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Viranjay M. Srivastava • Ghanshyam Singh

MOSFET Technologies for Double-Pole Four-Throw Radio-Frequency Switch

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Viranjay M. Srivastava
Assistant Professor
Department of Electronics
and Communication Engineering
Jaypee University of Information
Technology
Solan, Himachal Pradesh
India

Ghanshyam Singh
Professor
Department of Electronics
and Communication Engineering
Jaypee University of Information
Technology
Solan, Himachal Pradesh
India

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Contents

1	Introduction	1
1.1	Transceiver Systems	2
1.2	Radio-Frequency Switches	5
1.3	Radio-Frequency MOSFETs	7
1.4	Issues of Radio-Frequency MOSFET Modeling	9
1.5	Double-Gate MOSFET	13
1.6	Cylindrical Surrounding Double-Gate MOSFET	15
1.7	Hafnium Dioxide-Based MOSFET	16
1.8	Image Acquisition of the MOSFETs	16
1.9	Conclusion	16
	References	17
2	Design of Double-Pole Four-Throw RF Switch	23
2.1	Introduction	23
2.2	Comparison of Various Switches	23
2.2.1	PIN Diode Switch	24
2.2.2	GaAs FET Switch	24
2.2.3	MESFET Switch	24
2.2.4	MOSFET Switch	25
2.2.5	MEMS Switch	25
2.3	RF Transceiver Systems	26
2.4	RF Transceiver Switch	28
2.5	Design of CMOS Inverter for RF Switch	29
2.6	Configuration of Switches	31
2.6.1	Single-Pole Single-Throw Switch	31
2.6.2	Single-Pole Double-Throw Switch	32
2.6.3	Double-Pole Double-Throw Switch	33
2.6.4	Double-Pole Four-Throw Switch	33
2.7	Design of DP4T RF Switch Based on Single-Gate MOSFET	34
2.8	Operational Characteristics of DP4T CMOS Switch	36

2.9	RF Switch Performance Parameters	37
2.9.1	Insertion Loss	38
2.9.2	Return Loss	38
2.9.3	Isolation	38
2.9.4	RF Power Handling	38
2.9.5	Linearity	39
2.9.6	Transition Time	39
2.9.7	Switching Speed	39
2.10	Topologies for DP4T Switches	39
2.11	Conclusions	40
	References	41
3	Design of Double-Gate MOSFET	45
3.1	Introduction	45
3.2	Design Process of Double-Gate MOSFET	48
3.3	Effects of Double-Gate MOSFET on the Leakage Currents	50
3.3.1	Subthreshold Leakage	51
3.3.2	Gate Leakage	51
3.3.3	Band to Band Tunneling of Electrons	51
3.4	Performance Improvement of DG MOSFET over SG MOSFET	53
3.5	Resistive and Capacitive Model of DG MOSFET and SG MOSFET	56
3.6	Characteristics of the DG MOSFET with Aspect Ratios	63
3.7	Design of DG MOSFET with Several Gate-Fingers	66
3.8	Model of Series and Parallel Combination for Double-Gate MOSFET	73
3.9	Conclusions	75
	References	76
4	Double-Pole Four-Throw RF Switch Based on Double-Gate MOSFET	85
4.1	Introduction	85
4.2	Basics of Radio System Design	85
4.2.1	Path Loss	85
4.2.2	Gain Cascade	86
4.2.3	1 dB Compression Point	86
4.2.4	Third-Order Intercept Point	87
4.2.5	Thermal Noise	87
4.2.6	Noise Figure	88
4.2.7	Phase Noise	88
4.3	Design of DP4T DG RF CMOS Switch	88
4.4	Characteristics of DP4T DG RF CMOS Switch	90

