



# IEEE 1149.4 Mixed-Signal Test Bus

**An overview of this new testability bus standard,  
along with a discussion of the architecture and  
how to use it.**

# Test And Designfortestability In Mixedsignal Integrated

**Cheng-Ping Wang**



## **Test And Designfortestability In Mixedsignal Integrated:**

**Test and Design-for-Testability in Mixed-Signal Integrated Circuits** José Luis Huertas, 2004-10-18 Test and Design for Testability in Mixed Signal Integrated Circuits deals with test and design for test of analog and mixed signal integrated circuits Especially in System on Chip SoC where different technologies are intertwined analog digital sensors RF test is becoming a true bottleneck of present and future IC projects Linking design and test in these heterogeneous systems will have a tremendous impact in terms of test time cost and proficiency Although it is recognized as a key issue for developing complex ICs there is still a lack of structured references presenting the major topics in this area The aim of this book is to present basic concepts and new ideas in a manner understandable for both professionals and students Since this is an active research field a comprehensive state of the art overview is very valuable introducing the main problems as well as the ways of solution that seem promising emphasizing their basis strengths and weaknesses In essence several topics are presented in detail First of all techniques for the efficient use of DSP based test and CAD test tools Standardization is another topic considered in the book with focus on the IEEE 1149 4 Also addressed in depth is the connecting design and test by means of using high level behavioural description techniques specific examples are given Another issue is related to test techniques for well defined classes of integrated blocks like data converters and phase locked loops Besides these specification driven testing techniques fault driven approaches are described as they offer potential solutions which are more similar to digital test methods Finally in Design for Testability and Built In Self Test two other concepts that were taken from digital design are introduced in an analog context and illustrated for the case of integrated filters In summary the purpose of this book is to provide a glimpse on recent research results in the area of testing mixed signal integrated circuits specifically in the topics mentioned above Much of the work reported herein has been performed within cooperative European Research Projects in which the authors of the different chapters have actively collaborated It is a representative snapshot of the current state of the art in this emergent field

**Test and Design-for-Testability in Mixed-Signal Integrated Circuits** Jose Luis Huertas Díaz, 2010-02-23 Test and Design for Testability in Mixed Signal Integrated Circuits deals with test and design for test of analog and mixed signal integrated circuits Especially in System on Chip SoC where different technologies are intertwined analog digital sensors RF test is becoming a true bottleneck of present and future IC projects Linking design and test in these heterogeneous systems will have a tremendous impact in terms of test time cost and proficiency Although it is recognized as a key issue for developing complex ICs there is still a lack of structured references presenting the major topics in this area The aim of this book is to present basic concepts and new ideas in a manner understandable for both professionals and students Since this is an active research field a comprehensive state of the art overview is very valuable introducing the main problems as well as the ways of solution that seem promising emphasizing their basis strengths and weaknesses In essence several topics are presented in detail First of all techniques for the efficient use of DSP based test and CAD test tools

Standardization is another topic considered in the book with focus on the IEEE 1149.4. Also addressed in depth is the connecting design and test by means of using high level behavioural description techniques specific examples are given. Another issue is related to test techniques for well defined classes of integrated blocks like data converters and phase locked loops. Besides these specification driven testing techniques fault driven approaches are described as they offer potential solutions which are more similar to digital test methods. Finally in Design for Testability and Built In Self Test two other concepts that were taken from digital design are introduced in an analog context and illustrated for the case of integrated filters. In summary the purpose of this book is to provide a glimpse on recent research results in the area of testing mixed signal integrated circuits specifically in the topics mentioned above. Much of the work reported herein has been performed within cooperative European Research Projects in which the authors of the different chapters have actively collaborated. It is a representative snapshot of the current state of the art in this emergent field.

**Test and Diagnosis of Analogue, Mixed-signal and RF Integrated Circuits** Yichuang Sun, 2008-05-30 This book provides a comprehensive discussion of automatic testing diagnosis and tuning of analogue mixed signal and RF integrated circuits and systems in a single source. As well as fundamental concepts and techniques the book reports systematically the state of the arts and future research directions of those areas. A complete range of circuit components are covered and test issues from the SoC perspective. An essential reference for researchers and engineers in mixed signal testing postgraduate and senior undergraduate students.

**Oscillation-Based Test in Mixed-Signal Circuits** Gloria Huertas Sánchez, Diego Vázquez García de la Vega, Adoración Rueda Rueda, Jose Luis Huertas Díaz, 2007-06-03 Oscillation Based Test in Mixed Signal Circuits presents the development and experimental validation of the structural test strategy called Oscillation Based Test (OBT). In short the results here presented allow to assert not only from a theoretical point of view but also based on a wide experimental support that OBT is an efficient defect oriented test solution complementing the existing functional test techniques for mixed signal circuits.

