Proceedings of the
23rd European Solid-State Circuits Conference

Southampton, UK
16-18 September 1997

Edited by H. Grünbacher
## INVITED PAPERS

**Taking DRAM from 4MBytes/sec to 4 GBytes/sec**
R.C. Foss
MOSAID Technology Inc., Kanata, Ontario, Canada

**Contactless chipcards - trends and techniques**
K.U. Kloss
Siemens Semiconductors, Munich, Germany

**Very high-speed Digital Subscriber Lines (VDSL)**
J.M. Cioffi
Information Systems Laboratory, Stanford, United States

**Digital Television - A Quick Circuit of Next Grand Prix for Semiconductor Industry**
J. Forrest
Brewton Group Ltd., United Kingdom

**Hearing aids go digital**
E.C. Dijkmans
Philips Research Laboratories, Eindhoven, Netherlands

**Passive filters**
J.-M. Hode
Thomson Microsonics

**Microelectronics in Automotive Applications, Technical and Economic Impact**
B.W. Kalkhof
Robert Bosch GmbH, Reutlingen, Germany

**Advances in BJT Techniques for High-Performance Transceivers**
B. Gilbert
Analog Devices Inc., Beaverton, United States

## CONTRIBUTED PAPERS

### L1: LF Analogue I

**A -90 dB THD Rail-to-Rail input opamp using a new local charge pump in CMOS**
A.F. Duisters, E.C. Dijkmans
Philips Research Laboratories, Eindhoven, Netherlands

**A 3.3 Volt, low distortion ISDN line driver with a novel quiescent current control circuit**
H. Casier, P. Wouters, B. Graindourze, D. Sallaerts
Alcatel Mietec, Brussels, Belgium

**A Wide Range dB-linear Variable Gain CMOS Amplifier**
M. Gäfke, J. Oehm, K. Schumacher
Universität Dortmund, Germany

**Embedded 5V-to-3.3V Voltage Regulator for Supplying Digital IC’s in 3.3V CMOS Technology**
G.W. den Besten, B. Nauta
Philips Research Laboratories, Eindhoven, Netherlands

### L2: Oscillators & PLLs I

**A wide band Tuning System for Fully Integrated Satellite Receivers**
C. Vaucher, D. Kasperkovitz
Philips Research Laboratories, Eindhoven, Netherlands

**A lower ISM band frequency synthesizer and GMSK data modulator**
N.M. Filoöl, T.A.D. Riley, C. Plett, M.A. Copeland
Carleton University, Ottawa, Canada

**A 3-V delay-modulated PLL synthesizer for analog FM transmitters**
T. Rahkonen¹, S. Tammelin²
¹University of Oulu, Finland
²Nokia Mobile Phones, Finland

### L3: Data Converters I

**A 15-bit 2MHz Nyquist Rate delta-sigma ADC in a 1 µm CMOS Technology**
A. Marques, V. Peluso, M. Steyaert, W. Sansen
Katholieke Universiteit Leuven, Belgium

**A 74dB Dynamic Range, 1.1-MHz Signal Band 4th-Order 2-1-1 Cascade Multi-Bit CMOS sigma-delta Modulator for ADSL**
F. Modeiro, B. Pérez-Verdú, A. Rodriguez-Vázquez
Inst. de Microelectrónica Sevilla, Spain

**A 16 bit 500ks/s 2.7V 5mW ADC/DAC in 0.8um CMOS using error-correcting successive approximation**
W.G. Schofield, I.J. Dedic, A.K. Kemp
Fujitsu Microelectronics Ltd., Berkshire, United Kingdom

**Single Bit Sigma-Delta Modulator with Nonlinear Quantization for µ-Law Coding**
D. Weiž, P.A. Nielsen²
¹Fraunhofer-Institute, Duisburg, Germany
²Technical University of Denmark

