

Electronic Packaging and Interconnection Handbook

McGraw-Hill **Handbook**

ELECTRONIC PACKAGING AND INTERCONNECTION HANDBOOK

FOURTH EDITION

- Micro packaging
- Communications packaging
- Chip scale, flip-chip, and direct chip attachment

CHARLES A. HARPER

Electronic Packaging And Interconnection Handbook

William W. Sheng, Ronald P. Colino



Electronic Packaging And Interconnection Handbook:

Electronic Packaging and Interconnection Handbook Charles A. Harper, 2000 Covering every aspect of electronic packaging from development and design to manufacturing facilities and testing **Electronic Packaging and Interconnection Handbook** Third Edition continues to be the standard reference in its field Here in this single information packed resource are all the data and guidelines you need for all types and levels of electronic packages interconnection technologies and electronic systems No other book treats all of the subjects covered in this handbook in such an integrated and inter related manner a treatment designed to help you achieve a more reliable more manufacturable and more cost effective electronic package Here s everything you need to know about materials thermal management mechanical and thermomechanical stress behavior wiring and cabling soldering and solder technology integrated circuit packaging surface mount technologies rigid and flexible printed wiring boards And with over 60% new material this third edition brings you thoroughly up to speed on a new generation of packaging technologies single chip packaging ball gridarrays chip scale packaging low cost flip chiptechnologies direct chip attach and more

Electronic Packaging and Interconnection Handbook 4/E Charles A. Harper, 2005 Whether you re designing an electronic system from scratch or engineering the project from someone else s design the Handbook gives you the tools you need to get the job done faster cheaper and more reliably than ever We guarantee it From development and design to manufacturing and testing the Handbook has you covered It s the one resource to turn to first Why not put it to the test and see for yourself

Electronic Packaging and Interconnection Handbook Charles A. Harper, 1991

Area Array Interconnection Handbook Karl J. Puttlitz, Paul Totta, 2001 This handbook provides a comprehensive treatment of area array interconnections for both chips and microelectronic packages in terms of optimizing densification functionality and reliability It provides comparisons with alternative and competing technologies clearly defining cost versus benefit tradeoffs and strategies Process details are defined in the order of their typical manufacturing sequence indicating tooling requirements and potential yield detractors In addition the handbook has individual chapters devoted to supporting disciplines that play a key role in satisfying the requirements of microelectronic package applications efficient thermal dissipation techniques metallurgical and mechanical characteristics of interconnections and electrical design strategies Area array technology at both die and chip carrier levels offers the best opportunity of satisfying the demanding performance requirements that users at all levels of the product spectrum have come to expect

Microelectronics Packaging Handbook Rao Tummala, Eugene J. Rymaszewski, Alan G. Klopfenstein, 1997-01-31 This thoroughly revised and updated three volume set continues to be the standard reference in the field providing the latest in microelectronics design methods modeling tools simulation techniques and manufacturing procedures Unlike reference books that focus only on a few aspects of microelectronics packaging these outstanding volumes discuss state of the art packages that meet the power cooling protection and interconnection requirements of increasingly

dense and fast microcircuitry Providing an excellent balance of theory and practical applications this dynamic compilation features step by step examples and vital technical data simplifying each phase of package design and production In addition the volumes contain over 2000 references 900 figures and 250 tables Part I Technology Drivers covers the driving force of microelectronics packaging electrical thermal and reliability It introduces the technology developer to aspects of manufacturing that must be considered during product development Part II Semiconductor Packaging discusses the interconnection of the IC chip to the first level of packaging and all first level packages Electrical test sealing and encapsulation technologies are also covered in detail Part III Subsystem Packaging explores board level packaging as well as connectors cables and optical packaging **Materials for Advanced Packaging** Daniel Lu,C.P. Wong,2016-11-18

