hearts of readers worldwide. Lets delve into the realm of top-selling books, exploring the engaging narratives that have enthralled audiences this year. Electrostatic Discharge Protection Advances And Applications Devices Circuits And Systems : Colleen Hoover "It Ends with Us" This heartfelt tale of love, loss, and resilience has gripped readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can triumph. Electrostatic Discharge Protection Advances And Applications Devices Circuits And Systems : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This spellbinding historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids captivating storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This evocative coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens spins a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These popular novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a exceptional and suspenseful novel that will keep you guessing until the very end. The novel is a cautionary tale about the dangers of obsession and the power of evil.

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