

GaAs IC SYMPOSIUM

IEEE GALLIUM ARSENIDE INTEGRATED CIRCUIT SYMPOSIUM

Co-Sponsored by The IEEE Electron Devices Society
and The IEEE Microwave Theory and Techniques Society

17th
ANNUAL



TECHNICAL DIGEST 1995

SAN DIEGO, CALIFORNIA

OCTOBER 29 - NOVEMBER 1, 1995

95CH35851

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WELCOME TO THE 1995 IEEE GaAs IC SYMPOSIUM

It's indeed a great pleasure for me to welcome you to San Diego for the 17th annual IEEE GaAs IC Symposium.

Lisa Sobolewski and the Technical Program Committee have assembled an excellent program from the 143 papers submitted this year. Papers cover topics from low operating voltage designs to high power amplifiers, and from RF to millimeter wave frequencies. Communications applications continue to be a focus for new IC development. Twelve invited talks will provide a keynote to the technical sessions.

The Plenary Session on Monday will open with an international view of GaAs IC applications for mobile wireless communications. Additional topics of general interest include medical applications and advanced silicon and complementary GaAs IC technology. The eleven Technical Sessions address IC applications from gigabit switching to millimeter wave front ends. High speed networking technology will be covered in two sessions, with six sessions on analog and mixed-signal applications for communications and other commercial and military systems. Manufacturing, reliability and advanced process techniques will be addressed in the remaining three sessions.

In addition to the Technical Sessions, you will be able to choose from three Panel Sessions on topics such as practical millimeter wave ICs, the digital IC market and power amplifiers for commercial applications. The Vendor Product Forums have been moved to prime (lunch) time to permit IC and other product vendors to discuss their newest products with the Symposium attendees.

This year's Short Course, organized by Phil Wallace, focuses on Practical Wireless IC Design. Participants will learn techniques on how to design and apply GaAs ICs to fast-growing personal communications applications. The GaAs IC Primer Course continues to serve as an introduction to the Technical Program for those new to the technology.

The GaAs IC Technology Exhibition will open on Monday evening to permit attendees to see new products on display and allow our Exhibitors to meet with old and new customers. The Exhibition continues to be a popular event for both Exhibitors and GaAs IC Symposium attendees.

As usual you can count on an intense technical program, but the Symposium Committee has planned some time for relaxation in the beautiful, mild weather city of San Diego. This year in response to many requests, we left Monday evening free after the GaAs IC Technology Exhibition Reception for more socializing. A special Halloween event is planned for Tuesday, October 31, at SeaWorld, where you can enjoy the many sights of the aquatic world.

I would like to take this opportunity to acknowledge the many individuals whose hard work have made this Symposium a success. The volunteers, working on the Executive Committee and the Technical Program Committee and our International advisors who promote the Symposium in Europe and Japan, have put in many hours to bring you a well organized and high quality Symposium.

On behalf of the Executive and Technical Program Committees, I would like to thank you for your continued support.

George Bechtel
Chairman
1995 IEEE GaAs Symposium

1995 IEEE GaAs IC Symposium

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SYMPOSIUM HEADQUARTERS

Sheraton San Diego Hotel and Marina
San Diego, California

SESSION K: HIGH POWER EFFICIENT AMPLIFIERS AND DEVICES: WATTS UP?

275

2:00 p.m.

Harbor Island Ballroom 1

Chairmen: F. Ali, *Westinghouse, Baltimore*
J. Komiak, *Lockheed Martin, Syracuse, NY*

2:05 p.m.

277

K.1 A 50% EFFICIENCY 8 W C-BAND PHEMT POWER AMPLIFIER, P. White, T. OLeary, *Raytheon Co., Andover, MA*

2:25 p.m.

281

K.2 HIGH PAE PSEUDOMORPHIC InGaAs/AlGaAs HEMT X-BAND HIGH POWER AMPLIFIERS, Y. Chen, C. Wu, C. Pao, Z. Bardai, L. Hou, T. Midford, T. Cisco, *Hughes Aircraft Co., Torrance, CA*

2:45 p.m.

Withdrawn

K.3 PERFORMANCE COMPARISON OF 1-WATT Ka-BAND MMIC AMPLIFIERS USING PSEUDOMORPHIC HEMTs AND ION-IMPLANTED MESFETs, R. Yarborough, P. Saunier, H. Tserng, *Texas Instruments, Dallas, TX*

3:05 p.m.

284

K.4 A HIGH-VOLTAGE, Ka-BAND POWER MMIC WITH 41% EFFICIENCY, J. Schellenberg, *Schellenberg Associates, Huntington Beach, CA*

3:25 p.m. - 3:45 p.m.

Coffee Break

3:45 p.m.

