

HITACHI

Hitachi, Ltd.
Semiconductor and IC Division
Nippon Building
6-2, Otemachi 2-chome
Chiyoda-ku, Tokyo 100, Japan
Telephone: (81) (3) 3212-1111
Web Site: www.hitachi.co.jp/Sicd

IC Manufacturer
Founded: 1969

Regional Headquarters/Representative Locations

North America: Hitachi America, Ltd., Semiconductor and IC Division • Brisbane, California
 Telephone: (415) 589-8300 • Fax: (415) 583-4207

Europe: Hitachi Europe, Ltd., Berkshire, U.K. Hitachi Europe GmbH, PoStafach, Germany
 Telephone: 44-16-28-585-000 Telephone: 49-89-991-1800

Asia: Hitachi Asia Pte. Ltd., Singapore Hitachi Asia Ltd., Hong Kong
 Telephone: 65-535-2100 Telephone: 852-2375-9218

Hitachi Asia Pte. Ltd., Taipei Branch Office Hitachi Asia Ltd., Seoul Branch Office
 Telephone: 886-2-718-3115 Telephone: 82-2-796-3115

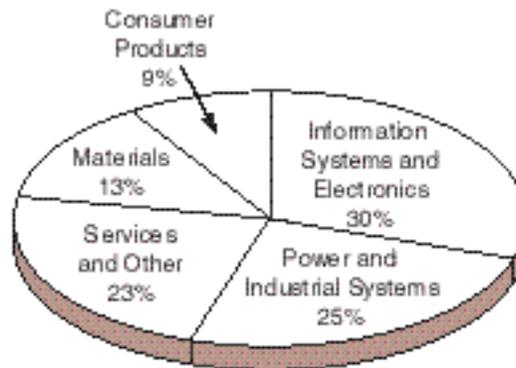
Financial History, Fiscal Year Ends March 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (¥B)						
Sales	¥7,766	¥7,536	¥7,400	¥7,592	¥8,124	¥8,523
Net Income	¥128	¥77	¥65	¥114	¥142	¥88
Semiconductor (\$M)*						
Sales	\$4,150	\$5,100	\$6,960	\$9,825	\$8,294	\$6,925
IC Sales	\$3,600	\$4,430	\$5,940	\$8,630	\$7,254	\$6,302
Discrete Sales	\$550	\$670	\$1,020	\$1,195	\$1,040	\$623
Capital Expenditures	\$515	\$785	\$1,115	\$1,755	\$1,388	\$1,177
Employees	—	—	—	15,000	15,000	15,000

*Calendar Year

Company Overview and Strategy

Hitachi, Ltd. is one of the largest companies in the world with about \$70 billion dollars in sales and over 330,000 employees around the world. Hitachi's product lines include automotive and computer equipment, semiconductors, office automation systems, power generation systems, consumer electronics, and telecommunications equipment. The company contributes nearly two percent of Japan's annual GNP and accounts for about six percent of the country's total R&D spending.



1997 Corporate Sales by Business Segment

Hitachi's semiconductor business emerged in the late 1950's and early 1960's when it started producing transistors. Production of integrated circuits followed in 1966. The Semiconductor and IC Division was established in 1969 and Hitachi has since grown into Japan's second largest semiconductor manufacturer, behind NEC, and the fourth largest in the world. It is among the world's leading SRAM and DRAM suppliers. The company's other semiconductor products include microprocessors and embedded controllers, ASICs, ASSPs such as telecommunications ICs and hard disk drive ICs, standard linear and logic ICs, and discrete devices.

Management

Hitachi, Ltd.

Tsutomu Kanai	President
Tsugio Makimoto	Executive Managing Director, Electronic Components Group
Kosei Nomiya	General Manager, Semiconductor and IC Division
Tokumasa Yasui	Deputy General Manager, Memory Business Operation, Semiconductor and IC Division

Hitachi America, Ltd.

William L. Gsand	General Manager, Semiconductor and IC Division
Hiromu Fukuda	President and Chief Executive Officer, Hitachi Semiconductor (America) Inc.
Jim Hartman	Vice President, Operations, Hitachi Semiconductor (America) Inc.
James F. Watson	President, TwinStar Semiconductor, Inc.

Products and Processes

Hitachi is decreasing its emphasis on the MOS memory IC market. In fact, 1996 marked the first year in which its MOS memory ICs were not the largest revenue generating product category. The company plans to increase its DRAM shipments at about the market's annual growth rate, allowing its memory business to shrink to about 28 percent of sales by 1999, down from 51 percent in 1995, while increasing sales of microprocessors/controllers and ASICs from 33 percent in 1995 to about 52 percent by 1999.

<p>MOS MEMORY</p> <table border="0"> <tr><td><input checked="" type="checkbox"/></td><td>DRAM</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>SRAM</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Flash Memory</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>EPROM</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>ROM</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>EEPROM</td></tr> <tr><td><input type="checkbox"/></td><td>Other (Including Non-Volatile RAM)</td></tr> </table>	<input checked="" type="checkbox"/>	DRAM	<input checked="" type="checkbox"/>	SRAM	<input checked="" type="checkbox"/>	Flash Memory	<input checked="" type="checkbox"/>	EPROM	<input checked="" type="checkbox"/>	ROM	<input checked="" type="checkbox"/>	EEPROM	<input type="checkbox"/>	Other (Including Non-Volatile RAM)	<p>ANALOG</p> <table border="0"> <tr><td><input checked="" type="checkbox"/></td><td>Amplifier</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Interface</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Consumer/Automotive</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Voltage Regulator/Reference</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Data Conversion</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Comparator</td></tr> <tr><td><input checked="" type="checkbox"/></td><td>Other (Includes Telecom)</td></tr> </table>	<input checked="" type="checkbox"/>	Amplifier	<input checked="" type="checkbox"/>	Interface	<input checked="" type="checkbox"/>	Consumer/Automotive	<input checked="" type="checkbox"/>	Voltage Regulator/Reference	<input checked="" type="checkbox"/>	Data Conversion	<input checked="" type="checkbox"/>	Comparator	<input checked="" type="checkbox"/>	Other (Includes Telecom)
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Details concerning Hitachi's semiconductor products are provided below.

Memory ICs

As a leading MOS memory IC manufacturer and supplier, Hitachi provides a variety of memory solutions, including standard DRAMs, synchronous DRAMs, synchronous graphics RAMs, SRAMs, flash memories, mask ROMs, and EEPROMs. In early 1995, the company became one of the first to announce it had developed a 1G DRAM. The prototype chip is based on a 0.16µm process and is not expected to enter production until around the year 2000.

- DRAMs — available in 4M, 16M, and 64M densities.
- Synchronous graphics RAMs (SGRAMs) — available in 8M density (up to 100MHz).
- Video RAMs (VRAMs) — available in 1M and 2M densities.
- CMOS fast SRAMs — available in 256K, 1M and 4M densities with access times as low as 45ns.
- CMOS low power SRAMs — available in 64K to 4M densities with access times as low as 55ns.

- Flash memories — available in 1M to 64M densities and based on DiNOR and AND technologies.
- EDO DRAMs — available in 4M, 16M, 64M, and 128M densities with access times as low as 60ns.
- Synchronous DRAMs (SDRAMs) — available in 2M, 4M, 16M, 64M, and 128M densities.
- EPROM/PROMs — available in 256K to 4M densities.
- EEPROMs — available in 64K to 1M densities.
- Ferroelectric RAMs (FRAMs) — available in 256K density.
- Frame memories — available in 2.5M densities with access times as low as 20ns.
- DRAM Modules offered include: Fast Page mode modules (1M-, 2M-, 4M- and 8M- by x36, x64, or x72), EDO modules (1M-, 2M-, 4M-, 8M-, by x32, x64, or x72), and Synchronous DRAM modules (1M-, 2M-, 4M- by x64).

Microcomponents

Hitachi's embedded controllers include its 4-bit HMCS400 Series, 8-bit H8/300 Series, and 16-bit H8/500 Series (including the new RISC-like H8S Series), as well as its popular 32-bit SuperH (SH) RISC Series. Since the introduction of the SuperH RISC engine series in 1992, the devices are claimed to have been designed into more than 1,000 applications, including video game systems, consumer electronics, office automation products, and industrial systems. As a result, Hitachi is now one of the world's leading suppliers of RISC controllers. The SH-3, which became available in 1995, is capable of 60MIPS at 3.3V. The next-generation SH-4 Series will reportedly include a floating-point unit and run at 300MIPS. Volume shipments of SH-4 chips are expected to begin in 2Q98.

Hitachi also offers microperipheral ICs, including low-power CMOS LCD drivers and controllers for flat panel displays, as well as stand-alone digital signal processors.

ASICs

Hitachi's ASIC products include gate arrays, embedded arrays, and digital/mixed-signal cell-based ICs fabricated in 0.8 μ m, 0.7 μ m, 0.5 μ m, and advanced 0.35 μ m CMOS technologies. Its three-layer-metal 0.5 μ m gate arrays provide up to 500,000 usable gates. In mid-1996, Hitachi unveiled a new series of standard cell ICs, the HG73C Series, which can incorporate a wide variety of cores and cells, including the company's SH 32-bit RISC microcontroller cores and high-speed, high-precision A/D and D/A converters. The HG73C ASICs provide up to five million gates using an advanced 0.35 μ m process.

ASSPs

The company's application-specific standard products include automotive ICs, graphics and imaging circuits, audio/video circuits, and wireless/cellular communications ICs.

Other Standard Products

Hitachi's other semiconductors include general purpose CMOS, bipolar, and BiCMOS logic ICs, standard linear ICs, smart power ICs, RF components, power management devices, keyboard controllers, discrete devices, and optoelectronic components.

Semiconductor Fabrication Facilities

In 1996, Hitachi began the construction of a \$1.2 billion DRAM production facility in Ibaraki. The plant, which is scheduled to open in the first half of 1998, will manufacture 64M DRAMs initially

Hitachi, Ltd., Kodaira Operation
 Kodaira-shi, Tokyo Prefecture, Japan
 Cleanroom size: 82,350 square feet
 Capacity (wafers/week): 17,500
 Wafer sizes: 100mm, 125mm, 150mm
 Processes: CMOS, MOS
 Products: MPUs, MCUs, SRAMs, DRAMs, ASICs, R&D.
 Feature sizes: 0.35 μ m-2.0 μ m

Hitachi, Ltd., Takasaki Operation
 Takasaki-shi, Gunma Prefecture, Japan
 Cleanroom size: 80,000 square feet
 Capacity (wafers/week): 12,000
 Wafer sizes: 125mm, 150mm, 200mm
 Processes: CMOS, MOS, bipolar, BiCMOS
 Products: Telecom and linear ICs, EPROMs, SRAMs, DRAMs, MCUs, discretes.
 Feature sizes: 0.35 μ m-2.0 μ m

Hitachi, Ltd., Kofu Operation
 Nakakoma-gun, Yamanishi Prefecture, Japan
 Capacity (wafers/week): 30,000
 Wafer sizes: 100mm, 125mm, 150mm, 200mm
 Processes: CMOS, MOS
 Products: SRAMs, DRAMs, EPROMs, flash ICs, MPUs, MCUs, logic ICs, discretes.
 Feature sizes: 0.4 μ m-3.0 μ m

Hitachi, Ltd., Komoro Operation
 Komoro-shi, Nagano Prefecture, Japan
 Capacity (wafers/week): 3,750
 Wafer size: 3 in.
 Processes: CMOS, GaAs
 Products: Telecom ICs, optoelectronics
 Feature sizes: 0.5 μ m-1.5 μ m

Hitachi Hokkai Semiconductor, Ltd.
 Chitose-shi, Hokkaido Prefecture, Japan
 Cleanroom size: 20,000 square feet
 Capacity (wafers/week): 3,750
 Wafer size: 150mm
 Process: CMOS
 Products: DRAMs, SRAMs, EEPROMs, ROMs
 Feature sizes: 0.8 μ m, 1.0 μ m

Hitachi Yonezawa Electronics, Co., Ltd.
 Yonezawa-shi, Yamagata Prefecture, Japan
 Capacity (wafers/week): 2,000
 Wafer size: 150mm
 Process: CMOS
 Products: MPUs, MCUs
 Feature sizes: 0.5 μ m, 0.8 μ m

Hitachi, Ltd., Instrument Division
 Hitachinaka-shi, Ibaraki Prefecture, Japan
 Capacity (wafers/week): 8,750
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, SRAMs
 Feature sizes: 0.35 μ m-0.8 μ m

Hitachi, Ltd., Electron Tube and Devices Division
 Mobarashi, Chiba Prefecture, Japan
 Cleanroom size: 60,000 square feet
 Capacity (wafers/week): 22,500
 Wafer sizes: 125mm, 150mm
 Processes: CMOS, MOS
 Products: DRAMs, EPROMs, MCUs, ASICs
 Feature sizes: 0.8 μ m-1.5 μ m

Hitachi Semiconductor (Europe) GmbH
Jenaer Strasse 1
Landshut, Germany
Telephone: (49) (871) 684-0
Cleanroom size: 48,000 square feet
Capacity (wafers/week): 5,000
Wafer sizes: 150mm, 200mm
Process: CMOS
Products: SRAMs, DRAMs, ASICs, MCUs
Feature sizes: 0.35 μ m, 0.5 μ m, 0.8 μ m

Hitachi Semiconductor (America) Inc.
6431 Longhorn Drive
Irving, Texas 75063-2738
Telephone: (214) 580-1514
Cleanroom size: 41,800 square feet
Capacity (wafers/week): 7,000
Wafer size: 150mm
Processes: CMOS, BiCMOS
Products: DRAMs, SRAMs, MCUs, MPUs, ASICs
Feature sizes: 0.5 μ m, 0.6 μ m, 0.8 μ m

Hitachi Nippon Steel Semiconductor
Singapore Pte. Ltd.
Tampiness, Singapore
Cleanroom size: 64,600 square feet
Capacity (wafers/week): 6,250
Wafer size: 200mm
Process: CMOS
Products: DRAMs
Feature size: 0.3 μ m
(Joint venture with Nippon Steel and the government of Singapore. Operations to start in 1998).