Significant progress has been made in advanced packaging in recent years Several new packaging techniques have been developed and new packaging materials have been introduced This book provides a comprehensive overview of the recent developments in this industry particularly in the areas of microelectronics optoelectronics digital health and bio medical applications The book discusses established techniques as well as emerging technologies in order to provide readers with the most up to date developments in advanced packaging *Electronic Packaging* John H. Lau,John Prince,C. P. Wong,Wataru Nakayama,1998 Here is the ultimate electronic packaging resource in which luminaries from the four intertwined disciplines of packaging present a one stop guide to the state of the art An absolute necessity for anyone working in the field this how to reference covers all the newest technologies including BGA Flip Chip and CSP *Chip On Board* John H. Lau,1994-06-30

This book is a one stop guide to the state of the art of COB technology For professionals active in COB and MCM research and development those who wish to master COB and MCM problem solving methods and those who must choose a cost effective design and high yield manufacturing process for their interconnect systems here is a timely summary of progress in all aspects of this fascinating field It meets the reference needs of design material process equipment manufacturing quality reliability packaging and system engineers and technical managers working in electronic packaging and interconnection

Electronic Packaging Materials and Their Properties Michael Pecht,Rakish Agarwal,F. Patrick McCluskey,Terrance J. Dishongh,Sirus Javadpour,Rahul Mahajan,2017-12-19 Packaging materials strongly affect the effectiveness of an electronic packaging system regarding reliability design and cost In electronic systems packaging materials may serve as electrical conductors or insulators create structure and form provide thermal paths and protect the circuits from environmental factors such as moisture contamination hostile chemicals and radiation *Electronic Packaging Materials and Their Properties* examines the array of packaging architecture outlining the classification of materials and their use for various tasks requiring performance over time Applications discussed include interconnections printed circuit boards substrates encapsulants dielectrics die attach materials electrical contacts thermal materials solders *Electronic Packaging Materials and Their Properties* also reviews key electrical thermal thermomechanical mechanical chemical and miscellaneous

properties as well as their significance in electronic packaging **Materials for Electronic Packaging** Deborah D.L. Chung, 1995-03-31 Although materials play a critical role in electronic packaging the vast majority of attention has been given to the systems aspect Materials for Electronic Packaging targets materials engineers and scientists by focusing on the materials perspective The last few decades have seen tremendous progress in semiconductor technology creating a need for effective electronic packaging Materials for Electronic Packaging examines the interconnections encapsulations substrates heat sinks and other components involved in the packaging of integrated circuit chips These packaging schemes are crucial to the overall reliability and performance of electronic systems Consists of 16 self contained chapters contributed by a variety of active researchers from industrial academic and governmental sectors Addresses the need of materials scientists engineers electrical engineers mechanical engineers physicists and chemists to acquire a thorough knowledge of materials science Explains how the materials for electronic packaging determine the overall effectiveness of electronic systems

Integrated Circuit, Hybrid, and Multichip Module Package Design Guidelines Michael G. Pecht, 1994-03-31 Circuit designers packaging engineers printed board fabricators and procurement personnel will find this book s microelectronic package design for reliability guidelines and approaches essential for achieving their life cycle cost effectiveness and on time delivery goals Its uniquely organized time phased approach to design development qualification manufacture and in service management shows you step by step how to Define realistic system requirements in terms of mission profile operating life performance expectations size weight and cost Define the system usage environment so that all operating shipping and storage conditions including electrical thermal radiation and mechanical loads are assessed using realistic data Identify potential failure modes sites mechanisms and architecture stress interactions PLUS appropriate measures you can take to reduce eliminate or accommodate expected failures Characterize materials and processes by the key controllable factors such as types and levels of defects variations in material properties and dimensions and the manufacturing and assembly processes involved Use experiment step stress and accelerated methods to ensure optimum design before production begins Detailed design guidelines for substrate wire and wire tape automated and flip chip bonding element attachment and case lead lead and lid seals incorporating dimensional and geometric configurations of package elements manufacturing and assembly conditions materials selection and loading conditions round out this guide s comprehensive coverage Detailed guidelines for substrate wire and wire tape automated and flip chip bonding element attachment and case lead lead and lid seals incorporating dimensional and geometric configurations of package elements manufacturing and assembly conditions materials selection and loading conditions round out this guide s comprehensive coverage *Multichip Module Technologies and Alternatives: The Basics* Daryl Ann Doane, Paul Franzon, 2013-11-27 Far from being the passive containers for semiconductor devices of the past the packages in today s high performance computers pose numerous challenges in interconnecting powering cooling and protecting devices While semiconductor circuit performance measured in picoseconds