288

K.5 A NOVEL LINEARIZING TECHNIQUE FOR GaAs POWER AMPLIFIERS, Y. Yamaguchi, M. Muraguchi, T. Nakagawa, M. Nakatsugawa, T. Tsukahara, *NTT, Kanagawa, JAPAN*

4:05 p.m.

292

K.6 PSEUDOMORPHIC Ku-BAND GaAs HFET LINEARIZER PREAMPLIFIER FRONT END FOR SATELLITE TWT-AMPLIFIERS, P. Narozy, H. Tobler, G. Kornfield, B. Adelseck, M. Ludwig, G. Eggers, *Daimler Benz AG, Ulm, GERMANY*

4:25 p.m.

296

K.7 Q Q-BAND 1 WATT 30% POWER-ADDED-EFFICIENCY HETERO-JUNCTION FET, S. Arai, H. Mizuno, H. Tanaka, H. Yoshinaga, K. Masuda, B. Abe, H. Tokuda, K. Shibata, *Toshiba, Kawasaki, JAPAN*

4:45 p.m.

Close of Symposium

SESSION L: ICs FOR DATA CONVERSION, COMPUTING, AND DATA COMMUNICATION

301

2:00 p.m.

Harbor Island Ballroom 2

Chairmen: R. Brown, *University of Michigan, Ann Arbor, MI*
K.C. Wang, *Rockwell, Thousand Oaks, CA*

2:05 p.m.

303

L.1 AN 8-BIT, 2 GIGASAMPLE PER SECOND ANALOG TO DIGITAL CONVERTER, K. Nary, R. Nubling, S. Beccue, W. Colleran, J. Penney, K. Wang, *Rockwell International, Newbury Park, CA*

2:25 p.m.

307

L.2 GaAs MULTIBIT DELTA-SIGMA A/D CONVERTERS BASED UPON A NEW COMPARATOR DESIGN, R. Hickling, M. Yagi, H. Salman, *TechnoConcepts, Inc., Newbury Park, CA*

2:45 p.m.

311

L.3 A VERY-WIDE BANDWIDTH DIGITAL VCO IMPLEMENTED IN GaAs HBTs USING FREQUENCY MULTIPLICATION AND DIVISION, P. Campbell, H. Greub, S. Steidl, A. Garg, C. Maier, S. Carlough, J. McDonald, *Rensselaer Polytechnic Inst., Troy, NY*

3:05 p.m.

315

L.4 A 7ns CYCLE, HIGH SPEED DUAL COMPARE CAM IN 0.6 (m GaAs), M. Venkataraman, M. Pai, S. Canaga, *Vitesse Semiconductor, Camarillo, CA*

3:25 p.m. - 3:45 p.m.

Coffee Break

3:45 p.m.

319

L.5 METASTABILITY IN SCFL, B. Cheney, R. Savara, *TriQuint Semiconductor, Beaverton, OR*

4:05 p.m.

323

L.6 GaAs 10K-GATES GATE ARRAY WITH DIGITAL VARIABLE DELAY MACRO CELL, A. Ohta, N. Higashisaka, M. Shimada, T. Heima, K. Hosogi, R. Ohmura, N. Tanino, *Mitsubishi, Hyogo, JAPAN*

4:25 p.m.

327

L.7 LOW POWER CURRENT MODE MULTI-VALUED LOGIC INTERCONNECT FOR HIGH SPEED INTERCHIP COMMUNICATIONS, J. Zhang, S. Long, F. Ho, J. Madsen, *University of CA, Santa Barbara, CA*

4:45 p.m.

Close of Symposium

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SYMPOSIUM AT A GLANCE

SATURDAY, OCTOBER 28, 1995

REGISTRATION (Short Course & Primer Course Only)

6:00 p.m.-8:00 p.m.

Harbor Island Foyer

SUNDAY, OCTOBER 29, 1995

REGISTRATION (Short Course & Primer Course Only)

7:00 a.m.-8:00 a.m.

Exhibit Hall Foyer

Continental Breakfast for Short Course

7:00 a.m.-7:45 a.m.

Harbor Island Foyer

SHORT COURSE: "Practical RF Circuits for Wireless Applications"

8:00 a.m.-5:00 p.m.

Harbor Island Ballroom 1

GaAs Reliability Workshop

8:00 a.m.-5:00 p.m.

Bel Aire South, West Tower

Short Course Lunch

12:15 p.m.-1:30 p.m.

Harbor Island Ballroom 2

REGISTRATION for Symposium

5:00 p.m.-8:00 p.m.

Exhibit Hall Foyer

Symposium Opening Reception

5:00 p.m.-8:00 p.m.

Harbor Island Ballroom 2 & 3

PRIMER COURSE: "Basics of GaAs ICs"

5:30 p.m.-8:30 p.m.

