



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

JANUARY 2000

VOLUME 47

NUMBER 1

IETDAI

(ISSN 0018-9383)

EDITORIAL

Changes in the Editorial Board	R. P. Jindal	1
--------------------------------------	--------------	---

PAPERS

Compound Semiconductor Devices

Analysis of Hot Carrier Transport in AlGaAs/InGaAs Pseudomorphic HEMT's by Means of Electroluminescence	G. Meneghesso, T. Grave, M. Manfredi, M. Pavesi, C. Canali, and E. Zanoni	2
A Simple Yet Comprehensive Unified Physical Model of the 2-D Electron Gas in Delta-Doped and Uniformly Doped High Electron Mobility Transistors	S. Karmalkar and G. Ramesh	11
Barrier Height Engineering on GaAs THz Schottky Diodes by Means of High-Low Doping, InGaAs- and InGaP-Layers	S. Sassen, B. Witzigmann, C. Wölk, and H. Brugger	24
Depletion- and Enhancement-Mode Modulation-Doped Field-Effect Transistors for Ultrahigh-Speed Applications: An Electrochemical Fabrication Technology	D. Xu, T. Suemitsu, J. Osaka, Y. Umeda, Y. Yamane, Y. Ishii, T. Ishii, and T. Tamamura	33

Materials Processing and Packaging

Compact and Comprehensive Database for Ion-Implanted As Profile...K. Suzuki, R. Sudo, T. Feudel, and W. Fichtner	44
--	----

Optoelectronics, Displays, Imaging

Study and Fabrication of PIN Photodiode by Using ZnSe/PS/Si Structure.....	C. C. Chang and C. H. Lee	50
Performance Analysis of a Color CMOS Photogate Image Sensor.....	A. J. Blanksby and M. J. Loinaz	55
A 1-mm 50 k-Pixel IT CCD Image Sensor for Miniature Camera System	K. Itakura, T. Nobusada, N. Kokusenya, R. Nagayoshi, and M. Ozaki	65
Conduction Mechanisms in Barium Tantalates Films and Modification of Interfacial Barrier Height.....	Y.-H. Lee, Y.-S. Kim, B.-K. Ju, and M.-H. Oh	71
Development of Panel Structure for a High-Resolution 21-in-Diagonal Full-Color Surface-Discharge Plasma Display Panel.....	T. Shinoda, M. Wakitani, T. Nanto, and N. Awaji	77

Silicon Devices

Soft Breakdown Conduction in Ultrathin (3-5 nm) Gate Dielectrics.....	E. Miranda, J. Suñé, R. Rodríguez, M. Nafria, X. Aymerich, L. Fonseca, and F. Campabadal	82
Interconnect Scaling Scenario Using a Chip Level Interconnect Model.....	K. Yamashita and S. Odanaka	90
Steady State Drain Current Technique for Generation and Recombination Lifetime Measurement in the SOI MOSFET	Z.-Y. Cheng and C. H. Ling	97
A Unified Simulation of Schottky and Ohmic Contacts	K. Matsuzawa, K. Uchida, and A. Nishiyama	103

(Continued on back cover)

Dynamic-Stress-Induced Enhanced Degradation of $1/f$ Noise in n-MOSFET's.....	J. P. Xu, P. T. Lai, and Y. C. Cheng	109
Exploring the Novel Characteristics of Hetero-Material Gate Field-Effect Transistors (HMGFET's) with Gate-Material Engineering.....	X. Zhou	113
Electrical Conduction and Dielectric Breakdown in Aluminum Oxide Insulators on Silicon.....		
..... J. Kolodzey, E. A. Chowdhury, T. N. Adam, I. Rau, J. O. Olowolafe, J. S. Suehle, and Y. Chen		121
A New On-Chip Interconnect Crosstalk Model and Experimental Verification for CMOS VLSI Circuit Design.....		
..... Y. Eo, W. R. Eisenstadt, J. Y. Jeong, and O.-K. Kwon		129
Effects of the Inversion-Layer Centroid on the Performance of Double-Gate MOSFET's.....		
..... J. A. López Villanueva, P. Cartujo-Cassinello, F. Gámiz, J. Banqueri, and A. J. Palma		141
Fabrication Method for IC-Oriented Si Single-Electron Transistors.....		
..... Y. Ono, Y. Takahashi, K. Yamazaki, M. Nagase, H. Namatsu, K. Kurihara, and K. Murase		147
A New Model for the Description of Gate Voltage and Temperature Dependence of Gate Induced Drain Leakage (GIDL) in the Low Electric Field Region.....	M. Rosar, B. Leroy, and G. Schweeger	154
MOSFET Channel Length: Extraction and Interpretation.....	Y. Taur	160
A Comprehensive Study of Hot-Carrier Induced Interface and Oxide Trap Distributions in MOSFET's Using a Novel Charge Pumping Technique.....	S. Mahapatra, C. D. Parikh, V. R. Rao, C. R. Viswanathan, and J. Vasi	171
Optimization Study of VLSI Interconnect Parameters.....	M. B. Anand, H. Shibata, and M. Kakumu	178
Low Frequency Conductance Voltage Analysis of $\text{SiGe}_x\text{Si}_{1-x}/\text{Si}$ Heterojunction Bipolar Transistors.....		
..... A. Neugroschel, G. Li, and C.-T. Sah		187
A Novel Low Noise IMPATT Diode.....	D. C. Herbert and R. G. Davis	197
Laser-Processed Thin-Film Transistors Fabricated from Sputtered Amorphous-Silicon Film.....		
..... G. K. Giust and T. W. Sigmon		207
A General Approach to Compact Threshold Voltage Formulation Based on 2-D Numerical Simulation and Experimental Correlation for Deep-Submicron ULSI Technology Development.....	X. Zhou, K. Y. Lim, and D. Lim	214
<i>Solid-State Device Phenomena</i>		
New Formulas of Interconnect Capacitances Based on Results of Conformal Mapping Method.....		
..... F. Stellari and A. L. Lacaita		222
On the Performance Limits for Si MOSFET's: A Theoretical Study.....		
..... F. Assad, Z. Ren, D. Vasileska, S. Datta, and M. Lundstrom		232
Very Large Radiative Transfer over Small Distances from a Black Body for Thermophotovoltaic Applications.....		
..... J. L. Pan, H. K. H. Choy, and C. G. Fonstad, Jr.		241
BRIEFS		
Improved Monte Carlo Algorithm for the Simulation of δ -Doped AlInAs/GaInAs HEMT's.....		
..... J. Mateos, T. González, D. Pardo, V. Hoel, H. Happy, and A. Cappy		250
Computational Investigation of Helical Traveling Wave Tube Transverse RF Field Forces.....		
..... C. L. Kory and J. A. Dayton, Jr.		253
ANNOUNCEMENTS		
Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Group III-Nitride Semiconductor Electronics.....		257
Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Vacuum Electronics.....		258
IEEE Copyright Form.....		259



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

FEBRUARY 2000

VOLUME 47

NUMBER 2

IETDAI

(ISSN 0018-9383)