### L4: Mixed Signal Systems I

**A Fully-Integrated CMOS AM Radio Receiver for Wrist-watch Calibration**
F. Op' Eynde³, P. Cathelin, N. Krasnanski³
³Mixed Silicon Structures, Roubaix, France
³Info Réalité
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
<th>Institution(s)</th>
</tr>
</thead>
</table>
| 88   | Low-Power Offset-Calibrated CMOS I/Q Transmit Interface for Portable Communications          | J. Goes¹, C. Azeredo-Leme¹, J. Vital¹, J. França¹, G. Bracmard¹, C. Dupuy¹                        | ¹Instituto Superior Técnico, Lisboa, Portugal
|      |                                                                                             |                                                                                                   | ²ATMEL/ES2, France                                                            |
| 92   | A Fully-Integrated FM Discriminator for RDS Applications                                     | A. Nitescu-Henry¹, F. Op’t Eynde², S.-A. Spinoche³, D. Claudius³, S.-M. Popescu³                  | ¹lEMN, Villeneuve d’Ascq, France
|      |                                                                                             |                                                                                                   | ²Mixed Silicon Structures, Roubaix, France
|      |                                                                                             |                                                                                                   | ³University of Bucharest, Romania                                             |
| 96   | 2.5 Gb/s ATM Physical Layer Controller in 0.8 µm BiCMOS                                     | F. Hansen, C.A.T. Salama                                                                          | University of Toronto, Canada                                                |
| 100  | A 3.3V Power Adaptive 1244 / 622 / 155 Mb/s TRANSCEIVER for ATM, SONET/SDH                   | D. Belot, L. Dugoujon, S. Dedieu                                                                   | SGS-Thomson, Crolles, France                                                 |
| 104  | Robust CMOS Comander                                                                       | D. Hossack                                                                                        | Wolfson Microelectronics Ltd., Edinburgh, United Kingdom                     |
| 108  | A 3.3 V 350 MHz 0.35 µm CMOS Programmable RIF Based on Redundant Coding in a Bit Plane Architecture | P. Thore1¹, J.L. Rainard¹, A. Abrial¹, F. Balestro¹, A. Gegout¹, C. Thomas¹                      | ¹France Telecom, Meylan, France
|      |                                                                                             |                                                                                                   | ²CCETT, Sesson Sevigne, France                                               |
| 112  | A novel driver architecture capable of driving high capacitive loads for sub-half-micron technologies | I. Bourns¹, C. Papadas¹, J.-P. Moreau¹, S.G. Katasopoulos¹                                       | ¹NCSR "Demokritos", Aghia Paraskevi, Greece
|      |                                                                                             |                                                                                                   | ²SGS-Thomson, Crolles, France                                                 |
| 116  | A Low-Power Low-Voltage Digital Bus Interface for MCM-Based Microsystems                     | J.H. Correia, E. Cretu, M. Bartek, R.F. Wolfenbuttel                                              | Delft University of Technology, Netherlands                                   |
| 118  | Implementation of a 5x5 trits multiplier in a Quasi-Adiabatic Ternary CMOS Logic            | D. Mateo, A. Rubito                                                                               | Univ. Politécnica de Catalunya, Barcelona, Spain                             |
| 120  | A Direct Conversion IC for Digital Satellite TV                                            | P. Blaud, N. Fiebig, M. Ipek                                                                       | Deutsche Thomson-Brandt GmbH, Villingen-Schwenningen, Germany                |
| 124  | An ISM band Transceiver Chip for Digital Spread Spectrum Communication                     | M. Moffat¹, M. Granger-Jones¹, S. Atkinson¹, S. Brett¹                                             | ¹GEC Plessey Semiconductors Inc., Scotts Valley, United States
|      |                                                                                             |                                                                                                   | ²Mosaic Microsystems Ltd., Kent, United Kingdom                              |
| 128  | The Impact of Scaling Down to Deep-Submicron on CMOS RF Circuits                             | Q. Huang¹, F. Piazza¹, P. Orsatti¹, T. Ohguro¹                                                    | Switzerland
|      |                                                                                             |                                                                                                   | ²Toshiba Corporation, Tokyo, Japan                                           |
| 130  | A Low-Voltage CMOS Downconversion Mixer for RF Applications                                 | R. Castello¹, M. Costa¹, V. Della Torre¹, F. Svelto¹                                               | ¹University of Pavia, Italy
|      |                                                                                             |                                                                                                   | ²Rockwell International, Newport Beach, United States                       |
| 136  | 1.25 Gb/s CMOS Differential Transimpedance Amplifier for Gigabit Networks                   | T. Yoon, B. Janaali                                                                                | Univ. of California at Los Angeles, United States                             |
| 140  | REMBRANDT: A RF ASIC for DECT TDM applications                                              | P.T.M. van Zeijl, N. Van Erven, F. Rissewou, M. Van Roosmalen                                    | Ericsson Business Mobile Networks, Enschede, Netherlands                     |
|      |                                                                                             |                                                                                                   | An IF-Strip with Integrated 2nd IF Filter for a Triple Conversion GPS Receiver | ETH Zurich, Switzerland                                                    |
| 144  | 2.5 MHz 55dB Switched-Current Bandpass sigma-delta Modulator for AM Signal Conversion      | J.M. de la Rosa, B. Pèrez-Verdu, F. Medeiro, A. Rodríguez-Vázquez                                 | Inst. de Microelektronica Sevilla, Spain                                    |
| 148  | 2.4: Data Converters II                                                                     | P. T.M. van Zeijl, N. Van Erven, F. Rissewou, M. Van Roosmalen                                    | Ericsson Business Mobile Networks, Enschede, Netherlands                     |
|      |                                                                                             |                                                                                                   | An IF-Strip with Integrated 2nd IF Filter for a Triple Conversion GPS Receiver | ETH Zurich, Switzerland                                                    |
|      |                                                                                             |                                                                                                   | A 1V CMOS fully-differential switched-opamp bandpass singa-delta modulator    | A. Baschirotto, R. Castello                                                 |
|      |                                                                                             |                                                                                                   | Università di Pavia, Italy                                                   |
| 152  | 2.5 MHz 55dB Switched-Current Bandpass sigma-delta Modulator for AM Signal Conversion      | J.M. de la Rosa, B. Pèrez-Verdu, F. Medeiro, A. Rodríguez-Vázquez                                 | Inst. de Microelektronica Sevilla, Spain                                    |
2.5: Neural & Fuzzy

