



IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES

JANUARY 1983

VOLUME MTT-31

NUMBER 1

(ISSN 0018-9480)

A PUBLICATION OF THE IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY



JOINT SPECIAL ISSUE ON MONOLITHIC MICROWAVE IC's

Also published in IEEE Transactions on Electron Devices, Volume ED-30, Number 1

FOREWORD	V. G. Gel'novatch	1
SPECIAL ISSUE PAPERS		
Design, Fabrication, and Evaluation of 2- and 3-Bit GaAs MESFET Analog-to-Digital Converter IC's	L. C. Upadhyayula, W. R. Curtice, and R. Smith	2
Ka-Band Monolithic GaAs Balanced Mixers	C. Chao, A. Contolatis, S. Jamison, and P. Bauhahn	11
Yield Considerations for Ion Implanted GaAs MMIC's	A. K. Gupta, W. C. Peterson, and D. R. Decker	16
A Two-Stage Monolithic IF Amplifier Utilizing a Ta ₂ O ₅ Capacitor	A. Chu, L. J. Mahoney, M. E. Elta, W. E. Courtney, M. C. Finn, W. J. Piacentini, and J. P. Donnelly	21
SPECIAL ISSUE SHORT PAPERS		
A Monolithic GaAs DC to 2 GHz Feedback Amplifier	W. C. Peterson, A. K. Gupta, and D. R. Decker	27
Monolithic GaAs Interdigitated Couplers	M. Kumar, S. N. Subbarao, R. J. Menna, and H.-C. Huang	29
EDITORIAL		
	R. H. Knerr	33
REGULAR PAPERS		
Coupling Coefficient Between Microstrip Line and Dielectric Resonator	Y. Komatsu and Y. Murakami	34
A Low-Pass Prototype Network Allowing the Placing of Attenuation Poles at Real Frequencies	D. S. G. Chambers and J. D. Rhodes	40
Electronically Cold Microwave Artificial Resistors	R. L. Forward and T. C. Cisco	45
Improving the Power-Added Efficiency of FET Amplifiers Operating with Varying-Envelope Signals	A. A. M. Saleh and D. C. Cox	51
Design of Interdigitated Capacitors and their Application to Gallium Arsenide Monolithic Filters	R. Esfandiari, D. W. Maki, and M. Siracusa	57
Optimized Waveguide E-Plane Metal Insert Filters for Millimeter-Wave Applications	R. Vahldieck, J. Bornemann, F. Arndt, and D. Grauerholz	65
SHORT PAPERS		
Capabilities of Multiapplicator Systems for Focussed Hyperthermia	R. Knoechel	70
Field Theory of Planar Helix Traveling-Wave Tube	D. Chadha, S. Aditya, and R. K. Arora	73
Choosing Line Lengths for Calibrating Network Analyzers	C. A. Hoer	76
Optical Injection Locking of BARITT Oscillators	R. Heidemann and D. Jäger	78
LETTERS		
Comments on "A Rigorous Technique for Measuring the Scattering Matrix of a Multiport Device with a Two-Port Network Analyzer"	H. Dropkin	79
Comment on "The Exact Noise Figure of Amplifiers with Parallel Feedback and Lossy Matching Circuit"	J. Engberg	81
PATENT ABSTRACTS		
	N. R. Dietrich	82
ANNOUNCEMENTS		
Special Issue on Electromagnetic Wave Interactions with Biological Systems		86
IEEE COPYRIGHT FORM		
		87



IEEE MICROWAVE THEORY AND TECHNIQUES SOCIETY

The Microwave Theory and Techniques Society is an organization, within the framework of the IEEE, of members with principal professional interest in the field of microwave theory and techniques. All members of the IEEE are eligible for membership in the Society and will receive this TRANSACTIONS upon payment of the annual Society membership fee of \$8.00. Affiliate membership is available upon payment of the annual affiliate fee of \$22.00. For information on joining write to the IEEE at the address below.

ADMINISTRATIVE COMMITTEE

C. T. RUCKER, *President*

H. G. OLTMAN, JR., *Vice President*

N. W. COX, *Secretary-Treasurer*

S. F. ADAM*

J. E. DEGENFORD, JR.

V. G. GELNOVATCH

P. T. GREILING

R. B. HICKS

* *Ex officio (past presidents)*

H. HOWE, JR.

T. ITOH

F. IVANEK

G. JERICIC

R. H. KNERR

Honorary Life Members

Y. KONISHI

H. J. KUNO

S. L. MARCH

D. N. MCQUIDDY, JR.

E. C. NIEHENKE

J. M. ROE

F. J. ROSENBAUM*

R. A. SPARKS*

B. E. SPIELMAN

Distinguished Lecturers

A. C. BECK

S. B. COHN

D. D. KING

W. W. MUMFORD

A. A. OLINER

T. S. SAAD

K. TOMIYASU

L. YOUNG

J. A. GIORDMAINE

S. ADAM

S-MTT Chapter Chairmen

Albuquerque: R. L. GARDNER

Atlanta: J. A. FULLER

Baltimore: D. BUCK

Benelux: A. GUISSARD

Boston: G. THOREN

Boulder/Denver: C. T. JOHNK

Buffalo: INACTIVE

Canaveral: G. G. RASSWEILLER

Central Illinois: G. E. STILLMAN

Chicago: R. M. HARGIS

Columbus: E. WALTON

Connecticut: M. GILDEN

Dallas: M. H. BEASLEY, JR.

Florida West Coast: M. MOCZYNSKI

Houston: W. L. WILSON, JR.

