

A Power Reconfigurable High-Efficiency X-Band Power Amplifier MMIC Using the Load Modulated Balanced Amplifier Technique

J. R. Powell, D. J. Sheppard, R. Quaglia[✉], Member, IEEE, and S. C.ripps, Life Fellow, IEEE

Abstract—The load modulated balanced amplifier (LMBA) technique uses a control signal, injected at the output coupler, to modulate the impedance of the balanced amplifier transistors. A 14.1-W X-band LMBA is reported, integrating for the first time the balanced, driver, and control signal amplifiers in a single microwave monolithic integrated circuit. Load modulation and bias settings are used to demonstrate that high circuit efficiency can be achieved as the LMBA is adjusted for operation in three RF-power regimes; 1.5, 5.6, and 14.1 W for a constant input power of 22 dBm. Power-added efficiencies above 37% are observed in all power regimes from 8 to 9 GHz under saturated conditions.

Index Terms—Balanced power amplifier, Doherty, gallium nitride (GaN), load modulation, microwave monolithic integrated circuit (MMIC).

I. INTRODUCTION

POWER amplifier efficiency is a critical parameter for all applications. Maintaining efficiency as the output-power requirement changes has been the subject of many inventions and papers. The Doherty technique [1], [2] has been widely adopted for its backed-off efficiency characteristic. Recently, a new technique, the load modulated balanced amplifier (LMBA) has been proposed and demonstrated [3]. In this technique, the output impedance seen by the transistors of a balanced amplifier is modulated using a control signal power (CSP) injected at the isolated port of the output coupler. It was shown in [2] that CSP power is recovered at the output.

Demonstrations of the LMBA technique have to date been confined to hybrid technologies and with a single-stage amplifier. The first published implementation [3] at 0.8–2 GHz yielded 60%–78% and 51%–67% drain efficiencies (DEs) at 42-dBm peak power and at 6-dB output-power back off (OPBO), respectively. A further hybrid LMBA [4] operated from 4.5 to 7.5 GHz with 39-dBm peak power and 47%–77% DE. In [3], it was demonstrated that using two drain bias states and three CSP power levels allows DE above 60%

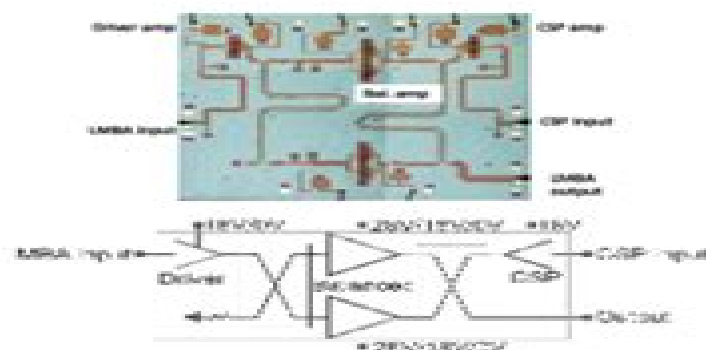


Fig. 1. Photograph of the LMBA MMIC fabricated using GaN 0.25- μ m gate technology at WIP Semiconductors (4×3.55 mm²), and block diagram representing the several integrated functions in the LMBA.

to be maintained at > 8 dB OPBO over regions of the band of operation. An extension of this letter [5] has employed a power splitter and on-board phase shifter network to allow a single input to be used in contrast to the separated CSP inputs in [3] and [4]. In this letter, an X-band LMBA in microwave monolithic integrated circuit (MMIC) technology is demonstrated for the first time. This MMIC was designed for specific applications which require discrete, rather than continuous, switched power levels with maximum efficiency.

II. DESIGN

The LMBA MMIC incorporates a balanced amplifier pair, a driver amplifier, and a CSP amplifier, as shown in Fig. 1. The design objective was to demonstrate that load modulation could be employed to enable the amplifier to maintain efficiency at three discrete output power states; 14.1, 5.6, and 1.5 W by using various bias voltage states. The design strategy was to configure the balanced amplifier circuit for peak efficiency at a drain voltage of 18 V and use the LMBA function to reconfigure the balanced amplifier output match when the balanced amplifier drain voltage is varied. In this way, the added power from the CSP will contribute to the overall higher power when the drain is increased to 28 V.