Harbor Island Ballroom 1

MONDAY, OCTOBER 30, 1995

REGISTRATION

7:00 a.m.-5:00 p.m.

Exhibit Hall Foyer

Continental Breakfast

7:00 a.m.-8:00 a.m.

Harbor Island Foyer

SYMPOSIUM OPENING

8:00 a.m.-8:15 a.m.

Harbor Island Ballroom 1 & 2

SESSION A: Plenary Session

8:15 a.m.-11:10 a.m.

Harbor Island Ballroom 1 & 2

Buffet Lunch

11:15 a.m.-12:15 p.m.

Spinnaker 1 & 2, Marina 4 - 6

PANEL SESSION 1: Cost Driven, Multifunction Millimeter Wave ICs: Are They Possible?

12:30 p.m.-2:00 p.m.

Harbor Island Ballroom 1

PANEL SESSION 2: High Speed Digital Shakeout: Co-existing With Silicon

12:30 p.m.-2:00 p.m.

Harbor Island Ballroom 2

VENDOR PRODUCT FORUM 1

12:30 p.m.-2:00 p.m.

Harbor Island Ballroom 3

GaAs MMIC Rel. Assurance Program Advisory Board Meeting

2:00 p.m.-5:00 p.m.

Marina 3

SESSION B: GB/s ICs for ATM Switching

2:30 p.m.-5:05 p.m.

Harbor Island Ballroom 1

SESSION C: ICs for Personal Communication Systems

2:30 p.m.-4:40 p.m.

Harbor Island Ballroom 2

GaAs IC Technology Exhibition Opening Reception

5:00 p.m.-7:30 p.m.

Lower Exhibit Hall

TUESDAY, OCTOBER 31, 1995

REGISTRATION

7:00 a.m.-5:00 p.m.

Exhibit Hall Foyer

Continental Breakfast

7:00 a.m.-8:00 a.m.

Harbor Island Foyer

GaAs IC TECHNOLOGY EXHIBITION

8:00 a.m.-5:00 p.m.

Lower Exhibit Hall

SESSION D: FET Reliability, Processing, and Power Issues

8:30 a.m.-11:45 a.m.

Harbor Island Ballroom 1

SESSION E: Materials, Manufacturing, and Packaging

8:30 a.m.-11:35 a.m.

Harbor Island Ballroom 2

Exhibition Lunch

12:00 noon-1:30 p.m.

Lower Exhibit Hall

SESSION F: HBTs: Power Issues, Reliability, and Novel Processing

1:40 p.m.-4:35 p.m.

Harbor Island Ballroom 1

SESSION G: Optical Communications Circuits

1:40 p.m.-4:35 p.m.

Harbor Island Ballroom 2

SEMI Compound Semiconductor Standards Committee Meeting

4:45 p.m.-6:30 p.m.

Marina 6

Symposium Theme Party

6:00 p.m.-10:00 p.m.

Sea World

WEDNESDAY, NOVEMBER 1, 1995

REGISTRATION

7:00 a.m.-12:00 noon

Harbor Island Foyer

Continental Breakfast

7:00 a.m.-8:00 a.m.

Harbor Island Foyer

SESSION H: Millimeter Wave Applications and Techniques

8:30 a.m.-11:15 a.m.

Harbor Island Ballroom 1

SESSION I: Frequency Conversion MMICs

8:30 a.m.-9:55 a.m.

Harbor Island Ballroom 2

SESSION J: Signal Generation and Control, and Novel Techniques

10:15 a.m.-11:40 a.m.

Harbor Island Ballroom 2

Buffet Lunch

11:45 a.m.-12:15 p.m.

Spinnaker 1 & 2, Marina 4 - 6

PANEL SESSION 3: Technology Choices for Commercial Power Amplifiers

12:20 p.m.-1:50 p.m.

Harbor Island Ballroom 1

VENDOR PRODUCT FORUM 2:

12:20 p.m.-1:50 p.m.

Harbor Island Ballroom 2

SESSION K: High Power Efficient Amplifiers & Devices: Watt's Up

2:00 p.m.-4:45 p.m.

Harbor Island Ballroom 1

SESSION L: ICs for Data Conversion, Computing, and Data Communication

2:00 p.m.-4:45 p.m.

Harbor Island Ballroom 2

Close of Symposium

4:45 p.m.

All rooms are in the East Tower except as noted

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Monday, October 30, 1995

REGISTRATION AND CONTINENTAL BREAKFAST

7:00 a.m. - 5:00 p.m.

Registration—Exhibit Hall Foyer

7:00 a.m. - 8:00 a.m.

Continental Breakfast—Harbor Island Foyer

SYMPOSIUM OPENING

8:00 a.m. - 8:15 a.m.