PAPERS

Compound Semiconductor Devices

- Hot Electron Effects on $\text{Al}_{0.25}\text{Ga}_{0.75}\text{As}/\text{GaAs}$ Power HFET's Under Off-State and On-State Electrical Stress Conditions D. Dieci, R. Menozzi, C. Lanzieri, L. Polenta, and C. Canali 261
- Measurement of High-Field Electron Transport in Silicon Carbide I. A. Khan and J. A. Cooper, Jr. 269
- Analysis of the Short-Term DC-Current Gain Variation During High Current Density-Low Temperature Stress of $\text{AlGaAs}/\text{GaAs}$ Heterojunction Bipolar Transistors N. Bovolon, R. Schultheis, J.-E. Müller, and P. Zwicknagl 274
- Determination of Energetic Distribution of Interface States Between Gate Metal and Semiconductor in Sub-Micron Devices from Current-Voltage Characteristics S. Dhar, V. R. Balakrishnan, V. Kumar, and S. Ghosh 282
- Direct Extraction Technique to Derive the Junction Temperature of HBT's Under High Self-Heating Bias Conditions S. P. Marsh 288
- The Influence of Ge Grading on the Bias and Temperature Characteristics of SiGe HBT's for Precision Analog Circuits S. L. Salmon, J. D. Cressler, R. C. Jaeger, and D. L. Harame 292
- Optimization of Active Channel Thickness of mm-Wavelength GaAs MESFET's by Using a Nonlinear I - V Model M. M. Ahmed 299
- Annealing Behavior of a Proton Irradiated $\text{Al}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$ High Electron Mobility Transistor Grown by MBE S. J. Cai, Y. S. Tang, R. Li, Y. Y. Wei, L. Wong, Y. L. Chen, K. L. Wang, M. Chen, Y. F. Zhao, R. D. Schrimpf, J. C. Keay, and K. F. Galloway 304
- Carrier Transport Related Analysis of High-Power $\text{AlGaIn}/\text{GaIn}$ HEMT Structures P. B. Shah, D. D. Smith, T. E. Griffin, K. A. Jones, and S. T. Sheppard 308

Materials Processing and Packaging

- Small Area Versus Narrow Line Width Effects on the C49 to C54 Transformation of TiSi_2 J. F. DiGregorio and R. N. Wall 313

Optoelectronics, Display, Imaging

- Electrical Modeling of Interface Roughness in Thin Film Electroluminescent Devices K. Neyts, P. De Visschere, B. Soenen, and G. Stuyven 318
- Long-Wavelength 256×256 GaAs/AlGaAs Quantum Well Infrared Photodetector (QWIP) Palm-Size Camera S. D. Gunapala, S. V. Bandara, J. K. Liu, E. M. Luong, N. Stetson, C. A. Shott, J. J. Bock, S. B. Rafol, J. M. Mumolo, and M. J. McKelvey 326
- Study on the Generation Process of the Discharge for Color Plasma Displays Based on the Observation by Using an Ultra-High-Speed Electronic Camera S. Zhang, M. Sawa, H. Uchiike, and K. Yoshida 333

Sensors and Actuators

- A Pulsed Mode Micromachined Flow Sensor with Temperature Drift Compensation N. Okulan, H. T. Henderson, and C. H. Ahn 340

(Continued on back cover)

Silicon Devices

A New Charge Pumping Technique for Profiling the Interface-States and Oxide-Trapped Charges	Y. Chu, D.-W. Lin, and C.-Y. Wu	348
Highly Suppressed Short-Channel Effects in Ultrathin SOI n-MOSFET's	E. Suzuki, K. Ishii, S. Kanemaru, T. Maeda, T. Tsutsumi, T. Sekigawa, K. Nagai, and H. Hiroshima	354
New Aspects and Mechanism of Kink Effect in Static Back-Gate Transconductance Characteristics in Fully-Depleted SOI MOSFET's on High-Dose SIMOX Wafers.....	T. Ushiki, K. Kotani, T. Funaki, K. Kawai, and T. Ohmi	360
Hydrogenated Amorphous Silicon Thin Film Transistor Fabricated on Plasma Treated Silicon Nitride.....	B. C. Lim, Y. J. Choi, J. H. Choi, and J. Jang	367
Transport Model in n^{++} -poly/SiO _x /SiO ₂ /p-sub MOS Capacitors for Low-Voltage Nonvolatile Memory Applications	F. Irrera and L. Marangolo	372
Degradation of Oxides and Oxynitrides Under Hot Hole Stress	J. F. Zhang, H. K. Sii, G. Groeseneken, and R. Degraeve	378
Self-Heating and Kink Effects in a-Si:H Thin Film Transistors	L. Wang, T. A. Fjeldly, B. Iniguez, H. C. Slade, and M. Shur	387
Simulation of Degradation of Dielectric Breakdown Field of Thermal SiO ₂ Films due to Voids in Si Wafers	Y. Satoh, T. Shiota, and H. Furuya	398
High Performance Low Temperature Metal-Induced Unilaterally Crystallized Polycrystalline Silicon Thin Film Transistors for System-on-Panel Applications.....	Z. Meng, M. Wang, and M. Wong	404
Integration of a Particle-Particle-Particle-Mesh Algorithm with the Ensemble Monte Carlo Method for the Simulation of Ultra-Small Semiconductor Devices	C. J. Wordelman and U. Ravaioli	410
Long-Term Stability and Electrical Properties of Compensation Doped Poly-Si IC-Resistors.....	M. Rydberg and U. Smith	417
Comparison of the New VBIC and Conventional Gummel-Poon Bipolar Transistor Models	X. Cao, J. McMacken, K. Stiles, P. Layman, J. J. Liou, A. Ortiz-Conde, and S. Moinian	427

Device Phenomena

Current Induced Degredation in GaAs HBT's	M. G. Adlerstein and J. M. Gering	434
Estimation of the Effects of Remote Charge Scattering on Electron Mobility of n-MOSFET's with Ultrathin Gate Oxides	N. Yang, W. K. Henson, J. R. Hauser, and J. J. Wortman	440
Characterization and Simulation of GaSb Device-Related Properties	G. Stollwerck, O. V. Sulima, and A. W. Bett	448
High-Temperature Characteristics of High-Quality SiC MIS Capacitors with O/N/O Gate Dielectric	X. W. Wang, Z. J. Luo, and T.-P. Ma	458
A p-Channel MOS Synapse Transistor with Self-Convergent Memory Writes.....	C. Diorio	464
Latent Damage Investigation on Lateral Nonuniform Charge Generation and Stress-Induced Leakage Current in Silicon Dioxide Subjected to High-Field Current Impulse Stressing.....	W.-K. Chim and P.-S. Lim	473

Solid-State Power and High Voltage

The 2.45 GHz 36 W CW Si Recessed Gate Type SIT with High Gain and High Voltage Operation	J. Nishizawa, K. Motoya, and A. Itoh	482
--	--------------------------------------	-----

BRIEFS

Lower Limit of Method for the Extraction of Ionization Coefficients from the Electrical Characteristics of Heterojunction Bipolar Transistors	N. Shamir and D. Ritter	488
---	-------------------------	-----

ANNOUNCEMENTS

Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Group III-Nitride Semiconductor Electronics.....		491
Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Vacuum Electronics		492



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

MARCH 2000

VOLUME 47

NUMBER 3

IETDAI

(ISSN 0018-9383)

PAPERS

Compound Semiconductor Devices

- Comparison Between Wurtzite Phase and Zincblende Phase GaN MESFET's Using a Full Band Monte Carlo Simulation M. Farahmand and K. F. Brennan 493
- Mechanism for Recoverable Power Drift in PHEMT's R. E. Leoni, III, J. Bao, J. Bu, X. Du, M. S. Shirokov, and J. C. M. Hwang 498
- Epitaxially-Grown GaN Junction Field Effect Transistors L. Zhang, L. F. Lester, A. G. Baca, R. J. Shul, P. C. Chang, C. G. Willison, U. K. Mishra, S. P. Denbaars, and J. C. Zolper 507
- Very Slow Charge Trapping and Release in Ion Implanted GaAs C.-H. Chiu, F. A. Boroumand, and J. G. Swanson 512
- Suppression of Gate Leakage Current in n-AlGaAs/GaAs Power HEMT's A. Nagayama, S. Yamauchi, and T. Hariu 517