Key Agreements and Alliances

- In February 1998, Hitachi and Philips Semiconductors reported an agreement to jointly develop contactless smartcard ICs utilizing Philips' MiFare technology. The license from Philips will allow Hitachi to produce, market and sell products based on MiFare without any limitations. MiFare is a family of compatible card ICs and reader ICs which operate at a frequency of 13.56MHz. It is currently the leading contactless smartcard architecture platform used as a standard for contactless smartcard systems.
- In February 1998, Hitachi and Texas Instruments Incorporated announced plans to discontinue their joint venture arrangement for the production of DRAM chips in Richardson, Texas. TI intends to form a new wholly owned subsidiary which would purchase the assets of the joint venture company, known as TwinStar Semiconductor Incorporated, and would hire all former joint venture employees. Hitachi and TI decided to discontinue the joint-venture because of severe financial pressures on TwinStar, which began operations in 1996, just as DRAMs began an unprecedented and unforeseen price decline. The decline prevented TwinStar from building the adequate cash reserves necessary to sustain ongoing operations and invest in future growth.

- In February 1998, Hitachi, Phillips Semiconductors, Pericom, Integrated Device Technology, and Texas Instruments announced multiple-sourcing of a single standard for low voltage logic components. The move indicates strong support for the advanced low-voltage CMOS (ALVC) format and suggests the components may be taking a step toward becoming a de facto standard. The competing low-voltage logic format is called LCX, which is produced by Motorola, Toshiba and Fairchild.
- It was announced in early 1997, that Hitachi, Mitsubishi, and Texas Instruments will co-develop the cell architecture for a 1G DRAM as well as the process technology needed to manufacture it.
- Hitachi licensed its H8/300H microprocessor core to Analog Devices, which will use it in GSM chipsets and other wireless communications products.
- In mid-1995, Hitachi licensed CompCore Multimedia, Inc.'s MPEG 2 engine technology. New decoder ICs are being developed under a technology agreement between the companies. The first MPEG 2 chips were sampled in early 1997.
- Hitachi and VLSI Technology renewed and expanded their 1988 standard cell and process technology exchange agreement. The new pact adds gate array technology, and the two companies are jointly developing gate array families. In July 1996, Hitachi licensed its SuperH core to VLSI.
- Nippon Steel has been producing 4M DRAMs for Hitachi on an OEM basis. Hitachi and Nippon Steel are building a joint-venture 64M DRAM fab in Singapore. It is expected to begin production in 1998.
- Hitachi co-developed a 16M flash memory device with Mitsubishi that is based on Mitsubishi's divided bitline NOR (DiNOR) design. The team has also developed a 64M version based on Hitachi's complementary AND cell.

Noteworthy News

- In March 1998, Hitachi announced that it will delay its plan to build a new factory at Yamanashi Prefecture. The new fab at Kohu, in Yamanashi Prefecture, was planned to begin construction in April 1998, but due to a poor performing semiconductor business, the build will be delayed until 2000, with production to begin the end of 2001. The facility, will produce logic ICs and next generation memories.
- In February 1998, Hitachi introduced the industry's first 256Mb SDRAM DIMM which complies with Intel's PC-100 specification for high speed memory requirements. Intel's PC-100 spec is designed to increase performance across the board, by bringing all information processing components up to the 100MHz rate. Most PCs are expected to adopt the standard this year.
- In January 1998, Hitachi announced the release of the industry's first 128Mb EDO and synchronous DRAM for main and expansion memory in PCs and engineering workstations. Two of these series are 128Mbit EDO DRAMs that use a stacking technology and provide access times of 60ns, and the other two in the series are 128Mbit synchronous DRAMs that use the same stacking technology and support a PC 66MHz memory bus. The EDO products as well as the SDRAMs will be available in sample quantities in 1998.

- In January 1998, Hitachi announced that Hitachi Microcomputer System Ltd., the Hitachi Group's semiconductor design arm, and Hitachi ULSI Engineering Corp. have signed an agreement under which the two companies would merge on April 1, 1998 to create a new company, Hitachi ULSI Systems Co., Ltd. The establishment of the new company will further strengthen Hitachi's system LSI design and developmental capabilities and thereby position the Company to meet the diversifying needs of the semiconductor market.

IBM MICROELECTRONICS

IBM Microelectronics
1580 Route 52, Building 504
Hopewell Junction, New York 12533
Telephone: (914) 894-2121
Fax: (914) 894-6891
Web Site: www.chips.ibm.com

IC Manufacturer
Founded: 1924

Regional Offices/Representative Locations

Europe: IBM Microelectronics Europe • Geneva, Switzerland
 Telephone: (41) (22) 918-4600 • Fax: (41) (22) 918-4650

Asia-Pacific: IBM Singapore Pte., Ltd., Microelectronics • Singapore
 Telephone: (65) 320-1000 • Fax: (65) 227-8721

Financial History (\$M), Fiscal Year Ends December 31

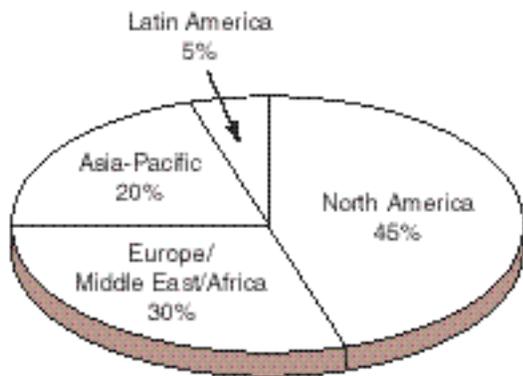
	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (IBM Corp.)						
Sales	64,523	62,716	64,052	71,940	75,947	78,508
Net Income	(4,965)	(8,101)	3,021	4,178	5,429	6,093
Semiconductor						
Sales	3,775	3,885	4,575	5,705	5,100	5,865
Internal Sales	3,725	3,510	3,605	4,020	3,550	4,083
External Sales	50	375	970	1,685	1,550	1,782
Capital Expenditures	—	—	650	1,000	1,500	1,700
Employees (IBM Microelectronics)	—	—	—	—	22,000	22,000

Ownership: Publicly held. NYSE: IBM.

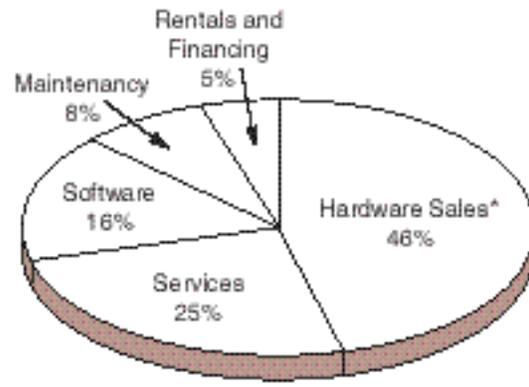
FY 1998 Semiconductor Sales Forecast: \$6.9B

Company Overview and Strategy

International Business Machines (IBM) was founded by Thomas J. Watson in 1924. Since then, IBM has grown into one of the world's largest corporations that sells in over 140 countries. IBM develops, manufactures, and sells advanced information processing products, including computers and microelectronics technology, software, networking systems, and information technology-related services.



1997 Corporate Sales by Geographic Region



*Includes external sales of semiconductors.

1997 Corporate Sales by Product/Service Group

The Microelectronics Division of IBM develops, manufactures, and markets a wide range of integrated microelectronic products and technologies. Products and services range from semiconductor design and fabrication to fully assembled and tested functional assemblies.

Prior to 1992, IBM Microelectronics supplied its products and services exclusively to one customer — IBM Corporation. Spurred by both a comprehensive restructuring of IBM into independent business units and the high cost of developing advanced semiconductor technologies, IBM Microelectronics launched a worldwide microelectronics merchant market effort in 1992, by offering to sell virtually every product and service in its technology portfolio. Its products and services are targeted at manufacturers of computers, communications, and consumer electronics systems.

IBM Microelectronics' strategic products are its ASICs and PowerPC embedded controllers, x86 and PowerPC microprocessors, memory ICs, and leading-edge packaging and services. Other important microelectronic products include analog and mixed-signal ICs and graphics chips. By combining several of its chips to form system solutions, IBM is seeking to strengthen its presence in the data processing, consumer electronics, and communications markets.

To bolster its technological leadership, IBM has entered into several major alliances. Examples of these alliances are Toshiba, Siemens, and Motorola in process technology, the PowerPC microprocessor alliance with Motorola and Apple Computer, and work in the area of X-ray lithography with Lucent Technologies, Motorola, and Lockheed-Martin Federal Systems.

Management

IBM Corporation

Louis V. Gerstner, Jr.	Chairman and Chief Executive Officer
J. Thomas Bouchard	Senior Vice President, Human Resources
Nicholas M. Donofrio	Senior Vice President, Technology and Manufacturing
J. Bruce Harreld	Senior Vice President, Strategy
Paul M. Horn	Senior Vice President, Research
Ned C. Lautenbach	Senior Vice President and Group Executive, Sales and Service
Lawrence R. Ricciardi	Senior Vice President and General Counsel
Robert M. Stephenson	Senior Vice President and Group Executive, Server Group
G. Richard Thoman	Senior Vice President and Chief Financial Officer
John M. Thompson	Senior Vice President and Group Executive, Software Group
David B. Kalis	Vice President, Communications
Abby F. Kohnstamm	Vice President, Corporate Marketing

IBM Microelectronics Division

Michael J. Attardo	General Manager, IBM Microelectronics Division
Orest Bilous	General Manager, Manufacturing
John C. Gleason	General Manager, Worldwide Sales and Marketing
Douglas A. Grose	Vice President, Strategy, Technology and Operations
Peter Draheim	Chief Executive Officer, Submicron Semiconductor Technologies GmbH
Stanley J. Grubel	Chief Executive Officer, MiCRUS

Products and Processes

IBM Microelectronics offers the following products.

Memory Products

- 4M, 16M, and 64M DRAMs (standard and low power versions). The company announced in April 1997, that it was halting production of 4M DRAMs to make more room for ASIC production.
- 16M and 64M synchronous DRAMs (SDRAMs).
- 8M and 16M synchronous graphics RAMs (SGRAMs).
- 4M enhanced DRAMs (EDRAMs) through its partnership with Enhanced Memory Systems Inc.
- 4M VRAMs.
- 1M and 4M high-performance CMOS synchronous SRAMs (250MHz and 225MHz, respectively).

ASIC Products

- CMOS digital ASICs — gate arrays and standard cells with gate counts ranging from 50,000 to 3.2 million gates (max.). IBM's system cores include PowerPC and x86 MPUs, DSPs, peripheral circuits, I/O circuits, USB devices, audio/video/graphics components, and communications interfaces.
- Bipolar analog and mixed-signal ASICs.
- CMOS analog and mixed-signal ASICs.
- BiCMOS analog and mixed-signal ASICs.
- High-performance BiCMOS analog and mixed-signal ASICs.
- IBM abandoned its FPGA development and production program in 1996.

Microprocessors and Controllers

- 6x86MX microprocessors.
- PowerPC™ 600 Series 32-bit and 64-bit RISC microprocessors (clock speeds of up to 275MHz).
- PowerPC™ 400 Series 32-bit RISC embedded controllers.
- MC196 16-bit microcontrollers (compatible with Intel's MCS-96 16-bit architecture).
- Mwave™ digital signal processor (DSP) products for multimedia and communications applications.

Communications, Networking, Interface, and Graphics Products

- PCI core logic chipsets and PCI-to-PCI bridge chips.
- Firewire (IEEE 1394) high-speed (200Mbps) serial bus transceiver chips.
- High-end RGB series of palette digital-to-analog converters for 2D and 3D graphics.
- Adaptive Lossless Data Compression (ALDC) ICs and MPEG-2 digital video encoders and decoders.
- High-performance ATM, Ethernet, and Token Ring networking chips and ASIC cores (made available to the merchant market in 3Q96).
- Silicon-germanium-based wireless communications and data-conversion devices.
- Infrared transceivers and communications controllers.

Other Products and Services

- Semiconductor contract manufacturing services for advanced ICs. Process technologies offered through IBM's foundry services include the CMOS 5S1 0.5µm process, the CMOS 5SF 0.35µm SPQM process, and the CMOS 6SF 0.25µm SPQM process, which will be available for volume production in 2Q98.
- Deep-UV photoresists.
- Semiconductor test equipment.
- Semiconductor packaging services for single or multiple chip applications.
- Printed circuit boards and cards.
- PCMCIA infrared wireless and data/fax modem products and solid-state file storage products.