Harbor Island Ballroom 1 & 2

1995 Symposium Chairman

George Bechtel, *Strategies Unlimited, Mountain View, CA*

1995 Technical Program Chairman

Elissa Sobolewski, *ARPA ESTO, Arlington, VA*

SESSION A: PLENARY SESSION

1

8:15 a.m.

Harbor Island Ballroom 1 & 2

Chairmen: P. Wallace, *ANADIGICS, Warren, NJ*
M. Wilson, *Motorola, Tempe, AZ*

8:20 a.m.

3

A.1 THE WIRELESS COMMUNICATIONS MARKET - IS THERE A PLACE FOR GaAs?, (Invited Paper) K. Baughan, Nokia

8:50 a.m.

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A.2 MOBILE COMMUNICATIONS SYSTEMS TREND IN JAPAN AND DEVICE REQUIREMENTS, (Invited Paper) M. Mitama, NEC, Yokohama, JAPAN

9:20 a.m. - 9:40 a.m.

Coffee Break

9:40 a.m.

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A.3 USE OF GALLIUM ARSENIDE IN MEDICAL APPLICATIONS, (Invited Paper) K. Carr, Microwave Medical Systems, Inc., Acton, MA

10:10 a.m.

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A.4 SiGe DEVICES AND CIRCUITS: WHERE ARE ADVANTAGES OVER III/V?, (Invited Paper) U. KÜnig, A. Gruhle, A. Schfppen, Daimler-Benz AG, Ulm, GERMANY

10:40 a.m.

18

A.5 COMPLEMENTARY GaAs (CGaAs™) TECHNOLOGY, (Invited Paper) B. Bernhardt, M. LaMacchia, J. Abrokwhah, K. Clauss, B. Crawford, S. Emmert, D. Foster, T. Lien, E. Lopez, B. Mathes, V. Mazzotta, B. Oh, J. Hallmark, R. Lucero, Motorola, Tempe, AZ

11:10 a.m.

End of Session A

BUFFET LUNCH

11:15 a.m. - 12:15 p.m.

Spinnaker 1 & 2, Marina 4, 5, & 6

**PANEL SESSION 1:
COST DRIVEN, MULTIFUNCTION MILLIMETER WAVE
ICs: ARE THEY POSSIBLE?**

12:30 p.m. - 2:00 p.m.
Harbor Island Ballroom 1

Organizers & Moderators:

Brad Nelson, *Pacific Monolithics, Sunnyvale, CA*
Sanjay Moghe, *Northrop Grumman, Rolling Meadows, IL*

With new commercial markets opening above 20 GHz, the underlying question is, 'What design approaches and technologies will cost effectively meet the needs of the market?' Discussions will address IC issues including circuit requirements, cost drivers, yield, material, technology tradeoffs, and levels of integration. These issues will be illustrated with examples.

Panel Members:

Duncan Smith, *TRW*
Rob Christ, *TriQuint Semiconductor*
Norman Chiang, *Litton Solid State*
Kuoh Siung Li, *ANADIGICS*

**23 PANEL SESSION 2:
HIGH SPEED DIGITAL SHAKEOUT + CO-EXISTING
WITH SILICON**

12:30 p.m. - 2:00 p.m.
Harbor Island Ballroom 2

Organizer:

Mark Wilson, *Motorola, Tempe, AZ*

DCFL, SCFL, HBT... There are so many players in the digital market. Who will survive? What will the world look like for GaAs-based logic two years from now? In five years? What will it take to still be around?

Representatives from GaAs logic suppliers will describe why they think they'll still be around five years from now. Panel members will be encouraged to discuss what technologies are good enough to find a place in the market, and what technologies are too weak to survive. Examples of successes and failures in the market will be used to illustrate what each vendor thinks it really takes to be a long term player. The answer may not be a matter of who has the best speed-power product.

Specific questions that will be addressed. How can GaAs keep its speed-power advantage over new and next generation silicon? Can GaAs keep up with the new supply and I/O standards emerging in silicon? Which GaAs logic families will become standards?

Panel Members:

Gary McCormack, *TriQuint Semiconductor*
Ira Deyhimy, *Vitesse Semiconductor*
Deepak Mehrotra, *Rockwell*
Peter Zdebel, *Motorola*

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VENDOR PRODUCT FORUM 1

12:30 p.m. - 2:00 p.m.

Harbor Island Ballroom 3

Chairman:

Jim Komiak, *Lockheed Martin, Syracuse, NY*

The 1995 Vendor Product Forums will provide an opportunity for potential customers and or business partners to learn about some of the latest products available in the GaAs IC marketplace. This is the first of two afternoon forums focused on Integrated Circuit and Packaging Products and Services. The Integrated Circuit Products to be presented include commercial, consumer, and military ICs targeted at wireless, mobile phone, LAN, and microwave module applications. Industry participants will include:

RF Micro-Devices
Siemens AG
Raytheon Advanced Device Center
TriQuint Semiconductor
M/A-Com, Inc.