A 12bit Medium-Time Analog Storage Device
in a CMOS Standard-Process
M. Ehlert, H. Klar
Technical University of Berlin, Germany

Building Blocks for Low-Power Stochastic
Pulse Coded Systems
S. Naess, T.S. Lande
University of Oslo, Norway

A 0.9V, 30μW Feature Extractor for Remote
Speech Recognition
A. Ferrari, M. Borgatti, M. Felici,
R. Guerrieri
University of Bologna, Italy

2.6: Sensor Interfaces I

A 0.5mW Passive Telemetry IC for Biomedical
Applications
Q. Huang, M. Oberle
Swiss Federal Inst. of Technology, Zurich,
Switzerland

A Resistance Variation Tolerant Constant
Power Heating Circuit for Integrated Sensor
Applications
S.S.W. Chan, Ph.C.H. Chan
Hong Kong Univ. of Science & Techn.,
Kowloon, Hong Kong

2.7: Memories I

New Two Single-Port GaAs Memory Cell
A. Bernal, A. Guyot
TIMA Laboratory, Grenoble, France

Novel Level-Identifying Circuit for Flash
Multi-Level Memories
D. Montanari, J. Van Houdt,
G. Groeseneken, H.E Maes
IMEC, Leuven, Belgium

2.8: Memories / DSP

Practical Low Power Design Architecture for
256 Mb DRAM
T. Tanizaki1, T. Fujino1, M. Tsukade1,
T. Tsuruda1, F. Morishita1, T. Amano1,
H. Kato1, M. Kobayashi1, K. Arimoto1
1Mitsubishi Electric Corp., Hyogo, Japan
2Daich Electric Corp., Itami, Japan

A Low Noise Folded Bit-Line Sensing
Architecture for Multi-Gb DRAM with Ultra
High Density 6T Cell
J.-S. Kim1, Y.-S. Choi1, H.-J. Yoo2,
K.-S. Seo2
1Seoul National University, Korea (South)
2Kangwon National Univ., Korea (South)

