

774  
1-63/4e3

# IEEE TRANSACTIONS ON ELECTRON DEVICES

A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY



JANUARY 2014

VOLUME 61

NUMBER 1

IETDAI

(ISSN 0018-9383)

## EDITORIAL

A Warm Welcome to a New T-ED Editor .....	<i>J. D. Cressler</i>	1
---	-----------------------	---

## REGULAR PAPERS

### Silicon and Column IV Semiconductors Devices

A Bandgap-Engineered Silicon-Germanium Biristor for Low-Voltage Operation .....	<i>J.-B. Moon, D.-I. Moon, and Y.-K. Choi</i>	2
Process Optimization of Integrated SiCr Thin-Film Resistor for High-Performance Analog Circuits .....	<i>Y.-C. Kwon, H.-C. Seol, S.-K. Hong, and O.-K. Kwon</i>	8
A Detailed Failure Analysis Examination of the Effect of Thermal Cycling on Cu TSV Reliability .....	<i>C. Okoro, J. W. Lau, F. Golshany, K. Hummler, and Y. S. Obeng</i>	15
A Computational Study on the Electronic Transport Properties of Ultranarrow Disordered Zigzag Graphene Nanoribbons .....	<i>N. Djavid, K. Khaliji, S. M. Tabatabaei, and M. Pourfath</i>	23
Effect of Load Capacitance and Input Transition Time on FinFET Inverter Capacitances .....	<i>A. Pandey, S. Raycha, S. Maheshwaram, S. K. Manhas, S. Dasgupta, A. K. Saxena, and B. Anand</i>	30
p-Type Nanowire Schottky Barrier MOSFETs: Comparative Study of Ge- and Si-Channel Devices .....	<i>W. Choi, J. Lee, and M. Shin</i>	37
Multiple Turn Ratios of On-Chip Transformer With Four Intertwining Coils .....	<i>H.-M. Hsu and C.-T. Chien</i>	44
An Open-Source Multiscale Framework for the Simulation of Nanoscale Devices .....	<i>S. Bruzzone, G. Iannaccone, N. Marzari, and G. Fiori</i>	48
Statistical SBD Modeling and Characterization and Its Impact on SRAM Cells .....	<i>S. Y. Kim, C.-H. Ho, and K. Roy</i>	54
Evolution of Unified-RAM: 1T-DRAM and BE-SONOS Built on a Highly Scaled Vertical Channel .....	<i>D.-I. Moon, J.-Y. Kim, J.-B. Moon, D.-O. Kim, and Y.-K. Choi</i>	60
nMOS Short Channel Device Characteristics After Soft Oxide Breakdown and Implications for Reliability Projections and Circuits .....	<i>P. E. Nicollian, M. Chen, Y. Yang, C. A. Chancellor, and V. K. Reddy</i>	66

### Thin Film Transistors

Enhancement of Electrical Stability in Oxide Thin-Film Transistors Using Multilayer Channels Grown by Atomic Layer Deposition .....	<i>C. H. Ahn, M. G. Yun, S. Y. Lee, and H. K. Cho</i>	73
---	---	----

(Contents Continued on Back Cover)

# IEEE TRANSACTIONS ON ELECTRON DEVICES

A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY



JANUARY 2014

VOLUME 61

NUMBER 1

IETDAI

(ISSN 0018-9383)

---

EDITORIAL

A Warm Welcome to a New T-ED Editor .....	<i>J. D. Cressler</i>	1
---	-----------------------	---

