



# CMOS

## Circuit Design, Layout, and Simulation

Third Edition

**R. Jacob Baker**

IEEE Press Series on Microelectronic Systems

Stuart K. Tewksbury and Joe E. Brewer, *Series Editors*



**IEEE PRESS**



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# Multipliers

Name	Symbol	Value
terra	T	$10^{12}$
giga	G	$10^9$
mega	M (MEG in SPICE)	$10^6$
kilo	k	$10^3$
milli	m	$10^{-3}$
micro	$\mu$ (or u)	$10^{-6}$
nano	n	$10^{-9}$
pico	p	$10^{-12}$
femto	f	$10^{-15}$
atto	a (not used in SPICE)	$10^{-18}$

# Physical Constants

Name	Symbol	Value/Units
Vacuum dielectric constant	$\epsilon_0$	$8.85 \text{ aF}/\mu\text{m}$
Silicon dielectric constant	$\epsilon_{\text{Si}}$	$11.7\epsilon_0$
SiO <sub>2</sub> dielectric constant	$\epsilon_{\text{ox}}$	$3.97\epsilon_0$
SiN <sub>3</sub> dielectric constant	$\epsilon_{\text{Ni}}$	$16\epsilon_0$
Boltzmann's constant	k	$1.38 \times 10^{-23} \text{ J/K}$
Electronic charge	q	$1.6 \times 10^{-19} \text{ C}$
Temperature	T	Kelvin
Thermal voltage	$V_T$	$kT/q = 26 \text{ mV @ } 300\text{K}$

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445 Hoes Lane  
Piscataway, NJ 08854

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Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Published simultaneously in Canada.

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***Library of Congress Cataloging-in-Publication Data:***

Baker, R. Jacob, 1964-

CMOS : circuit design, layout, and simulation / Jake Baker. — 3rd ed.

p. cm.

Summary: "The third edition of CMOS: Circuit Design, Layout, and Simulation continues to cover the practical design of both analog and digital integrated circuits, offering a vital, contemporary view of a wide range of analog/digital circuit blocks, the BSIM model, data converter architectures, and much more. The 3rd edition completes the revised 2nd edition by adding one more chapter (chapter 30) at the end, which describes on implementing the data converter topologies discussed in Chapter 29. This additional, practical information should make the book even more useful as an academic text and companion for the working design engineer. Images, data presented throughout the book were updated, and more practical examples, problems are presented in this new edition to enhance the practicality of the book"— Provided by publisher.

Summary: "The third edition of CMOS: Circuit Design, Layout, and Simulation continues to cover the practical design of both analog and digital integrated circuits, offering a vital, contemporary view of a wide range of analog/digital circuit blocks, the BSIM model, data converter architectures, and much more"— Provided by publisher.

ISBN 978-0-470-88132-3 (hardback)

1. Metal oxide semiconductors, Complementary—Design and construction. 2. Integrated circuits—Design and construction. 3. Metal oxide semiconductor field-effect transistors. I. Title.

TK7871.99.M44B35 2010

621.39'732—dc22

2010016630

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

*To my wife Julie*



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