Manuscript received December 19, 2017; revised March 6, 2018; accepted April 3, 2018. Date of publication April 25, 2018; date of current version June 5, 2018. (Corresponding author: R. Quaglia.)

J. R. Powell is with Skyrama Ltd., Halesowen B63 3TE, U.K. (e-mail: jrp.powell@skyrama.com).

D. J. Sheppard, R. Quaglia, and S. C.ripps are with the School of Engineering, Cardiff University, Cardiff CF10 3AC, U.K. (e-mail: quaglia@cardiff.ac.uk).

Color versions of one or more of the figures in this paper are available online at <http://ieeexplore.ieee.org>.

Digital Object Identifier 10.1109/MWCL.2018.2824560

Compact Highly Integrated X Band Power Amplifier Using

Anthony S. Fauci



Compact Highly Integrated X Band Power Amplifier Using:

RF Power Semiconductor Generator Application in Heating and Energy Utilization Satoshi Horikoshi, Nick Serpone, 2020-03-26 This is a specialized book for researchers and technicians of universities and companies who are interested in the fundamentals of RF power semiconductors their applications and market penetration Looking around we see that products using vacuum tube technology are disappearing For example branch tube TVs have changed to liquid crystal TVs and fluorescent light have turned into LED The switch from vacuum tube technology to semiconductor technology has progressed remarkably At the same time high precision functionalization miniaturization and energy saving have advanced On the other hand there is a magnetron which is a vacuum tube device for generating microwaves However even this vacuum tube technology has come to be replaced by RF power semiconductor technology In the last few years the price of semiconductors has dropped sharply and its application to microwave heating and energy fields will proceed In some fields the transition from magnetron microwave oscillator to semiconductor microwave oscillator has already begun From now on this development will progress remarkably Although there are several technical books on electrical systems that explain RF power semiconductors there are no books yet based on users viewpoints on actual microwave heating and energy fields In particular none have been written about exact usage and practical cases to answer questions such as What are the advantages and disadvantages of RF power semiconductor oscillator What kind of field can be used and the difficulty of the market and application Based on these issues this book explains the RF power semiconductors from the user s point of view by covering a very wide range of fields [Switchmode RF and Microwave Power Amplifiers](#) Andrei Grebennikov, Marc J. Franco, 2021-03-19 Switchmode RF and Microwave Power Amplifiers Third Edition is an essential reference book on developing RF and microwave switchmode power amplifiers The book combines theoretical discussions with practical examples allowing readers to design high efficiency RF and microwave power amplifiers on different types of bipolar and field effect transistors design any type of high efficiency switchmode power amplifiers operating in Class D or E at lower frequencies and in Class E or F and their subclasses at microwave frequencies with specified output power also providing techniques on how to design multiband and broadband Doherty amplifiers using different bandwidth extension techniques and implementation technologies This book provides the necessary information to understand the theory and practical implementation of load network design techniques based on lumped and transmission line elements It brings a unique focus on switchmode RF and microwave power amplifiers that are widely used in cellular wireless satellite and radar communication systems which offer major power consumption savings Provides a complete history of high efficiency Class E and Class F techniques Presents a new chapter on Class E with shunt capacitance and shunt filter to simplify the design of high efficiency power amplifier with broader frequency bandwidths Covers different Doherty architectures including integrated and monolithic implementations which are and will be used in modern communication systems to save power

consumption and to reduce size and costs Includes extended coverage of multiband and broadband Doherty amplifiers with different frequency ranges and output powers using different bandwidth extension techniques Balances theory with practical implementation avoiding a cookbook approach and enabling engineers to develop better designs including hybrid integrated and monolithic implementations *The Engineering Index Annual*, 1992 Since its creation in 1884 Engineering Index has covered virtually every major engineering innovation from around the world It serves as the historical record of virtually every major engineering innovation of the 20th century Recent content is a vital resource for current awareness new production information technological forecasting and competitive intelligence The world's most comprehensive interdisciplinary engineering database Engineering Index contains over 10.7 million records Each year over 500,000 new abstracts are added from over 5,000 scholarly journals trade magazines and conference proceedings Coverage spans over 175 engineering disciplines from over 80 countries Updated weekly

