

1999 SYMPOSIUM ON VLSI TECHNOLOGY

DIGEST OF TECHNICAL PAPERS



☐ The Japan Society of Applied Physics



☐ The IEEE Electron Devices Society



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FOREWORD

001716

Welcome to the 1999 Symposium on VLSI Technology

Widely spread multimedia applications, including networks, require high speed, low power and low cost system VLSIs. On the other hand, as design rules approach to $0.1\ \mu\text{m}$ or less, many technology barriers remain to be solved. A new paradigm for developing VLSIs has to be introduced, instead of traditional scaling. In these circumstances, the 1999 Symposium on VLSI Technology focuses on technology for realizing high performance and low cost system VLSIs.

For the plenary session, we have two distinguished invited speakers. Mr. Yoshiaki Kushiki from Matsushita, will speak on the Digital Consumer Electronics Evolution in the Multimedia and Network Age, and Mr. Daniel T. Niles from BancBoston Robertson Stephens will speak on the Silicon Opportunity of the New Millenium—Digital Information Appliances.

Out of more than 210 papers submitted from all over the world, 79 high-quality papers have been selected and organized into 20 sessions. This year, we have a joint special session on Technology for System LSI in the afternoon of Wednesday, June 16, which will provide a good opportunity for both technology and circuit engineers to discuss solution oriented technology for system VLSIs.

To provide a forum for informal discussion on important and timely topics, three regular rump session and one joint rump session have been organized in the evening of June 15, and June 16, respectively. The regular sessions are on "Technology Challenges for Scaled Cu/Low k Interconnects", "Gate Insulator: Hi-k vs. SiO_2 " and "Flash vs. FeRAM: Which is the real winner?" and the joint session is on "SOI", which is the common topic for both technology and circuit communities.

Preceding the Symposium, a one-day short course on the Embedded Technologies for System on a Chip is scheduled on June 13.

Special thanks for the success of the Symposium are due to the program chairman, M. Kakumu and the co-chairman, C. Lage; to secretaries, T. Kunio and B. Havemann; to publications, M. Ohkura and W-K Loh; to treasurers, S. Konaka and R. Jaeger; to local arrangements, Y. Inoue, S. Matsumoto and Y. Taur; to short course organizers, T. Nishimura and S. Wong.

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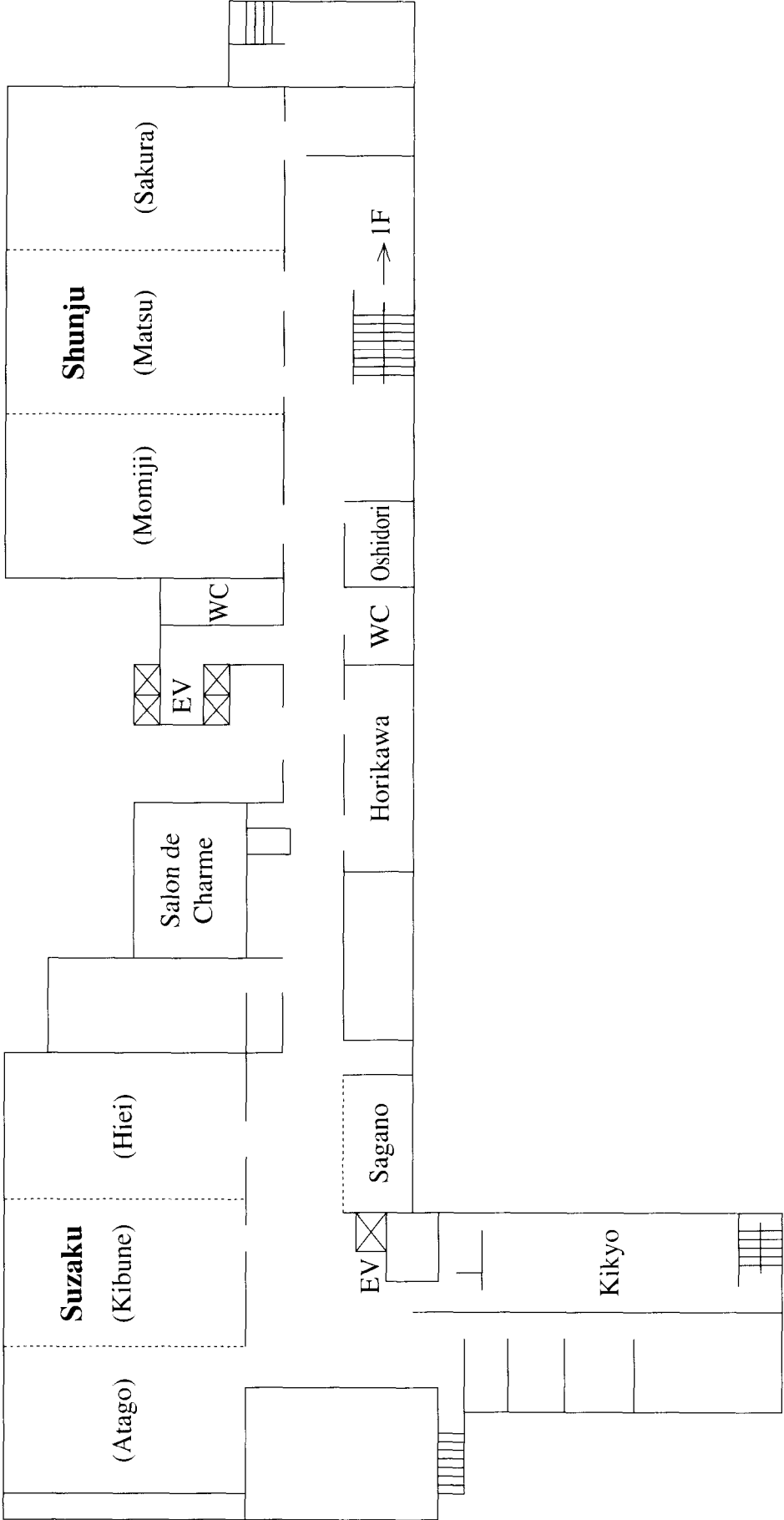
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2F FLOOR MAP