Materials Processing and Packaging

- Models of Boron Redistribution During Thermal Oxidation with General Oxidation Rate K. Suzuki and T. Miyashita 523

Optoelectronics, Displays, Imaging

- Numerical Simulation of Neutron Radiation Effects in Avalanche Photodiodes M. D. Osborne, P. R. Hobson, and S. J. Watts 529
- Low-Frequency Noise in Single Growth Planar Separate Absorption, Grading, Charge, and Multiplication Avalanche Photodiodes S. An and M. J. Deen 537
- Theoretical Analysis of the Detectivity in N-p and P-n GaSb/GaInAsSb Infrared Photodetectors Y. Tian, B. Zhang, T. Zhou, H. Jiang, and Y. Jin 544

Sensors and Actuators

- High-Selectivity Single-Chip Spectrometer in Silicon for Operation at Visible Part of the Spectrum J. H. Correia, M. Bartek, and R. F. Wolffenbuttel 553

Silicon Devices

- Physical Modeling of Spiral Inductors on Silicon C. P. Yue and S. S. Wong 560
- Ultra-Thin Elevated Channel Poly-Si TFT Technology for Fully-Integrated AMLCD System on Glass S. Zhang, C. Zhu, J. K. O. Sin, J. N. Li, and P. K. T. Mok 569
- Interfacial Electronic Traps in Surface Controlled Transistors J. Cai and C.-T. Sah 576

(Contents continued on back cover)

Fabrication and Performance of Selective HSG Storage Cells for 256 Mb and 1 Gb DRAM Applications	
... A. Banerjee, R. L. Wise, D. L. Plimton, M. Bevan, M. F. Pas, D. L. Crenshaw, S. Aoyama, and M. M. Mansoori	584
The Behavior of Narrow-Width SOI MOSFET's with MESA Isolation	
H. Wang, M. Chan, Y. Wang, and P. K. Ko	593
<i>Solid-State Device Phenomena</i>	
Limitations of Conductance to the Measurement of the Interface State Density of MOS Capacitors with Tunneling Gate Dielectrics	
E. M. Vogel, W. K. Henson, and C. A. Richter	601
A Probe Detector for Defectivity Assessment in p-n Junctions.....	
A. Zanchi, F. Zappa, and M. Ghioni	609
Two-Dimensional Analysis of Substrate-Trap Effects on Turn-On Characteristics in GaAs MESFET's	
K. Horio, A. Wakabayashi, and T. Yamada	617
Dead-Space-Based Theory Correctly Predicts Excess Noise Factor for Thin GaAs and AlGaAs Avalanche Photodiodes	
M. A. Saleh, M. M. Hayat, B. E. A. Saleh, and M. C. Teich	625
<i>Vacuum Electron Devices</i>	
Analysis of a Large-Orbit Gyrotron in a Coaxial Waveguide Under Assistant Background Fields.....	
Y. Muralidhar, P. K. Jain, and B. N. Basu	634
BRIEFS	
An Experimental Study of the Effect of Quantization on the Effective Electrical Oxide Thickness in MOS Electron and Hole Accumulation Layers in Heavily Doped Si	
G. Chindalore, W.-K. Shih, S. Jallepalli, S. A. Harelund, A. F. Tasch, and C. M. Maziar	643
A Method for Locating the Position of Oxide Traps Responsible for Random Telegraph Signals in Submicron MOSFET's	
Z. Çelik-Butler, P. Vasina, and N. V. Amarasinghe	646
A Channel Resistance Derivative Method for Effective Channel Length Extraction in LDD MOSFET's	
G. Niu, J. D. Cressler, S. J. Mathew, and S. Subbanna	648
Characterization of Leakage Current in Thin Gate Oxide Subjected to 10 KeV X-Ray Irradiation	
C. H. Ling, C. H. Ang, and D. S. Ang	650
Enhanced Corrugated QWIP Performance Using Dielectric Coverage	
N. C. Das and K. K. Choi	653
Shallow Source/Drain Extension Effects on External Resistance in Sub-0.1 μm MOSFET's	
C.-H. Choi, J.-S. Goo, Z. Yu, and R. W. Dutton	655
ANNOUNCEMENTS	
Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Group III-Nitride Semiconductor Electronics.....	
	659
Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Vacuum Electronics	
	660



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

APRIL 2000

VOLUME 47

NUMBER 4

IETDAI

(ISSN 0018-9383)

EDITORIAL

Changes in the Editorial Board	R. P. Jindal	661
--------------------------------------	--------------	-----

PAPERS

Compound Semiconductor Devices

Base Transit Time in Abrupt GaN/InGaN/GaN HBT's	S.-Y. Chiu, A. F. M. Anwar, and S. Wu	662
A Simple Yet Comprehensive Unified Physical Model of the Donor Layer Electrons in Delta-Doped and Uniformly Doped HEMT's	S. Karmalkar and R. R. K. Rao	667
Relation Between Low-Frequency Noise and Long-Term Reliability of Single AlGaAs/GaAs Power HBT's	S. Mohammadi, D. Pavlidis, and B. Bayraktaroglu	677
High Temperature Performance of NMOS Integrated Inverters and Ring Oscillators in 6H-SiC	U. Schmid, S. T. Sheppard, and W. Wondrak	687
High Voltage GaN Schottky Rectifiers	G. T. Dang, A. P. Zhang, F. Ren, X. A. Cao, S. J. Pearton, H. Cho, J. Han, J.-I. Chyi, C.-M. Lee, C.-C. Chuo, S. N. G. Chu, and R. G. Wilson	692

Sensors and Actuators

Tunnel Magnetoresistance Devices Processed by Oxidation in Air and UV Assisted Oxidation in Oxygen	E. Girgis, J. Schelten, P. Gruenberg, P. Rottlaender, and H. Kohlstedt	697
A High-Speed Capacitive Humidity Sensor with On-Chip Thermal Reset	U. Kang and K. D. Wise	702

Silicon Devices

Double Sided Minority Carrier Collection in Silicon Solar Cells	E. Van Kerschaver, C. Zechner, and J. Dicker	711
Explaining the Dependences of the Hole and Electron Mobilities in Si Inversion Layers	A. Pirovano, A. L. Lacaita, G. Zandler, and R. Oberhuber	718
A Closed-Form Back-Gate-Bias Related Inverse Narrow-Channel Effect Model for Deep-Submicron VLSI CMOS Devices Using Shallow Trench Isolation	S.-C. Lin, J. B. Kuo, K.-T. Huang, and S.-W. Sun	725
A Four-Step Method for De-Embedding Gigahertz On-Wafer CMOS Measurements	T. E. Kolding	734
Dielectric Breakdown Mechanism of Thin-SiO ₂ Studied by the Post-Breakdown Resistance Statistics	H. Satake and A. Toriumi	741
Effect of Physical Stress on the Degredation of Thin SiO ₂ Films Under Electrical Stress	T.-C. Yang and K. C. Saraswat	746
New Channel Engineering for Sub-100 nm MOS Devices Considering Both Carrier Velocity Overshoot and Statistical Performance Fluctuations	T. Mizuno	756
Characterization of Shallow Silicided Junctions for Sub-Quarter Micron ULSI Technology—Extraction of Silicidation Induced Schottky Contact Area	H.-D. Lee	762
A Physical Thermal Noise Model for SOI MOSFET	W. Jin, P. C. H. Chan, and J. Lau	768

