

# Handbook Of 3d Integration Technology And Applications Of 3d Integrated Circuits

Handbook of 3D Integration, Volume 1 3D Integration in VLSI Circuits 3D Integration in VLSI Circuits Handbook of 3D Integration, Volume 3 3D Integration for VLSI Systems 3D Integration Technology for Lab-on-a-chip Applications Handbook of 3D Integration 3D Stacked Chips Advances In 3d Integrated Circuits And Systems 3D IC Stacking Technology Through-Silicon Vias for 3D Integration 3D Integration in VLSI Circuits Handbook of 3D Integration, Volume 4 Handbook of 3D Integration, Volumes 1 and 2 Three-Dimensional Integrated Circuits Design of 3D Integrated Circuits and Systems A Novel Chip-to-wafer 3D Integration Technology Three Dimensional System Integration Low Temperature 3D Integration Technology 3D Integration for NoC-based SoC Architectures Philip Garrou Katsuyuki Sakuma Katsuyuki Sakuma Philip Garrou Chuan Seng Tan Yüksel Temiz John Wiley & Sons Ibrahim (Abe) M. Elfadel Hao Yu Banqiu Wu John H. Lau Katsuyuki Sakuma Paul D. Franzon Philip Garrou Guangyu Sun Rohit Sharma Dingyou Zhang Antonis Papanikolaou Sang Kevin Kim Abbas Sheibanyrad Handbook of 3D Integration, Volume 1 3D Integration in VLSI Circuits 3D Integration in VLSI Circuits Handbook of 3D Integration, Volume 3 3D Integration for VLSI Systems 3D Integration Technology for Lab-on-a-chip Applications Handbook of 3D Integration 3D Stacked Chips Advances In 3d Integrated Circuits And Systems 3D IC Stacking Technology Through-Silicon Vias for 3D Integration 3D Integration in VLSI Circuits Handbook of 3D Integration, Volume 4 Handbook of 3D Integration, Volumes 1 and 2 Three-Dimensional Integrated Circuits Design of 3D Integrated Circuits and Systems A Novel Chip-to-wafer 3D Integration Technology Three Dimensional System Integration Low Temperature 3D Integration Technology 3D Integration for NoC-based SoC Architectures Philip Garrou Katsuyuki Sakuma Katsuyuki Sakuma Philip Garrou Chuan Seng Tan Yüksel Temiz John Wiley & Sons Ibrahim (Abe) M. Elfadel Hao Yu Banqiu Wu John H. Lau Katsuyuki Sakuma Paul D. Franzon Philip Garrou Guangyu Sun Rohit Sharma Dingyou Zhang Antonis Papanikolaou Sang Kevin Kim Abbas Sheibanyrad

the first encompassing treatise of this new but very important field puts the known physical limitations for classic 2d electronics into perspective with the requirements for further electronics developments and market necessities this two volume handbook presents 3d solutions to the feature density problem addressing all important issues such as wafer processing die bonding packaging technology and thermal aspects it begins with an introductory part which defines necessary goals existing issues and relates 3d integration to the semiconductor roadmap of the industry before going on to cover processing technology and 3d structure fabrication strategies in detail this is followed by fields of application and a look at the future of 3d integration the contributions come from key players in the field from both academia and industry including such companies as lincoln labs fraunhofer rpi aset imec cea leti ibm and renesas

currently the term 3d integration includes a wide variety of different integration methods such as 2.5 dimensional 2.5d interposer based integration 3d integrated circuits 3d ics 3d systems in package sip 3d heterogeneous integration and monolithic 3d ics the goal of this book is to provide readers with an understanding of the latest challenges and issues in 3d integration tsvs are not the only technology element needed for 3d integration there are numerous other key enabling technologies required for 3d integration and the speed of the development in this emerging field is very rapid to provide readers with state of the art information on 3d integration research and technology developments each chapter has been contributed by some of the world's leading scientists and experts from academia research institutes and industry from around the globe covers chip wafer level 3d integration technology memory stacking reconfigurable 3d and monolithic 3d ic discusses the use of silicon interposer and organic interposer presents architecture design and technology implementations for 3d fpga integration describes oxide bonding cu/sio<sub>2</sub> hybrid bonding adhesive bonding and solder bonding addresses the issue of thermal dissipation in 3d integration

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edited by key figures in 3d integration and written by top authors from high tech companies and renowned research institutions this book covers the intricate details of 3d process technology as such the main focus is on silicon via formation bonding and debonding thinning via reveal and backside processing both from a technological and a materials science perspective the last part of the book is concerned with assessing and enhancing the reliability of the 3d integrated devices which is a prerequisite for the large scale implementation of this emerging technology invaluable reading for materials scientists semiconductor physicists and those working in the semiconductor industry as well as it and electrical engineers

three dimensional 3d integration is identified as a possible avenue for continuous performance growth in integrated circuits ic as the conventional scaling approach is faced with unprecedented challenges in fundamental and economic limits wafer level 3d ic can take several forms and they usually include a stack of several thinned ic layers th

this book explains for readers how 3d chip stacks promise to increase the level of on chip integration and to design new heterogeneous semiconductor devices that combine chips of different integration technologies incl sensors in a single package of the smallest possible size the authors focus on heterogeneous 3d integration

addressing some of the most important challenges in this emerging technology including contactless optics based and carbon nanotube based 3d integration as well as signal integrity and thermal management issues in copper based 3d integration coverage also includes the 3d heterogeneous integration of power sources photonic devices and non volatile memories based on new materials systems

