

# Chapter 3 SOLUTIONS

1) a)  $I_D = \frac{V_{in} - 2V_{D0n}}{R_1 + R_2}$   
 $= \frac{2.5 - 1.4}{4k\Omega} = \frac{1.1V}{4k\Omega}$

$I_D = 275\mu A$

b)  $I_S = 10^{-16} A$ ,  $T = 300K$ ,  $V_{D0n} = 0.7V$

$I_D = I_S (e^{V_D/\phi_T} - 1)$

where  $\phi_T = \frac{kT}{q} = 26mV @ 300K$

★  $I_D = \frac{V_{in} - 2V_D}{R_1 + R_2} = I_S (e^{V_D/\phi_T} - 1)$   
 $\frac{2.5 - 2V_D}{4k\Omega} = 10^{-16} (e^{V_D/0.026} - 1)$

iterating on this expression  
 we can obtain.

$V_D = 0.628V$   
 $I_D = 311\mu A$

c) SPICE

exercise 3.1

vin in 0 dc 2.5  
 r1 in 2 2k  
 d1 2 3 D  
 r2 3 out 2k  
 d2 out 0 D

.options post=2  
 .op

.model D D level=1 is=1e-16 ns=0.5  
 .end

\*\*\*\*\*  
 NODE VOLTAGE  
 2 1.8750E+00  
 3 1.2500E+00  
 OUT 6.2501E-01

CURRENT 3.1249E-04

d)  $I_S = 10^{-16} A$ ,  $T = 300K$ ;  
 again use ★ from b and iterate  
 to find:

$V_D = 0.743V$   
 $I_D = 253\mu A$

$I_S = 10^{-14} A$ ,  $T = 350K$ ;

$V_D = 0.728V$   
 $I_D = 261\mu A$

exercise 3.1d  
 vin in 0 dc 2.5  
 r1 in 2 2k  
 d1 2 3 D  
 r2 3 out 2k  
 d2 out 0 D

.options post=2  
 .op

\* temp 27  
 .temp 77  
 \* model D D level=1 is=1e-16 ns=0.5  
 .model D D level=1 is=1e-14 ns=0.5  
 .end

\*\*\*\*\*  
 t=27C  
 NODE VOLTAGE  
 2 1.9889E+00  
 3 1.2500E+00  
 IN 2.5000E+00  
 OUT 7.3892E-01

ID 2.5554E-04  
 \*\*\*\*\*  
 t=77C  
 NODE VOLTAGE  
 2 1.7844E+00  
 3 1.2500E+00  
 IN 2.5000E+00  
 OUT 5.3436E-01  
 ID 3.3782E-04

