CONTENTS

Chapter 1
THE PREDICTMOS MOSFET MODEL AND ITS PARAMETER EXTRACTION
1.1 Introduction to ASICs 2
1.2 Physics of Device Operation 7
1.3 Problem Statement 16
1.4 Physical MOSFET Modeling 19
1.5 PREDICTMOS MOSFET Model 26
1.6 A Simplified Methodology for the Extraction of the PREDICTMOS MOSFET
   Model Parameters
   1.6.1 Introduction 29
   1.6.2 Parameter Extraction of the PREDICTMOS Model Parameters from
       the BSIM3 Model Parameters 31
   1.6.3 Results And Discussion 37
   1.6.4 Conclusion 40
1.6 References 42

Chapter 2
STATIC CHARACTERISTICS OF SUBMICRON CMOS INVERTER
2.1 Introduction 44
2.2 Logic Levels 45
2.3 Analytical Expressions for Static Characteristics of Submicron CMOS
   Inverters 48
Chapter 4

SHORT CIRCUIT POWER DISSIPATION OF SUBMICRON CMOS INVERTERS

4.1 Introduction 101

4.2 Short Circuit Power Dissipation of a CMOS Inverter Using the PREDICTMOS Model

4.2.1 Introduction 105

4.2.2 Short Circuit Power Dissipation Derivation 106

4.2.3 Results And Discussion 110

4.2.4 Conclusion 114

4.2 References 115

4.3 Transistor Sizing to Improve Performance and Power Budget

4.3. 1 Introduction 116

4.3. 2 Short channel short circuit power dissipation expression 117

4.3. 3 Results 124

4.3. 4 Discussion 125

4.3. 5 Conclusions 126

4.3 References 127
4.4 Macromodel for Short Circuit Power Dissipation of Submicron CMOS

Inverters and Its Application to Design CMOS Buffers

4.4.1 Introduction 128
4.4.2 Derivation of a Macromodel 132
4.4.3 Results and Discussion 134
4.4.4 Conclusion 135

4.4 References 136

Chapter 5
SUMMARY AND FUTURE RESEARCH

5.1 Introduction 140
5.2 Device Speed 143
5.3 Delay Through Series Connected MOSFETS 145
  5.3.1 Introduction 145
  5.3.2 Delay Expression of SCMOS 147
  5.3.3 Results and Discussion 149
5.3 References 154
5.4 Comparative Evaluation of the Schmitt Trigger Architecture
  5.4.1 Introduction 155
  5.4.2 Design Methodology of the Three Schmitt Trigger's 156
  5.4.3 Design Methodology of KST 159
  5.4.4 Design Methodology of SSST 160
  5.4.5 Observations 162
5.5.1 Introduction 167

5.5.2 Derivation of the Current Expression & Propagation Delay Model Incorporating the Source / Drain Series Resistance 168

5.5.3 Results 172

5.5.4 Discussion and Conclusion 173

5.5 References 175

5.6 Conclusion 177

Appendix 178

List of Publications 181