REGULAR PAPERS

**Silicon and Column IV Semiconductors Devices**

A Bandgap-Engineered Silicon-Germanium Biristor for Low-Voltage Operation .....	<i>J.-B. Moon, D.-I. Moon, and Y.-K. Choi</i>	2
Process Optimization of Integrated SiCr Thin-Film Resistor for High-Performance Analog Circuits .....	<i>Y.-C. Kwon, H.-C. Seol, S.-K. Hong, and O.-K. Kwon</i>	8
A Detailed Failure Analysis Examination of the Effect of Thermal Cycling on Cu TSV Reliability .....	<i>C. Okoro, J. W. Lau, F. Golshany, K. Hummler, and Y. S. Obeng</i>	15
A Computational Study on the Electronic Transport Properties of Ultranarrow Disordered Zigzag Graphene Nanoribbons .....	<i>N. Djavid, K. Khaliji, S. M. Tabatabaei, and M. Pourfath</i>	23
Effect of Load Capacitance and Input Transition Time on FinFET Inverter Capacitances .....	<i>A. Pandey, S. Raycha, S. Maheshwaram, S. K. Manhas, S. Dasgupta, A. K. Saxena, and B. Anand</i>	30
p-Type Nanowire Schottky Barrier MOSFETs: Comparative Study of Ge- and Si-Channel Devices .....	<i>W. Choi, J. Lee, and M. Shin</i>	37
Multiple Turn Ratios of On-Chip Transformer With Four Intertwining Coils .....	<i>H.-M. Hsu and C.-T. Chien</i>	44
An Open-Source Multiscale Framework for the Simulation of Nanoscale Devices .....	<i>S. Bruzzone, G. Iannaccone, N. Marzari, and G. Fiori</i>	48
Statistical SBD Modeling and Characterization and Its Impact on SRAM Cells .....	<i>S. Y. Kim, C.-H. Ho, and K. Roy</i>	54
Evolution of Unified-RAM: 1T-DRAM and BE-SONOS Built on a Highly Scaled Vertical Channel .....	<i>D.-I. Moon, J.-Y. Kim, J.-B. Moon, D.-O. Kim, and Y.-K. Choi</i>	60
nMOS Short Channel Device Characteristics After Soft Oxide Breakdown and Implications for Reliability Projections and Circuits .....	<i>P. E. Nicollian, M. Chen, Y. Yang, C. A. Chancellor, and V. K. Reddy</i>	66
<b>Thin Film Transistors</b>		
Enhancement of Electrical Stability in Oxide Thin-Film Transistors Using Multilayer Channels Grown by Atomic Layer Deposition .....	<i>C. H. Ahn, M. G. Yun, S. Y. Lee, and H. K. Cho</i>	73

(Contents Continued on Back Cover)