4.5	Effective ON-State Resistance of DP4T DG RF CMOS Switch . . .	94
4.5.1	Parallel Combination of Resistance in a Device	96
4.5.2	Choosing Transistor with Large Mobility	96
4.5.3	Keeping $V_{gs} - V_{th}$ Large	96
4.5.4	Aspect Ratio of a Transistor	96
4.6	Attenuation of DP4T CMOS Switch	97
4.6.1	Causes of Attenuation	100
4.6.2	Counteracting Attenuation	100
4.7	OFF-Isolation	101
4.8	Resistive and Capacitive Model of DP4T DG RF CMOS Switch	101
4.9	Switching Speed of DP4T DG RF CMOS Switch	103
4.10	S-Parameters of DP4T DG RF CMOS Switch	103
4.11	Conclusions	106
	References	107
5	Cylindrical Surrounding Double-Gate RF MOSFET	111
5.1	Introduction	111
5.2	Analysis of CSDG RF MOSFET	114
5.3	Fabrication Process for CSDG RF MOSFET	117
5.4	Characteristics of CSDG MOSFET	118
5.5	Resistive and Capacitive Model of the CSDG MOSFET	122
5.6	Explicit Model of CSDG MOSFET	129
5.7	Gate Leakage Current, Noise Model, and Short Channel Effects for CSDG MOSFET	131
5.8	Cross talk in CSDG MOSFET Model	132
5.9	Advantages of the CSDG MOSFET Model	135
5.10	Conclusions	137
	References	138
6	Hafnium Dioxide-Based Double-Pole Four-Throw Double-Gate RF CMOS Switch	143
6.1	Introduction	143
6.2	MOSFET Model with HfO_2	146
6.3	Fabrication Process of HfO_2 -Based DG MOSFET	147
6.4	Parameters of HfO_2 -Based MOSFET	149
6.4.1	Oxide Capacitance per Unit Area	149
6.4.2	Threshold Voltage	149
6.4.3	Drain Currents	149
6.4.4	Body Bias Effect	150
6.4.5	Resistances	150
6.4.6	Capacitances	150
6.4.7	Figure of Merit	151
6.5	Switching Characteristics of HfO_2 -Based MOSFET	151
6.5.1	Fall Time	151
6.5.2	Rise Time	152

6.5.3	Maximum Signal Frequency	152
6.5.4	Propagation Delay	152
6.5.5	Power Dissipation	153
6.6	DP4T Switch Design with HfO ₂ -Based DG MOSFET	153
6.7	Characteristics of DP4T Switch with HfO ₂ -Based DG MOSFET	155
6.7.1	Drain Current Analysis	156
6.7.2	ON/OFF Ratio and Insertion Loss	156
6.7.3	ON-Resistance (R_{ON}) and Attenuation	157
6.7.4	Flat-Band Capacitance and Dynamic Power	159
6.7.5	Debye Length Calculation and Mobility	159
6.7.6	Potential Barrier	160
6.8	Conclusions	160
	References	161
7	Testing of MOSFETs Surfaces Using Image Acquisition	165
7.1	Introduction	165
7.2	Proposed Model for the Image Acquisition of MOSFETs	166
7.2.1	Preprocessing	167
7.2.2	Image Sensor	167
7.2.3	Discrete Fourier Transform	169
7.2.4	Filter Function	169
7.2.5	Inverse Discrete Fourier Transform	170
7.2.6	Postprocessing	170
7.2.7	Image Enhancement	170
7.3	Image Analysis	171
7.4	Conclusion	172
	References	173
8	Conclusions and Future Scope	177
8.1	Conclusions	177
8.2	Future Scope	179
	References	181
	Appendix A List of Symbols	183
	Appendix B List of Definitions	187
	Appendix C Outcomes of the Book	191
	About the Authors	193
	Index	195

List of Figures

Fig. 1.1	Simple RF transceiver architecture	3
Fig. 2.1	Radio-frequency design hexagon	26
Fig. 2.2	A radio front-end block diagram with (a) the integration of transceiver switch and matching networks, (b) simplified schematic of a transceiver switch, and (c) typical transistor based transceiver switch	27
Fig. 2.3	Schematic of the CMOS (a) internal structure and (b) inverter circuit	30
Fig. 2.4	Schematic of the (a) SPDT, (b) DPDT, and (c) DP4T	32
Fig. 2.5	DP4T CMOS transceivers switch with single-gate transistor	34
Fig. 2.6	Schematic of the (a) basic SG MOSFET and (b) DP4T SG RF CMOS switch	35
Fig. 2.7	Proposed DP4T switch with two transistors	35
Fig. 2.8	Proposed DP4T switch layout with two transistors	37
Fig. 3.1	Schematic of the basic n-type double-gate MOSFET	46
Fig. 3.2	Layout of (a) DG MOSFET and (b) SG MOSFET	54
Fig. 3.3	Output voltage with gate and control voltage of (a) DG MOSFET and (b) SG MOSFET	55
Fig. 3.4	Drain current characteristics of (a) DG MOSFET and (b) SG MOSFET	57
Fig. 3.5	Voltage gain of (a) DG MOSFET and (b) SG MOSFET	58
Fig. 3.6	Layout of (a) n-type DG MOSFET and (b) p-type DG MOSFET	59
Fig. 3.7	The Circuit Models of (a) DG MOSFET and (b) SG MOSFET operating as a switch at ON-state	60
Fig. 3.8	Effect of the aspect ratio (when it is 2000) on the characteristics of DG MOSFET (a) drain current with gate to source voltage and (b) threshold voltage with the length (nm) of the channel	64