IBM has developed and uses some of the industry's most advanced CMOS processing technologies including the following: 0.35µm, 0.5µm, and 0.6µm CMOS with up to five layers of metal. The company unveiled its 0.25µm CMOS 6S process technology in mid-1996, and its CMOS75 process technology in 1997. While digital CMOS is the company's principal technology, various other processes are used, including bipolar, analog CMOS, BiCMOS, complementary BiCMOS, and silicon-germanium (SiGe).

In September 1997, IBM scientists announced a new advance in semiconductor process that entails replacing aluminum with copper. Copper has less "resistance" than aluminum, and therefore transmits electrical signals faster. However, it doesn't mix as well with silicon, the base material of semiconductor chips. The IBM researchers found a way to put a microscopic barrier between the copper and silicon in a way that actually reduced the number of steps needed to complete a chip. With this development, IBM is able to produce extremely intricate circuit designs with copper at widths of 0.20 microns -- down from the current industry standard of 0.25 microns.

IBM is putting the work of its researchers into production in existing manufacturing facilities, and in addition is building a \$700 million chip development center in East Fishkill, N.Y. When the plant is up and running in 1999, IBM will produce hundreds of chips containing the new copper. Each chip will contain up to 200 million transistors – about 30 times more than the microprocessor chip in a typical desktop or notebook computer. In the near future, IBM's copper-chip technology may soon appear in a variety of consumer electronics.

Semiconductor Fabrication Facilities

IBM Microelectronics
 East Fishkill Facility
 1580 Route 52
 Hopewell Junction, New York 12533
 Telephone: (914) 894-5647
 Cleanroom size: 230,000 square feet
 Capacity (wafers/week): 16,750
 Wafer sizes: 125mm, 200mm
 Processes: CMOS, BiCMOS, SiGe
 Products: Logic ICs, linear ICs, mixed-signal ICs, memories, R&D.
 Feature sizes: 0.25 μ m-0.8 μ m
 (IBM's ASTC — Advanced Semiconductor Technology Center is located here).

IBM Microelectronics
 1000 River Street
 Essex Junction, Vermont 05452
 Telephone: (802) 769-0111
 Capacity (wafers/week): 15,000
 Wafer size: 200mm
 Processes: CMOS, BiCMOS, bipolar
 Products: DRAMs, SRAMs, logic ICs, mixed-signal ICs, linear ICs, ASICs, MPUs, foundry services.
 Feature sizes: 0.25 μ m-1.0 μ m

IBM Microelectronics
 Thomas J. Watson Research Center
 Route 134
 Yorktown Heights, New York 10598
 Telephone: (914) 945-3000
 Capacity (wafers/week): 1,500
 Wafer size: 100mm
 Process: CMOS
 Products: R&D
 Feature size: 0.25 μ m

IBM United Kingdom Labs Ltd.
 Hursley Park
 North Winchester
 Hampshire SO21 2JN
 England
 United Kingdom
 Telephone: (44) (962) 84-4433
 Wafer size: 200mm
 Processes: Bipolar, MOS
 Products: R&D

IBM France
 224 Bd. John Kennedy
 P.O. Box 58
 F-91102 Corbeil Essonnes-Cedex
 France
 Telephone: (33) (1) 60-88-51-51
 Cleanroom size: 390,000 square feet
 Capacity (wafers/week): 10,750
 Wafer sizes: 125mm, 200mm
 Process: CMOS
 Products: MPUs, MCUs, ASICs, DRAMs, SRAMs
 Feature sizes: 0.35 μ m-0.8 μ m

IBM/Siemens
 Corbeil Essonnes Cedex
 France
 Cleanroom size: 116,000 square feet
 Capacity (wafers/week): 3,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs (logic ICs in future)
 Feature sizes: 0.35 μ m-0.5 μ m

IBM Duetschland GmbH
Werk Singdelfingen
Postfach 266
Singdelfingen, Germany
Telephone: (49) 7031-910
Capacity (wafers/week): 18,750
Wafer sizes: 125mm, 200mm
Processes: Bipolar, CMOS
Products: DRAMs, SRAMs, ASICs, DSPs, MPUs
Feature sizes: 0.8 μ m-2.0 μ m

MiCRUS
1580 Route 52
Hopewell Junction, New York 12533
Telephone: (914) 892-2121
Capacity (wafers/week): 9,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs, MPRs
Feature sizes: 0.35 μ m-0.6 μ m
(Joint venture with Cirrus Logic,
see Key Agreements).

Dominion Semiconductor LLC
9600 Godwin Drive
Manassas, Virginia 22110
Telephone: (703) 367-3280
Fax: (703) 367-3271
Cleanroom size: 90,000 square feet
Capacity (wafers/week): 7,500
Wafer size: 200mm
Process: CMOS
Products: DRAMs
Feature size: 0.35 μ m
(Joint venture with Toshiba. Scheduled to begin
production in early 1998, see Key Agreements).

IBM Japan Ltd.
800 Ohaza Ichimayake, Yasu-Machi
Yasu-gun, Shiga-ken 520-23, Japan
Telephone: (81) (755) 88-2511
Capacity (wafers/week): 10,000
Wafer sizes: 125mm, 200mm
Process: CMOS
Products: MPUs, DSPs, ASICs, logic ICs
Feature sizes: 0.6 μ m, 0.8 μ m
(DRAM production discontinued here in 1996).

Submicron Semiconductor Technologies GmbH (SMST)
Schoenaicherstrasse 220
Boeblingen Hulb, Germany
Cleanroom size: 107,640 square feet (Class 1)
Capacity (wafers/week): 4,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs, logic ICs
Feature size: 0.65 μ m
(Joint venture with Philips. The partners plan
to upgrade the fab to handle 0.5 μ m line
widths, see Key Agreements).

Key Agreements and Alliances

- In March 1998, IBM and Advanced Micro Devices signed a two year agreement for IBM to manufacture AMD-K6 Windows PC microprocessors. The agreement will augment AMD's capacity for the AMD-K6 production. Wafer starts at IBM are planned to commence during 3Q98. Manufacturing will most likely take place at IBM Microelectronics' plant in Essex Junction, VT.
- In March 1998, RFMD signed a multi-year Master Purchase Agreement with IBM's Microelectronics Division that provides for RFMD's expanded development, manufacture and sale of custom RF ICs using IBM's advanced Blue Logic silicon process technology. RFMD has developed more than 40 RFICs using IBM's silicon technology. These products cover three major application groups: CDMA telephones (both 800MHz and PCS applications), transceivers for ISM bands up to 2.5GHz, and general purpose amplifiers. Most of these components operate on 3.0 volts making them compatible with the latest wireless applications. RFMD's silicon chips are typically very small, ranging from 0.5-1.5 square millimeters. The small size of the chip processed on IBM's 8 inch silicon process results in maximum cost efficiency.
- In February 1998, IBM announced plans to merge privately held CommQuest Technologies, Inc., into its Microelectronics Division, allowing IBM to apply its silicon germanium semiconductor technology to CommQuest's products for wireless communication applications. The seven-year-old CommQuest, based in Encinitas, CA, makes semiconductors for cellular telephones, satellite communications, and other wireless communication systems. The company has about 215 employees.
- During the first quarter of 1998, IBM announced a licensing agreement with Sun Microsystems, Inc., to use Sun's Pico-Java I® microprocessor chip design. The Pico-Java I processor core can be used to accelerate Java application performance by up to a factor of 20 over other solutions. This agreement signals a new stage in evolution of Java technology, a key component in IBM's network computing strategy.
- In mid-1996, IBM announced an agreement with Mitsubishi that allows the Japanese company to sell IBM PowerPC embedded controller chips under the Mitsubishi brand name.
- IBM and Synopsys announced a six-year R&D agreement in February 1996, to jointly develop tools and methodologies for designing complex ICs with as many as 10 million gates.
- IBM licensed the Rambus ASIC Cell (RAC) high-bandwidth interface technology in early 1996 from Rambus to use in its SystemCore ASIC megacell library.
- IBM granted licensing rights to Exponential Technology, Inc. to develop and market a new ultra-high-performance BiCMOS microprocessor based on the PowerPC architecture. Volume shipments of Exponential's MPU are expected to begin in early 1997.
- In late 1995, IBM and Toshiba began building a new 64M DRAM plant at the site of a closed IBM fab in Manassas, Virginia. IBM and Toshiba will each own 50 percent of the facility, which will operate under the name Dominion Semiconductor. Production is scheduled to begin in 1998.

- The PowerPC RISC architecture has been, and continues to be, co-developed by IBM, Motorola, and Apple Computer. The trio of companies are also working on combining the PowerPC technology with an open hardware platform supporting a range of operating systems.
- IBM is jointly developing with Siemens and Toshiba, 0.25 μ m technology for shrink-version 64M DRAMs and 256M DRAMs. Additionally, in 3Q96, Toshiba, IBM, and Siemens agreed to jointly develop system-on-a-chip devices. As part of a separate agreement, Siemens and IBM are jointly producing 16M DRAMs in Corbeil-Essonnes, France.
- IBM and Cirrus Logic formed a joint manufacturing venture called MiCRUS in 1994. IBM and Cirrus Logic own 52 percent and 48 percent of MiCRUS, respectively. Volume production of logic chips for Cirrus and memory ICs for IBM began in mid-1995. The agreement does not include product and/or technology exchange. In 1996, Cirrus Logic entered into a similar joint venture agreement with Lucent Technologies to form Cirent Semiconductor in Orlando, Florida. Cirrus Logic has access to the production outputs of up to 55 percent and 25 percent of the MiCRUS and Cirent fabs, respectively.
- Toshiba licensed the PowerPC microprocessor technology from IBM Microelectronics. Although Toshiba was not given the right to sell PowerPC MPUs on the merchant market, it does have the right to develop and manufacture its own derivatives of the processor. For now, IBM will produce the MPUs for Toshiba.
- IBM is working with Motorola, Lockheed-Martin Federal Systems, and Lucent Technologies to establish a manufacturing infrastructure for X-ray lithography. The team hopes to have a manufacturing capability by the end of 1997.
- Analog Devices has an alliance with IBM in the joint design, production, and marketing of mixed-signal and RF ICs based on IBM's silicon-germanium (SiGe) process technology.
- In 1994, Philips agreed with IBM Microelectronics to form a joint venture to manufacture ICs at IBM's fab facility in Boeblingen Hulb, Germany. Philips holds 51 percent and IBM 49 percent of the new company, called SubMicron Semiconductor Technologies GmbH (SMST). SMST is supplying products solely to IBM and Philips, manufacturing DRAMs for IBM and logic ICs for Philips. Separately, Philips acquired the rights to IBM's 16M DRAM technology for embedded applications. Embedded DRAM products will also be produced by SMST.

Noteworthy News

- In April 1998, IBM announced that it will be shipping the first AMD K6@ 300MHz microprocessors as part of its Aptiva E Series PC systems.
- In February 1998, IBM announced the world's first experimental CMOS microprocessor that can operate at one billion cycles per second (1,000MHz or 1GHz). The 1GHz chip contains one million transistors using 0.25 micron CMOS 6X technology. The micro-architecture will eventually be applied to microprocessors using IBM's recently introduced CMOS 7S "copper chip" technology. These chips were fabricated at IBM's advanced Semiconductor Technology Center in East Fishkill, NY and tested at T.J. Watson Research Center in Yorktown Heights, NY.

- In their 1997 Annual Report, IBM cited that the weight of adverse currency movements in Asia lowered IBM's year-to-year corporate revenue growth from approximately eight percent to the "as reported" three percent for FY97.
- In December 1997, IBM acquired Eastman Kodak's share of Technology Service Solutions (TSS), which was formed in 1994 by IBM and Eastman Kodak. TSS is now a wholly owned subsidiary of IBM, offering comprehensive services solutions to its customers.
- In December 1997, IBM acquired Unison Software, Inc., a leading developer of workload management software and announced plans to acquire Software Artistry, Inc., a leading provider of both consolidated service desk and customer relationship management solutions for distributed enterprise environments.
- In September 1997, IBM acquired the 30 percent equity interest held by Sears in Advantis, the U.S. network services arm of the IBM Global Network. Advantis is now 100 percent owned by IBM.
- In September 1997, IBM scientists announced a new advance in semiconductor process that entails replacing aluminum with copper. Copper has less "resistance" than aluminum, and therefore transmits electrical signals faster. However, it doesn't mix as well with silicon, the base material of semiconductor chips. The IBM researchers found a way to put a microscopic barrier between the copper and silicon in a way that actually reduced the number of steps needed to complete a chip. With this development, IBM is able to produce extremely intricate circuit designs with copper at widths of 0.20 microns -- down from the current industry standard of 0.25 microns.
- In April 1997, IBM and NetObjects, Inc. announced that IBM had purchased a majority interest in NetObjects, a leading provider of web site development tools for designers and intranet developers.