continues to improve computer performance is expected to be in nanoseconds for the rest of this century a factor of 1000 difference between on chip and off chip performance which is attributable to losses associated with the package Thus the package which interconnects all the chips to form a particular function such as a central processor is likely to set the limits on how far computers can evolve Multichip packaging which can relax these limits and also improve the reliability and cost at the systems level is expected to be the basis of all advanced computers in the future In addition since this technology allows chips to be spaced more closely in less space and with less weight it has the added advantage of being useful in portable consumer electronics as well as in medical aerospace automotive and telecommunications products The multichip technologies with which these applications can be addressed are many They range from ceramics to polymer metal thin films to printed wiring boards for interconnections flip chip TAB or wire bond for chip to substrate connections and air or water cooling for the removal of heat

Practical Guide to the Packaging of Electronics Ali Jamnia, 2016-12-01 Successfully Estimate the Thermal and Mechanical Characteristics of Electronics Systems A definitive guide for practitioners new to the field or requiring a refresher course Practical Guide to the Packaging of Electronics Thermal and Mechanical Design and Analysis Third Edition provides an understanding of system failures and helps identify the areas where they can occur Specifically designed for the mechanical electrical or quality engineer the book addresses engineering issues involved in electronics packaging and provides the basics needed to design a new system or troubleshoot a current one Updated to reflect recent developments in the field this latest edition adds two new chapters on acoustic and reliability fundamentals and contains more information on electrical failures and causes It also includes tools for understanding heat transfer shock and vibration Additionally the author Addresses various cross discipline issues in the design of electromechanical products Provides a solid foundation for heat transfer vibration and life expectancy calculations Identifies reliability issues and concerns Develops the ability to conduct a more thorough analysis for the final design Includes design tips and guidelines for each aspect of electronics packaging Practical Guide to the Packaging of Electronics Thermal and Mechanical Design and Analysis Third Edition explains the mechanical and thermal fluid aspects of electronic product design and offers a basic understanding of electronics packaging design issues Defining the material in depth it also describes system design guidelines and identifies reliability concerns for practitioners in mechanical electrical or quality engineering

Semiconductor Packaging Andrea Chen, Randy Hsiao-Yu Lo, 2016-04-19 In semiconductor manufacturing understanding how various materials behave and interact is critical to making a reliable and robust semiconductor package Semiconductor Packaging Materials Interaction and Reliability provides a fundamental understanding of the underlying physical properties of the materials used in a semiconductor package By tying together the disparate elements essential to a semiconductor package the authors show how all the parts fit and work together to provide durable protection for the integrated circuit chip within as well as a means for the chip to communicate with the outside world The text also covers packaging materials for

MEMS solar technology and LEDs and explores future trends in semiconductor packages **Microelectronic Packaging**

M. Datta, Tetsuya Osaka, J. Walter Schultze, 2004-12-20 Microelectronic Packaging analyzes the massive impact of electrochemical technologies on various levels of microelectronic packaging. Traditionally, interconnections within a chip were considered outside the realm of packaging technologies, but this book emphasizes the importance of chip wiring as a key aspect of microelectronic packaging and focuses on electrochemical processing as an enabler of advanced chip metallization. Divided into five parts, the book begins by outlining the basics of electrochemical processing, defining the microelectronic packaging hierarchy, and emphasizing the impact of electrochemical technology on packaging. The second part discusses chip metallization topics, including the development of robust barrier layers and alternative metallization materials. Part III explores key aspects of chip package interconnect technologies, followed by Part IV's analysis of packages, boards, and connectors, which covers materials development, technology trends in ceramic packages and multi-chip modules, and electroplated contact materials. Illustrating the importance of processing tools in enabling technology development, the book concludes with chapters on chemical mechanical planarization, electroplating, and wet etching/cleaning tools. Experts from industry, universities, and national laboratories submitted reviews on each of these subjects, capturing the technological advances made in each area. A detailed examination of how packaging responds to the challenges of Moore's law, this book serves as a timely and valuable reference for microelectronic packaging and processing professionals and other industrial technologists.