---

Negative-Bias Light Stress Instability Mechanisms of the Oxide-Semiconductor Thin-Film Transistors Using In–Ga–O Channel Layers Deposited With Different Oxygen Partial Pressures .....	<i>J. Y. Bak, S. Yang, H.-J. Ryu, S. H. K. Park, C. S. Hwang, and S. M. Yoon</i>	79
Comparison of High- $\kappa$ Gd <sub>2</sub> O <sub>3</sub> and GdTiO <sub>3</sub> $\alpha$ -InGaZnO Thin-Film Transistors .....	<i>T.-M. Pan, C.-H. Chen, J.-H. Liu, F.-H. Chen, J.-L. Her, and K. Koyama</i>	87
Effects of Etching Residue on Positive Shift of Threshold Voltage in Amorphous Indium–Zinc-Oxide Thin-Film Transistors Based on Back-Channel-Etch Structure .....	<i>D. Luo, H. Xu, M. Li, H. Tao, L. Wang, J. Peng, and M. Xu</i>	92
Accurate Capacitance Modeling and Characterization of Organic Thin-Film Transistors .....	<i>T. Zaki, S. Scheinert, I. Hörselmann, R. Rödel, F. Letzkus, H. Richter, U. Zschieschang, H. Klauk, and J. N. Burghartz</i>	98
<b>Optoelectronics, Displays, and Imaging</b>		
Analysis of Thermal Resistance Characteristics of Power LED Module .....	<i>C.-P. Wang, S.-W. Kang, K.-M. Lin, T.-T. Chen, H.-K. Fu, and P.-T. Chou</i>	105
A Statistical Model for Signal-Dependent Charge Sharing in Image Sensors .....	<i>K. D. Stefanov</i>	110
<b>Materials, Processing and Packaging</b>		
High-Density Capacitor Devices Based on Macroporous Silicon and Metal Electroplating .....	<i>D. Vega, J. Reina, R. Pavón, and A. Rodríguez</i>	116
<b>Solid State Device Phenomena</b>		
A Dual-Material Gate Junctionless Transistor With High- $k$ Spacer for Enhanced Analog Performance .....	<i>R. K. Baruah and R. P. Paily</i>	123
<b>Sensors and Actuators</b>		
A Prototype of Piezoresistive Fringe-Electrodes-Element Based on Conductive Polymer Composite .....	<i>L. Wang, J. Li, and Y. Han</i>	129
High-Sensitivity Charge-Transfer-Type pH Sensor With Quasi-Signal Removal Structure .....	<i>H. Nakazawa, R. Otake, M. Futagawa, F. Dasai, M. Ishida, and K. Sawada</i>	136
<b>Vacuum Electron Devices</b>		
Characterization of High Power Microwave Radiation by an Axially Extracted Vircator .....	<i>R. Verma, R. Shukla, S. K. Sharma, P. Banerjee, R. Das, P. Deb, T. Prabakaran, B. Das, E. Mishra, B. Adhikary, K. Sagar, M. Meena, and A. Shyam</i>	141
Numerical Design and Optimization of a Curved Collector for a Q-Band Gyro-Traveling Wave Tube .....	<i>W. Jiang, Y. Luo, and R. Yan</i>	147
Researches on an X-Band Sheet Beam Klystron .....	<i>D. Zhao, X. Lu, Y. Liang, X. Yang, C. Ruan, and Y. Ding</i>	151
Development of an S-Band High Average Power Multibeam Klystron With Bandwidth of 10% .....	<i>D. Gao, Z. Zhang, Y. Ding, B. Shen, H. Ding, Z. Zhang, J. Cao, H. Gu, C. Wang, and F. Wang</i>	159
Analysis of Helical Slow-Wave Structures for Modeling Helix Thickness Using an Improved Helical-Harmonics Approximation—Part I: Theory .....	<i>A. Mahmoudi, M. Kamarei, and M. Shahabadi</i>	166
Analysis of Helical Slow-Wave Structures for Modeling Helix Thickness Using an Improved Helical-Harmonics Approximation—Part II: Simulation Results .....	<i>A. Mahmoudi, M. Kamarei, and M. Shahabadi</i>	172
<b>Emerging Technologies and Devices</b>		
Optimization of n- and p-type TFETs Integrated on the Same InAs/Al <sub>x</sub> Ga <sub>1-x</sub> Sb Technology Platform .....	<i>E. Baravelli, E. Gnani, R. Grassi, A. Gnudi, S. Reggiani, and G. Baccarani</i>	178
A Comparative Study of Tunneling FETs Based on Graphene and GNR Heterostructures .....	<i>N. Ghobadi and M. Pourfath</i>	186
<b>BRIEF PAPERS</b>		
Design of U-Shape Channel Tunnel FETs With SiGe Source Regions .....	<i>W. Wang, P.-F. Wang, C.-M. Zhang, X. Lin, X.-Y. Liu, Q.-Q. Sun, P. Zhou, and D. W. Zhang</i>	193
Analytical Expression for Thermionic Transport Through Isotype Heterojunction Interfaces of Arbitrary Doping Ratio .....	<i>M. Gil, J. Yang, and R. N. Kleiman</i>	198
An Effective Thermal Model for FinFET Structure .....	<i>M.-C. Cheng, J. A. Smith, W. Jia, and R. Coleman</i>	202
A Stress Concentration MOSFET Structure .....	<i>X. Wang, Q. Zeng, B. Liu, C. Gan, Q. Luo, Q. Yu, Y. Liu, K. Tan, and X. Ying</i>	207
<b>COMMENTS AND CORRECTIONS</b>		
Corrections to “Multipactor Susceptibility Charts for Ridge and Multi-Ridge Waveguides” .....	<i>D. González-Iglesias, P. Soto, S. Anza, B. Gimeno, V. E. Boria, C. Vicente, and J. Gil</i>	212
Corrections to “A Warm Welcome to a New T-ED Editor” .....	<i>J. D. Cressler</i>	213

---