Huntsville: M. D. FAHEY

India: S. R. K. ARORA

Israel: A. MADJAR

Kitchener-Waterloo: Y. L. CHOW

Los Angeles: F. J. BERNUES

Milwaukee: C. J. KOTLARZ

Montreal: J. L. LEIZEROWICZ

New Jersey Coast: M. V. SCHNEIDER

New York/Long Island: J. HAUSNER

North Jersey: R. SNYDER

Orange County: J. C. AUKLAND

Orlando: C. F. SCHUNEMANN

Ottawa: J. WIGHT

Philadelphia: C. C. ALLEN

Phoenix: H. GORONKIN

Portland: INACTIVE

Princeton: C. UPADHYAYULA

San Diego: J. H. ZICKGAF

Santa Clara Valley: J. CRESCENZI

Schenectady: R. A. DEHN; J. BORREGO

Seattle: C. K. CHOU

Southeastern Michigan: P. I. PRESSEL

St. Louis: W. P. CONNORS

Syracuse: B. MITCHELL

Tokyo: T. OKOSHI

Tucson: E. P. PIERCE

Washington, DC: J. H. DOUGLAS

IEEE TRANSACTIONS® ON MICROWAVE THEORY AND TECHNIQUES

Editor

T. ITOH

N. R. DIETRICH

(*Patent Abstracts*)

Associate Editors

F. IVANEK

E. YAMASHITA

(*Abstracts Editor—Asia*)

Address all manuscripts to the Editor, T. Itoh, Dept. of Electrical Engineering, University of Texas at Austin, Austin, TX 78712. Submission of three copies of manuscripts, including figures, will expedite the review. *Publication Policy:* All papers will be reviewed for their technical merit, and decisions to publish will be made independently of an author's ability or willingness to pay charges. Voluntary page charges of \$95 per printed page will be requested for papers of five pages or less. Page charges of \$100 per page are mandatory for each page in excess of five printed pages. Also, the MTT-S Administrative Committee has established a quota for the number of pages printed in each issue of this TRANSACTIONS whose costs are not defrayed by payment of page charges. Papers not covered by page charges may be delayed until space in an issue is available. The Editor can waive the quota requirement for exceptional papers or because of other extenuating circumstances.

THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC.

Officers

JAMES B. OWENS, *President*

RICHARD J. GOWEN, *President-Elect*

CHARLES A. ELDON, *Executive Vice President*

CYRIL J. TUNIS, *Treasurer*

V. PRASAD KODALI, *Secretary*

J. BARRY OAKES, *Vice President, Educational Activities*

EDWARD J. DOYLE, *Vice President, Professional Activities*

G. P. RODRIGUE, *Vice President, Publication Activities*

MERRILL W. BUCKLEY, JR., *Vice President, Regional Activities*

JOSE B. CRUZ, JR., *Vice President, Technical Activities*

EMERSON W. PUGH, *Division IV Director*

Headquarters Staff

ERIC HERZ, *Executive Director and General Manager*

ELWOOD K. GANNETT, *Deputy General Manager*

THOMAS W. BARTLETT, *Controller*

DONALD CHRISTIANSEN, *Editor of Spectrum*

IRVING ENGELSON, *Staff Director, Technical Activities*

LEO FANNING, *Staff Director, Professional Activities*

SAVA SHERR, *Staff Director, Standards*

DAVID L. STAIGER, *Staff Director, Publishing Services*

CHARLES F. STEWART, JR., *Staff Director, Administration Services*

DONALD L. SUPPERS, *Staff Director, Field Services*

THOMAS C. WHITE, *Staff Director, Public Information*

JOHN F. WILHELM, *Staff Director, Professional Activities*

Publications Department

Production Managers: ANN H. BURGMAYER, CAROLYN ELENOWITZ, GAIL S. FERENC*,

Associate Editors: JOHN DE GASPARI, MARY E. GRANGEIA, THOMAS R. GRECO,

JEFFREY S. MARTIN, NELA RYBOWICZ, BARBARA A. SOMOGYI

* *Responsible for this Transactions*

IEEE TRANSACTIONS ON MICROWAVE THEORY AND TECHNIQUES is published monthly by The Institute of Electrical and Electronics Engineers, Inc. **Headquarters:** 345 East 47 Street, New York, NY 10017. Responsibility for the contents rests upon the authors and not upon the IEEE, the Society, or its members. **IEEE Service Center** (for orders, subscriptions, address changes, Region/Section/Student Services): 445 Hoes Lane, Piscataway, NJ 08854. **Telephones:** Headquarters 212-705 + extension: Information -7900, General Manager -7910, Controller -7748, Educational Services -7860, Publishing Services -7560, Standards -7960, Technical Services -7890. **IEEE Service Center** 201-981-0060. **Professional Services:** Washington Office 202-785-0017. **NY Telecopier:** 212-752-4929. **Telex:** 236-411 (International messages only). Individual copies: IEEE members \$6.00 (first copy only), nonmembers \$12.00 per copy. Annual subscription price: IEEE members, dues plus Society fee. Price for nonmembers on request. Available in microfiche and microfilm. **Copyright and Reprint Permission:** Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limits of U.S. Copyright law for private use of patrons, (1) those post-1977 articles that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through the Copyright Clearance Center, 21 Congress Street, Salem, MA 01970; (2) pre-1978 articles without fee. Instructors are permitted to photocopy isolated articles for noncommercial classroom use without fee. For other copying, reprint or republication permission, write to Director, Publishing Services at IEEE Headquarters. All rights reserved. Copyright © 1983 by The Institute of Electrical and Electronics Engineers, Inc. Printed in U.S.A. Second-class postage paid at New York, NY and at additional mailing offices. **Postmaster:** Send address changes to IEEE, 445 Hoes Lane, Piscataway, NJ 08854.