Applications in Electronics Pervading Industry, Environment and Society Alessandro De Gloria, 2015-08-07 This book provides a thorough overview of cutting edge research on electronics applications relevant to industry the environment and society at large A wide spectrum of application domains are covered from automotive to space and from health to security and special attention is devoted to the use of embedded devices and sensors for imaging communication and control The book is based on the 2014 APPLEPIES Conference held in Rome which brought together researchers and stakeholders to consider the most significant current trends in the field of applied electronics and to debate visions for the future Areas covered by the conference included information communication technology biotechnology and biomedical imaging space secure clean and efficient energy the environment and smart green and integrated transport As electronics technology continues to develop apace constantly meeting previously unthinkable targets further attention needs to be directed toward the electronics applications and the development of systems that facilitate human activities This book written by industrial and academic professionals will hopefully contribute in this endeavor

Broadband RF and Microwave Amplifiers Andrei Grebennikov, Narendra Kumar, Binboga S. Yarman, 2017-07-12 *Broadband RF and Microwave Amplifiers* provides extensive coverage of broadband radio frequency RF and microwave power amplifier design including well known historical and recent novel schematic configurations theoretical approaches circuit simulation results and practical implementation strategies The text begins by introducing two port networks to illustrate the behavior of linear and nonlinear circuits explaining the basic principles of power amplifier design and discussing impedance matching and broadband power amplifier design using lumped and distributed parameters The book then Shows how dissipative or lossy gain compensation matching circuits can offer an important trade off between power gain reflection coefficient and operating frequency bandwidth Describes the design of broadband RF and microwave amplifiers using real frequency techniques RFTs supplying numerous examples based on the MATLAB programming process Examines Class E power amplifiers Doherty amplifiers low noise amplifiers microwave

gallium arsenide field effect transistor GaAs FET distributed amplifiers and complementary metal oxide semiconductor CMOS amplifiers for ultra wideband UWB applications Broadband RF and Microwave Amplifiers combines theoretical analysis with practical design to create a solid foundation for innovative ideas and circuit design techniques **Conference Proceedings** ,2000 **Electrical & Electronics Abstracts** ,1997 **Observation of the Earth and Its Environment** Herbert J. Kramer,2002 Windows Macintosh Version **Bibliography of Scientific and Industrial Reports** ,1965-07 **Proceedings of the ... Annual AIAA/USU Conference on Small Satellites** , **Hi Fi/stereo Review** ,1961 **1996 International Symposium on Microelectronics** ,1996 Proceedings of the ... International Symposium on Microelectronics ,1996 **Microwave Journal** ,2008 **NEREM Record** ,1968 *RCA Engineer* ,1968 *Cumulative Index to Entire IEEE Group Transactions/journals, 1951-1971: Subject* Nichigai Asoshiëtsu,1973 34th Aerospace Sciences Meeting & Exhibit ,1996 Index to IEEE Publications Institute of Electrical and Electronics Engineers,1990 Issues for 1973 cover the entire IEEE technical literature *Microwave Integrated Circuits* Jeffrey Frey,K. B. Bhasin,1985

Whispering the Techniques of Language: An Mental Quest through **Compact Highly Integrated X Band Power Amplifier Using**

In a digitally-driven earth wherever screens reign great and quick interaction drowns out the subtleties of language, the profound strategies and psychological subtleties concealed within phrases frequently go unheard. Yet, nestled within the pages of **Compact Highly Integrated X Band Power Amplifier Using** a captivating literary prize pulsating with raw thoughts, lies an exceptional quest waiting to be undertaken. Composed by a skilled wordsmith, that charming opus invites visitors on an introspective trip, lightly unraveling the veiled truths and profound impact resonating within the cloth of each and every word. Within the emotional depths with this poignant evaluation, we shall embark upon a honest exploration of the book is core subjects, dissect its charming publishing design, and yield to the powerful resonance it evokes heavy within the recesses of readers hearts.

https://yousky7.com/public/book-search/HomePages/Bose_Speaker_Repair_Usa.pdf

Table of Contents Compact Highly Integrated X Band Power Amplifier Using

1. Understanding the eBook Compact Highly Integrated X Band Power Amplifier Using
 - The Rise of Digital Reading Compact Highly Integrated X Band Power Amplifier Using
 - Advantages of eBooks Over Traditional Books
2. Identifying Compact Highly Integrated X Band Power Amplifier Using
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Compact Highly Integrated X Band Power Amplifier Using
 - User-Friendly Interface
4. Exploring eBook Recommendations from Compact Highly Integrated X Band Power Amplifier Using