**Computer-Aided Design of Analog Integrated Circuits and Systems** Rob A. Rutenbar, Georges G. E. Gielen, 2002-05-06 The tools and techniques you need to break the analog design bottleneck. Ten years ago analog seemed to be a dead end technology. Today System on Chip (SoC) designs are increasingly mixed signal designs. With the advent of application specific integrated circuits (ASIC) technologies that can integrate both analog and digital functions on a single chip analog has become more crucial than ever to the design process. Today designers are moving beyond hand crafted one transistor at a time methods. They are using new circuit and physical synthesis tools to design practical analog circuits, new modeling and analysis tools to allow rapid exploration of system level alternatives and new simulation tools to provide accurate answers for analog circuit behaviors and interactions that were considered impossible to handle only a few years ago. To give circuit designers and CAD professionals a better understanding of the history and the current state of the art in the field this volume collects in one place the essential set of analog CAD papers that form the foundation of today's new

analog design automation tools Areas covered are Analog synthesis Symbolic analysis Analog layout Analog modeling and analysis Specialized analog simulation Circuit centering and yield optimization Circuit testing Computer Aided Design of Analog Integrated Circuits and Systems is the cutting edge reference that will be an invaluable resource for every semiconductor circuit designer and CAD professional who hopes to break the analog design bottleneck

**Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits** M. Bushnell,Vishwani Agrawal,2006-04-11 The modern electronic testing has a forty year history Test professionals hold some fairly large conferences and numerous workshops have a journal and there are over one hundred books on testing Still a full course on testing is offered only at a few universities mostly by professors who have a research interest in this area Apparently most professors would not have taken a course on electronic testing when they were students Other than the computer engineering curriculum being too crowded the major reason cited for the absence of a course on electronic testing is the lack of a suitable textbook For VLSI the foundation was provided by semiconductor device technology circuit design and electronic testing In a computer engineering curriculum therefore it is necessary that foundations should be taught before applications The field of VLSI has expanded to systems on a chip which include digital memory and mixed signalsubsystems To our knowledge this is the first textbook to cover all three types of electronic circuits We have written this textbook for an undergraduate foundations course on electronic testing Obviously it is too voluminous for a one semester course and a teacher will have to select from the topics We did not restrict such freedom because the selection may depend upon the individual expertise and interests Besides there is merit in having a larger book that will retain its usefulness for the owner even after the completion of the course With equal tenacity we address the needs of three other groups of readers

Efficient Testability Design Methodology for Analog/mixed Signal Integrated Circuits Cheng-Ping Wang,1997

**An Introduction to Mixed-signal IC Test and Measurement** Gordon W. Roberts,Friedrich Taenzler,Mark Burns,2012 With the proliferation of complex semiconductor devices containing digital analog mixed signal and radio frequency circuits the economics of test has come to the forefront and today s engineer needs to be fluent in all four circuit types Having access to a book that covers these topics will help the evolving test engineer immensely and will be an invaluable resource In addition the second edition includes lengthy discussion on RF circuits high speed I Os and probabilistic reasoning Appropriate for the junior senior university level this textbook includes hundreds of examples exercises and problems

**Emerging Trends in Technological Innovation** Luis M. Camarinha-Matos,Pedro Pereira,Luis Ribeiro,2010-02-26 Identifying Emerging Trends in Technological Innovation Doctoral programs in science and engineering are important sources of innovative ideas and techniques that might lead to new products and technological innovation Certainly most PhD students are not experienced researchers and are in the process of learning how to do research Nevertheless a number of empiric studies also show that a high number of technological innovation ideas are produced in the early careers of researchers The combination of the eagerness to try new

approaches and directions of young doctoral students with the experience and broad knowledge of their supervisors is likely to result in an important pool of innovation potential The DoCEIS doctoral conference on Computing Electrical and Industrial Engineering aims at creating a space for sharing and discussing ideas and results from doctoral research in these inter related areas of engineering Innovative ideas and hypotheses can be better enhanced when presented and discussed in an encouraging and open environment DoCEIS aims to provide such an environment releasing PhD students from the pressure of presenting their propositions in more formal contexts

**Low-power HF Microelectronics** Gerson A. S. Machado,1996 This book brings together innovative modelling simulation and design techniques in CMOS SOI GaAs and BJT to achieve successful high yield manufacture for low power high speed and reliable by design analogue and mixed mode integrated systems