INTEL

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Santa Clara, California 95052-8119
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Fax: (408) 765-1821
Web Site: www.intel.com

IC Manufacturer
Founded: 1968

Regional Offices/Representative Locations

Europe: Intel Corporation (UK) Ltd. • Swindon, Wiltshire, United Kingdom
Telephone: (44) (1793) 403-000

Japan: Intel K.K. • Tsukuba-shi, Ibaraki, Japan
Telephone: (81) (289) 47-8522

Asia-Pacific: Intel Semiconductor Ltd. • Hong Kong
Telephone: (852) 2844-4555

Financial History (\$M), Fiscal Year Ends December 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	5,844	8,782	11,521	16,202	20,847	25,070
IC Sales	4,950	7,550	9,850	13,590	17,870	21,490
Net Income	1,067	2,295	2,285	3,566	5,157	6,945
R&D Expenditures	780	970	1,111	1,296	1,808	2,347
Capital Expenditures	1,228	1,933	2,441	3,550	3,024	4,501
Employees	25,800	29,500	32,600	41,600	48,500	63,700

FY 1998 Forecast

Semiconductor Sales: \$26B

Corporate R&D Expenditures: \$2.8B

Corporate Capital Expenditures: \$5.3B

Ownership: Publicly held. NASDAQ: INTC.

Company Overview and Strategy

Intel Corporation is the world's leading manufacturer of semiconductors, specializing in microprocessors and related technologies. Primarily focused on the computer industry, the Company provides semiconductor, board-level and software products to all major segments of the computing market from PCs and workstations to networking and communications. Principal products include microprocessors, motherboards based on Intel architecture, flash memory devices, embedded control chips, and networking and communications products. Intel's IC products are sold to manufacturers of computer systems and peripherals, automotive equipment, industrial systems, and telecommunications products.

Intel's core strategy is to tailor microprocessor and related technologies for each segment of the computing market. They will continue to provide high-performance microprocessors to support the high-end PCs and workstations/servers. The Company also continues to support the Intel brand preference strategy, which has made Intel a household name around the world, i.e., "Intel inside." In addition, in November 1997, Intel started a new drive to offer powerful microprocessors to the "basic PC" (the low-end PC) market segment. This news came much to the dismay of AMD and Cyrix/National, key Intel competitors.

The Company plans to cultivate new businesses and continue to work with the software industry to develop compelling applications that can take advantage of higher performance microprocessors, thus driving demand toward the newer products in each computing market segment. In line with this strategy, the Company is seeking to develop higher performance microprocessors for each market segment, including servers, workstations, high-end business PCs, the basic PC and other product lines. Intel may continue to reduce microprocessor prices at such times as it deems appropriate in order to bring its technology to market within each relevant market segment.

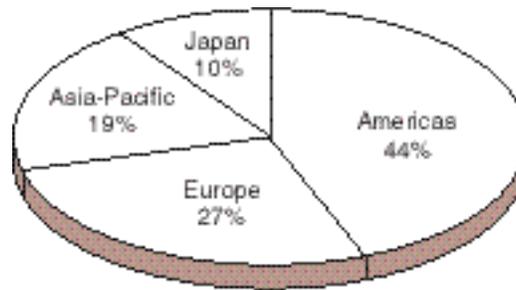
Growth in revenues from 1996 to 1997 was primarily due to higher volumes of the Pentium® microprocessor family (including processors with Intel's MMX™ media enhancement technology) and Pentium® Pro processors, and the ramp of the Pentium® II processors. Sales of Pentium® Pro and Pentium® II microprocessors were a significant portion of the Company's revenues and gross margin in 1997. From 1995 to 1997, the increased revenues on microprocessors were partially offset by decreased revenues from sales of related board-level products, as sales of board-level products became less significant to the Company's business, and insignificant in 1997.

Higher volumes of chipset products also contributed toward the increase in revenues from 1995 to 1997, and helped enable the Pentium® and Pentium® Pro microprocessor ramps and the ongoing ramp of the Pentium® II microprocessor. Flash memory products declined from 1996 to 1997.

In November 1997, Intel announced a reorganization to better address the changing computing marketplace. Specifically, three new groups and a division were created: the Consumer Products Group (CPG); the Business Platform Group (BPG); the Small Business and Networking Group (SBNG); and the Digital Imaging and Video Division.

CPG targets consumer desktop PCs, TV set-top computing devices, and automobile PCs. BPG focuses on all business computers, including PCs, lean clients, NetPCs, workstations, and data security solutions for personal computers. SBNG provides networking products, management software, business communications (ProShare® video conferencing technology), reseller products, Internet Services Operations, and the reseller channel sales organization. The Digital Imaging and Video Division was formed to focus on the emerging fields of digital imaging and video associated with the PC and stand-alone digital cameras.

These groups will run in parallel to the existing Mobile/Handheld Products Group, the Enterprise Server Group and the Computing Enhancement Group (i.e., flash memory, embedded controllers, USB).



1997 Sales by Geographic Region

Company History

Intel Corporation was established in 1968, to pursue the potential of integrating large numbers of transistors into silicon chips. The company created the first DRAM, the first EPROM, and the first microprocessor, revolutionizing the electronics industry by making possible small and powerful computing systems. Intel originally flourished as a MOS memory supplier. However, in 1985 Intel abandoned the DRAM business, in favor of microprocessors. Today, Intel is by far the world's leading supplier of MOS microprocessors.

Thanks to strong demand for its microprocessors, Intel grew to become the world's largest semiconductor manufacturer in 1993. Part of Intel's strategy to maintaining momentum and supporting demand for its products is heavy reinvesting with its profits. Since 1991, Intel has invested more in new plants and equipment each year than any other semiconductor company in the world.

Due to the growth of Pentium® microprocessor-based systems, Intel has become a major supplier of core-logic chipsets. The company's Intel430 PCIset products, designed for desktop and mobile Pentium processors, were the first chipsets to support the Universal Serial Bus (USB) high-performance bus architecture.

In flash memories, Intel has dominated the market essentially from the beginning. However, its share of the market has dropped from 75 percent or more in the early 1990's to about 44 percent in 1996, as several other players have aggressively pursued the market.

Over the past couple of years Intel has stepped up its strategy of investing in other companies, typically startups, to help facilitate new application software content and hardware. The company investments number in the "hundreds," and are not limited to chip companies. Companies in which it has recently invested include Chips and Technologies, The Fantastic Corporation, Corollary Inc., and Case Technology. In addition, they acquired Semiconductor facilities in Hudson Massachusetts from Digital Equipment Corporation and made a \$1.3B investment in Samsung Electronics' semiconductor memory fabrication plant in Austin, Texas.

Management

Gordon E. Moore	Chairman Emeritus of the Board
Andrew S. Grove	Chairman of the Board and Chief Executive Officer
Craig R. Barrett	President and Chief Operating Officer
Andy D. Bryant	Vice President and Chief Financial Officer
Leslie L. Vadasz	Senior Vice President and Director, Corporate Business Development
Louis J. Burns	Vice President and Director, Information Technology
Sunlin Chou	Vice President and Director, Components Technology Development
F. Thomas Dunlap, Jr.	Vice President, General Counsel and Secretary
Kirby A. Dyess	Vice President and Director, New Business Development
Hans G. Geyer	Vice President and GM, Flash Products Division
Robert T. Jenkins	Vice President and Director, Corporate Licensing
Avram C. Miller	Vice President and Director, Business Development
Patricia Murray	Vice President and Director, Human Resources
Arvind Sodhani	Vice President and Treasurer
Peter N. Detkin	Vice President, Legal and Assistant General Counsel
Shelley L. Floyd	Vice President, Finance and Director, Investor Relations
James W. Jarrett	President, Intel PRC Corporation
Patrick S. Jones	Vice President, Finance and Corporate Controller
Michael C. Maibach	Vice President, Government Affairs
Robert H. Perlman	Vice President, Finance and Director, Tax, Customs and Licensing

Small Business and Networking Group

Frank C. Gill	Executive Vice President and GM, Small Business and Networking Group
Mark A. Christensen	Vice President, Small Business and Networking Group and General Manager, Network Products Division
Edward D. Ekstrom	Vice President, Small Business and Networking Group and General Manager, Systems Management Division
James B. Johnson	Vice President, Small Business and Networking Group and General Manager, Internet Services Operation
James H. Yasso	Vice President, Small Business and Networking Group and GM, Reseller Products Division

Intel Architecture Labs

Paul S. Otellini	Executive Vice President and GM, Intel Architecture Business Group
D. Craig Kinnie	Vice President and Director, Intel Architecture Labs
Richard A. DeLateur	Vice President, Finance, Intel Architecture Groups
Richard L. Coulson	Director, I/O Architecture
Kevin C. Kahn	Director, Communications Architecture
Peter D. MacWilliams	Director, Platform Architecture

Technology and Manufacturing Group

Gerhard H. Parker	Executive Vice President and GM, Technology and Manufacturing Group
Michael R. Splinter	Vice President and Assistant GM, Technology and Manufacturing Group
Frank Alvarez	Vice President, Technology and Manufacturing Group and General Manager, Systems Manufacturing
Robert J. Baker	Vice President, Technology and Manufacturing Group and General Manager, Fab/Sort Manufacturing
Alan C. Baldwin	Vice President, Technology and Manufacturing Group and Director, Planning and Logistics
Leslie S. Culbertson	Vice President, Technology and Manufacturing Group and Director, Materials
Youssef A. El-Mansy	Vice President, Technology and Manufacturing Group and Director, Portland Technology Development
Robert M. Jecmen	Vice President, Technology and Manufacturing Group and Director, California Technology and Manufacturing
Bruce H. Leising	Vice President, Technology and Manufacturing Group and Assistant General Manager, Fab/Sort Manufacturing
David B. Marsing	Vice President, Technology and Manufacturing Group and General Manager, Assembly/Test Manufacturing
Frank A. McCabe	Vice President, Technology and Manufacturing Group and General Manager, Ireland Operations
Jacob A. Peña, Jr.	Vice President, Technology and Manufacturing Group and GM, Philippine Operations
Gidu K. Shroff	Vice President, Technology and Manufacturing Group and Director, Materials
William M. Siu	Vice President, Technology and Manufacturing Group and Director, Assembly Technology Development
Jon F. Slusser	Vice President, Technology and Manufacturing Group and Director, Corporate Quality Network
Edward Y. So	Vice President, Technology and Manufacturing Group and D2 Plant Manager and Director, California Technology and Manufacturing
Kenneth Thompson	Vice President, Technology and Manufacturing Group and GM, Technology Manufacturing Engineering
Keith L. Thomson	Vice President, Technology and Manufacturing Group and Oregon Site Manager
Gregory E. Atwood	Director, Flash Memory Architecture
Mark T. Bohr	Director, Process Architecture and Integration
Paolo A. Gargini	Director, Technology Strategy
Eugene S. Meieran	Director, Manufacturing Strategic Support
George E. Sery	Director, Device Technology Optimization
Carl J. Simonsen	Director, Advanced Library Architecture and Design Integration
Leo D. Yau	Director, Innovative Technology Modules
Ian A. Young	Director, Advanced Circuit and Technology Integration

Content Group

Ronald J. Whittier	Senior Vice President and GM, Content Group
Claude M. Leglise	Vice President, Content Group and Director, Entertainment/Education Developer Relations
Steven D. McGeady	Vice President, Content Group and Director, Health Technology Initiative

Microprocessor Products Group

Albert Y. C. Yu	Senior Vice President and GM, Microprocessor Products Group
Michael J. Fister	Vice President, Microprocessor Products Group and General Manager, Microprocessor Division 6
Dov Frohman	Vice President, Microprocessor Products Group and General Manager, Israel Operations
David Perlmutter	Vice President, Microprocessor Products Group and GM, Israel Development Center
Stephen L. Smith	Vice President and GM, Santa Clara Processor Division
Robert P. Colwell	Director, IA-32 Architecture
John H. Crawford	Director, Microprocessor Architecture
Paul D. Madland	Director, Circuit Technology
David B. Papworth	Director, Microprocessor Product Development
Frederick J. Pollack	Director, Measurement, Architecture and Planning
Uri C. Weiser	Director, Israel Development Center Architecture
Richard B. Wirt	Director, Microcomputer Labs

Consumer Products Group

Michael A. Aymar	Vice President and GM, Consumer Products Group
William O. Howe	Vice President, Consumer Products Group and Director, Strategic Projects

Sales and Marketing Group

Dennis L. Carter	Vice President and Director, Sales and Marketing Group
Sean M. Maloney	Vice President and Director, Sales and Marketing Group
Edwin G. Bauer	Vice President, Sales and Marketing Group and Director, Americas Sales and Marketing
John E. Davies	Vice President, Sales and Marketing Group and General Manager, Asia-Pacific Operations
Nobuyuki Denda	Vice President, Sales and Marketing Group and President, Japan Operations
Jami K. Dover	Vice President, Sales and Marketing Group and Director, Worldwide Co-op Marketing
Ikuo Nishioka	Vice President, Sales and Marketing Group and Chairman, Japan Operations
Pamela L. Pollace	Vice President, Sales and Marketing Group and Director, Worldwide Press Relations
Earl L. Whetstone	Vice President, Sales and Marketing Group and GM, European Operations
Ellen R. Konar	Director, Corporate Strategic Marketing

Business Platform Group

Patrick P. Gelsinger	Vice President and GM, Business Platform Group
Boon Chye Ooi	Vice President, Business Platform Group and GM, OEM Platform Solutions Division
William A. Swope	Vice President, Business Platform Group and Director, Business Desktop Marketing

Computing Enhancement Group

Ronald J. Smith	Vice President and GM, Computing Enhancement Group
Thomas R. Franz	Vice President, Computing Enhancement Group and General Manager, Embedded Microcomputer Division
William B. Pohlman	Vice President, Computing Enhancement Group and GM, Central Logic Engineering
Avtar K. Saini	Vice President, Computing Enhancement Group and GM, Platform Components Division
James F. Stafford	Vice President, Computing Enhancement Group and GM, Graphics Components Division

Enterprise Server Group

John H. F. Miner	Vice President and GM, Enterprise Server Group
David M. Cowan	Vice President, Enterprise Server Group and General Manager, High-End Server Division
Justin R. Rattner	Director, Server Architecture Lab

Mobile/Handheld Products Group

Stephen Nachtsheim	Vice President and GM, Mobile/Handheld Products Group
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Products and Processes

Intel's principal products are microprocessors, core logic chipsets based on the PCI bus, embedded processors and microcontrollers, flash memory chips, computer modules and boards, network and communications products, personal conferencing products, and scaleable parallel processing computers. Some of these products are described in more detail below.