3d integration is an emerging technology for the design of many core microprocessors and memory integration this book advances in 3d integrated circuits and systems is written to help readers understand 3d integrated circuits in three stages device basics system level management and real designs contents presented in this book include fabrication techniques for 3d tsv and 2 5d tsi device modeling physical designs thermal power and i o management and 3d designs of sensors i os multi core processors and memory advanced undergraduates graduate students researchers and engineers may find this text useful for understanding the many challenges faced in the development and building of 3d integrated circuits and systems

the latest advances in three dimensional integrated circuit stacking technology with a focus on industrial applications 3d ic stacking technology offers comprehensive coverage of design test and fabrication processing methods for three dimensional device integration each chapter in this authoritative guide is written by industry experts and details a separate fabrication step future industry applications and cutting edge design potential are also discussed this is an essential resource for semiconductor engineers and portable device designers 3d ic stacking technology covers high density through silicon stacking tss technology practical design ecosystem for heterogeneous 3d ic products design automation and tcad tool solutions for through silicon via tsv based 3d ic stack process integration for tsv manufacturing high aspect ratio silicon etch for tsv dielectric deposition for tsv barrier and seed deposition copper electrodeposition for tsv chemical mechanical polishing for tsv applications temporary and permanent bonding assembly and test aspects of tsv technology

a comprehensive guide to tsv and other enabling technologies for 3d integration written by an expert with more than 30 years of experience in the electronics industry through silicon vias for 3d integration provides cutting edge information on tsv wafer thinning thin wafer handling microbumping and assembly and thermal management technologies applications to highperformance high density low power consumption wide bandwidth and small form factor electronic products are discussed this book offers a timely summary of progress in all aspects of this fascinating field for professionals active in 3d integration research and development those who wish to master 3d integration problem solving methods and anyone in need of a low power wide bandwidth design and high yield manufacturing process for interconnect systems coverage includes nanotechnology and 3d integration for the semiconductor industry tsv etching dielectric barrier and seed layer deposition cu plating cmp and cu revealing tsvs mechanical thermal and electrical behaviors thin wafer strength measurement wafer thinning and thin wafer handling microbumping assembly and reliability microbump electromigration transient liquid phase bonding c2c c2w and w2w 2 5d ic integration with interposers 3d ic integration with interposers thermal management of 3d ic integration 3d ic packaging

currently the term 3d integration includes a wide variety of different integration methods such as 2.5 dimensional 2.5d interposer based integration 3d integrated circuits 3d ics 3d systems in package sip 3d heterogeneous integration and monolithic 3d ics the goal of this book is to provide readers with an understanding of the latest challenges and issues in 3d integration tsvs are not the only technology element needed for 3d integration there are numerous other key enabling technologies required for 3d integration and the speed of the development in this emerging field is very rapid to provide readers with state of the art information on 3d integration research and technology developments each chapter has been contributed by some of the world's leading scientists and experts from academia research institutes and industry from around the globe covers chip wafer level 3d integration technology memory stacking reconfigurable 3d and monolithic 3d ic discusses the use of silicon interposer and organic interposer presents architecture design and technology implementations for 3d fpga integration describes oxide bonding cu/sio<sub>2</sub> hybrid bonding adhesive bonding and solder bonding addresses the issue of thermal dissipation in 3d integration

this fourth volume of the landmark handbook focuses on the design testing and thermal management of 3d integrated circuits both from a technological and materials science perspective edited and authored by key contributors from top research institutions and high tech companies the first part of the book provides an overview of the latest developments in 3d chip design including challenges and opportunities the second part focuses on the test methods used to assess the quality and reliability of the 3d integrated circuits while the third and final part deals with thermal management and advanced cooling technologies and their integration

the first encompassing treatise of this new and very important field puts the known physical limitations for classic 2d microelectronics into perspective with the requirements for further microelectronics developments and market necessities this two volume handbook presents 3d solutions to the feature density problem addressing all important issues such as wafer processing die bonding packaging technology and thermal aspects it begins with an introductory part which defines necessary goals existing issues and relates 3d integration to the semiconductor roadmap of the industry before going on to cover processing technology and 3d structure fabrication strategies in detail this is followed by fields of application and a look at the future of 3d integration the editors have assembled contributions from key academic and industrial players in the field including intel micron ibm infineon qimonda nxp philips toshiba semitool evg tezzaron lincoln labs fraunhofer rpi imec cea leti and many others

presents the background on 3d integration technology and shows the major benefits offered by 3d integration eda design tools and methodologies for 3d ics are reviewed the cost of 3d integration is also analyzed

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 through chip 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

three dimensional 3d integrated circuit ic stacking is the next big step in electronic system integration it enables packing more functionality as well as integration of heterogeneous materials devices and signals in the same space volume this results in consumer electronics e g mobile handheld devices which can run more powerful applications such as full length movies and 3d games with longer battery life this technology is so promising that it is expected to be a mainstream technology a few years from now less than 10 15 years from its original conception to achieve this type of end product changes in the entire manufacturing and design process of electronic systems are taking place this book provides readers with an accessible tutorial on a broad range of topics essential to the non expert in 3d system integration it is an invaluable resource for anybody in need of an overview of the 3d manufacturing and design chain

this book presents the research challenges that are due to the introduction of the 3rd dimension in chips for researchers and covers the whole architectural design approach for 3d socs nowadays the 3d integration technologies 3d design techniques and 3d architectures are emerging as interesting truly hot broad topics the present book gathers the recent advances in the whole domain by renowned experts in the field to build a comprehensive and consistent book around the hot topics of three dimensional architectures and micro architectures this book includes contributions from high level international teams working in this field

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