A Guide to LSI Implementation

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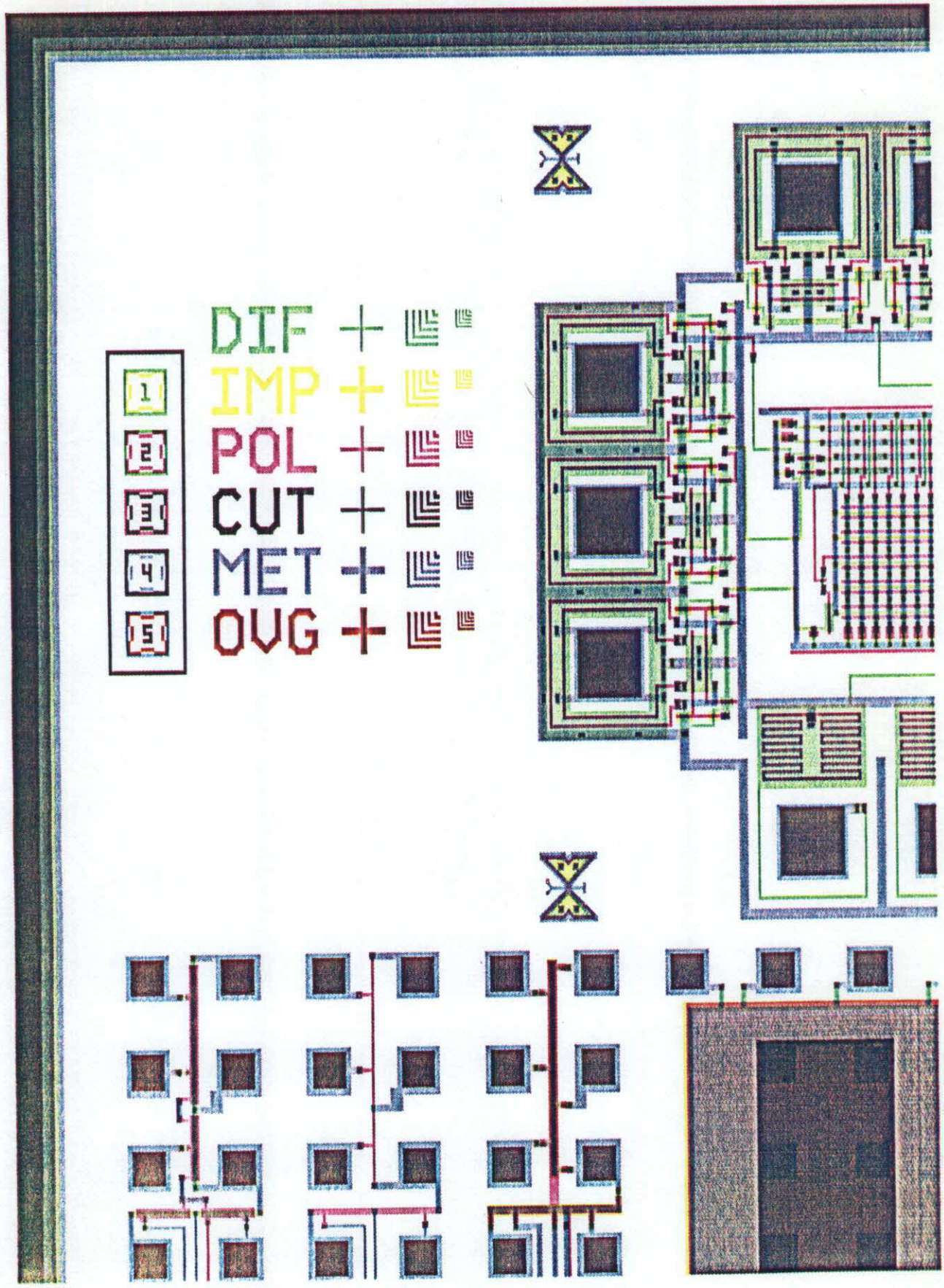
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Foreword

This book was produced as a result of the 1978 Summer Program of the LSI Systems Area of Xerox Palo Alto Research Center (PARC). This program involved the participation of summer employees Bob Baldwin (undergraduate at MIT), Peter Dobrowolski (master's student at UC Berkeley), Bob Hon (Ph.D. student at Carnegie-Mellon University), and Steve Trimberger (Ph.D. student at UC Irvine). These students and our consultants Carlo Sequin (professor at UC Berkeley), Carver Mead (professor at Caltech), and Jim Rowson and Dave Johannsen (Ph.D. students at Caltech) have spent the summer working with us on various aspects of integrated systems design and implementation, including a multi-project chip and this document. Xerox employees who participated in the program include Rick Davies (General Sciences Lab), Maureen Stone (Advanced Systems Department), and our own group members Lynn Conway, Doug Fairbairn, Dick Lyon, and Wayne Wilner.

In spite of the difficulty of working on a short schedule with people of widely differing backgrounds, co-editors Bob Hon and Carlo Sequin have managed to produce this timely document, to help bring integrated system capability to a wide range of users, including universities. Bob Hon, the principal author, has collected considerable relevant information about current patterning and fabrication technologies, and prospects for future changes that readers should be aware of; he also personally carried the PARC summer-1978 multi-project chip from individual project designs through maskmaking, and arranged for subsequent processing.

The other three students cooperated in the writing of this book by contributing sections, and became involved in the multi-project chip by producing project designs and by helping with design tools. Bob Baldwin assisted in establishing a cell library, designing two projects, writing design conversion software, and documenting his work in sections of this book. Steve Trimberger is building our new design system, and has built some of our existing tools; he has provided the writeup on automated design systems, and designed a project with the aid of a hybrid of our graphical layout system and a general purpose programming language. Peter Dobrowolski designed and built some IC test hardware for us this summer, and wrote the book section which summarizes testing strategies; in addition, his chip project illustrates the use of PLA's for a novel bit-staggered timing scheme for fast arithmetic functions.

Rick Davies provided the section on process test patterns, documenting his project on the chip. Maureen Stone wrote a section on symbolic layout languages and the appendix on ICLIC. Within our own group, Wayne Wilner has described the problem of design rule checking, and Dick Lyon

has provided the section on circuit simulation.

Carver Mead provided important technical advice and encouragement. Lynn Conway (manager of our LSI Systems Area) provided the drive that it took to make this book happen. She and Carver have recently written the book *Introduction to VLSI Systems*, which is assumed to be available as a reference with this document.

Richard F. Lyon
Douglas G. Fairbairn

The authors would like to acknowledge the help of Dick Lyon, who spent considerable time working on this document as the final deadline approached.

Bob Hon
Carlo Sequin