(Continued on back cover)

Theoretical Study of Deep-Trap-Assisted Anomalous Currents in Worst-Bit Cells of Dynamic Random-Access Memories	K. Yamaguchi	774
FRAM Cell Design with High Immunity to Fatigue and Imprint for 0.5 μm 3 V 1T1C 1 Mbit FRAM	S. Tanaka, R. Ogiwara, Y. Itoh, T. Miyakawa, Y. Takeuchi, S. Doumae, H. Takenaka, and H. Kamata	781
Device Scaling Effects on Hot-Carrier Induced Interface and Oxide-Trapped Charge Distributions in MOSFET's	S. Mahapatra, C. D. Parikh, V. R. Rao, C. R. Viswanathan, and J. Vasi	789
An Electrical Method for Measuring the Difference in Bandgap across the Neutral Base in SiGe HBT's	Y. T. Tang and J. S. Hamel	797
Polysilicon Gate Enhancement of the Random Dopant Induced Threshold Voltage Fluctuations in Sub-100 nm MOSFET's with Ultrathin Gate Oxide	A. Asenov and S. Saini	805
Design Optimization of High-Performance Low-Temperature 0.18 μm MOSFET's with Low-Impurity-Density Channels at Supply Voltage Below 1 V	J. Xu and M.-C. Cheng	813
Isolation Edge Effect Depending on Gate Length of MOSFET's with Various Isolation Structures	T. Oishi, K. Shiozawa, A. Furukawa, Y. Abe, and Y. Tokuda	822
Trading-Off Programming Speed and Current Absorption in Flash Memories with the Ramped-Gate Programming Technique	D. Esseni, C. Villa, S. Tassan, and B. Riccò	828
Gate Length Scalability of n-MOSFET's Down to 30 nm: Comparison Between LDD and Non-LDD Structures	E. Murakami, T. Yoshimura, Y. Goto, and S. Kimura	835
New Self-Adjusted Dynamic Source Multilevel P-Channel Flash Memory	R.-L. Lin, T. Chang, A. C. Wang, and C. C.-H. Hsu	841
High-Performance Deep Submicron CMOS Technologies with Polycrystalline-SiGe Gates	Y. V. Ponomarev, P. A. Stolk, C. Salm, J. Schmitz, and P. H. Woerlee	848
Transistor Characteristics of 14-nm-Gate-Length EJ-MOSFET's	H. Kawaura, T. Sakamoto, T. Baba, Y. Ochiai, J. Fujita, and J. Sone	856
A New Substrate Current Model for Submicron MOSFET's	J. S. Kolhatkar and A. K. Dutta	861
RF Potential of a 0.18- μm CMOS Logic Device Technology	J. N. Burghartz, M. Hargrove, C. S. Webster, R. A. Groves, M. Keene, K. A. Jenkins, R. Logan, and E. Nowak	864

Solid-State Device Phenomena

Universal Impurity Ionization Parameters in MIS C-V Freeze-Out Characteristics and Direct Extraction of Surface Doping Concentration	P. Bouillon, R. Gwoziecki, T. Skotnicki, J. Alieu, and P. Gentil	871
Surface Geometric Effects on Tunneling Rates	M. Encinosa	878
Temperature Dependent Minority Electron Mobilities in Strained $\text{Si}_{1-x}\text{Ge}_x$ ($0.2 \leq x \leq 0.4$) Layers	J.-S. Rieh, P. K. Bhattacharya, and E. T. Croke	883

BRIEFS

Limitations of the Modified Shift-and-Ratio Technique for Extraction of the Bias Dependence of L_{eff} and R_{sd} of LDD MOSFET's	K. Ahmed, I. De, C. Osburn, J. Wortman, and J. Hauser	891
A Three Terminal Varactor for RF IC's in Standard CMOS Technology	F. Svelto, S. Manzini, and R. Castello	893
Novel AlInAsSb/InGaAs Heterostructure for Double-Barrier Resonant Tunneling Diode	Y.-K. Su, J.-R. Chang, Y.-T. Lu, C.-L. Lin, and K.-M. Wu	895
Theory of the Single Contact Electron Beam Induced Current Effect	V. K. S. Ong, K. T. Lau, and J. G. Ma	897

CORRESPONDENCE

Comments on "A Numerical Analysis of the Storage Times of Dynamic Random-Access Memory Cells Incorporating Ultrathin Dielectrics"	Y. S. Yu, S. W. Hwang, D.-H. Song, and K. H. Lee	900
---	--	-----

ANNOUNCEMENTS

Call for Papers—IEEE TRANSACTIONS ON ELECTRON DEVICES Special Issue on Vacuum Electronics	902
Call for Papers—International Semiconductor Conference, October 2000	903
12th International Conference on Indium Phosphide and Related Materials, May 2000	904



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

MAY 2000

VOLUME 47

NUMBER 5

IETDAI

(ISSN 0018-9383)

PAPERS

Compound Semiconductor Devices

- An Analytic Model for Estimating the Length of the Velocity Saturated Region in GaAs MESFET's C. Leifso and J. W. Haslett 905
- Avalanche Noise Characteristics of Thin GaAs Structures with Distributed Carrier Generation K. F. Li, D. S. Ong, J. P. R. David, R. C. Tozer, G. J. Rees, S. A. Plimmer, K. Y. Chang, and J. S. Roberts 910
- Numerical Modeling of Energy Balance Equations in Quantum Well $\text{Al}_x\text{Ga}_{1-x}\text{As}/\text{GaAs}$ p-i-n Photodiodes H. Z. Fardi, D. W. Winston, R. E. Hayes, and M. C. Hanna 915
- A Physical Model for the Kink Effect in InAlAs/InGaAs HEMT's M. H. Somerville, A. Ernst, and J. A. del Alamo 922

Optoelectronics, Displays, Imaging

- Combined Optical/Electric Simulation of CCD Cell Structures by Means of the Finite-Difference Time-Domain Method T. O. Körner and R. Gull 931
- An a-SiGe:H Phototransistor Integrated with a Pd Film on Glass Substrate for Hydrogen Monitoring W. T. Hsieh, Y. K. Fang, W. J. Lee, K.-H. Wu, J.-J. Ho, K.-H. Chen, and S. Y. Huang 939
- Design and Characterization of Superlattice Infrared Photodetector Operating at Low Bias Voltage M. C. Hsu, Y. F. Hsu, S. Y. Lin, and C. H. Kuan 944
- Analysis and Reduction of Signal Readout Circuitry Temporal Noise in CMOS Image Sensors for Low-Light Levels Y. Değerli, F. Lavernhe, P. Magnan, and J. A. Farré 949
- 640 × 486 Long-Wavelength Two-Color GaAs/AlGaAs Quantum Well Infrared Photodetector (QWIP) Focal Plane Array Camera S. D. Gunapala, S. V. Bandara, A. Singh, J. K. Liu, S. B. Rafol, E. M. Luong, J. M. Mumolo, N. Q. Tran, D. Z.-Y. Ting, J. D. Vincent, C. A. Shott, J. Long, and P. D. LeVan 963

Sensors and Actuators

- Magnetic Field Measurements with a Novel Surface Micromachined Magnetic-Field Sensor H. Emmerich and M. Schöffthaler 972
- Impact of CdTe/CdZnTe Substrate Resistivity on Performance Degradation of Long-Wavelength n^+ -on-p HgCdTe Infrared Photodiodes V. Dhar, A. K. Garg, and R. K. Bhan 978

(Contents Continued on Back Cover)