**Information Technology** Ricardo Reis,2006-04-11 This book contains a selection of tutorials on hot topics in information technology which were presented at the IFIP World Computer Congress WCC2004 took place at the Centre de Congr s Pierre Baudis in Toulouse France from 22 to 27 August 2004 The 11 chapters included in the book were chosen from tutorials proposals submitted to WCC2004 These papers report on several important and state of the art topics on information technology such as Quality of Service in Information Networks Risk Driven Development of Security Critical Systems Using UMLsec Developing Portable Software Formal Reasoning About Systems Software and Hardware Using Functionals Predicates and Relations The Problematic of Distributed Systems Supervision Software Rejuvenation Modeling and Analysis Test and Design for Test of Mixed Signal Integrated Circuits Web Services Applications of Multi Agent Systems Discrete Event Simulation Human Centered Automation We hereby would like to thank IFIP and more specifically WCC2004 Tutorials Committee and the authors for their contribution We also would like to thank the congress organizers who have done a great job Ricardo Reis Editor QUALITY OF SERVICE IN INFORMATION NETWORKS Augusto Casaca IST INESC R Alves Redol 1000 029 Lisboa Portugal Abstract This article introduces the problems concerned with the provision of end end quality of service in IP networks which are the basis of information networks describes the existing solutions for that provision and presents some of the current research items on the subject Key words Information networks IP networks Integrated Services Differentiated Services Multiprotocol Label Switching UMTS

**System-on-Chip** Bashir M. Al-Hashimi,2006-01-31 This book highlights both the key achievements of electronic systems design targeting SoC implementation style and the future challenges presented by the continuing scaling of CMOS technology

**Advances in Signal Processing and Intelligent Recognition Systems** Sabu M. Thampi,Oge Marques,Sri Krishnan,Kuan-Ching Li,Domenico Ciuonzo,Maheshkumar H. Kolekar,2019-01-05 This book constitutes the refereed proceedings of the 4th International Symposium on Advances in Signal Processing and Intelligent Recognition Systems SIRS 2018 held in Bangalore India in September 2018 The 28 revised full papers and 11 revised short papers presented were carefully reviewed and selected from 92 submissions The papers cover wide research fields including information retrieval human computer

interaction HCI information extraction speech recognition      Communication and Networking Thanos Vasilakos, Kouichi Sakurai, Yang Xiao, Gansen Zhao, Dominik Ślęzak, 2010-11-29 Welcome to the proceedings of the 2010 International Conference on Future Generation Communication and Networking FGCN 2010 one of the partnering events of the Second International Mega Conference on Future Generation Information Technology FGIT 2010 FGCN brings together researchers from academia and industry as well as practitioners to share ideas problems and solutions relating to the multifaceted aspects of communication and networking including their links to computational sciences mathematics and information technology In total 1 630 papers were submitted to FGIT 2010 from 30 countries which includes 150 papers submitted to the FGCN 2010 Special Sessions The submitted papers went through a rigorous reviewing process 395 of the 1 630 papers were accepted for FGIT 2010 while 70 papers were accepted for the FGCN 2010 Special Sessions Of the 70 papers 6 were selected for the special FGIT 2010 volume published by Springer in LNCS series Fifty one papers are published in this volume and 13 papers were withdrawn due to technical reasons We would like to acknowledge the great effort of the FGCN 2010 International Advisory Board and Special Session Co chairs as well as all the organizations and individuals who supported the idea of publishing this volume of proceedings including SERSC and Springer Also the success of the conference would not have been possible without the huge support from our sponsors and the work of the Organizing Committee      **Fault Diagnosis of Analog Integrated Circuits** Prithviraj Kabisatpathy, Alok Barua, Satyabroto Sinha, 2006-01-13 System on Chip SOC having both digital and analog circuits has become increasingly prevalent in integrated circuit manufacturing industry Electronic tests are classified as digital analog and mixed signal Current methodologies for the testing of digital circuits are well developed In contrast methodologies for the testing of analog circuits remain relatively underdeveloped due to the complex nature of analog signals Compared to digital testing analog testing lags far behind in methodologies and tools and therefore demands substantial research and development effort Fault Diagnosis of Analog Integrated Circuits is a textbook for advanced undergraduate and graduate level students as well as practicing engineers The objective of this book is to study the testing and fault diagnosis of analog and analog part of mixed signal circuits A background in analog integrated circuit artificial neural network is desirable but not essential The text covers the testing and fault diagnosis of both bipolar and Metal Oxide Semiconductor MOS circuits Fault model of the devices in analog domain has been introduced in the text The test stimulus generations are also discussed in details Experimental verification of some state of the art techniques has also been presented in the book It also contains problems that can be used as quiz or homework This book enables the reader to test an analog circuit that is implemented either in bipolar or MOS technology      **Design of Systems on a Chip: Design and Test** Ricardo Reis, Marcelo Soares Lubaszewski, Jochen A.G. Jess, 2007-05-06 This book is the second of two volumes addressing the design challenges associated with new generations of semiconductor technology The various chapters are compiled from tutorials presented at workshops in recent years by prominent authors from all over the world Technology

productivity and quality are the main aspects under consideration to establish the major requirements for the design and test of upcoming systems on a chip