The forum will consist of short focused presentations by leading suppliers of their respective products and services, opportunity for audience and participant questions and discussions, and possible demonstrations. Product literature will also be available.

27 SESSION B: GB/s ICs FOR ATM SWITCHING

29

2:30 p.m.

Harbor Island Ballroom 1

Chairmen: R. Cordell, *Belcore, Red Bank, NJ*
G. McCormack, *TriQuint, Beaverton, OR*

2:35 p.m.

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B.1 AN InP-BASED HBT FAB FOR HIGH SPEED DIGITAL, ANALOG, MIXED-SIGNAL, AND OPTOELECTRONIC ICs, (Invited Paper) W. Stanchina, M. Hafizi, H. Sun, J. Jensen, R. Walden, K. Elliott, G. Raghavan, A. Schmitz, M. Kardos, Y. Brown, M. Montes, *Hughes, Malibu, CA*

3:05 p.m.

35

B.2 GaAs MULTIPLEXER CHIP FOR ATM SWITCHING, J. Jakobsen, *Tele Danmark Jydsk Telefon, Tranbjerg, DENMARK*

3:25 p.m.

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B.3 ULTRA-LOW-POWER-CONSUMPTION HETERO-JUNCTION FET 8:1 MUX / 1:8 DEMUX FOR 2.4 GBPS OPTICAL FIBER COMMUNICATION SYSTEMS, K. Numata, M. Fujii, T. Maeda, M. Tokushima, S. Wada, M. Fukaishi, M. Ishikawa, *NEC Corporation, Ibaraki, JAPAN*

3:45 p.m. - 4:05 p.m.

Coffee Break

4:05 p.m.

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B.4 A 2.5 GB/S GaAs ATM MUX DEMUX ASIC, J. Madsen, P. Lassen, *Technical University of Denmark, Lyngby DENMARK*

4:25 p.m.

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B.5 A 40 GBS FULLY DIFFERENTIAL HIGH SPEED, HIGH FIDELITY 16 x 16 BIT CROSSPOINT SWITCH WITH FAST PROGRAMMING DESIGNED WITH SCFL STANDARD CELLS, R. Savara, A. Turudic, *TriQuint Semiconductor, Beaverton, OR*

4:45 p.m.

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B.6 A 10GB/S ATM DATA SYNCHRONISER, T. Wong, J. Sitch, *Bell Northern Research, Ottawa, CANADA*

5:05 p.m.

End of Session B

SESSION C: ICs FOR PERSONAL COMMUNICATION SYSTEMS

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2:30 p.m.

Harbor Island Ballroom 2

Chairmen: B. Nelson, *Pacific Monolithics, Sunnyvale, CA*
J. Mfller, *Siemens AG, Mfnchen, GERMANY*

2:35 p.m.

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C.1 A 3.3V FRONT-END RECEIVER GaAs MMIC FOR DIGITAL / ANALOG DUAL-MODE HAND-HELD

PHONE, C. Kim, M. Kim, I. Hwang, E. Oh, J. Yang, C. Lee, C. Park, J. Lee, K. Pyun, H. Park, *Electronics and Telecommunications Research Institute, Taejon, KOREA*

2:55 p.m.

59

C.2 A HIGH POWER AND HIGH EFFICIENCY GaAs BPLDD SAGFET WITH WSi/W DOUBLE-LAYER GATE FOR MOBILE COMMUNICATION SYSTEMS, N. Kasai,

M. Noda, K. Ito, K. Yamamoto, K. Maemura, Y. Ohta, T. Ishikawa, Y. Yoshii, M. Nakayama, H. Takano, O. Ishihara, *Misubishi, Hyogo, JAPAN*

3:15 p.m.

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C.3 3.4V OPERATION POWER AMPLIFIER MULTI-CHIP IC FOR DIGITAL CELLULAR PHONE, Y. Hasegawa, Y.

Ogata, K. Inosako, N. Iwata, M. Kanamori, I. Nagasako, T. Itoh, *NEC Corporation, Kawasaki-shi, JAPAN*

3:35 p.m. - 4:00 p.m.

Coffee Break

4:00 p.m.

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C.4 A LOW COST LINEAR AlGaAs/GaAs HBT MMIC POWER AMPLIFIER WITH ACTIVE BIAS SENSING FOR PCS APPLICATIONS, P. Walters, P. Lau, K.

Buehring, J. Penney, C. Farley, P. McDade, K. Weller, *Rockwell International, Newbury Park, CA*

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C.5 PNP AlGaAs/GaAs HBT LOW NOISE AMPLIFIERS, K.