- Personalized Recommendations
 - Compact Highly Integrated X Band Power Amplifier Using User Reviews and Ratings
 - Compact Highly Integrated X Band Power Amplifier Using and Bestseller Lists
5. Accessing Compact Highly Integrated X Band Power Amplifier Using Free and Paid eBooks
 - Compact Highly Integrated X Band Power Amplifier Using Public Domain eBooks
 - Compact Highly Integrated X Band Power Amplifier Using eBook Subscription Services
 - Compact Highly Integrated X Band Power Amplifier Using Budget-Friendly Options
 6. Navigating Compact Highly Integrated X Band Power Amplifier Using eBook Formats
 - ePub, PDF, MOBI, and More
 - Compact Highly Integrated X Band Power Amplifier Using Compatibility with Devices
 - Compact Highly Integrated X Band Power Amplifier Using Enhanced eBook Features
 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Compact Highly Integrated X Band Power Amplifier Using
 - Highlighting and Note-Taking Compact Highly Integrated X Band Power Amplifier Using
 - Interactive Elements Compact Highly Integrated X Band Power Amplifier Using
 8. Staying Engaged with Compact Highly Integrated X Band Power Amplifier Using
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Compact Highly Integrated X Band Power Amplifier Using
 9. Balancing eBooks and Physical Books Compact Highly Integrated X Band Power Amplifier Using
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Compact Highly Integrated X Band Power Amplifier Using
 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
 11. Cultivating a Reading Routine Compact Highly Integrated X Band Power Amplifier Using
 - Setting Reading Goals Compact Highly Integrated X Band Power Amplifier Using
 - Carving Out Dedicated Reading Time
 12. Sourcing Reliable Information of Compact Highly Integrated X Band Power Amplifier Using

- Fact-Checking eBook Content of Compact Highly Integrated X Band Power Amplifier Using
- Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

Compact Highly Integrated X Band Power Amplifier Using Introduction

Compact Highly Integrated X Band Power Amplifier Using Offers over 60,000 free eBooks, including many classics that are in the public domain. Open Library: Provides access to over 1 million free eBooks, including classic literature and contemporary works. Compact Highly Integrated X Band Power Amplifier Using Offers a vast collection of books, some of which are available for free as PDF downloads, particularly older books in the public domain. Compact Highly Integrated X Band Power Amplifier Using : This website hosts a vast collection of scientific articles, books, and textbooks. While it operates in a legal gray area due to copyright issues, its a popular resource for finding various publications. Internet Archive for Compact Highly Integrated X Band Power Amplifier Using : Has an extensive collection of digital content, including books, articles, videos, and more. It has a massive library of free downloadable books. Free-eBooks Compact Highly Integrated X Band Power Amplifier Using Offers a diverse range of free eBooks across various genres. Compact Highly Integrated X Band Power Amplifier Using Focuses mainly on educational books, textbooks, and business books. It offers free PDF downloads for educational purposes. Compact Highly Integrated X Band Power Amplifier Using Provides a large selection of free eBooks in different genres, which are available for download in various formats, including PDF. Finding specific Compact Highly Integrated X Band Power Amplifier Using, especially related to Compact Highly Integrated X Band Power Amplifier Using, might be challenging as theyre often artistic creations rather than practical blueprints. However, you can explore the following steps to search for or create your own Online Searches: Look for websites, forums, or blogs dedicated to Compact Highly Integrated X Band Power Amplifier Using, Sometimes enthusiasts share their designs or concepts in PDF format. Books and Magazines Some Compact Highly Integrated X Band Power Amplifier Using books or magazines might include. Look for these in online stores or libraries. Remember that while Compact Highly Integrated X Band Power Amplifier Using, sharing copyrighted material without permission is not legal. Always ensure youre either creating your own or obtaining them from legitimate sources that allow sharing and downloading. Library Check if your local library offers eBook lending

services. Many libraries have digital catalogs where you can borrow Compact Highly Integrated X Band Power Amplifier Using eBooks for free, including popular titles. Online Retailers: Websites like Amazon, Google Books, or Apple Books often sell eBooks. Sometimes, authors or publishers offer promotions or free periods for certain books. Authors Website Occasionally, authors provide excerpts or short stories for free on their websites. While this might not be the Compact Highly Integrated X Band Power Amplifier Using full book, it can give you a taste of the authors writing style. Subscription Services Platforms like Kindle Unlimited or Scribd offer subscription-based access to a wide range of Compact Highly Integrated X Band Power Amplifier Using eBooks, including some popular titles.