Silicon Devices

Comprehensive Study of Rapid, Low-Cost Silicon Surface Passivation Technologies	987
..... A. Rohatgi, P. Doshi, J. Moschner, T. Lauinger, A. Aberle, and D. S. Ruby	
The Effect of Co Incorporation on Electrical Characteristics of n^+/p Shallow Junction Formed by Dopant Implantation into CoSi_2 and Anneal	994
..... J.-S. Park, D. K. Sohn, J.-U. Bae, C. H. Han, and J. W. Park	
Impact of Electron and Hole Inversion-Layer Capacitance on Low Voltage Operation of Scaled n - and p -MOSFET's	999
..... S. Takagi, M. Takayanagi, and A. Toriumi	
An Analytical Model for Breakdown Voltage of Surface Implanted SOI RESURF LDMOS	1006
..... S.-K. Chung	
A New Quantum Effect Model for Practical Device Simulation	1010
..... N. Shigyo and H. Tanimoto	
Hot-Carrier Degradation Behavior of Thin-Film SOI nMOSFET with Isolation Scheme and Buried Oxide Thickness	1013
..... J.-W. Lee, H.-K. Kim, W.-H. Lee, M.-R. Oh, and Y.-H. Koh	
A Review of the Pseudo-MOS Transistor in SOI Wafers: Operation, Parameter Extraction, and Applications	1018
..... S. Cristoloveanu, D. Munteanu, and M. S. T. Liu	
High Performance Damascene Metal Gate MOSFET's for 0.1 μm Regime	1028
..... A. Yagishita, T. Saito, K. Nakajima, S. Inumiya, Y. Akasaka, Y. Ozawa, K. Hieda, Y. Tsunashima, K. Suguro, T. Arikado, and K. Okumura	
A Strategy for Modeling of Variations due to Grain Size in Polycrystalline Thin-Film Transistors	1035
..... A. W. Wang and K. C. Saraswat	
A Better Insight into the Performance of Silicon BJT's Featuring Highly Nonuniform Collector Doping Profiles	1044
..... P. Palestri, C. Fiegna, L. Selmi, M. S. Peter, G. A. M. Hurkx, J. W. Slotboom, and E. Sangiorgi	
Coupled Drift-Diffusion/Quantum Transmitting Boundary Method Simulations of Thin Oxide Devices with Specific Application to a Silicon Based Tunnel Switch Diode	1052
..... E. S. Daniel, X. Cartoixa, W. R. Frensley, D. Z.-Y. Ting, and T. C. McGill	
Characterization of the MIC/MILC Interface and Its Effects on the Performance of MILC Thin-Film Transistors	1061
..... M. Wong, Z. Jin, G. A. Bhat, P. Wong, and H. S. Kwok	
RF Performance Degradation in nMOS Transistors due to Hot Carrier Effects	1068
..... J.-T. Park, B.-J. Lee, D.-W. Kim, C.-G. Yu, and H.-K. Yu	
On-Chip Characterization of Interconnect Parameters and Time Delay in 0.18 μm CMOS Technology for ULSI Circuit Applications	1073
..... H.-D. Lee, D. M. Kim, and M.-J. Jang	

Solid-State Device Phenomena

The Merits and Limitations of Local Impact Ionization Theory	1080
..... S. A. Plimmer, J. P. R. David, and D. S. Ong	
Avalanche Multiplication in $\text{Al}_x\text{Ga}_{1-x}\text{As}$ ($x = 0$ to 0.60)	1089
..... S. A. Plimmer, J. P. R. David, R. Grey, and G. J. Rees	
Theoretical and Experimental Characterization of Self-Heating in Silicon Integrated Devices Operating at Low Temperatures	1098
..... F. J. De la Hidalga, M. J. Deen, and E. A. Gutiérrez	
Temperature Dependence and Electrical Properties of Dominant Low-Frequency Noise Source in SiGe HBT	1107
..... S. Bruce, L. K. J. Vandamme, and A. Rydberg	

BRIEFS

Alternating-Current Thin-Film Electroluminescent Device Modeling via SPICE Fowler-Nordheim Diode	1113
..... J. P. Bender and J. F. Wager	
Fabrication of Strained and Double Heterojunction $\text{In}_x\text{Ga}_{1-x}\text{P}/\text{In}_{0.2}\text{Ga}_{0.8}\text{As}$ High Electron Mobility Transistors Grown by Solid-Source Molecular Beam Epitaxy	1115
..... S. F. Yoon, B. P. Gay, H. Q. Zheng, H. T. Kam, and J. Degenhardt	
On the Behavior of p - n Junction Solar Cells Made in Fine-Grained Silicon Layers	1118
..... G. Beaucarne, J. Poortmans, M. Caymax, J. Nijs, and R. Mertens	
On the Origin of the Dispersion of Erased Threshold Voltages in Flash EEPROM Memory Cells	1120
..... D. Esseni and B. Riccò	

ANNOUNCEMENTS

Call for Papers—2000 IEEE International SOI Conference	1124
--	------



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

JUNE 2000

VOLUME 47

NUMBER 6

IETDAI

(ISSN 0018-9383)

PAPERS

Compound Semiconductor Devices

- Avalanche Multiplication in InP/InGaAs Double Heterojunction Bipolar Transistors with Composite Collector *H. Wang and G.-I. Ng* 1125
- A Planar Gate Double Beryllium Implanted GaAs Power MESFET for Low Voltage Digital Wireless Communication Application *E. Y. Chang, C.-S. Fuh, C.-C. Meng, K. B. Wang, and S. H. Chen* 1134
- Stepping Toward Standard Methods of Small-Signal Parameter Extraction for HBT's *M. Sotoodeh, L. Sozzi, A. Vinay, A. H. Khalid, Z. Hu, A. A. Rezazadeh, and R. Menozzi* 1139

Materials Processing and Packaging

- Integrated GaAs Schottky Mixers by Spin-on-Dielectric Wafer Bonding *S. M. Marazita, W. L. Bishop, J. L. Hesler, K. Hui, W. E. Bowen, and T. W. Crowe* 1152

Optoelectronics, Displays, Imaging

- Optimization Procedure for the Design of Ultrafast, Highly Efficient and Selective Resonant Cavity Enhanced Schottky Photodiodes *J. A. Jervase and H. Bourdouce* 1158

Silicon Devices

- Novel Source-Controlled Self-Verified Programming for Multilevel EEPROM's *F. R.-L. Lin, S.-Y. Lin, M.-L. Lee, C.-H. Boe, C.-P. Yeh, P.-H. Wu, J. Ni, Y.-C. King, and C. C.-H. Hsu* 1166
- CMOS Shallow-Trench-Isolation to 50-nm Channel Widths *P. VanDerVoorn, D. Gan, and J. P. Krusius* 1175
- Reliability of Ultrathin Silicon Dioxide Under Combined Substrate Hot-Electron and Constant Voltage Tunneling Stress *E. M. Vogel, J. S. Suehle, M. D. Edelstein, B. Wang, Y. Chen, and J. B. Bernstein* 1183
- Physical Noise Modeling of SOI MOSFET's with Analysis of the Lorentzian Component in the Low-Frequency Noise Spectrum *G. O. Workman and J. G. Fossum* 1192
- Short Channel MOSFET Model Using a Universal Channel Depletion Width Parameter *K. Suzuki* 1202
- Novel Self-Limiting High-Speed Program Scheme of P-Channel DINOR Flash Memory with N-Channel Select Transistors *T. Ohnakado and S. Satoh* 1209
- On the Reverse Short Channel Effect in Deep Submicron Heterojunction MOSFET's and Its Impact on the Current-Voltage Behavior *N. Collaert, P. Verheyen, and K. De Meyer* 1214
- Approach to Electrochemical C-V Profiling in Semiconductor with Sub-Debye-Length Resolution *V. I. Shashkin, I. R. Karetnikova, A. Murel, I. Nefedov, and I. A. Shereshevskii* 1221
- Analysis of the Relationship Between Defect Site Generation and Dielectric Breakdown Utilizing A-Mode Stress Induced Leakage Current *K. Okada* 1225
- On the Design Robustness of Threshold Logic Gates Using Multi-Input Floating Gate MOS Transistors *A. Luck, S. Jung, R. Brederlow, R. Thewes, K. Goser, and W. Weber* 1231
- Simulation of Schottky Barrier MOSFET's with a Coupled Quantum Injection/Monte Carlo Technique *B. Winstead and U. Ravaioli* 1241