Kobayashi, L. Tran, T. Block, J. Cowles, A. Oki, D. Streit, *TRW, Redondo Beach, CA*

4:40 p.m.

End of Session C

GaAs Technology Exhibition

5:00 p.m. - 7:30 p.m.

Opening Reception

Lower Exhibit Hall

REGISTRATION AND CONTINENTAL BREAKFAST

7:00 a.m. - 5:00 p.m.

Registration—Exhibit Hall Foyer

7:00 a.m. - 8:00 a.m.

Continental Breakfast—Harbor Island Foyer

SESSION D: FET RELIABILITY, PROCESSING, AND POWER ISSUES

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8:30 a.m.

Harbor Island Ballroom 1

Chairmen: T. Wandinger, *Watkins-Johnson, Palo Alto, CA*
C. Bozada, *Wright Labs, WPAFB, OH*

8:35 a.m.

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D.1 GRADUAL DEGRADATION UNDER RF OVERDRIVE OF MESFETs AND PHEMTs, (Invited Paper) J. Hwang, *Lehigh University, Bethlehem, PA*

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D.2 DRAIN CURRENT DRIFT BY HOLES TRAPPED IN SCHOTTKY CONTACT IN WSi GATE GaAs MESFETs, T. Shiga, R. Hattori, T. Kunii, T. Oku K. Sato, O. Ishihara, *Mitsubishi, Hyogo, JAPAN*

9:25 a.m.

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D.3 A HIGHLY MANUFACTURABLE 0.2 (M AlGaAs/InGaAs PHEMT FABRICATED USING THE SINGLE-LAYER INTEGRATED-METAL FET (SLIMFET) PROCESS, C. Havasy, T. Quach, C. Bozada, G. DeSalvo, R. Dettmer, J. Ebel, J. Gillespie, K. Nakano, G. Via, *Wright Laboratory, WPAFB, OH*

9:45 a.m.

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D.4 ION-IMPLANTED WN 0.25 (M GATE MESFET FABRICATED USING I-LINE PHOTOLITHOGRAPHY FOR APPLICATION TO MMIC AND DIGITAL IC, E. Oh, J. Yang, C. Park, K. Pyun, *Electronics and Telecommunications Research Institute, Taejon, KOREA*

10:05 a.m. - 10:25 a.m.

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D.5 IMPROVEMENT OF BREAKDOWN VOLTAGE IN InGaP/InGaAs/GaAs HETEROSTRUCTURE MESFET FOR MMICs, K. Inoue, Y. Yamane, K. Shiojima, M. Tokumitsu, F. Hyuga, K. Yamasaki, *NTT, Kanagawa, JAPAN*

10:45 a.m.

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D.6 DOUBLE RECESSED AlInAs/GaInAs/InP HEMTs WITH HIGH BREAKDOWN VOLTAGES, K. Hur, R. McTaggart, B. LeBlanc, W. Hoke, P. Lemonias, A. Miller, T. Kazior, L. Aucoin, *Raytheon Co., Andover, MA*

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D.7 0.15 (M InGaAs/AlGaAs/GaAs HEMT PRODUCTION PROCESS FOR HIGH PERFORMANCE V-BAND POWER MMICs, R. Lai, M. Biedenbender, J. Lee, K. Tan, D. Streit, P. Liu, M. Hoppe, B. Allen, *TRW, Redondo Beach, CA*

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D.8 UNDERSTANDING THE CAUSE OF IV KINK IN GaAs MESFETs WITH 2D NUMERICAL SIMULATIONS, M. Wilson, P. Zdebel, P. Wennekers, R. Anholt, *Motorola, Tempe, AZ*

11:45 a.m.

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SESSION E: MATERIALS, MANUFACTURING, AND PACKAGING

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Chairmen: M. Hoppe, *TRW, Redondo Beach, CA*
T. Henderson, *Texas Instruments, Dallas, TX*

8:35 a.m.

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E.1 LARGE DIAMETER III-V SUBSTRATES: CURRENT ISSUES AND PERSPECTIVE, (Invited Paper) S. Sawada, K. Oida, H. Miyajima, K. Nambu, R. Nakai, R. Tatsumi, K. Fujita, Y. Nishida, *Sumitomo, Hyogo, JAPAN*

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E.2 MANAGING HIGH WAFER YIELD AND SHORT CYCLE TIME, (Invited Paper) S. Khetan, P. Fowler, *ANADIGICS, Warren, NJ*

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E.3 STATISTICAL CIRCUIT SIMULATION WITH MEASUREMENT-BASED ACTIVE DEVICE MODELS: IMPLICATIONS FOR PROCESS CONTROL AND IC MANUFACTURABILITY, D. Root, D. McGinty, B. Hughes, *Hewlett-Packard, Santa Rosa, CA*