A High Speed SRAM macro for 0.35 μm Low
Voltage SOI/CMOS Gate Arrays
K. Nii, K. Ueda, Y. Wada, S. Iwade,
H. Hamano, K. Tsuchihashi
Mitsubishi Electric Corporation, Hyogo,
Japan

2.9: LF Analogue II

A CMOS Chopper Opamp with Integrated
Low-Pass Filter
A. Bakker, J.H. Huijsing
Delft University of Technology,
Netherlands

Low-power low-voltage chopped
transconductance amplifier for noise and
offset reduction
M.A.T. Sanduleanu1, B. Nauta1,
H. Wallinga1
1University of Twente, Enschede,
Netherlands
2Philips Research Laboratories, Eindhoven,
Netherlands

3.1: Oscillators & PLLs II

Accurate Simulation of Phase Noise in
Oscillators
B. De Smedt, G. Gielen
Katholieke Universiteit Leuven, Belgium

CMOS circuit technique for serial IC
interconnection up to 1.1 Gb/s
R. Laren1, A. Rothermel1, R. Schweer1
1University of Ulm, Germany
2THOMSON multimedia, Villingen-
Schwenningen, Germany

3.2: Oscillators & PLLs III

A Direct Digital Synthesizer with an On-chip
D/A-converter
J. Vankka, M. Waltari, M. Kosunen,
K. Halonen
Helsinki University of Technology, Espoo,
Finland

1-V Low-Noise 200 MHz Relaxation Oscillator
Y. Deval, J. Tornas, J.B. Begueret,
H. Lapuyade, J.P. Dom
Universite Bordeaux, Talence, France

A Wide-Tunable Translinear Second-Order
Oscillator
W. A. Serdijn, J. Mulder, A.C. Van der
Woerd, A.H.M. Van Roermund,
Delft University of Technology,
Netherlands

3.3: Sensor Interfaces II

A Switched Current, Switched Capacitor
Temperature Sensor in 0.6u CMOS
M. Tuthill
Analog Devices, Limerick, Ireland

A 9-channel Time-to-Digital Converter for an
Imaging Lidar Application
A. Mäntyniemi, T. Rahkonen,
J. Kostamoavaara
University of Oulu, Finland
3.4: Sensor Interfaces III
CMOS Photosensor Arrays with On-Chip Signal Processing 236
M. Schanz1, W. Brockherde1, R. Hauschild1, B.J. Hosticka1, A. Teuner1
1Gerhard-Mercator Univ. of Duisburg, Germany
2Fraunhofer-Institute, Duisburg, Germany
A 5-bit 150 MS/s, 3.3 V CMOS A/D Converter with a 32 Step Adjustable Reference Circuit 240
Th. Desel1, F. Kuttner1, C. Kropf2, M. Haas2
1Fraunhofer-Institute, Erlangen, Germany
2Siemens Entwicklungszenrum, Villach, Austria

3.5: Analogue Filters I
Realization of a 10 MHz Integrated bipolar DECT band-pass filter 244
P.M. Stroet1, P.T.M. van Zeijl1, R.F. Wassenaar1
1University of Twente, Enschede, Netherlands
2Ericsson Mobile Networks B.V., Netherlands
10-MHz 60-dB Dynamic-Range 4th-Order Butterworth Lowpass Filter 248
D. Cheung1, K. Buit1, A. Buchwald2
1Hong Kong Univ. of Science & Technology, Hong Kong
2Broadcom Corporation, Irvine, United States

3.6: Analogue Filters II
High-Accuracy Charge-Redistribution Switched-Capacitor Video Bandpass Filter in Standard 0.8 μm CMOS 252
P.J. Quinn
Philips Semiconductors, Eindhoven, Netherlands
A Low-Voltage Power and Area Efficient BiCMOS Log-Domain Filter 256
M. Punzenberger, C.C. Enz
Swiss Federal Inst. of Technology, Lausanne, Switzerland
A high-Q Bandpass Fully Differential SC Filter with Enhanced Testability 260
D. Vázquez, A. Rueda, J.L. Huertas, E. Peralías
University of Sevilla, Spain

3.7: Modelling & Matching I
An EEPROM in a Standard CMOS technology 264
F. Op’t Eynde, C. Zorio
Mixed Silicon Structures, Roubaix, France
Mismatch Modelling for Large Area MOS Devices 268
U. Grünebaum, J. Oehm, K. Schumacher
Universität Dortmund, Germany