*Analog and Mixed-Signal Boundary-Scan* Adam Osseiran, 2013-03-09 This book contains more than the IEEE Standard 1149 4 It also contains the thoughts of those who developed the standard Adam Osseiran has edited the original writings of Brian Wilkins Colin Maunder Rod Tulloss Steve Sunter Mani Soma Keith Lofstrom and John McDermid all of whom have personally contributed to this standard To preserve the original spirit only minor changes were made and the reader will sense a chapter to chapter variation in the style of expression This may appear awkward to some although I found the lack of monotonicity refreshing A system consists of a specific organization of parts The function of the system cannot be performed by an individual part or even a disorganized collection of the same parts Testing has a system like characteristic Testing of a system does not follow directly from the testing of its parts and a system built with testable parts can sometimes be impossible to test Therefore testability of the system must be organized Some years ago the IEEE published the boundary scan Standard 1149 1 That Standard provided an architecture for digital VLSI chips The chips designed with the 1149 1 architecture can be integrated into a testable system However many systems today contain both analog and digital chips Even if all digital chips are compliant with the standard the testability of a mixed signal system cannot be guaranteed The new Standard 1149 4 described in this book extends the previous architecture to mixed signal systems

**Analog Test Signal Generation Using Periodic  $\Sigma\Delta$ -Encoded Data Streams** Benoit Dufort, G.W.

Roberts, 2012-12-06 *Analog Test Signal Generation Using Periodic SigmaDelta Encoded Data Streams* presents a new method to generate high quality analog signals with low hardware complexity The theory of periodic SigmaDelta encoded bitstreams is presented along with a set of empirical tables to help select the appropriate parameters of a bitstream An optimization procedure is also outlined to help select a bit sequence with the desired attributes A large variety of signals can be generated using this approach Silicon implementation issues are discussed with a specific emphasis on area overhead and ease of design One FPGA circuit and three different silicon implementations are presented along with experimental results It is shown that simple designs are capable of generating very high precision signals on chip The technique is further extended to multi bit signal generation where it is shown how to increase the performance of arbitrary waveform generators commonly found in past and present day mixed signal testers No hardware modifications are required only the numbers in memory are changed Three different calibration techniques to reduce the effects of the AWG's non linearities are also introduced together with supporting experimental evidence The main focus of this text is to describe an area efficient technique for analog signal generation using SigmaDelta encoded data stream The main characteristics of the technique are High quality signals SFDR of 110 dB observed Large variety of signals generated Bitstreams easily obtained with a fast optimization program Good frequency resolution compatible with coherent sampling Simple and fast hardware implementation Mostly digital except an easily testable 1 bit DAC and possibly a reconstruction filter Memory already available on chip can be



reused reducing area overhead Designs can be incorporated into existing CAD tools High frequency generation      *Analog VHDL* Andrzej T. Rosinski,Alain Vachoux,2012-12-06 Analog VHDL brings together in one place important contributions and up to date research results in this fast moving area Analog VHDL serves as an excellent reference providing insight into some of the most challenging research issues in the field      Defect-Oriented Testing for Nano-Metric CMOS VLSI Circuits Manoj Sachdev,José Pineda de Gyvez,2007-06-04 Defect oriented testing methods have come a long way from a mere interesting academic exercise to a hard industrial reality Many factors have contributed to its industrial acceptance Traditional approaches of testing modern integrated circuits have been found to be inadequate in terms of quality and economics of test In a globally competitive semiconductor market place overall product quality and economics have become very important objectives In addition electronic systems are becoming increasingly complex and demand components of the highest possible quality Testing in general and defect oriented testing in particular help in realizing these objectives For contemporary System on Chip SoC VLSI circuits testing is an activity associated with every level of integration However special emphasis is placed for wafer level test and final test Wafer level test consists primarily of dc or slow speed tests with current voltage checks per pin under most operating conditions and with test limits properly adjusted Basic digital tests are applied and in some cases low frequency tests to ensure analog RF functionality are exercised as well Final test consists of checking device functionality by exercising RF tests and by applying a comprehensive suite of digital test methods such as I delay fault testing DDQ stuck at testing low voltage testing etc This partitioning choice is actually application dependent

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