An Introduction to Microelectromechanical Systems Engineering Nadim Maluf, Kirt Williams, 2004. Bringing you up to date with the latest developments in MEMS technology, this major revision of the best-selling *An Introduction to Microelectromechanical Systems Engineering* offers you a current understanding of this cutting-edge technology. You gain practical knowledge of MEMS materials, design, and manufacturing and learn how it is being applied in industrial, optical, medical, and electronic markets. The second edition features brand new sections on RF MEMS, photo MEMS, micromachining on materials other than silicon, reliability analysis, plus an expanded reference list. With an emphasis on commercialized products, this unique resource helps you determine whether your application can benefit from a MEMS solution, understand how other applications and companies have benefited from MEMS, and select and define a manufacturable MEMS process for your application. You discover how to use MEMS technology to enable new functionality, improve performance, and reduce size and cost. The book teaches you the capabilities and limitations of MEMS devices and processes and helps you communicate the relative merits of MEMS to your company's management. From critical discussions on design, operation, and process/fabrication of devices and systems to a thorough explanation of MEMS packaging, this easy-to-understand book clearly explains the basics of MEMS engineering, making it an invaluable reference for your work in the field.

Advances in Imaging and Electron Physics, 2012-11-01. *Advances in Imaging and Electron Physics* merges two long-running serials, *Advances in Electronics and Electron Physics* and *Advances in Optical and Electron Microscopy*. This series features extended

articles on the physics of electron devices especially semiconductor devices particle optics at high and low energies microlithography image science and digital image processing electromagnetic wave propagation electron microscopy and the computing methods used in all these domains Contributions from leading authorities Informs and updates on all the latest developments in the field Power Electronic Modules William W. Sheng, Ronald P. Colino, 2004-09-29 Designing and building power semiconductor modules requires a broad interdisciplinary base of knowledge and experience ranging from semiconductor materials and technologies thermal management and soldering to environmental constraints inspection techniques and statistical process control This diversity poses a significant challenge to engine **Cost-driven Design of Smart Microsystems** Michael Niedermayer, 2012 Today's professionals are constantly striving to create sensor technology and systems with lower cost and higher efficiency Miniaturization and standardization have become critical drivers for cost reduction in the design and development process giving rise to a new era of smart sensors and actuators These devices contain more components but normally provide significant cost savings due to wider applicability and mass production This first of its kind resource presents methods for cost optimization of smart microsystems to help you select highly cost efficient implementation variants Written by leading experts the book offers detailed coverage of the key topics that you need to understand for your work in the field such as methods for cost estimation holistic design optimization a methodology for a cost driven design and applied cost optimization This practical book focuses on fundamental cost influences rather than absolute numbers helping you appreciate relative values which reflect the competitive advantage of the various design implementations Moreover you find specific recommendations on which cost reduction methods will be most advantageous in varying situations This forward looking volume provides keen insight into the underlying factors which drive the current economics and determine future trends of smart microsystems *Mechanical Microsensors* M. Elwenspoek, R. Wiegerink, 2012-12-06 This book on mechanical microsensors is based on a course organized by the Swiss Foundation for Research in Microtechnology FSRM in Neuchâtel Switzerland and developed and taught by the authors Support by FSRM is herewith gratefully acknowledged This book attempts to serve two purposes First it gives an overview on mechanical microsensors sensors for pressure force acceleration angular rate and fluid flow realized by silicon micromachining Second it serves as a textbook for engineers to give them a comprehensive introduction on the basic design issues of these sensors Engineers active in sensor design are usually educated either in electrical engineering or mechanical engineering These classical educational programs do not prepare the engineer for the challenging task of sensor design since sensors are instruments typically bridging the disciplines one needs a rather deep understanding of both mechanics and electronics Accordingly the book contains discussion of the basic engineering sciences relevant to mechanical sensors hopefully in a way that it is accessible for all colours of engineers Engineering students in their 3 or 4 year should have enough knowledge to be able to follow the arguments presented in this book In this sense this book should be useful as textbook for

students in courses on mechanical microsensors as is currently being done at the University of Twente

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