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E.4 A TWO LAYER HERMETIC-LIKE COATING PROCESS FOR ON-WAFER ENCAPSULATION OF GaAs MMICs, T. Kaleta, C. Varmazis, P. Chinoy, M. Murphy, N. Jansen, M. Loboda, *M/A Com, Lowell, MA*

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E.5 A VERY HIGH ISOLATION GaAs SPDT SWITCH IC SEALED IN AN ULTRA-COMPACT PLASTIC PACKAGE, H. Uda, T. Hirai, H. Tominaga, K. Nogawa, T. Sawai, T. Higashino, Y. Harada, *Sanyo, Osaka, JAPAN*

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E.6 THE BOOTSTRAP GATE FET (BGFET) - A NEW CONTROL TRANSISTOR, R. Bayruns, K. Li, D. Osika, D. Stofman, *ANADIGICS, Warren, NJ*

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E.7 THE EFFECTS OF HYDROGEN AND DEUTERIUM INCORPORATION ON THE ELECTRICAL PERFORMANCE OF A GaAs MESFET, D. Eng, R. Culbertson, K. MacWilliams, *The Aerospace Corp., Los Angeles, CA*

11:35 a.m.

End of Session E

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Exhibition Lunch

Lower Exhibit Hall

SESSION F: HBTs: POWER ISSUES, RELIABILITY, AND NOVEL PROCESSING

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1:40 p.m.

Harbor Island Ballroom 1

Chairmen: D. Johnson, *Vitesse Semiconductor, Camarillo, CA*
D. Mayer, *The Aerospace Corp., Los Angeles, CA*

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F.1 THERMAL MANAGEMENT TO AVOID THE COLLAPSE OF CURRENT GAIN IN POWER HBTs, (Invited Paper) W. Liu, *Texas Instruments, Dallas, TX*

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F.2 RELIABILITY OF SELF-ALIGNED, LEDGE PASSIVATED 7.5 GHz GaAs/AlGaAs HBT POWER AMPLIFIERS UNDER RF BIAS STRESS AT ELEVATED TEMPERATURES, T. Henderson, P. Ikalainen, *Texas Instruments, Dallas, TX*

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F.3 MICROWAVE POWER HETEROJUNCTION BIPOLAR TRANSISTORS FABRICATED WITH THERMAL SHUNT AND BATHTUB, C. Bozada, D. Barlage, J. Barrette, R. Dettmer, M. Mack, J. Sewell, G. Via, *Wright Laboratory, WPAFB, OH*, L. Yang, D. Helms, J. Komiak, *Lockheed Martin, Syracuse, NY*

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F.4 HIGH POWER AlGaAs/GaAs HBTs FOR Ka-BAND OPERATION, C. Kim, S. Tanaka, Y. Amamiya, N. Furuhashi, H. Shimawaki, Y. Miyoshi, N. Goto, K. Honjo, *NEC, Ibaraki, JAPAN*

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F.5 OVER 220 GHz Ft and Fmax InP/InGaAs DOUBLE-HETEROJUNCTION BIPOLAR TRANSISTORS WITH A NEW HEXAGONAL-SHAPED EMITTER, S. Yamahata, K. Kurishima, H. Ito, Y. Matsuoka, *NTT, Kanagawa, JAPAN*

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F.6 A NOVEL PROCESSING TECHNIQUE TO REDUCE BC CAPACITANCE IN HBTs, W. Liu, D. Hill, H. Chau, J. Sweder, *Texas Instruments, Dallas, TX*

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F.7 PHYSICAL MODELING OF SURFACE AND HETEROJUNCTION FOR MESA-STRUCTURED HBTs, E. Kan, R. Dutton, *Stanford University, Stanford, CA*

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Chairmen: R Mand, *Furukawa Electric Technology, Santa Clara, CA*
P. Robertson, *Sandia National Laboratory, Albuquerque, NM*

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G.1 THE USE OF III-V ICs IN WDM NETWORK

ELEMENTS, (Invited Paper) J. Sitch, C. Dr  ze, D. Pollex,
K. Warbrick, K. Lowe, E. Best, T. Wilson, P. Corr, G.
Weston, *BNR, Ottawa, Ontario, CANADA*

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G.2 LOW-POWER, HIGH-SPEED InGaAs/InP

PHOTO-RECEIVER FOR HIGHLY PARALLEL

OPTICAL DATA LINKS, M. Lovejoy, G. Patrizi, P.

Enquist, B. Ross, D. Slater, R. Shul, R. Carson, D. Craft, D.
Rieger, J. Hutchby, *Sandia National Labs, Albuquerque, NM*

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G.3 A MONOLITHICALLY INTEGRATED

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DOUBLE-HETEROSTRUCTURE BIPOLAR

TRANSISTOR TECHNOLOGIES FOR

OPTICAL/MICROWAVE INTERACTION SYSTEMS, H.