(Contents Continued on Back Cover)

Solid-State Device Phenomena

Monte Carlo Study of Sub-0.1 μm $\text{Si}_{0.97}\text{C}_{0.03}/\text{Si}$ MODFET: Electron Transport and Device Performance	<i>P. Dollfus, S. Galdin, P. Hesto, and J. E. Velázquez</i>	1247
Electrical/Thermal Properties of Nonplanar Polyoxides and the Consequent Effects for EEPROM Cell Operation	<i>H. J. Mattausch, H. Baumgärtner, R. Allinger, M. Kerber, and H. Braun</i>	1251
Modeling of SILC Based on Electron and Hole Tunneling—Part I: Transient Effects	<i>D. Ielmini, A. S. Spinelli, M. A. Rigamonti, and A. L. Lacaita</i>	1258
Modeling of SILC Based on Electron and Hole Tunneling—Part II: Steady-State	<i>D. Ielmini, A. S. Spinelli, M. A. Rigamonti, and A. L. Lacaita</i>	1266
A New Approach for Computing the Bandwidth Statistics of Avalanche Photodiodes	<i>M. M. Hayat and G. Dong</i>	1273

Solid-State Power and High Voltage

A Novel High-Voltage Sustaining Structure with Buried Oppositely Doped Regions	<i>X. B. Chen, X. Wang, and J. K. O. Sin</i>	1280
--	--	------

Vacuum Electron Devices

Theory of Long-Term Gain Growth in Traveling Wave Tubes	<i>D. M. Goebel</i>	1286
Monte Carlo Simulations for Tilted-Channel Electron Multipliers	<i>Y. S. Choi and J. M. Kim</i>	1293

BRIEFS

Fast Tunneling Programming of Nonvolatile Memories	<i>R. Versari, A. Pieracci, D. Morigi, and B. Riccò</i>	1297
A Physically-Based Semi-Empirical Series Resistance Model for Deep-Submicron MOSFET <i>I-V</i> Modeling	<i>K. Y. Lim and X. Zhou</i>	1300
Simplified Method to Investigate Quantum Mechanical Effects in MOS Structure Inversion Layer	<i>Y. Ma, L. Liu, Z. Yu, and Z. Li</i>	1303

ANNOUNCEMENTS

Call for Papers—IEEE International Electron Devices Meeting, December 2000	1306
Call for Papers—IEEE International Integrated Reliability Workshop, October 2000	1307
Call for Papers—13th International Symposium on Power Semiconductor Devices and IC's, June 2001	1308

UPCOMING SPECIAL ISSUES OF THE IEEE TRANSACTIONS ON ELECTRON DEVICES

Vacuum Electronics

Contacts:

Dr. W. Devereux Palmer
MCNC Electronic Technologies
P.O. Box 12889, 3021 Cornwallis Road
Research Triangle Park, NC 27709-2889
Ph.: (919) 248-1837; Fax: (919) 248-1455
dpalmer@mcnc.org

Group III-Nitride Semiconductor Electronics

Contacts:

Dr. John C. Zolper
Office of Naval Research, Code 312
800 North Quincy Street
Arlington, VA 22217
Ph.: (703) 696-2611
Fax: (703) 696-2611
zolperj@onr.navy.mil

January 2001

Dr. Dan. M. Goebel
Hughes Electron Dynamics
3100 W. Lomita Blvd., MS 232/4030
Torrance, CA 90509
Ph.: (310) 517-5127; Fax: (310) 517-6873
dan.goebel@hughesed.com

March 2001

Prof. Umesh Mishra
Dept. Electrical Engineering
University of California, Santa Barbara
Santa Barbara, CA 93106
Ph.: (805) 893-2953
Fax: (805) 893-8714
mishra@ece.ucsb.edu

Also upcoming:

Bipolar Transistor Technology: Past and Future Directions: September 2000
Computational Electronics: New Challenges and Directions: October 2000



IEEE TRANSACTIONS ON ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

JULY 2000

VOLUME 47

NUMBER 7

IETDAI

(ISSN 0018-9383)

SPECIAL SECTION ON 1999 EUROPEAN SOLID-STATE DEVICE RESEARCH CONFERENCE

Editorial—Expanded Papers from the 1999 European Solid-State Device Research Conference..... R. P. Jindal 1309

PAPERS

Compound Semiconductor Devices

Theory and Small Signal Analysis for a New Bipolar Injection Transit Time Device (BIPOLITT) L. Chen and D.-S. Pan 1310

Modeling of Current Gain's Temperature Dependence in Heterostructure-Emitter Bipolar Transistors
..... E. S. Yang, C. C. Hsu, H. B. Lo, and Y.-F. Yang 1315

Materials Processing and Packaging

GaN N- and P-Type Schottky Diodes: Effect of Dry Etch Damage
..... X. A. Cao, S. J. Pearton, G. T. Dang, A. P. Zhang, F. Ren, and J. M. Van Hove 1320

Optoelectronics, Displays, Imaging

Comparison of Hole and Electron Intersubband Absorption Strengths for Quantum Well Infrared Photodetectors
..... J. L. Pan and C. G. Fonstad, Jr. 1325

The Red Shift of ZnS_{1-x}Se_x Metal-Semiconductor-Metal Light Emitting Diodes with High Injection Currents
..... Y. K. Su, W. R. Chen, S. J. Chang, F. S. Juang, W. H. Lan, A. C. H. Lin, and H. Chang 1330

Dynamic Performance of UV Photodetectors Based on Polycrystalline Diamond S. Salvatori, M. C. Rossi, and F. Galluzzi 1334

Reliability

Stress Induced Leakage Current Analysis via Quantum Yield Experiments
..... A. Ghetti, M. Alam, J. Bude, D. Monroe, E. Sangiorgi, and H. Vaidya 1341

Comparative Physical and Electrical Metrology of Ultrathin Oxides in the 6 to 1.5 nm Regime
..... K. Ahmed, E. Ibok, G. Bains, D. Chi, B. Ogle, J. J. Wortman, and J. R. Hauser 1349

Silicon Devices

Plasma-Induced Charging Damage in Ultrathin (3-nm) Gate Oxides
..... C.-C. Chen, H.-C. Lin, C.-Y. Chang, M.-S. Liang, C.-H. Chien, S.-K. Hsien, T.-Y. Huang, and T.-S. Chao 1355

The Performance and Reliability of PMOSFET's with Ultrathin Silicon Nitride/Oxide Stacked Gate Dielectrics with Nitrided Si-SiO₂ Interfaces Prepared by Remote Plasma Enhanced CVD and Post-Deposition Rapid Thermal Annealing
..... Y. Wu, G. Lucovsky, and Y.-M. Lee 1361

Highly Robust Ultrathin Silicon Nitride Films Grown at Low-Temperature by Microwave-Excitation High-Density Plasma for Giga Scale Integration K. Sekine, Y. Saito, M. Hirayama, and T. Ohmi 1370