FAQs About Compact Highly Integrated X Band Power Amplifier Using Books

How do I know which eBook platform is the best for me? Finding the best eBook platform depends on your reading preferences and device compatibility. Research different platforms, read user reviews, and explore their features before making a choice. Are free eBooks of good quality? Yes, many reputable platforms offer high-quality free eBooks, including classics and public domain works. However, make sure to verify the source to ensure the eBook credibility. Can I read eBooks without an eReader? Absolutely! Most eBook platforms offer web-based readers or mobile apps that allow you to read eBooks on your computer, tablet, or smartphone. How do I avoid digital eye strain while reading eBooks? To prevent digital eye strain, take regular breaks, adjust the font size and background color, and ensure proper lighting while reading eBooks. What the advantage of interactive eBooks? Interactive eBooks incorporate multimedia elements, quizzes, and activities, enhancing the reader engagement and providing a more immersive learning experience. Compact Highly Integrated X Band Power Amplifier Using is one of the best book in our library for free trial. We provide copy of Compact Highly Integrated X Band Power Amplifier Using in digital format, so the resources that you find are reliable. There are also many Ebooks of related with Compact Highly Integrated X Band Power Amplifier Using. Where to download Compact Highly Integrated X Band Power Amplifier Using online for free? Are you looking for Compact Highly Integrated X Band Power Amplifier Using PDF? This is definitely going to save you time and cash in something you should think about.

Find Compact Highly Integrated X Band Power Amplifier Using :

bose speaker repair usa

[bose 321 series iii manual](#)

bose lifestyle 2operating guide

bosch bsg81265uc vacuums owners manual

~~bose ta 2 owners manual~~

bosch injection pump repair manual troubleshooting

bosch dah9566uc owners manual

bosch wiper motors parts

bosch classixx user manual

bowflex sport user manual

boston frommers guide irreverent irreverent

bottom fish field guide

boston acoustics tvee model 2 guide

bosch dishwasher guide

boule et bill quelle famille

Compact Highly Integrated X Band Power Amplifier Using :

Instruction Manual for Welbilt Bread Machine Maker ... Instruction Manual for Welbilt Bread Machine Maker Manual (ABM3400) Reprint ; Sold by. Every Instruction Manual ; Returns. Returnable until Jan 31, 2024 ; Payment. Instruction Manual for Welbilt Bread Machine ... Instruction Manual for Welbilt Bread Machine Manual & Recipes (Model: ABM3400) Bread ... 3.8 3.8 out of 5 stars 32 Reviews. Instruction Manual for Welbilt ... Wel-Bilt instruction manual for welbilt bread machine ... Wel-Bilt instruction manual for welbilt bread machine maker manual (abm3400) reprint ; Using Mountain View, CA 94043 ; Shipping. Buy now, receive by Mon, December ... Welbilt Bread Machine Model Abm3400 Instruction Manual Welbilt Bread Machine Model Abm3400 Instruction Manual ... Remove your bread pan from your breadmaker. Using a one-cup (8oz) liquid measure, fill your bread pan ... Need a manual for Welbilt The Bread Machine Model Aug 3, 2011 — Manuals and free owners instruction pdf guides. Find the user manual and the help you need for the products you own at ManualsOnline. Welbilt-manual-ABM4000.pdf INSIDER'S GUIDE TO EASY BAKING. Your Welbilt Bread Machine produces delicious baked goods with ease. This marvelous machine asks only that you carefully ... Complete Welbilt Bread Machine Manuals in 2023 Complete Welbilt Bread Machine Manuals | PDF. Breadmachine Welbilt manual for ... Welbilt ABM 100 Bread Machine Manual | PDF | Dough | Flour. Welbilt ABM 100 ... Manual for Welbilt Breadmaker? I am looking for an instruction manual for a Welbilt abm 3400. Does anyone know where to get one, I don't really want to pay 10 bucks for a copy? Welbilt Bread Machine Maker Manual ABM3000 ABM3100 ... Professionally Printed on Laser Printer using High Quality Paper. New Comb-Bound COPY of Manual listed in Title. Instruction/Owners manual ONLY - no other ... ABM3400