Kamitsuna, Y. Matsuoka, S. Yamahata, K. Kurishima, *NTT,*
Kanagawa, JAPAN

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G.4 INTEGRATING OPTICAL RECEIVER

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C. Brys, P. DeDobbelaere, P. van Daele, P. Demeester T.

Martinson, W. B  chtold, *Swiss Federal Institute of*
Technology, Zurich, SWITZERLAND

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G.5 NOVEL DISTRIBUTED BASEBAND AMPLIFYING

TECHNIQUES FOR 40-GB/S OPTICAL

COMMUNICATION, S. Kimura, Y. Imai, Y. Miyamoto,

NTT, Atsugi, JAPAN

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G.6 A PACKAGED BROADBAND MONOLITHIC

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AlGaAs/GaAs HBT TECHNOLOGY, R. Yu, S. Beccue, P.

Zampardi, R. Pierson, K. Wang, *Rockwell International,*
Thousand Oaks, CA

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G.7 A 10 GB/S AlGaAs/GaAs HBT HIGH POWER FULLY

DIFFERENTIAL LIMITING DISTRIBUTED

AMPLIFIER FOR III-V MACH-ZEHNDER

MODULATOR, T. Wong, *Bell-Northern Research, Ottawa,*
Ontario, CANADA

4:35 p.m.

End of Session G

6:00 p.m. - 10:00 p.m.

Symposium Party

Sea World

REGISTRATION AND CONTINENTAL BREAKFAST

7:00 a.m. - 12:00 noon

Registration+Harbor Island Foyer

7:00 a.m. - 8:00 a.m.

Continental Breakfast+Harbor Island Foyer

SESSION H: MILLIMETER WAVE APPLICATIONS AND TECHNIQUES

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8:30 a.m.

Harbor Island Ballroom 1

Chairmen: P. Staecker, *M/A Com, Lowell, MA*
T. Ho, *Ho-Tech International, Rockville, MD*

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H.1 LOW COST MILLIMETER-WAVE MONOLITHIC INTEGRATED CIRCUITS USING DIRECT ION IMPLANTED GaAs MESFETs, M. Feng, D. Scherrer, P. Apostolakis, J. Middleton, *University of Illinois, Urbana, IL*, M. McPartlin, B. Lauterwasser, J. Oliver, *Raytheon Co., Andover, MA*

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H.2 A Q-BAND HIGH GAIN AND LOW NOISE VARIABLE GAIN AMPLIFIER USING DUAL GATE HEMTs, T. Kashiwa, T. Katoh, H. Matsubayashi, N. Yoshida, M. Komaru, T. Takagi, O. Ishihara, *Mitsubishi, Hyogo, JAPAN*

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H.3 110 GHz AMPLIFIERS BASED ON COMPACT COPLANAR W-BAND RECEIVER TECHNOLOGY, M. Schlechtweg, W. Haydl, J. Braunstein, P. Tasker, A. Bangert, W. Reinert, L. Verweyen, H. Massler, J. Seibel, K. Zffle, W. Bronner, T. Fink, A. Hflsmann, P. Hofmann, G. Kaufel, K. KÜhler, B. Raynor, J. Schneider, *Fraunhofer Institute, Freiburg, GERMANY*

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H.4 MONOLITHIC MILLIMETER WAVE SCHOTTKY DIODE-BASED FREQUENCY CONVERTERS WITH LOW DRIVE REQUIREMENTS USING AN InP HBT-COMPATIBLE PROCESS, E. Lin, H. Wang, K. Chang, L. Tran, J. Cowles, T. Block, D. Lo, G. Dow, A. Oki, D. Streit, B. Allen, *TRW, Redondo Beach, CA*

9:55 a.m. - 10:15 a.m.

Coffee Break

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H.5 60 GHz MMIC IMAGE-REJECTION DOWNCONVERTER USING InGaP/InGaAs HEMT, T. Saito, K. Ono, N. Hidaka, *Advanced Millimeter Wave Technologies Co., Kawasaki, JAPAN*, T. Shimura, Y. Ohashi, *Fujitsu, Kawasaki, JAPAN*

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H.6 MMIC-BASED W-BAND DICKE SWITCHED DIRECT-DETECTION RECEIVER, D. Lo, E. Lin, H. Wang, M. Biedenbender, R. Lai, G. Ng, G. Dow, B. Allen, *TRW, Redondo Beach, CA*

10:55 a.m.

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H.7 HIGHLY INTEGRATED AND COMPACT W-BAND FRONT-END FOR RADIOMETRY APPLICATION, M. Camiade, C. Dourlens, V. Serru, P. Savary, J. Blanc, *Thompson CSF, Orsay Cedex, FRANCE*

11:15 a.m.

End of Session H