Fig. 3.9	Effect of the aspect ratio (when it is 500) on the characteristics of DG MOSFET (a) drain current with gate to source voltage and (b) threshold voltage with the length (nm) of the channel ...	65
Fig. 3.10	Characteristics of capacitances with drain to source voltage for n-type MOSFET with the aspect ratio 2,000	66
Fig. 3.11	Layout of n-type DG MOSFET for (a) $NF = 1$ and (b) $NF = 10$	67
Fig. 3.12	Voltage characteristic of n-type DG MOSFET for (a) $NF = 1$ and (b) $NF = 10$	68
Fig. 3.13	Drain current characteristics of n-type DG MOSFET for (a) $NF = 1$ and (b) $NF = 10$	69
Fig. 3.14	Output voltage characteristics of n-type DG MOSFET for (a) $NF = 1$ and (b) $NF = 10$	70
Fig. 3.15	Conversion of the series and parallel combination of n-MOSFET/p-MOSFET to DG MOSFET. Case 1. Series combination of n-MOSFET to DG MOSFET. Case 2. Series combination of p-MOSFET to DG MOSFET. Case 3. Parallel combination of n-MOSFET to DG MOSFET. Case 4. Parallel combination of p-MOSFET to DG MOSFET ...	74
Fig. 4.1	1 dB compression point	87
Fig. 4.2	Third-order intercept point	87
Fig. 4.3	Proposed DP4T DG RF CMOS switch	89
Fig. 4.4	Layout of the proposed DP4T DG RF CMOS switch	91
Fig. 4.5	Characteristics of the proposed DP4T DG RF CMOS transceiver switch such as (a) applied input voltages, (b) antenna voltage with input voltages, (c) drain current, and (d) antenna output at various frequencies	92
Fig. 4.6	Equivalent capacitive model of the proposed DP4T DG RF CMOS switch	95
Fig. 4.7	Attenuation at $V_{CTL} = 0.7\text{--}1.2$ V for (a) 0.8- μm technology and (b) 45-nm technology	98
Fig. 4.8	Attenuation at $V_{CTL} = -0.1$ V to 0.7 V for (a) 0.8- μm technology and (b) 45-nm technology	98
Fig. 4.9	Resistive and capacitive model of DP4T DG RF CMOS switch at ON-state	102
Fig. 4.10	Equivalent capacitive circuit of the DP4T DG RF CMOS switch	104
Fig. 5.1	Schematic of (a) basic DG MOSFET, (b) CSDG MOSFET, and (c) cross-section of CSDG MOSFET	116
Fig. 5.2	Model of CSDG MOSFET transistor with its components at ON-state	122

Fig. 5.3 Design of the CSDG MOSFET with SPICE (a) capacitive models operating as a switch at ON-state, (b) input signal applied to gates, (c) output signal at drain, (d) source current variation with frequency, and (e) drain current variation with frequency 124

Fig. 5.4 Design of the CSDG MOSFET with ADS (a) capacitive models operating as a switch at ON-state, (b) input signal applied to both gates, and (c) output signal at drain 126

Fig. 5.5 Equivalent resistive and capacitive model of the CSDG MOSFET 133

Fig. 5.6 (a) Substrate cross talk mechanism and (b) Reduction of cross talk with CSDG MOSFET model 134

Fig. 6.1 Dielectric constant vs. bandgap for gate oxides 144

Fig. 6.2 Schematic of the basic n-type MOSFET (a) with HfO₂ and (b) HfO₂ film on Si-substrate 147