# Digital Integrated Circuits By Rabaey 2nd Edt Solution Manual

**J Spring**



## **Digital Integrated Circuits By Rabaey 2nd Edt Solution Manual:**

### **Solution Manual to Accompany CMOS Digital Integrated Circuits : Analysis and Design, Second Edition**

Sung-Mo Kang, Yusuf Leblebici, 1999      Embedded SoPC Design with Nios II Processor and Verilog Examples Pong P. Chu, 2012-05-14 Explores the unique hardware programmability of FPGA based embedded systems using a learn by doing approach to introduce the concepts and techniques for embedded SoPC design with Verilog An SoPC system on a programmable chip integrates a processor memory modules I O peripherals and custom hardware accelerators into a single FPGA field programmable gate array device In addition to the customized software customized hardware can be developed and incorporated into the embedded system as well allowing us to configure the soft core processor create tailored I O interfaces and develop specialized hardware accelerators for computation intensive tasks Utilizing an Altera FPGA prototyping board and its Nios II soft core processor Embedded SoPC Design with Nios II Processor and Verilog Examples takes a learn by doing approach to illustrate the hardware and software design and development process by including realistic projects that can be implemented and tested on the board Emphasizing hardware design and integration throughout the book is divided into four major parts Part I covers HDL and synthesis of custom hardware Part II introduces the Nios II processor and provides an overview of embedded software development Part III demonstrates the design and development of hardware and software of several complex I O peripherals including a PS2 keyboard and mouse a graphic video controller an audio codec and an SD secure digital card Part IV provides several case studies of the integration of hardware accelerators including a custom GCD greatest common divisor circuit a Mandelbrot set fractal circuit and an audio synthesizer based on DDFS direct digital frequency synthesis methodology While designing and developing an embedded SoPC can be rewarding the learning can be a long and winding journey This book shows the trail ahead and guides readers through the initial steps to exploit the full potential of this emerging methodology      **Embedded SoPC Design with Nios II Processor and VHDL Examples** Pong P. Chu, 2011-08-29 The book is divided into four major parts Part I covers HDL constructs and synthesis of basic digital circuits Part II provides an overview of embedded software development with the emphasis on low level I O access and drivers Part III demonstrates the design and development of hardware and software for several complex I O peripherals including PS2 keyboard and mouse a graphic video controller an audio codec and an SD secure digital card Part IV provides three case studies of the integration of hardware accelerators including a custom GCD greatest common divisor circuit a Mandelbrot set fractal circuit and an audio synthesizer based on DDFS direct digital frequency synthesis methodology The book utilizes FPGA devices Nios II soft core processor and development platform from Altera Co which is one of the two main FPGA manufactures Altera has a generous university program that provides free software and discounted prototyping boards for educational institutions details at [www.altera.com/university](http://www.altera.com/university) The two main educational prototyping boards are known as DE1 99 and DE2 269 All experiments can be implemented and tested with these boards A

board combined with this book becomes a turn key solution for the SoPC design experiments and projects Most HDL and C codes in the book are device independent and can be adapted by other prototyping boards as long as a board has similar I O configuration

**FPGA Prototyping by VHDL Examples** Pong P. Chu, 2011-09-20 This book uses a learn by doing approach to introduce the concepts and techniques of VHDL and FPGA to designers through a series of hands on experiments FPGA Prototyping by VHDL Examples provides a collection of clear easy to follow templates for quick code development a large number of practical examples to illustrate and reinforce the concepts and design techniques realistic projects that can be implemented and tested on a Xilinx prototyping board and a thorough exploration of the Xilinx PicoBlaze soft core microcontroller

**Integrated Circuit and System Design. Power and Timing Modeling, Optimization and Simulation** Vassilis Paliouras, 2005-09-06 This book constitutes the refereed proceedings of the 15th International Workshop on Power and Timing Optimization and Simulation PATMOS 2005 held in Leuven Belgium in September 2005 The 74 revised full papers presented were carefully reviewed and selected from numerous submissions The papers are organized in topical sections on low power processors code optimization for low power high level design telecommunications and signal processing low power circuits system on chip design busses and interconnections modeling design automation low power techniques memory and register files applications digital circuits and analog and physical design

**Integrated Circuit and System Design**, 2005 *Forthcoming Books* Rose Arny, 2002-04 *The Proceedings of the European Design Automation Conference*, 1990

**Solutions Manual Digital Integrated Circuits** CRC Press, 2009-07-10 Any textbook more than five years old simply won't do in digital integrated circuits as dynamic CMOS circuits have emerged to dominate the field Providing a revised instructional text for engineers involved with Very Large Scale Integrated Circuit design and fabrication this second edition delves into the dramatic advances including new applications and changes in the physics of operation made possible by relentless miniaturization Each chapter includes numerous worked examples case studies and SPICE computer simulations The book's website offers supplementary material and more worked problems Qualifying instructors will have access to a new instructor's manual

**Solutions Manual to Accompany Analysis and Design of Digital Integrated Circuits** David A. Hodges, Yu Chen, Horace G. Jackson, 1983 [Solutions Manual for Digital Integrated Circuits](#) Ayers John E, 2003-09 [Digital Integrated Circuits](#) Jan M. Rabaey, 2003 Contents p pChapter 1 Introductionp pChapter 2 The Manufacturing Processp pChapter 3 The Devicesp pChapter 4 The Wirep pChapter 5 The CMOS Inverterp pChapter 6 Designing Combinational Logic Gates in CMOS [Digital Integrated Circuits](#) DeMassa, 1996-02-01

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