

CONTENTS

<i>List of Figures</i>		xi-xiv
<i>List of Tables</i>		xv
<i>List of Abbreviations</i>		xvi-xvii
<i>Preface</i>		xviii-xxi
CHAPTER 1	Introduction and Scope of the Thesis	1-47
1.1	Introduction	1
1.2	Short Channel Effects in the Scaled MOSFETs	9
1.2.1	Threshold Voltage Roll-off	9
1.2.2	Drain Induced Barrier Lowering (DIBL)	10
1.2.3	Channel Length Modulation	12
1.2.4	Punchthrough	13
1.2.5	Hot Carrier Effects	14
1.2.6	Sub-Threshold Swing	15
1.3	Device Engineering Techniques for Future Generation Technology Scaling	16
1.3.1	Gate Material Engineering	16
1.3.2	III-V Group Material Based MOSFET Technology	17
1.3.3	Strained-Silicon Channel Based MOSFETs	18
1.3.4	Source/Drain Engineering	19
1.3.5	Lateral Channel Engineering	20
1.3.6	Gate Material Engineering	22
1.3.7	Gate Structure Engineering: Multiple Gate MOS Transistor Structures	24
1.3.8	The Channel Doping Engineering	26
1.4	The Junctionless Field Effect Transistors (JLFETs): A Potential MOS Transistor for Future Generation Technology	28

	Scaling	
1.5	State-of-the-Art-Works of the JLFETs	32
	1.5.1 Review of Some Simulation-Based Study on JLFETs	32
	1.5.2 Review of Modeling of Long Channel DG JLFETs	34
	1.5.3 Review of Modeling of Short Channel DG-JLFETs	37
	1.5.4 Summary of the Literature Survey: Motivation Behind the Present Thesis	42
1.6	Scopes and Chapter Outline of the Thesis	45
CHAPTER 2	Analytical Modeling of Channel Potential and Threshold Voltage of DG-JLFETs with a Vertical Gaussian-Like Doping Profile	48-71
2.1	Introduction	48
2.2	Model Derivation	49
	2.2.1 Channel Potential	49
	2.2.2 Conduction Path Potential	58
	2.2.3 Threshold Voltage Model	59
2.3	Results and Discussion	60
2.4	Conclusion	71
CHAPTER 3	Analytical Modeling of Subthreshold Current and Subthreshold Swing of DG-JLFETs with a Vertical Gaussian-Like Channel Profile	72-85
3.1	Introduction	72
3.2	Model Derivation	73
	3.2.1 Subthreshold Current Model	75
	3.2.2 Modeling of Subthreshold Swing	77
3.3	Results and Discussion	78
3.4	Conclusion	85

CHAPTER 4	Analytical Modeling of Channel Potential and Threshold Voltage of Dielectric Pocket DG-JLFETs	86-103
4.1	Introduction	86
4.2	Model Derivation	87
4.2.1	Channel Potential	87
4.2.2	Threshold Voltage Model	95
4.3	Results and Discussion	96
4.4	Conclusion	103
CHAPTER 5	Analytical Modeling of Subthreshold Current and Subthreshold Swing of DP- DG-JLFETs	104-116
5.1	Introduction	104
5.2	Model Derivation	105
5.2.1	Subthreshold Current Model	106
5.2.2	Modeling of Subthreshold Swing	107
5.3	Results and Discussion	108
5.4	Conclusion	115
CHAPTER 6	Conclusions and Future Scope	117-123
6.1	Introduction	117
6.2	Chapter-Wise Summary and Conclusions	117
6.3	Future Scopes of Work	122
	<i>References</i>	124-136
	<i>Author's Relevant Publications</i>	137