Performance of the Floating Gate/Body Tied NMOSFET Photodetector on SOI Substrate W. Zhang, M. Chan, and P. K. Ko 1375

Inverse Modeling of Two-Dimensional MOSFET Dopant Profile via Capacitance of the Source/Drain Gated Diode
..... C. Y. T. Chiang, Y. T. Yeow, and R. Ghodsi 1385

Analysis of Leakage Currents and Impact on Off-State Power Consumption for CMOS Technology in the 100-nm Regime
..... W. K. Henson, N. Yang, S. Kubicek, E. M. Vogel, J. J. Wortman, K. De Meyer, and A. Naem 1393

(Contents Continued on Back Cover)

Use of Transient Enhanced Diffusion to Tailor Boron Out-Diffusion	
..... H.-H. Vuong, Y.-H. Xie, M. R. Frei, G. Hobler, L. Pelaz, and C. S. Rafferty	1401
Fabrication and Analysis of Deep Submicron Strained-Si N-MOSFET's	
..... K. Rim, J. L. Hoyt, and J. F. Gibbons	1406
<i>Solid-State Device Phenomena</i>	
Time Dependent Breakdown of Ultrathin Gate Oxide	
..... A. Yassine, H. E. Nariman, M. McBride, M. Uzer, and K. R. Olasupo	1416
Studies of High DC Current Induced Degradation in III-V Nitride Based Heterojunctions	
..... W. Y. Ho, C. Surya, K. Y. Tong, L. W. Lu, and W. K. Ge	1421
1/f Noise Model of Fully Overlapped Lightly Doped Drain MOSFET	
..... A. Kumar, E. Kalra, S. Haldar, and R. S. Gupta	1426
Accurate Contact Resistivity Extraction on Kelvin Structures with Upper and Lower Resistive Layers	
..... J. Santander, M. Lozano, A. Collado, M. Ullán, and E. Cabruja	1431
Hot Electron and Hot Hole Degradation of UHV/CVD SiGe HBT's	
..... U. Gogineni, J. D. Cressler, G. Niu, and D. L. Harame	1440
Equations of State for Silicon Inversion Layers	
..... M. G. Ancona	1449
<i>Vacuum Electron Devices</i>	
Sensitivity Analysis of TWT's Small Signal Gain Based on the Effect of Rod Shape and Dimensions	
..... S. D'Agostino, F. Emma, and C. Paoloni	1457
BRIEFS	
Effect of Vacuum Ultraviolet Radiation on the Gap Fill Properties of Teflon Amorphous Fluoropolymer Film Deposited by Direct Liquid Injection	
..... V. Parihar, R. Singh, R. Sharangpani, S. D. Russell, and C. A. Young	1463
Novel Fabrication of Ti-Pt-Au/GaAs Schottky Diodes	
..... C. A. St. Jean, W. L. Bishop, Jr., B. K. Sarpong, S. M. Marazita, and T. W. Crowe	1465
Light Dependence of SOI MOSFET with Nonuniform Doping Profile	
..... G. K. Abraham, B. B. Pal, and R. U. Khan	1469
SPECIAL SECTION PAPERS	
High-Sensitivity Photodetectors with On-Chip Pinhole for Laser Scanning Microscopy	
..... F. Zappa, M. Ghioni, R. Zappa, and U. Drodofsky	1472
Low Temperature Analysis of 0.25 μm T-Gate Strained Si/Si _{0.55} Ge _{0.45} N-MODFET's	
..... F. Aniel, N. Zerounian, R. Adde, M. Zeuner, T. Hackbarth, and U. König	1477
Elevated Source/Drain by Sacrificial Selective Epitaxy for High Performance Deep Submicron CMOS: Process Window versus Complexity	
..... E. Augendre, R. Rooyackers, M. Caymax, E. P. Vandamme, A. De Keersgieter, C. Perelló, M. Van Dievel, S. Pochet, and G. Badenes	1484
40% Efficient Thin-Film Surface-Textured Light-Emitting Diodes by Optimization of Natural Lithography	
..... R. Windisch, B. Dutta, M. Kujik, A. Knobloch, S. Meinlschmidt, S. Schoberth, P. Kiesel, G. Borghs, G. H. Döhler, and P. Heremans	1492
A Cost Effective Embedded DRAM Integration for High Density Memory and High Performance Logic Using 0.15 μm Technology Node and Beyond	
..... D. Ha, D. Shin, G.-H. Koh, J. Lee, S. Lee, Y.-S. Ahn, H. Jeong, T. Chung, and K. Kim	1499
A 0.13 μm Poly-SiGe Gate CMOS Technology for Low-Voltage Mixed-Signal Applications	
..... Y. V. Ponomarev, P. A. Stolk, C. J. J. Dachs, and A. H. Montree	1507
The Influence of Elevated Temperature on Degradation and Lifetime Prediction of Thin Silicon-Dioxide Films	
..... B. Kaczer, R. Degraeve, N. Pangon, and G. Groeseneken	1514
Fracture Strength and Fatigue of Polysilicon Determined by a Novel Thermal Actuator	
..... H. Kapels, R. Aigner, and J. Binder	1522
Compact Modeling of High-Frequency Distortion in Silicon Integrated Bipolar Transistors	
..... M. Schröter, D. R. Pehlke, and T.-Y. Lee	1529
A Novel Lateral Bipolar Transistor with 67 GHz f_{max} on Thin-Film SOI for RF Analog Applications	
..... H. Nii, T. Yamada, K. Inoh, T. Shino, S. Kawanaka, M. Yoshimi, and Y. Katsumata	1536
ANNOUNCEMENTS	
2000 IEEE GaAs IC Symposium	1542
Call for Papers—IEEE International Conference on Microelectronic Test Structures, March 2001	1543
Preliminary Call for Papers—2000 GaAs REL Workshop, November 2000	1544



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

AUGUST 2000

VOLUME 47

NUMBER 8

IETDAI

(ISSN 0018-9383)

PAPERS

Compound Semiconductor Devices

- Characteristics of Polysilicon Oxides Combining N_2O Nitridation and CMP Processes..... *T. F. Lei, J. H. Chen, M. F. Wang, and T. S. Chao* 1545
- Multiple-Route and Multiple-State Current-Voltage Characteristics of an InP/AlInGaAs Switch for Multiple-Valued Logic Applications *W.-C. Liu, W.-C. Wang, H.-J. Pan, J.-Y. Chen, S.-Y. Cheng, K.-W. Lin, K.-H. Yu, K.-B. Thei, and C.-C. Cheng* 1553
- Physical Mechanisms Limiting the Manufacturing Uniformity of Millimeter-Wave Power InP HEMT's..... *S. Krupenin, R. R. Blanchard, M. H. Somerville, J. A. del Alamo, K. G. Duh, and P. C. Chao* 1560

Optoelectronics, Displays, Imaging

- Technologies to Improve Photo-Sensitivity and Reduce VOD Shutter Voltage for CCD Image Sensors..... *I. Murakami, T. Nakano, K. Hatano, Y. Nakashiba, M. Furumiya, T. Nagata, T. Kawasaki, H. Utsumi, S. Uchiya, K. Arai, N. Mutoh, A. Kohno, N. Teranishi, and Y. Hokari* 1566