Microprocessors

The Pentium® Pro is the base microprocessor product offered by Intel. It is available in 60 to 200 MHz clock speeds at 66MHz bus speed. The 32-bit Pentium® Pro includes built-in math co-processor support, built-in level 1 and level 2 Cache, dual independent bus architecture (enabling the processor to access data from either of its two buses simultaneously and in parallel, rather than in a singular sequential manner as in a single bus system), and dynamic execution (a technique designed to help the processor manipulate data more efficiently). The Pentium® Pro is built using 0.6 micron technology for 256K L2 Cache and 0.35 micron technology for 512K and 1M L2 Cache sizes.

With Intel's MMX™ media enhancement technology the Pentium Pro® can run up to 233MHz. Intel's MMX™ allows for a higher level of multimedia and communications performance, improving video compression/decompression, image manipulation, encryption and I/O processing. This technology introduces 57 instructions oriented to highly parallel operations with multimedia and communications data types. These instructions use a technique known as Single Instruction, Multiple Data (SIMD) to deliver better performance for multimedia and communications computation.

The Pentium® II processor combines the power of the Pentium® Pro with Intel MMX™ Technology, on a single chip. Available at speeds of 333, 266, and 233MHz, the Pentium® II has brought new levels of visual computing to the desktop for consumers allowing for enhanced audio, fluid video and dramatic 3D graphics.

More details on Intel's microprocessors are provided by market segment, as follows.

For the PC Market

- Intel offers Pentium® II processors, which include MMX™ technology, operating at 200, or 233MHz. These chips include level 1 Cache and floating point on die. MMX™ chipsets are also offered, the 430TX, which runs at 66MHz bus speeds.
- In 1998, Intel plans to offer a level 2 Cache Pentium® II MMX™ which operates at 266MHz. A corresponding low cost chipset is planned for introduction in the second half of 1998.
- Also planned for later in 1998, Intel plans to introduce a Pentium® II MMX™ (product name: Medocino) with level 2 Cache which can operate at even higher speeds.
- For the higher end PC, Intel offers Pentium® II processors operating at speeds up to 333MHz, manufactured using 0.25 micron technology. Corresponding chipsets are also offered (440LX) operating at 66MHz bus speeds.
- Intel's AGP (Accelerated Graphics Port), tailored for the high-end market, improves system performance by providing a high-speed pathway between the PC's graphics controller and system memory. The AGP technology enables the graphics controller to execute texture maps directly from memory rather than caching them in its limited local video memory, making performance much faster.
- The Intel 740 graphics controller which uses hyperpipeline 3D architecture, allows 15 instructions to be processed in parallel, enhancing graphics processing.
- Chipsets of the Pentium® II processor operating at 350 or 400MHz clock speeds and 100MHz bus speeds are planned for introduction in early 1998. A 450MHz processor version is planned for later in 1998.

For the Server /Workstation Markets

Intel offers the Pentium® Pro Processor, using a full-speed bus between processor and the Cache (i.e., the processor and bus run at the same speed). The Pentium® Pro, which is available in 150MHz, 166MHz, 180MHz, and 200MHz speed grades, makes use of RISC-like techniques that Intel has chosen to call "dynamic execution."

In 1997, Intel unveiled their new 64bit microprocessor architecture, Merced™ designed for the high-end workstation and server market segments. The Merced™ processors are scheduled to ship in 1999, which will be followed by the next generation UA-64™ microprocessor, scheduled for 2001.

In the first half of 1998, Intel plans to introduce a new Pentium® II processor, Slot 1 for performance for professional PCs and entry-level servers and workstations with a 100MHz system bus, which will also support new high-speed SDRAM technology

Also, in the second half of 1998, the Company plans to introduce the Pentium® micro-architecture in the Slot 2 form factor with a 100MHz system bus and optimized L2 Cache configurations designed specifically for mid-range to high-end servers and workstations.

Mobile/Handheld Products

The Intel mobile processor family, based on 0.25 micron technology, are designed for low power applications. The product line consists of the following –

- 266- and 233MHz mobile Pentium® II processors
- 266-, 233-, 200-, and 166MHz mobile Pentium® processors with MMX™ technology

Also offered are mobile chipsets that run at 66MHz bus.

In early 1997, the company introduced the Intel Mobile Module, an integrated Pentium®-based module that plugs into a mobile system's motherboard. The Mobile Module is thought to be the kick off of Intel's planned sales shift from processors to processor modules.

In addition, within the first half of 1998 Intel will be introducing a mobile Pentium® II processor that will be offered in multiple frequencies, up to 300MHz. A corresponding chipset will also be offered.

Embedded Processors and Microcontrollers

This product group includes the i960 high performance embedded processors and the MCS® 96 family of microcontrollers. The i960 is a high performance 32-bit RISC embedded processor family, with performance range of 7 MIPS to 150 MIPS. The i960 is targeted for applications that execute large amounts of code (usually over 1Meg), move large amounts of data rapidly, and/or require very fast response times. Specifically, the i960 processors are a good fit for:

- Local and wide area networking - bridges, routers, hubs, ATM, FDDI;
- Intelligent PC I/O controllers - SCSI, RAID; and
- Imaging - printers, scanners, X-terminals, medical imaging.

Intel's MCS® 96 microcontroller product family is the industry standard for 16-bit embedded microcontrollers. The high-performance register-to-register architecture is well suited for complex real-time control applications such as hard disk drives, modems, printers, pattern recognition and motor control.

The MCS® 96 microcontroller product family has three distinct product lines. The most recent products form the EPA family. This family of devices has the advanced peripherals which include a flexible input/output system and EPA (Event Processor Array). The HSIO family consists of devices that have the High Speed Input/Output sub-system. The Motion Control family is comprised of devices that support motor control applications. This family also uses the EPA system for I/O control.

Intel's MCS® 296 microcontroller is the latest addition to the Intel MCS® 96 microcontroller family. The 80296SA is performance enhanced from the 8XC196NP and 8XC196NU controllers while maintaining binary code compatibility. Hence, the 80296SA can be dropped into a 8XC196NP/NU socket and immediately boost system performance. The 80296SA exhibits improved math performance over previous architectures making it suitable for embedded digital signal processing and feedback control systems. The 80296SA can perform 12.5 DSP MIPS and 16 general purpose MIPS.

Flash Memory Chips

Intel continues to be the industry's largest flash memory producer. The Company provides a broad line of flash memory devices, with densities ranging from 1M to 32M. Included are the 2.7V High-Integration Boot Block flash devices (4M to 16M) that are targeted at wireless communications applications; the High Performance Fast Flash devices (4M to 16M) that have either a synchronous burst-read interface or a DRAM system read interface; and the High Value FlashFile™ Memory products (4M to 16M) that are partitioned into independently erasable 64K blocks, making them optimal for partial code updates or file storage applications.

In February 1998, Intel announced plans to transition their flash memory products from 0.4 micron to 0.25 micron technology, on 200mm wafers. Half of Intel's flash products will be made on the new geometry within a year. The company plans to begin the transition at Fab 9, in Albuquerque, New Mexico.

Networking and Communications

In the second quarter of 1997, Intel introduced the 82558, the industry's first single-chip Fast Ethernet solution for networking at speeds of 10 or 100Mbps. The 82558 supports three key capabilities required by the Wired for Management Baseline and Net PC specifications for remotely managing PCs via the LAN, including the Advanced Configuration and Power Interface, Wake-on-LAN and remote boot functionality.

In the first quarter of 1997, Intel announced the Wired for Management Baseline Specification, which is designed to help manufacturers produce a wide range of business PCs that can be more effectively managed over networks to help reduce ownership costs.

Intel uses advanced CMOS and BiCMOS process technologies in the manufacture of its integrated circuits. In 1996, most of Intel's IC products were manufactured using 0.8µm technology moving toward 0.35µm and 0.4µm process technologies. In 1997, the processes were predominantly 0.35µm. In the later half of 1997, Intel introduced the 333MHz processor using 0.25µm technology.

The 0.25 micron process uses a five layer metal process with tungsten plug interconnect between first and second and third metal layers. Shallow trench isolation is employed to further reduce chip "real estate."

By the end of 1998, the majority of Intel products will be manufactured using the 0.25µm process. The next generation, 0.18µm, technology is currently under development.

Semiconductor Fabrication Facilities

Intel Corporation
Ronler Acres
Hillsboro, Oregon 97007
Telephone: (503) 681-8080
Fab D1B
Cleanroom size: 70,000 square feet
Capacity (wafers/week): 1,000 (6,250 in 1998)
Wafer size: 200mm
Process: CMOS
Products: MPUs, R&D
Feature sizes: 0.18 μ m, 0.25 μ m

Intel Corporation
2111 Northeast 25th Avenue
Aloha, Oregon 97124
Telephone: (503) 681-8080
Fab 5 (former Fab D1 R&D fab)
Cleanroom size: 10,000 square feet
Capacity (wafers/week): 500
Wafer size: 150mm
Processes: CMOS
Products: Logic and memory ICs, MPUs, R&D
Feature sizes: 0.6 μ m, 0.8 μ m, 1.0 μ m

Intel Corporation
4100 Sara Road SE
Rio Rancho, New Mexico 87124
Telephone: (505) 893-7000
Fab 7
Cleanroom size: 60,000 square feet
Capacity (wafers/week): 8,000
Wafer size: 150mm
Process: CMOS
Products: Flash memories
Feature sizes: 0.4 μ m, 0.6 μ m, 0.8 μ m

Intel Corporation
3601 Juliet Lane
Santa Clara, California 95050
Telephone: (408) 496-9023
Fab D2
Cleanroom size: 60,000 square feet (Class 1)
Capacity (wafers/week): 5,000
Wafer size: 200mm
Processes: CMOS, BiCMOS
Products: MPUs, flash memories, R&D
Feature sizes: 0.25 μ m-0.8 μ m

Intel Corporation
5000 West Chandler Boulevard
Chandler, Arizona 85226-3699
Telephone: (602) 554-8080
Fab 6
Cleanroom size: 35,000 square feet
Capacity (wafers/week): 5,375
Wafer size: 150mm
Processes: CMOS
Products: MPUs, MCUs
Feature sizes: 0.8 μ m, 1.0 μ m

Intel Israel, Ltd.
Jerusalem, Israel
Fab 8
Cleanroom size: 10,000 square feet
Capacity (wafers/week): 3,500
Wafer size: 150mm
Process: CMOS
Products: MPUs, MCUs, logic ICs
Feature sizes: 0.6 μ m-1.0 μ m

Intel Corporation
4100 Sara Road SE
Rio Rancho, New Mexico 87124
Telephone: (505) 893-7000
Fab 9
Cleanroom size: 60,000 square feet
Capacity (wafers/week): 7,000
Wafer size: 150mm
Process: CMOS
Products: Flash memories
Feature sizes: 0.4 μ m, 0.6 μ m

Intel Corporation
4100 Sara Road SE
Rio Rancho, New Mexico
Telephone: (505) 893-7000
Fab 11
Cleanroom size: 185,000 square feet (Class 1)
Capacity (wafers/week): 10,000
Wafer size: 200mm
Processes: BiCMOS, CMOS
Products: MPUs, logic ICs
Feature sizes: 0.35 μ m-0.6 μ m

Intel Ireland, Ltd.
Collinstown Industrial Park
Leixlip, County Kildare, Ireland
Telephone: (353) (1) 707-7000
Fab 14 (Startup in 1998)
Cleanroom size: 75,000 square feet (Class 1)
Capacity (wafers/week): 7,000
Wafer size: 200mm
Processes: CMOS, BiCMOS
Products: MPUs
Feature size: 0.25 μ m (0.18 μ m capable)

Intel Ireland, Ltd.
Collinstown Industrial Park
Leixlip, County Kildare, Ireland
Telephone: (353) (1) 707-7000
Fab 10
Cleanroom size: 60,000 square feet (Class 1)
Capacity (wafers/week): 6,000
Wafer size: 200mm
Process: BiCMOS
Products: MPUs
Feature size: 0.6 μ m

Intel Corporation
Chandler, Arizona
Fab 12
Cleanroom size: 160,000 square feet (Class 1)
Capacity (wafers/week): 12,000
Wafer size: 200mm
Processes: CMOS, BiCMOS
Products: MPUs
Feature size: 0.35 μ m (0.25 μ m capable)

Intel Corporation
3585 Southwest 98th Avenue
Aloha, Oregon 97007
Telephone: (503) 681-8080
Fab 15 (former D1A R&D fab)
Cleanroom size: 20,000 square feet
Capacity (wafers/week): 3,225
Wafer size: 200mm
Process: CMOS
Products: MPUs
Feature sizes: 0.35 μ m-0.6 μ m

Intel Corporation	Intel Israel, Ltd.
Fort Worth, Texas	Kiryat Gat, Israel
Fab 16 (Startup in 1999)	Fab 18 (Startup in 1998)
Cleanroom size: 75,000 square feet	Cleanroom size: 86,000 square feet (Class 1)
Wafer size: 200mm	Capacity (wafers/week): 7,500
Process: CMOS	Wafer size: 200mm
Products: MPUs	Process: CMOS
Feature sizes: 0.18 μ m, 0.25 μ m	Products: Flash memories
	Feature sizes: 0.25 μ m, 0.4 μ m

The majority of Intel's semiconductor assembly and testing takes place at the company's facilities in Penang, Malaysia, and Manila, the Philippines. Some assembly and testing is performed in the U.S. In addition, the company is building new assembly and test factories in Shanghai, China, and San Jose, Costa Rica, both scheduled for completion in 1998.