1999 SYMPOSIUM ON VLSI TECHNOLOGY—CONFERENCE SCHEDULE

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[Shunju I] = [Momiji] + [Matsu], [Shunju II] = [Sakura]

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C. Lage, *Motorola*

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C. Lage, *Motorola*

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Digital Consumer Electronics Evolution in the Multimedia and Network Age

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Abstract

The rapid progress of semiconductors and software has improved the performance, features and form of digital consumer electronics products. The key technologies here are the one-chip LSI solution, merging memory and processor, system LSI-zation, and software solutions for multimedia processing and device control. Towards the 21st century, End-to-End networks, which include digital consumer electronics devices as an important element, are expected to proliferate. New solutions for digital consumer electronics are required.

Introduction

Information and communication technology has benefited greatly in the past few decades from the improvement and development of digital technology including computers, semiconductors and networking. Nowadays, such digitalization is having a wide and profound impact in the area of consumer electronics devices as the latest wave of the multimedia revolution.

It is well known that digital technologies, such as high performance microprocessors, high-speed compression and decompression of audio/video data and a high level of integration of semiconductors which enables miniaturization and low power consumption, contributes to the widespread use of digital consumer electronics devices like DVD, STB, digital cellular phones, etc. However, it is worthy of note that software processing such as video/audio decompression and device control is vital for the major features of digital consumer electronics devices, and this has caused a recent increase in software size.

Thus, the key feature in the realization of digital consumer electronics devices has been the software solution for multimedia processing, as well as the one-chip LSI solution by merging memory and processor, and system LSI-zation which enables real-time processing of video/audio, low power consumption and miniaturization of device.

However, regarding the solutions for digital consumer electronics, a new platform shift is now required as a use for digital network consumer electronics, since digital broadcasting, the Internet and IEEE 1394 have become widespread. In this paper, what types of services will be advanced towards the 21st century, and what types of solutions will be required for digital consumer electronics products are discussed by referring to their past history, transitions and future development.

Multimedia Revolution and Digital Consumer Electronics

Digitalization of devices, started with the introduction of the microcomputer in consumer electronics products 25 years ago, has improved in performances and functions in tandem with the progress of semiconductor technology. The transition of digital consumer electronics products can be classified into the following three levels:

(1) Digital Control Consumer Electronics products

In the mid-1970s, the microcomputer was introduced into washing machines and microwave ovens, and their performances and features were dramatically improved by device control by microcomputer. This was the era of digitalization of device control, and these products are called "Digital Control Consumer Electronics" products.

(2) Digital Media Consumer Electronics products

At the beginning of 1980, digital-signal processing for characters and voice band was enabled, and products such as the CD, personal computer and word processor were developed. The word, "Multimedia", was first coined around 1988. It was in this timeframe that the AD converter was incorporated into CMOS-LSI, then digital processing of video became feasible. In the 1990s, many multimedia devices including the Digital Video Camera (DVC), Car Navigation, Cellular Phone, and Digital Video Disk (DVD) were successfully developed. This was the era of digitalization of contents as media, and these products are called "Digital Media Consumer Electronics" products.

(3) Digital Network Consumer Electronics products

Now the digital network society is ushering in a new era, in which the digitalization of broadcasting and high-speed/large-capacity of communication unite broadcasting and communication. The consumer electronics products in this era are called "Digital Network Consumer Electronics" products, due to the fact that they can send or receive various types of information and services through a network connection between content providers and equipment, or a home network of Digital Media Consumer Electronics products.

As shown in Fig.1, we are now in a market expansion period of Digital Media Consumer Electronics, as well as a technological development period of Digital Network Consumer Electronics in which network features are incorporated and a new kind of culture and life style are