Silicon Devices

- Comparison of Deep-Submicrometer Conventional and Retrograde n-MOSFET's *S. T. Ma and J. R. Brews* 1573
- Super Thin-Film Transistor with SOI CMOS Performance Formed by a Novel Grain Enhancement Method *H. Wang, M. Chan, S. Jagar, V. M. C. Poon, M. Qin, Y. Wang, and P. K. Ko* 1580
- A Dynamic-Threshold SOI Device with a J-FET Embedded Source Structure and a Merged Body-Bias-Control Transistor—Part I: A J-FET Embedded Source Structure Properties *M. Horiuchi* 1587
- A Dynamic-Threshold SOI Device with a J-FET Embedded Source Structure and a Merged Body-Bias-Control Transistor—Part II: Circuit Simulation *M. Horiuchi* 1593
- Thin-Film Transistors in Polycrystalline Silicon by Blanket and Local Source/Drain Hydrogen Plasma-Seeded Crystallization *K. Pangal, J. C. Sturm, S. Wagner, and N. Yao* 1599
- A Thorough Study of Quasi-Breakdown Phenomenon of Thin Gate Oxide in Dual-Gate CMOSFET's *H. Guan, M.-F. Li, Y. He, B. J. Cho, and Z. Dong* 1608
- A Dual Body SOI Structure for Mixed Analog-Digital Mode Circuits *H. Lee, J.-H. Lee, Y. J. Park, and H. S. Min* 1617

Solid-State Device Phenomena

- Analytical Theory of Semiconductor P-N Junctions and the Transition Between Depletion and Quasineutral Region *A. Haggag and K. Hess* 1624
- Ferroelectric Neuron Integrated Circuits Using $SrBi_2Ta_2O_9$ -Gate FET's and CMOS Schmitt-Trigger Oscillators *S.-M. Yoon, E. Tokumitsu, and H. Ishiwara* 1630

(Contents Continued on Back Cover)

(Contents Continued from Front Cover)

A Comparative Study of Gate Direct Tunneling and Drain Leakage Currents in N-MOSFET's with Sub-2-nm Gate Oxides	N. Yang, W. K. Henson, and J. J. Wortman	1636
High Performance 0.1 μm Gate-Length P-Type SiGe MODFET's and MOS-MODFET's	W. Lu, A. Kuliev, S. J. Koester, X.-W. Wang, J. O. Chu, T.-P. Ma, and I. Adesida	1645
Frequency Domain Lifetime Characterization	D. K. Schroder, J.-E. Park, S.-E. Tan, B. D. Choi, S. Kishino, and H. Yoshida	1653
<i>Solid-State Power and High Voltage</i>		
A New Trench Base-Shielded Bipolar Transistor	Q. Chen, B. You, A. Q. Huang, and J. K. O. Sin	1662
<i>Vacuum Electron Devices</i>		
Increasing Emission Current from MIM Cathodes by Using an Ir-Pt-Au Multilayer Top Electrode	T. Kusunoki and M. Suzuki	1667
Analysis for Charged Spacers in FED	Y. S. Choi, S. N. Cha, S. Y. Jung, J. W. Kim, J. E. Jung, and J. M. Kim	1673
BRIEFS		
Study of the Extended P ⁺ Dual Source Structure for Eliminating Bipolar Induced Breakdown in Submicron SOI MOSFET's	V. Verma and M. J. Kumar	1678
A Transient SPICE Model for Digitally Modulated RF Characteristics of Ion-Implanted GaAs MESFET's	M. S. Shirokov, R. E. Leoni, III, J. Bao, and J. C. M. Hwang	1680
Forward Gated-Diode Measurement of Filled Traps in High-Field Stressed Thin Oxides	M.-J. Chen, T.-K. Kang, H.-T. Huang, C.-H. Liu, Y. J. Chang, and K.-Y. Fu	1682
Information for Authors		1684

UPCOMING SPECIAL ISSUES OF THE IEEE TRANSACTIONS ON ELECTRON DEVICES

Vacuum Electronics

Contacts:

Dr. W. Devereux Palmer
MCNC Electronic Technologies
P.O. Box 12889, 3021 Cornwallis Road
Research Triangle Park, NC 27709-2889
Ph.: (919) 248-1837; Fax: (919) 248-1455
dpalmer@mcnc.org

January 2001

Dr. Dan M. Goebel
Hughes Electron Dynamics
3100 W. Lomita Blvd., MS 232/4030
Torrance, CA 90509
Ph.: (310) 517-5127; Fax: (310) 517-6873
dan.goebel@hughesed.com

Group III-Nitride Semiconductor Electronics

Contacts:

Dr. John C. Zolper
Office of Naval Research, Code 312
800 North Quincy Street
Arlington, VA 22217
Ph.: (703) 696-2611
Fax: (703) 696-2611
zolperj@onr.navy.mil

March 2001

Prof. Umesh Mishra
Dept. Electrical Engineering
University of California, Santa Barbara
Santa Barbara, CA 93106
Ph.: (805) 893-2953
Fax: (805) 893-8714
mishra@ece.ucsb.edu

Also upcoming:

Computational Electronics: New Challenges and Directions: October 2000



IEEE TRANSACTIONS ON

ELECTRON DEVICES



A PUBLICATION OF THE IEEE ELECTRON DEVICES SOCIETY

SEPTEMBER 2000

VOLUME 47

NUMBER 9

IETDAI

(ISSN 0018-9383)

PAPERS

Optoelectronics, Displays, Imaging

- Dead Space Effect on the Wavelength Dependence of Gain and Noise in Avalanche Photodiodes A. R. Pauchard, P.-A. Besse, and R. S. Popovic 1685
- EL Characteristics of a TFEL/TFT Stacked Structure Display Device Driven by a HV-Si-TFT Circuit T. Unagami 1694
- Dynamic Range Improvement by Narrow-Channel Effect Suppression and Smear Reduction Technologies in Small Pixel IT-CCD Image Sensors A. Tanabe, Y. Kudoh, Y. Kawakami, K. Masubuchi, S. Kawai, T. Yamada, M. Morimoto, K. Arai, K. Hatano, M. Furumiya, Y. Nakashiba, N. Mutoh, K. Orihara, and N. Teranishi 1700

Silicon Devices

- Current-Voltage Characteristics of High Current Density Silicon Esaki Diodes Grown by Molecular Beam Epitaxy and the Influence of Thermal Annealing M. W. Dashiell, R. T. Troeger, S. L. Rommel, T. N. Adam, P. R. Berger, C. Guedj, J. Kolodzey, A. C. Seabaugh, and R. Lake 1707
- Design, Fabrication, and Analysis of SiGeC Heterojunction PMOSFETs E. J. Quinones, S. John, S. K. Ray, and S. K. Banerjee 1715
- Two Formulations of Semiconductor Transport Equations Based on Spherical Harmonic Expansion of the Boltzmann Transport Equation T.-w. Tang and H. Gan 1726

Solid-State Device Phenomena

- Effects of NH_3 -Plasma Nitridation on the Electrical Characterizations of Low- k Hydrogen Silsesquioxane with Copper Interconnects P.-T. Liu, T.-C. Chang, Y.-L. Yang, Y.-F. Cheng, and S.-M. Sze 1733
- Tradeoff Between Interconnect Capacitance and RC Delay Variations Induced by Process Fluctuations N. Shigyo 1740
- Noise Associated with Interdigitated Gate Structures in RF Submicron MOSFETs E. F. Tsakas and A. N. Birbas 1745
- AC Characteristics of $\text{Cr/p}^+\text{-Si:H/V}$ Analog Switching Devices J. Hu, J. Hajto, A. J. Snell, and M. J. Rose 1751

Solid-State Power

- Analysis of Fast Electro-Thermal Dynamics in Power BJT D. D'Amore and P. Maffezzoni 1758

(Contents Continued on Back Cover)