Key Agreements

- In February 1998, Intel announced an agreement with Advanced RISC Machines (ARM), based in Cambridge UK, to produce, sell and enhance the StrongARM® microprocessor family under license. The agreement includes a technology cross license between the companies. The agreement signals Intel's plans to continue support for the StrongARM family of high-performance, low-power microprocessors, as well as plans for future enhancements to the product.
- In February 1998, C-Cube announced a cooperative engineering effort with Intel Corporation. The C-Cube/Intel solution will allow audio/video data to be directly decoded by C-Cube's ZiVA DVD chip and passed to the Intel processor for scaling and display.
- In January 1998, Intel acquired the outstanding shares of Chips and Technologies, Inc. of San Jose, California, for approximately \$430M. Chips and Technologies, a fabless IC designer, is currently the market segment leader for notebook graphics accelerator chips.
- In December 1997, Intel and The Fantastic Corporation announced a working relationship to enable delivery of media rich content to PCs via broadband infrastructures such as satellite, cable, digital terrestrial and digital subscriber lines (DSL). The Fantastic Corporation, which develops and sells software for broadband multimedia distribution, enables content providers to deliver large amounts of rich multimedia content quickly and efficiently to PCs and advanced set-top computers over any type of high-speed network. Intel also disclosed that it has an investment in the Fantastic Corporation and that it is providing the company with technical support.
- In October 1997, Intel and Digital Equipment Corporation announced that they have agreed to establish a broad-based business relationship. Under the agreement, Intel will purchase Digital's semiconductor operations, including facilities in Hudson, Massachusetts, as well as development operations in Jerusalem, Israel and Austin, Texas, for approximately \$700M. The agreement is subject to US government review.

- In October 1997, Intel announced it had signed a letter of intent with Cisco Systems, Inc. aimed at accelerating the deployment of high-speed cable modems to homes. The parties intend to focus on the development and deployment of consumer-installable, Data Over Cable Service Specification compliant external cable modems using the USB standard.
- In October 1997, Intel and @Home Network announced an agreement to work together to accelerate the deployment of high-speed cable modems for the home. The companies will work jointly to develop, test and promote external cable modems using USB and IEEE 1394 standards – designed to allow easy “plug-and-play” installation.
- During the fourth quarter 1997, Intel acquired Corollary Inc., a privately held supplier of multiprocessing technology based on Intel Architecture. The acquisition was aimed at accelerating the availability of high-performance, eight-way server solutions based on the Intel Architecture.
- In May 1997, Intel signed an agreement with Samsung Electronics Co., Ltd., to work on future computer and consumer electronics projects. The agreement will allow both companies to explore and accelerate the development of products and technologies that combine personal computer technology with consumer devices.
- During the second quarter of 1997, Intel and Hewlett-Packard announced that they plan to team up to offer quick and easy image capture, editing and publishing capabilities for home and business consumers. The two companies plan to work together to advance PC imaging industry specifications such as USB, Flash Memory Miniature Card, FlashPix® and MMX™ technology.
- In April 1997, Intel, Compaq Computer Corporation, and Microsoft Corporation announced their intent to work cooperatively with the broadcasting and cable television industries to realize the full potential of digital television (DTV) across a range of PCs, hybrid PC/TVs and digital TV appliances. Their vision of DTV is one in which high-resolution video and high-fidelity audio are married to the interactive content of the PC and the Internet.
- In March 1997, Intel and Avid Technology Inc. announced a strategic alliance to support Avid’s plans to offer video and audio editing products on the Intel architecture. Under terms of the agreement, Avid will develop digital content creation products for the Intel architecture. Also under terms of the agreement, Intel will purchase 1,555,632 newly issued shares of Avid common stock for a total investment of \$14.75M.
- In March 1997, Intel and Eastman Kodak Company announced plans to work together to drive PC imaging specification efforts. The purpose of the alliance is to enable users to edit, store, share, communicate and publish images more easily. Specifically, Intel and Kodak have agreed to leverage MMX™ media enhancement technology for improved image processing, drive PC portable camera specifications and expand retail opportunities through Kodak’s Picture Network Service.

- In February 1997, Intel, Marimba Inc. and Macromedia, Inc. announced the development of an “Infinite CD” for the Public Broadcasting Service (PBS), enabling KPBS ONLINE to deliver quality entertainment, information and commerce through the Connected PC. The CD-ROM, containing video footage of PBS programs, will link to PBS ONLINE, allowing consumers to receive updated information via the Internet. “Infinite CD” technology will enable PBS to demonstrate PBS videos and learning materials and inform teachers, consumers, and families of future offers and related services.
- In February 1997, Intel announced an equity investment in Samsung Electronics’ \$1.3B advanced semiconductor memory fabrication plant in Austin, Texas. Under the agreement, Samsung will provide Intel with a reliable supply of advanced memory products. Samsung will retain full operational and technological management of the Austin Facility. This investment was executed for the purpose of assuring Intel a stable supply of advanced memory products.
- In January 1997, Intel announced their intent to acquire Case Technology, based in Copenhagen, Denmark for \$72M. Case Technology is a subsidiary of Anite Group plc, a London-based technology group and specializes in Ethernet switching and small business and branch office routing products. Case Technology’s products will become key elements of Intel’s strategy for providing customers with a cost-effective range of comprehensive networking solutions to enhance the performance and manageability of today’s PC networks.
- Integrated Silicon Solution Inc. (ISSI) licensed flash memory-related patents from Intel in early 1996.
- Intel and AMD signed a five-year patent cross-licensing agreement near the end of 1995, giving the two companies rights to use each other’s MPU-related patents and certain copyrights — excluding microprocessor code. AMD agreed not to use Intel microcode beyond the 486 MPU generation.
- In November 1995, Catalyst signed a cross-licensing agreement with Intel. The agreement provides Catalyst with the right to utilize all of Intel’s flash memory patents.

Noteworthy News

- In February 1998, Intel introduced a 333MHz Pentium® II microprocessor for desktop systems, raising the high-end of the company’s speed level by more than ten percent. The processor was the first to be built on Intel’s 0.25 micron process technology. The 0.25 micron process will enable Intel to achieve 450MHz speeds for the Pentium® II line by the end of 1998.
- In February 1998, Intel announced its intention to enter the graphics chip market with a graphics accelerator, the i740. Intel is forecasting to have a 40 percent market share in the high performance graphics chips market by 1999. The chip was developed out of a joint venture with Chips and Technologies, which Intel purchased earlier in the month, and Real 3D Inc., a Lockheed Martin Corp. spin-off. (Intel of Santa Clara, California, owns twenty percent of the spin-off).
- In February 1998, Intel announced plans to build a 300mm development and pilot manufacturing facility in Hillsboro, Oregon. Intel will invest \$1.5 billion to erect a facility capable of processing 8,000 wafers per month. The new plant will feature a 120,000 square foot “Class 1” cleanroom which will be used to develop 0.13 micron technology. Groundbreaking is scheduled for early 1998, and the fab should be operational in 1999.

- In February 1998, Intel announced plans to transition their flash memory products from 0.4 micron to 0.25 micron technology, on 200mm wafers. Half of Intel's flash products will be made on the new geometry within a year. The company plans to begin the transition at Fab 9, in Albuquerque, New Mexico.
- In January 1998, Intel announced the establishment of a new business group, the Intel Architecture (IA) Business Group. The IA group will be responsible for managing all Intel architecture roadmaps, strategies, and resources between the Business Platform Group, the Consumer Products Group, the Mobile/Handheld Products Group, and the Enterprise Server Group.
- In November 1997, Intel announced a reorganization to better address the changing computing market place. Specifically, four new groups were created: the Consumer Products Group, the Business Platform Group, the Small Business and Networking Group, and the Digital Imaging and Video Division.
- In September 1997, the U.S. Federal Trade Commission (FTC) staff notified Intel that it had begun an investigation of Intel's business practices. To date, no allegations have been made, nor have any charges been filed. Intel has an aggressive program in place to make sure its business practices are in full compliance with federal laws in this area.
- In the third quarter of 1997, Intel announced its breakthrough multiple-bit-per-cell flash memory technology, called StrataFlash™ memory. Intel's StrataFlash™ technology stores two pieces of information in each memory cell compared to current memory technologies that store only one. Intel plans to begin production of a 64Mbit flash memory chip using this technology in the first quarter of 1998.
- In June 1997, Intel began shipping the first processors to use 0.25 micron manufacturing process. The 0.25 micron technology allows for more transistors per processor and more processors per wafer at a lower cost per transistor than previous technologies.
- In May 1997, Intel introduced the Pentium® II processor, their most powerful processor to date, available at speeds of 300, 266, and 233MHz. The Pentium® II processor has brought new levels of visual computing to the desktop for consumers enabling for enhanced audio, fluid video and dramatic 3D graphics.
- In January 1997, Intel introduced the Pentium® processor with MMX™ technology, the first chip to include Intel's new technology for improved performance on media-rich applications.
- In 1997, Intel unveiled their new 64-bit microprocessor architecture, designed for the high-end workstation and server market segments. The Merced™ processors are scheduled to ship in 1999, which will be followed by the next generation UA-64™ microprocessor, scheduled for 2001.

MITSUBISHI

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Web Site: www.melco.co.jp

IC Manufacturer
Founded: 1921

Regional Offices/Representative Locations

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 Telephone: (408) 730-5900 • Fax: (408) 732-9382 • Web Site: www.mitsubishi.com

Europe: Mitsubishi Electric Europe GmbH • Ratingen, Germany
 Telephone: (49) (2102) 486-0 • Fax: (49) (2102) 486-367

Financial History, Fiscal Year Ends March 31

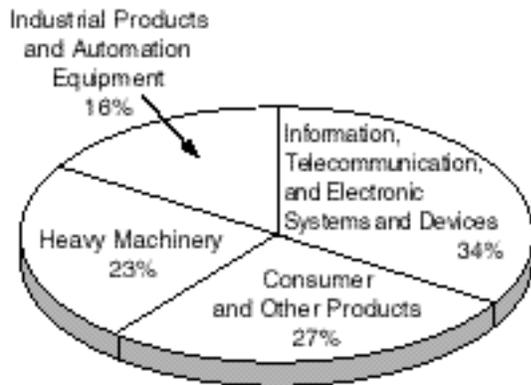
	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (¥B)						
Sales	¥3,343	¥3,260	¥3,105	¥3,251	¥3,511	¥3,725
Net Income	¥36	¥29	¥21	¥42	¥59	¥9
Semiconductor (\$M)*						
Sales	\$2,490	\$2,958	\$3,874	\$5,065	\$4,150	\$4,090
IC Sales	\$2,068	\$2,405	\$3,286	\$4,435	\$3,545	\$3,630
Discrete Sales	\$422	\$553	\$588	\$630	\$605	\$460
Capital Expenditures	\$480	\$455	\$690	\$1,120	\$1,055	\$890

*Calendar Year

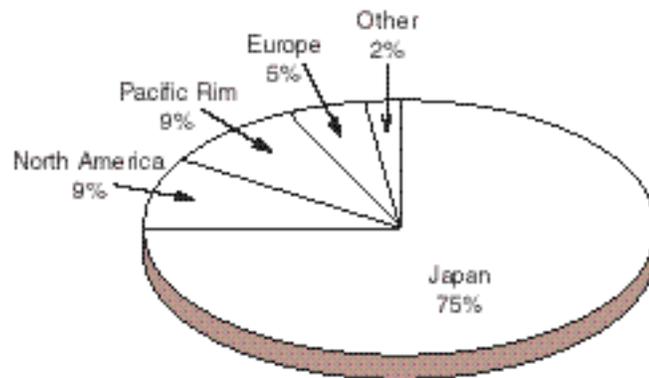
Ownership: Publicly held. Stock exchange listings: London, Paris, Amsterdam, Frankfurt, Luxembourg, Tokyo, Osaka, Nagoya, Sappora, Niigata, Kyoto, Hiroshima, and Fukuoka.