3.8: Modelling & Matching II
FET Mobility Degradation and Device Mismatch due to Packaging Induced Die Stress 272
R.C. Jaeger, A.T. Bradley, J.C. Suhling, Y. Zou
Auburn University, Auburn, United States
Drain Current Mismatch in SOI CMOS Current Mirrors and D/A Converters due to Localised Internal and Coupled Heating 276
B. Tenbroek1, M.S. Lee1, W. Redman-White1, C.F. Edwards1, M.J. Uren1, R.J.T. Bunyan2
1University of Southampton, United Kingdom
2DERA, Malvern, United Kingdom

3.9: DSP Architectures
Low-Power 200 Msps, Area Efficient, 5-Tap Programmable FIR Filter 280
D. Moloney1, J. O’Brien1, E. O’Rourke1, F. Brianti2
1Silicon Systems Design Ltd., Dublin, Ireland
2SGS-Thomson Microelectronics, San Jose, United States
Rapid design of complex DSP cores 284
J.V. McCanny1, D. Trainor2, Y. Hu2, T.J. Ding1
1The Queen’s University of Belfast, United Kingdom
2Integrated Silicon Systems Ltd., Belfast, United Kingdom

3.10: Mixed Signal Systems II
R, G, B acquisition interface with line locked clock generator, for LCD driver 288
H. Marie, P. Belin
Philips Semiconductors, Caen, France
Read front end of a new AC coupled Preamplifier for 300 Mb/s Hard Disk Drives using single stripe Magneto Resistive heads 292
F. Punch, P. Leclerc, E. Pieraerts, S. Crespin
Philips Composants et Semiconduct., Caen, France
A Robust Analogue Interface System for Sub-Micron CMOS Video DSP 296
W. Redman-White1, R. Duffee1, S. Bramweli, H. Rijns1, S. James1, J. Tijou1, G. van der Weide1
1Philips Semiconductors, Southampton, United Kingdom
2Philips Semiconductors, Nijmegen, Netherlands
3Philips Research, Eindhoven, Netherlands
3.11: Logic Circuits II

A Low-Power, High-Speed 0.25 µm GaAs D-FF 300
T. Enomoto1, A. Hirobe1, H. Iwata1, M. Fuji1, N. Yoshida1, S. Asai2
1Chuo University, Tokyo, Japan
2NEC Corporation, Ibaraki, Japan
Reduced complexity two-phase micropipeline latch controller 304
G.S. Taylor, G.M. Blair
The University of Edinburgh, United Kingdom

3.12: Logic Circuits III

Novel High-Speed and Low-Power Dynamic MOS Flip-Flops for a Low-Power 1.25GHz Multiplexer/Demultiplexer 308
H. Kanno, T. Saito, M. Sato
NEC Corporation, Kanagawa, Japan
A High Speed, Low Power 8-Tap Digital FIR Filter for PRML Disk-Drive Read Channels 312
H.-J. Ki1, W.-H. Pak2, J.-S. Yoo2, S.-W. Kim1
1Korea University, Seoul, Korea (South)
2LG Corporate Inst of Technology