Fig. 6.3 Schematic of n-type DG MOSFET with HfO₂ 148

Fig. 6.4 DP4T RF CMOS switch with HfO₂-layered double-gate MOSFET 154

Fig. 6.5 ON/OFF ratio for the proposed DP4T RF CMOS switch 157

Fig. 6.6 Attenuation for the proposed DP4T RF CMOS switch with respect to the applied control voltage 158

Fig. 6.7 Insertion loss for the proposed DP4T RF CMOS switch with the ON-state resistance 158

Fig. 7.1 Flow chart of a device testing using Image Acquisition 168

Fig. 7.2 Various images which can be obtained from the image acquisition of DG MOSFET 171

Fig. 7.3 Various images which can be obtained from the image acquisition of CSDG MOSFET 172

List of Tables

Table 1.1	Electromagnetic radiation spectrum	2
Table 1.2	Electromagnetic radiation spectrum based on IEEE	3
Table 3.1	Comparison of the various circuit parameters of the DG and SG MOSFET for proposed model	61
Table 3.2	Comparison of the drain current for proposed DG MOSFET model with the existing model	62
Table 3.3	Comparison of the various circuit parameters of the DG MOSFET for $NF = 1$ and $NF = 10$	71
Table 3.4	Design for independent gate configuration (IGC) and tied gate configuration (TGC)	74
Table 3.5	An effective aspect ratio for different combination of transistors as shown in Fig. 3.15	75
Table 4.1	Simulation results for drain current and switching speed for several switches	94
Table 4.2	Comparison of the switching speed	94
Table 4.3	Performance parameters of the double-gate MOSFET transceiver switch	95
Table 4.4	DP4T DG RF CMOS switch attenuation for control voltage range 0.7 V–2.1 V	100
Table 4.5	DP4T DG RF CMOS switch attenuation for control voltage range –0.1 V to 0.7 V	100
Table 4.6	Simulated parameters of the DP4T DG RF CMOS switch	104
Table 4.7	Impedance, admittance, series equivalent, and parallel equivalent circuit parameters of the proposed switch	104
Table 4.8	S-parameters of a designed switch at various frequencies (Mag. = magnitude, Ang. = angle)	105
Table 4.9	Magnitude of S_{12} and S_{21} (both are equal) at various frequencies	105

Table 5.1	Comparison of the various circuit parameters of the CSDG MOSFET and existing CSSG MOSFET model	129
Table 5.2	Advantage of the proposed CSDG MOSFET model over several reported literatures for CSSG MOSFET	136
Table 6.1	Properties of hafnium dioxide	144
Table 6.2	Dielectric constant, bandgap, and conduction band offset on Si of the candidate gate dielectrics	148
Table 6.3	Comparison of parameters of HfO ₂ -based MOSFET with the SiO ₂ -based MOSFET	153
Table 6.4	Working functionality of DP4T RF CMOS switch with HfO ₂ DG MOSFET	155

Abstract

With the development of modern silicon technology, more and more high-frequency circuits can be implemented in standard complementary metal-oxide-semiconductor (CMOS) processes. The feasibility of RF ICs in standard CMOS process is established, and the trend in putting all components of a system on a chip includes integration of the transceiver (T/R) antenna switch.

In this book, we have designed a double-gate (DG) MOSFET and double-pole four-throw (DP4T) RF switch to enhance its performance for the next generation wireless communication systems. Further we have combined the ideas of DG MOSFET and DP4T switch to design a novel DP4T DG RF CMOS switch. The designed DP4T DG RF CMOS switch can route four inputs to two outputs at a time or vice versa. So it is twice effective as compared to the previously existing SPDT switches.

In the DG MOSFET, the gates are only on the two sides of the substrate. Hence, to utilize all the sides of the substrate, we have widened the gate all around the device and designed like a cylinder. Therefore, we extend this work to the cylindrical surrounding double-gate (CSDG) MOSFET. It has less contact area with the board compared to the other MOSFETs. Due to the circular source and drain, the gate contact with the source and drain is on a long circular region, which avoids the gate misalignment. This work has been extended by replacing SiO_2 with HfO_2 as a high dielectric material to design DG MOSFET.

Finally, we have analyzed the image acquisition of DG MOSFET and CSDG MOSFETs for the purpose of RF switch. The proposed model emphasized on the basics of single image sensor for two-dimensional images of a three-dimensional device, so that we can obtain a satisfactory device parameter.