Company Overview and Strategy

Mitsubishi Electric is a leading manufacturer of electronic and electrical equipment with sales of about \$30 billion in 1997 (fiscal year ending March 1997) and some 111,000 employees worldwide. The company's business is divided into four operational categories: information, telecommunication, and electronic systems and devices; heavy machinery; industrial products and automation equipment; and consumer and other products. Mitsubishi started mass production of integrated circuits in 1961.



1997 Corporate Sales by Business Segment



1997 Corporate Sales by Geographical Region

Management

Mitsubishi Electric Corporation

Takashi Kitaoka	President
Shoji Hirabayashi	Senior Managing Director and General Manager, Semiconductor Group
Tsuyoshi Toyama	General Manager, Memory Division, Semiconductor Group
Toyohiko Yoshida	General Manager, Mediaprocessor Product Division, Semiconductor Group

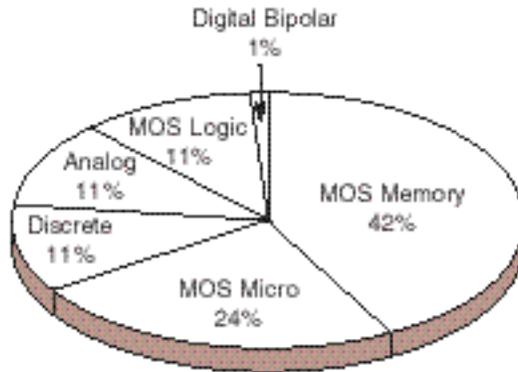
Mitsubishi Electronics America Inc., Electronic Device Group

Takao Nishimura	President
John Zucker	Executive Vice President

Products and Processes

Mitsubishi's semiconductor products include standard and application-specific memory ICs, gate and embedded arrays, ASSPs, JPEG and MPEG encoder/decoders, microcontrollers, digital and analog standard ICs, optoelectronic products, and microwave GaAs FET and RF power semiconductors.

DRAMs accounted for about 40 percent of Mitsubishi's semiconductor sales in 1997. That figure is expected to fall below 30 percent in 1998, as the company plans to put more energy into its embedded RAM products, microcontrollers, ASICs, and flash memory devices.



1997 Semiconductor Sales by Device Type

- MOS MEMORY**
- DRAM
 - SRAM
 - Flash Memory
 - EPROM
 - ROM
 - EEPROM
 - Other (Including Non-Volatile RAM)

- ANALOG**
- Amplifier
 - Interface
 - Consumer/Automotive
 - Voltage Regulator/Reference
 - Data Conversion
 - Comparator
 - Other (Includes Telecom)

- MOS LOGIC**
- General Purpose Logic
 - Gate Array
 - Standard Cell
 - Field Programmable Logic
 - Other Special Purpose Logic

- DIGITAL BIPOLAR**
- Bipolar Memory
 - General Purpose Logic
 - Gate Array/Standard Cell
 - Field Programmable Logic
 - Other Special Purpose Logic
 - MPU/MCU/MPR

- MOS MICROCOMPONENT**
- MPU
 - MCU
 - MPR
 - DSP

- OTHER**
- Full Custom IC
 - Discrete
 - Optoelectronic

Mitsubishi's top strategic semiconductor products are as follows.

Memory ICs

The company's DRAM product line includes 1M, 4M, 16M, and 64M EDO DRAMs; 4M, 16M and 64M synchronous DRAMs; 256K, 1M, and 2M VRAMs; 10M 3D RAMs; and 4M and 16M Cache DRAMs. In 2Q97, Mitsubishi purchased a Rambus DRAM license to develop a successor technology to the SDRAM. Called Direct RDRAM technology, the new high-bandwidth memories are expected to enter volume production in 1999.

Mitsubishi's fifth generation of HyperDRAM process combines 64Mbit DRAM and 0.25 micron logic on a single chip, allowing for the integration of an extensive ASIC library along with memory and CPU. The HyperDRAM process includes 4 layer metal interconnect, 4 million logic gates (maximum), 150MHz operation, at 85ps.

In flash memories, the company has a strategic alliance with Hitachi. The two companies offer 8M and 16M flash devices based on Mitsubishi's divided-bitline NOR (DiNOR) architecture and 64M parts based on Hitachi's AND technology. Mitsubishi also offers 1M NOR flash parts.

Mitsubishi's SRAM products include CMOS standard SRAMs in 1M and 4M densities, fast SRAMs in 256K, 512K, 1M, and 4M densities, and 1M and 2M synchronous pipeline burst SRAMs for high-speed Cache applications (up to 133MHz).

Microcomponents

Mitsubishi is a second source for Digital Semiconductor's Alpha RISC microprocessor and is one of the world's leading suppliers of 8-/16-/32-bit microcontrollers, with a broad portfolio that includes a 32-bit part with 1M of built-in flash memory. The company also produces 8-bit MCUs. Products include microcontrollers for display functions, multi-function timers, UART development tools, LCD drivers, keyboard controllers, and power management ICs.

In early 1997, the company announced its entrance into the media coprocessor market with the first generation of the D30V product family. The D30V is a dual issue, very-long-instruction-word (VLIW) RISC processor targeted at DVD players and other consumer electronic applications.

ASICs and ASSPs

The company's ASIC products include CMOS gate arrays, embedded arrays, and digital and mixed-signal standard cells. Its ASSPs focus on image processing applications (e.g., MPEG-2 and JPEG encoding and decoding), audio, phone, and automobile applications. Mitsubishi also sells, through an agreement with IBM, ASSPs based on IBM's PowerPC embedded controller core.

GaAs ICs

Mitsubishi is experiencing strong demand for its gallium-arsenide mobile communications-related devices and optoelectronic products. Products include low noise FET/HEMT, high power FETs, internally matched power FETs and 1.9GHz band PHS ICs.

Other Products

Mitsubishi also manufactures and sells optical devices and high frequency semiconductors for portable applications.

Semiconductor Fabrication Facilities

Mitsubishi's fab projects include the construction of the \$1.1 billion 64M DRAM facility at its Saijo site. The fab will have the capacity to produce 2,500 200mm wafers per week, beginning in late 1997, or early 1998. In addition, Mitsubishi plans to build a 300mm wafer fab at its Kochi site by 2000 for 64M and 256M DRAM production. Construction of the \$2.5 billion facility is expected to start in 1998. Mitsubishi has also indicated that it will build a future generation DRAM fab at its North Carolina site.

Mitsubishi Electric, Kochi Factory
Kami-gun, Kochi Prefecture, Japan
Capacity (wafers/week): 8,750
Wafer size: 150mm
Process: CMOS
Products: ASICs, MPUs, MCUs, MPRs,
 DRAMs, SRAMs, ROMs.
Feature sizes: 0.6 μ m-1.0 μ m

Mitsubishi Electric, Saijo Factory
Saijo-shi, Ehime Prefecture, Japan
Capacity (wafers/week): 28,000
Wafer sizes: 100mm, 125mm, 150mm, 200mm
Processes: CMOS, BiCMOS
Products: SRAMs, MPUs, MCUs, ASICs,
 flash memories, DRAM/logic.
Feature sizes: 0.35 μ m-1.0 μ m

Mitsubishi Electric, Kita-Itami Works
Itami-shi, Hyogo Prefecture, Japan
Capacity (wafers/week): 6,000
Wafer size: 100mm
Process: GaAs
Products: Optoelectronics
Feature size: 0.5 μ m

Mitsubishi Semiconductor Europe GmbH
Konrad-Zuse Strasse 1
52477 Alsdorf, Germany
Telephone: (49) (2404) 990-0
Capacity (wafers/week): 5,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs
Feature size: 0.35 μ m

Mitsubishi Electric, Fukuoka Works
Fukuoka-shi, Fukuoka Prefecture, Japan
Capacity (wafers/week): 12,500
Wafer sizes: 100mm, 150mm
Process: Bipolar
Products: Analog ICs, ASICs, discretes, bipolar ICs
Feature sizes: 2.0 μ m-3.0 μ m

Mitsubishi Electric, Kumamoto Works
Kikuchi-gun, Kumamoto Prefecture, Japan
Capacity (wafers/week): 32,250
Wafer sizes: 125mm, 150mm, 200mm
Process: CMOS
Products: SRAMs, MCUs, CMOS Logic, CMOS gate arrays
Feature sizes: 0.3 μ m-2.0 μ m

Mitsubishi Electric, Kita-Itami Works
Itami-shi, Hyogo Prefecture, Japan
Capacity (wafers/week): 1,625
Wafer sizes: 150mm, 200mm
Processes: CMOS, BiCMOS
Products: R&D
Feature sizes: 0.3 μ m-0.5 μ m

Powerchip Semiconductor Corporation
Hsinchu, Taiwan
Telephone: (886) (3) 5783-344
Capacity (wafers/week): 3,750
Wafer size: 200mm
Process: CMOS
Products: DRAMs, logic ICs
Feature size: 0.4 μ m
(Joint venture with UMAX-Elite Group and
Kanematsu Corporation, see Key Agreements.
Began production in 4Q96).

Key Agreements and Alliances

- In October 1997, Mitsubishi and Motorola finalized an agreement to offer the first merchant market second source of customized solutions utilizing Motorola's ColdFire architecture. Integrating Motorola's technologies with Mitsubishi's 0.35 micron process, and the signing of this agreement, signifies a commitment by both companies to provide the embedded market with system solutions incorporating processor and DRAM memory functions on a single chip. Under the terms of the current contract, Mitsubishi receives Motorola's version 2 and version 3 ColdFire architecture technologies, with the right to include encrypted synthesizable models and core views in its cell library for customers to design and develop products. Motorola will in turn receive Mitsubishi's 0.35 micron embedded DRAM technology and design tools for future products.
- It was announced in early 1997, that Hitachi, Mitsubishi, and Texas Instruments will codevelop the cell architecture for a 1G DRAM as well as the process technology needed to manufacture it.
- Mitsubishi and Lucent Technologies agreed in mid-1996, to jointly develop a set of ICs that together will perform all of the functions needed for next-generation high-definition television (HDTV) sets for the U.S. market. The first samples of the chips are expected to be available in early 1998.
- Mitsubishi and Stone Group Co., a leading private electronics manufacturer in China, formed a joint venture in Beijing for the assembly and test of Mitsubishi's ASICs, microcontrollers, and memories. Operations at Mitsubishi Stone Semiconductor Co., Ltd. began in May 1997. A wafer fabrication facility may be built at the site in the future.
- Motorola and Mitsubishi announced a couple of joint cooperation agreements in 1996. In October, Motorola agreed to exchange its 32-bit ColdFire RISC and 68EC000 embedded MPU technologies for Mitsubishi's M32R microprocessor with embedded DRAM technology. In December, the two companies agreed to jointly market MobileFlash™ memory devices based on the DiNOR flash technology developed by Mitsubishi. Motorola and Mitsubishi have said that their alliance in flash memories may be expanded in the future to include a joint venture fab dedicated to the manufacture of flash chips.
- In mid-1996, Mitsubishi announced an agreement with IBM that allows the company to sell IBM PowerPC embedded controller chips under the Mitsubishi brand name.
- Mitsubishi is cooperating with Rockwell in high-speed modem IC production. Under the partnership, Mitsubishi is producing 28.8kps modem ICs and supplying them to Rockwell on condition that it and its customers can preferentially procure such ICs.
- Mitsubishi joined with the Japanese trading firm Kanematsu Corporation and Taiwan's UMAX Elite Group to establish a new DRAM manufacturing company in Taiwan called Powerchip Semiconductor. Powerchip's fabrication facility began volume production of 16M DRAMs in the fourth quarter of 1996.

- Mitsubishi agreed to cooperate in development and production of Digital Semiconductor's Alpha 64-bit RISC microprocessor.
- SGS-Thomson signed on as a second source for Mitsubishi's flash memory products.
- Mitsubishi codeveloped a 8M and 16M flash memory device with Hitachi that is based on Mitsubishi's divided bitline NOR (DiNOR) design. The team has also developed a 64M version based on Hitachi's complementary AND cell.

Noteworthy News

- In December 1997, Mitsubishi announced plans to ship eRAM-enabled embedded memory products the first half of 1998, using its 0.25 micron HyperDRAM process technology. This announcement will make Mitsubishi the first company to ship embedded memory products using 0.25 micron process. The benefits of Mitsubishi's HyperDRAM technology include the general advantages of integration plus higher bandwidth, elimination of granularity problems, lower power consumption, greater quality and reliability, and lower electromagnetic interference.
- In January 1997, Mitsubishi and SRS Labs, Inc. announced that Mitsubishi has developed the audio industry's first multifunction digital sound control IC to use SRS Labs' innovative SRS Sound Retrieval System, 3D surround audio technology. Mitsubishi's digital sound control IC, the M62430FP, integrates the SRS technology, tone and volume controls, and a microcontroller interface circuit on a single chip for consumer audio, television and personal computer applications.