Posters

A Novel 1.5-V CMOS Operational Amplifier 316
G. Palmisano, G. Palumbo, R. Salerno
Università di Catania, Italy
A Generic CAD Model for Arbitrarily Shaped and Multi-Layer Integrated Inductors on Silicone Substrates 320
Y. Koutsosyanopoulos1, Y. Papananos1, C. Alemanini1, S. Bantas1
1National Technical Univ. of Athens, Greece
2SGS-Thomson Microelectronics, Catania, Italy
A High Resolution Electron Imaging Integrated Circuit 324
D.G. Lomas, J.V. Hatfield
UMIST, Manchester, United Kingdom
A Current-Mode ASIC for Use with Position Sensitive Detector Arrays 328
K.S. Chai, J.V. Hatfield
UMIST, Manchester, United Kingdom
A High Resolution Time-to-Digital Converter Based on Time-to-Voltage Interpolation 332
E. Räisänen-Ruotsalainen, T. Rahkonen, J. Kosiamovaara
University of Oulu, Finland
A 5V CMOS Chip for Interpolation of Sine/Cosine Signals 336
M. Krauss1, U. Leuschner1, H.-G. Schneick1, A. Hilbert1
1Zentrum Mikroelektronik Dresden GmbH, Herrenberg, Germany
2MAZET, Jena, Germany
A 1.2µ BiCMOS realization of a low power and offset-free Voltage/Frequency converter 340
M. Zhang, F. Rodes
IXL-ENSERB, Talence, France
Integrated RF transmitter based on SAW Oscillator 344
A. Heuberger, T. Drischel
Fraunhofer-Institute, Erlangen, Germany
Hierarchical N-Port Memory Architecture based on 1-Port Memory Cells 348
H.J. Mattausch
Hiroshima University, Higashi, Japan
A 1V Bootstrapped CMOS Digital Logic Family 352
S.Y. Choe, G.A. Rigby
The University of New South Wales, Sydney, Australia
A Full-Custom Self-timed DSP Processor Implementation 356
M. Laiho, O. Vainio
Tampere University of Technology, Finland
High Speed Arithmetic Design Using CPL and DPL Logic 360
P.Y.K. Cheung1, M. v. Scotti2, J. Blake2, B. Brewer2, R. Grisentiwai2, D. Hitchcox2, P. Shepherd2
1Imperial College of Science, Techn., & Med., London, United Kingdom
2Analog Devices Newbury Design Centre, Newbury, Berks, United Kingdom
A 1GHz, 40 mW Fully Integrated Continuous-Time Second-Order Bandpass Filter in GaAs Technology 364
R. Moughabghub
Rockwell Semiconductor Systems, Sophia Antipolis, France
Multilevel Decoder-Decision Circuit for High Bitrate ETDM Transmission 368
P. Desrouseaux, Ph. André, M. Meghelli, A. Koneczynrowska, J. Godin
France Telecom, Bagneux, France
10 Gb/s Single-Chip Data Regeneration with an Injection Synchronised Ring Oscillator and an Automatic Phase Adjustment 372
Fraunhofer-Institute, Freiburg, Germany
Constructing High Level Macrocell Models using the Shlaer-Mellor Method 376
D. Whipp
GEC Plessey Semiconductors, Swindon, United Kingdom
A 1mW only Wireless Phone Voiceband D to A CODEC 380
N. Moeneclaey, F. Rouleau, P. Guignon, P. Carbou
Texas Instruments France, Villeneuve Loubet, France
A Variable Gain Transimpedance Amplifier Channel with a Timing Discriminator for a Time-of-Flight Laser Radar

P. Palojarvi, T. Ruotsalainen, J. Kostamovaara
University of Oulu, Finland

A 200 MHz Cell for a Parallel-Successive-Approximation ADC in 0.8 μm CMOS, using a Reference Pre-Select scheme

J.-E. Eklund
Linköping University, Sweden

A Low-Voltage, High-Speed and Low-Power Full Current-Mode Video-rate CMOS A/D Converter

Y. Sugimoto1, T. Iida1
1Chuo University, Tokyo, Japan
2Toshiba Corporation, Kawasaki, Japan

A 103 MHz Open-Loop Full CMOS Highly Linear Sample-and-Hold Amplifier

Kh. Hadidi1, M. Sasaki1, T. Watanabe1, D. Muramatsu1, T. Matsumoto1
1Urmia University, Iran
2Waseda University, Tokyo, Japan

Performance enhancement in stochastic pulse code systems using parallelism and redundancy

S. Naess, T.S. Lande, Y. Berg
University of Oslo, Norway

A 0.9V 960 MHz CMOS Radio Front End Employing a Doubly Balanced Transconductance Mixer

B.A. Xavier1, P.J. Sullivan1, B. Fransis1, W. Ku1
1Hughes Network Systems, San Diego, United States
2Univ. of California at San Diego, United States
3Rockwell Semiconductor Systems, San Diego, United States

200 Megasample per second 6 bit A/D converter

O. Leuthold
GEC Plessey Semiconductors, Scotts Valley, United States