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Nota di contenuto	ESD; Contents; About the Author; Preface; Acknowledgements; 1 Electrostatics and Electrothermal Physics; 1.1 Introduction; 1.2 A Time Constant Approach; 1.2.1 ESD Time Constants; 1.2.2 Time Constant Hierarchy; 1.2.3 Thermal Time Constant; 1.2.4 Thermal Diffusion; 1.2.5 Adiabatic, Thermal Diffusion Time Scale and Steady State; 1.2.6 Electroquasistatics and Magnetoquasistatics; 1.3 Instability; 1.3.1 Electrical Instability; 1.3.2 Electrothermal Instability; 1.3.3 Spatial Instability and Current Constriction; 1.4 Breakdown; 1.4.1 Paschen's Breakdown Theory; 1.4.2 Townsend's Concept 1.4.3 Toepler's Law 1.5 Avalanche Breakdown; 1.5.1 Breakdown in Air; 1.5.2 Air Breakdown and Peak Currents; 1.5.3 Air Breakdown and Rise Times; 1.5.4 Mesoplasmas and Microplasmas; 1.5.5 Mesoplasma Phenomena; Problems; References; 2 Electrothermal Methods and ESD

Models; 2.1 Electrothermal Methods; 2.1.1 Green's Function and Method of Images; 2.1.2 Integral Transforms of the Heat Conduction Equation; 2.1.3 Flux Potential Transfer Relations Matrix Methodology; 2.1.4 Heat Equation with Variable Conductivity; 2.1.5 Duhamel Formulation; 2.2 Electrothermal Models; 2.2.1 Tasca Model 2.2.2 Wunsch-Bell Model 2.2.3 Smith-Littau Model; 2.2.4 Arkhipov-Astvatsatryan-Godovosyn-Rudenko Model; 2.2.5 Vlasov-Sinkevitch Model; 2.2.6 Dwyer-Franklin-Campbell Model; 2.2.7 Greve Model; 2.2.8 Negative Differential Resistance Model; 2.2.9 Ash Model; 2.2.10 Statistical Models; Problems; References; 3 Semiconductor Devices and ESD; 3.1 Device Physics; 3.1.1 Nonisothermal Simulation; 3.2 Diodes; 3.2.1 Diode Equation; 3.2.2 Recombination and Generation Mechanisms; 3.3 Bipolar High-current Device Physics; 3.3.1 Bipolar Transistor Equation; 3.3.2 Kirk Effect; 3.3.3 Johnson Limit 3.4 Silicon-Controlled Rectifiers 3.4.1 Regenerative Feedback; 3.5 Resistors; 3.6 MOSFET High-current Device Physics; 3.6.1 Parasitic Bipolar Transistor Equation; 3.6.2 Avalanche Breakdown and Snapback; 3.6.3 Instability and Current Constriction Model; 3.6.4 Dielectric Breakdown; 3.6.5 Gate Induced Drain Leakage (GIDL); Problems; References; 4 Substrates and ESD; 4.1 Methods of Substrate Analysis; 4.2 Substrate as a Semi-infinite Domain; 4.3 Substrate as a Stratified Medium Using the Transfer Matrix Approach; 4.4 Substrate Transmission Line Model; 4.5 Substrate Lossy Transmission Line Models 4.6 Substrate Absorption, Reflection and Transmission 4.7 Substrate Electrical and Thermal Discretization; 4.8 Substrate Effects: Electrical Transfer Resistance; 4.9 Substrate Effects: Thermal Transfer Resistance; 4.10 Substrate Thermal Resistance Models; 4.10.1 Variable Cross-section Model; 4.10.2 Variable Elliptical Cross-section Model; 4.10.3 Back-surface Substrate Lumped Analytical Model; 4.11 Heavily Doped Substrates; 4.12 Low-doped Substrates; Problems; References; 5 Wells, Sub-collectors and ESD; 5.1 Diffused Wells; 5.2 Retrograde and Vertically Modulated Wells; 5.2.1 Retrograde Wells 5.2.2 Retrograde Well Substrate Modulation

Sommario/riassunto

This volume is the first in a series of three books addressing Electrostatic Discharge (ESD) physics, devices, circuits and design across the full range of integrated circuit technologies. ESD Physics and Devices provides a concise treatment of the ESD phenomenon and the physics of devices operating under ESD conditions. Voldman presents an accessible introduction to the field for engineers and researchers requiring a solid grounding in this important area. The book contains advanced CMOS, Silicon On Insulator, Silicon Germanium, and Silicon Germanium Carbon. In addition it also address
