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Third Edition

CMOS

Digital Integrated Circuits

Analysis and Design

Sung-Mo Kang
Yusuf Leblebici

TSMC 1011

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Physical and Materials Constants

Boltzmann's constant	k	1.38×10^{-23}	J/K
Electron charge	q	1.6×10^{-19}	C
Thermal voltage	kT/q	0.026 (at $T = 300$ K)	V
Energy gap of silicon (Si)	E_g	1.12 (at $T = 300$ K)	eV
Intrinsic carrier concentration of silicon (Si)	n_i	1.45×10^{10} (at $T = 300$ K)	cm^{-3}
Dielectric constant of vacuum	ϵ_0	8.85×10^{-14}	F/cm
Dielectric constant of silicon (Si)	ϵ_{Si}	$11.7 \times \epsilon_0$	F/cm
Dielectric constant of silicon dioxide (SiO ₂)	ϵ_{ox}	$3.97 \times \epsilon_0$	F/cm

Commonly Used Prefixes for Units

giga	G	10^9
mega	M	10^6
kilo	k	10^3
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

second edition

CMOS DIGITAL INTEGRATED CIRCUITS

Analysis and Design

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CONTENTS

PREFACE	xi
1 INTRODUCTION	1
1.1 Historical Perspective	1
1.2 Objective and Organization of the Book	5
1.3 A Circuit Design Example	8
2 FABRICATION OF MOSFETs	20
2.1 Introduction	20
2.2 Fabrication Process Flow: Basic Steps	21
2.3 The CMOS n-Well Process	29
2.4 Layout Design Rules	37
2.5 Full-Custom Mask Layout Design	40
References	44
Exercise Problems	45
3 MOS TRANSISTOR	47
3.1 The Metal Oxide Semiconductor (MOS) Structure	48
3.2 The MOS System under External Bias	52
3.3 Structure and Operation of MOS Transistor (MOSFET)	55
3.4 MOSFET Current-Voltage Characteristics	66
3.5 MOSFET Scaling and Small-Geometry Effects	81
3.6 MOSFET Capacitances	97
References	110
Exercise Problems	111

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