Bread Machine ABM-3400 Instruction Manual ... Dec 5, 2007 — Have a manual for Welbilt ABM3400 Bread Machine ABM-3400 Instruction Manual Recipes PDF? Upload a Manual (+5pts). Or just drag it here ... The Magic of Psychograms: New Way... by Hitchcock, Helyn The mystical Psychograms revealed within these pages work like magic to solve your problems and attract all of the good things in life, states the author. The Magic of Psychograms: New Way to Power and ... The Magic of Psychograms: New Way to Power and Prosperity (BN 4016) ... Select Format. Hardcover – \$41.94. The magic of psychograms : new way to power and ... Apr 5, 2013 — The magic of psychograms : new way to power and prosperity ; Publication date: 1975 ; Topics: Occultism, Parapsychology, Success ; Publisher: West ... The Magic of Psychograms: New Way to Power and ... The Magic of Psychograms: New Way to Power and Prosperity by Hitchcock, Helyn - ISBN 10: 0135453437 - ISBN 13: 9780135453438 - Parker Pub. The Magic of Psychograms: New Way to Power and ... The Magic of Psychograms: New Way to Power and Prosperity. Helyn Hitchcock. 5.00. 2 ratings0 reviews. Want to read. Buy on Amazon. Rate this book. The Magic of Psychograms: New Way to Power... The Magic of Psychograms: New Way to Power... by Helyn Hitchcock. \$39.69. Format: Hardcover. Condition: Good. Quantity: 1. 1 available. Add to Cart. The magic of psychograms : new way to power and ... The magic of psychograms : new way to power and prosperity ; Author: Helyn Hitchcock ; Edition: View all formats and editions ; Publisher: Parker Pub. Co., West ... The Magic of Psychograms: New Way to Power and ... The Magic of Psychograms: New Way to Power and Prosperity ; EAN. 9780135453438 ; Accurate description. 5.0 ; Reasonable shipping cost. 5.0 ; Shipping speed. 5.0. The Magic of Psychograms - Helyn Hitchcock The Magic of Psychograms: New Way to Power and Prosperity. Author, Helyn Hitchcock. Publisher, Parker Publishing Company, 1975. ISBN, 0135453437, 9780135453438. The Magic of Psychograms: New Way to Power and ... The Magic of Psychograms: New Way to Power and Prosperity by Helyn Hitchcock isbn: 0135453437. isbn13: 9780135453438. author: Helyn Hitchcock. Natural Swimming Pools: Inspiration for Harmony ... Michael Littlewood. Natural Swimming Pools: Inspiration for Harmony with Nature (Schiffer Design Books). 4.4 4.4 out of 5 stars 63 Reviews. 4.0 on Goodreads. (... Natural Swimming Pools: Inspiration For Harmony ... Michael Littlewood (A Schiffer Design Book) Natural swimming pools rely on the correct balance of plants and microorganisms to clean and purify the water. Natural Swimming Pools: (Schiffer Design Books) ... This book is a necessary resource for people who consider a natural swimming pool. It shows how the natural system works to provide environmental, health, and ... Natural Swimming Pools: (Schiffer Design Books) ... Drawings, diagrams, and charts cover planning, design, biology, materials, construction, planting, and maintenance. Over 300 beautiful color pictures feature ... Natural Swimming Pools: (Schiffer Design Books) ... This book is a necessary resource for people who consider a natural swimming pool. It shows how the natural system works to provide environmental, health, and ... Natural Swimming Pools: Inspiration for Harmony with ... Natural Swimming Pools: Inspiration for Harmony with Nature (Schiffer Design Books) by Littlewood, Michael - ISBN 10: 0764321838 - ISBN 13: 9780764321832 ... Natural Swimming Pools: Inspiration for Harmony with Nature

... Natural Swimming Pools: Inspiration for Harmony with Nature (Schiffer Design Books). \$58.10. Regular price \$58.10 Sale. Format. Hardcover. Hardcover. Buy it Now ... Natural Swimming Pools: (Schiffer Design Books) ... Nov 2, 2001 — Description. Natural swimming pools rely on the correct balance of living plants and micro-organisms to clean and purify the water. Natural Swimming Pools: (Schiffer Design Books) (Hardcover) This book is a necessary resource for people who consider a natural swimming pool. It shows how the natural system works to provide environmental, health, and ...