MOTOROLA

Motorola, Inc.
Semiconductor Products Sector (SPS)
3102 North 56th Street
Phoenix, Arizona 85018
Telephone: (602) 244-6900
Fax: (602) 952-4067
Web Site: www.motorola.com/sps

IC Manufacturer
Founded: 1928

Regional Offices/Representative Locations

Europe: Motorola, European Semiconductor Group • Geneva, Switzerland
 Telephone: (41) (22) 7991-1111 • Fax: (41) (22) 799-1499

Asia-Pacific: Motorola Silicon Harbor Centre • Tai Po, Hong Kong
 Telephone: (852) 2666-8333 • Fax: (852) 2666-6123

Financial History (\$M), Fiscal Year Ends December 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate						
Sales	13,303	16,963	22,245	27,037	27,973	29,794
Net Income	453	1,022	1,560	1,781	1,154	1,180
Semiconductor						
Sales	4,470	5,800	6,960	8,540	7,858	8,003
IC Sales	3,606	4,825	5,600	6,850	6,379	6,562
Discrete Sales	864	975	1,360	1,690	1,479	1,441
Capital Expenditures	666	1,120	1,640	2,530	1,400	1,153
Employees (SPS)	41,000	44,000	46,000	52,000	50,000	53,000

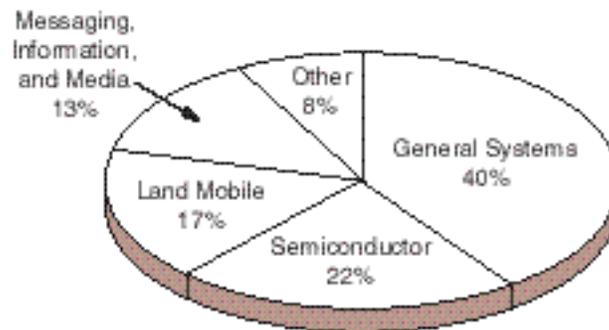
1998 Sales Projection: \$ 9.3B

Ownership: Publicly held. NASDAQ: MOT.

Company Overview and Strategy

Motorola is one of the world's leading providers of wireless communications, semiconductors and advanced electronic systems, components and services. Major equipment businesses include cellular telephone, two-way radio, paging and data communications, personal communications, automotive, defense and space electronics and computers. Motorola semiconductors are primarily used for power communications devices and computers.

The company's operations are divided into six sections and one group: the Semiconductor Products Sector; the Cellular Subscriber Sector; the Cellular Networks and Space Sector; the Land Mobile Products Sector; the Messaging, Information and Media Sector; the Automotive, Energy and Components Sector; and the Motorola Computer Group.



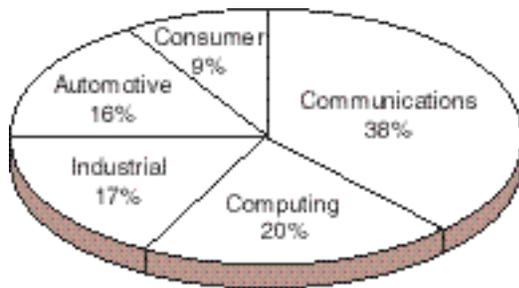
1997 Corporate Sales by Product Group/Sector

The Semiconductor Products Sector (SPS), headquartered in Austin Texas, designs, produces and distributes a broad line of discrete semiconductors and integrated circuits, including microprocessors RF devices, microcontrollers, digital signal processors, memories, logic and analog circuits, and sensors. Motorola's SPS produces product support applications such as communications, computing and consumer products – from cellular phones, PCs and printers to multimedia devices; from airbags, antilock brakes and keyless entry in automobiles to air monitoring; products for "smart buildings" and motor controls for environmental protection and entry management.

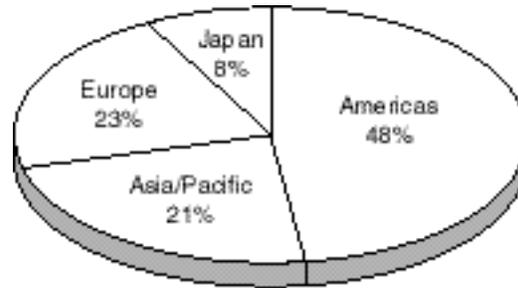
The Semiconductor Products Sector consists of five Market Business Units, as follows:

1. Consumer Systems Group
2. Networking and Computing Systems Group
3. Semiconductor Components Group
4. Transportation Systems Group
5. Research and Development

Sales by End-Use Market and Geographic Region are provided below.



1997 Semiconductor Sales by End-Use Market (est)



1997 Semiconductor Sales by Geographic Region

A Description of each SPS Group is provided below.

Consumer Systems Group – based in Hong Kong, focuses on entertainment monitor, display, imaging storage, personal systems, PC media and other new areas as they develop. The Group consists of five divisions, as follows.

1. Advanced Digital Consumer – Tokyo, Japan
2. Displays – Hong Kong
3. Personal and PC Media – Hong Kong
4. Smart Information Transfer – East Kilbride, Scotland
5. Imaging and Storage – Austin, Texas

The Group's objective is to enhance personal productivity and enrich individual lifestyle while supporting specific consumer entertainment markets. These markets include advanced digital audio and video products, digital camera, advanced digital TV, games, home entertainment segments, flat panel display, computer monitor, TV display, home appliances, corded telephone, computer keyboard and mouse, PC media cards, electronic organizer, and the innovative system solutions such as SmartCard, security tags, and other devices for information transfer, data security protection, identification and authentication.

Networking and Computing Systems Group – based in Austin, Texas, focuses on networking systems, communication transmission and access, wireless infrastructure and high performance memory technologies. The Group consists of six divisions, as follows.

1. Communication, Transmission and Access Systems – Austin, Texas
2. Fast Static RAM – Austin, Texas
3. Networking Systems – Austin Texas
4. Nonvolatile Memory – Austin, Texas
5. Personal Computing – Austin, Texas
6. Wireless Infrastructure Systems – Phoenix, Arizona

This group is responsible for the Power-PC microprocessor architecture across the Sector. The Group's market focus is to deliver first class networking systems, communications transmission and access capabilities, and superior wireless infrastructure, while providing high performance memory components and computing technologies.

Semiconductor Components Group – headquartered in Geneva, Switzerland, combines SPS's standard discrete and integrated circuit products and focuses on the Sector's other four target markets with additional emphasis on distribution and electronic subcontracting manufacturing. The group consists of six divisions, as follows.

1. Consumer Components – Singapore
2. Networking and Computing Components – Chandler, Arizona
3. Transportation Components – Munich, Germany
4. Wireless Subscriber Components – Tempe, Arizona
5. Distribution – Phoenix, Arizona
6. Electronic Manufacturer's Service Industry – Aylesbury, U.K.

The Group's mission is to deliver custom components support to the other four Sector's target markets.

Transportation Systems Group – based in Austin, Texas, focuses on telegraphy, messaging, wireless systems, and new media through the following divisions.

1. Wireless Messaging Division – Austin, Texas
2. Wireless Subscriber-Platforms/Systems – Austin, Texas
3. Wireless Subscriber-RF/IF – Phoenix, Arizona
4. New Media Operation – Austin, Texas

The group is responsible for DSP technologies across the Sector with a mission to be the leader in wireless subscriber systems solutions by delivering a compelling portfolio of services, architecture, software, semiconductors, and technology modules that accelerate customers' success.

Research and Development – also known as the Sector Technology Advisory Resource (STAR) has a global presence in order to leverage Motorola's worldwide manufacturing and technological capabilities. Major R&D laboratories are located in Europe (France; Germany; Russia), Japan, and China. In addition, Motorola technologists at software and systems laboratories in 11 countries focus on areas that include Wireless Systems, Advanced Design Technology and Advanced Interconnect Systems.

All Motorola SPS customers are served through a worldwide network of design, manufacturing, marketing and support operations in North America, Asia-Pacific, Europe, Japan, and developing markets.

Management

Motorola, Inc.

Gary L. Tooker	Chairman
Christopher B. Galvin	Chief Executive Officer
Robert L. Growney	President and Chief Operating Officer
Carl F. Koenemann	Executive Vice President and Chief Financial Officer

Motorola Semiconductor Products Sector

Hector Ruiz	President
C.D. Tam, Sr.	Vice President and GM, Transportation Systems Group
Carlos Genardini	Sr. Vice President and GM, Consumer Systems Group
Fred Shlapak	Sr. Vice President and GM, Wireless Subscriber Systems Group
Bertrand Cambou	Sr. Vice President and GM, Network & Computing Systems Group
Steve Hanson	Sr. Vice President and GM, Semiconductor Components Group
Bill Walker	Corporate Vice President, Manufacturing
Rick Sivan	Vice President & Director, Technology
Billy Edwards	Vice President & Director, Strategic Management & Planning
Larry Barton	Vice President & Director, Communications & Public Affairs
Bill Seiferth	Sr. Vice President and GM, Americas Region
Barry Waite	Sr. Vice President and GM, Europe, Middle East & Africa
Joe Yiu	Vice President & General Manager, Asia-Pacific and Japan
Bob Rivet	Vice President & Director, Finance
Brian Bedford	Sr. Vice President & Director, Human Resources

Products and Processes

MOS MEMORY

- DRAM
- SRAM
- Flash Memory
- EPROM
- ROM
- EEPROM
- Other (Including Non-Volatile RAM)

ANALOG

- Amplifier
- Interface
- Consumer/Automotive
- Voltage Regulator/Reference
- Data Conversion
- Comparator
- Other (Includes Telecom)

MOS LOGIC

- General Purpose Logic
- Gate Array
- Standard Cell
- Field Programmable Logic
- Other Special Purpose Logic

DIGITAL BIPOLAR

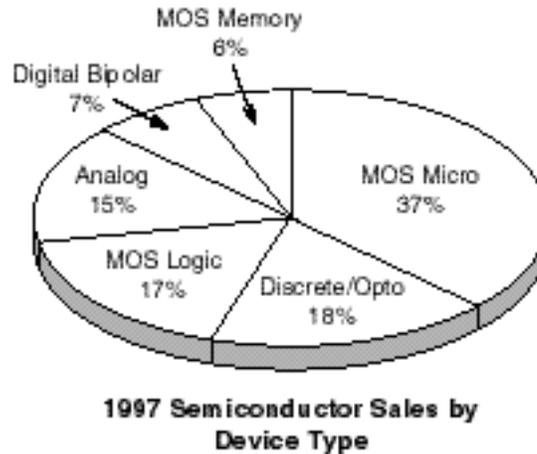
- Bipolar Memory
- General Purpose Logic
- Gate Array/Standard Cell
- Field Programmable Logic
- Other Special Purpose Logic
- MPU/MCU/MPR

MOS MICROCOMPONENT

- MPU
- MCU
- MPR
- DSP

OTHER

- Full Custom IC
- Discrete
- Optoelectronic



Provided below are details concerning Motorola's semiconductor products.

Analog ICs

Motorola offers an extensive line of linear ICs, including amplifiers and comparators, power supply circuits, power and motor control devices, voltage references, data converters, interface circuits, communications circuits, consumer electronics ICs, and automotive ICs.

Application-Specific ICs (ASICs)

Motorola's ASIC products include CMOS, bipolar, and BiCMOS gate arrays and FPGAs. Its most advanced digital gate arrays (M5C Series) are based on three-layer-metal 0.45 μm (L_{eff}) CMOS process technology, which allows for up to 557,000 available gates and 556 I/Os.

Audio/Video Products

Motorola currently offers a full family of audio/video products to support STB, DVD, ATV, Cable Modems and other applications for multimedia industry.

Digital Signal Processors (DSP)

The Motorola DSP portfolio includes the 16-bit, 16/24-bit, 24-bit, and 32-bit DSP core families, along with the development tools and peripherals to support them. These comprise the industry's only architecturally compatible digital signal processor line. All family members benefit from the same extended triple-bus Harvard architecture integrated with a number of execution units, memories, ports, controllers, and buses working in parallel.

Display Products

Motorola supplies a growing family of state-of-the-art cost effective LCD driver ICs for mobile communications appliances and controller ICs for MOSD (monitor on-screen display) incorporating either standard or customizable font and optional analog PWM control outputs.

Fast Static RAM (FSRAM)

Motorola has been the world's leading supplier for Fast SRAMs for the last consecutive years. Products include asynchronous, synchronous, cam (content addressable memory) and integrated device memory sub-systems solutions.

Flash Memory

Motorola's Flash Memory products are focused towards networking applications for non-volatile code or data storage. Their products are interface compatible with Motorola's network processors to maximize system performance.

Logic ICs

Serving the needs of system designers requiring interface circuits for more complex ICs and semiconductor designs, Motorola concentrates on supplying state-of-the-art logic families and functions, using ECL, TTL and CMOS technologies.

Microcontrollers (MCUs)

MCUs by Motorola perform the functions of a central processor unit (CPU) in a control system or computer-based product and provide additional functions for real-time control applications. The MCU typically includes memory, timers, and I/O circuitry on a single chip to reduce the number of ICs required in a product.

Microprocessors (MPUs)

Motorola's MPUs are high performance, low cost devices that contain basic arithmetic, logic and control circuitry for processing calculations and carrying out stored instructions in multi-user, multi-tasking applications. Motorola manufactures and markets high-performance microprocessors for computer applications and embedded processors for a variety of applications, including communications, imaging, office peripherals, multimedia systems, games, and industrial controls.

MPU product offerings include ColdFire™ variable-length RISC processors, M-CORE, ultra low power microRISC MPU, PowerPC™ RISC processors, and FlexCore program, which offers semi-custom, integrated processors to high-volume customers. PowerPC RISC microprocessors are used for Apple Macintosh, Mac OS compatible systems, embedded control applications and new emerging markets.

Optoelectronic Devices

Motorola manufactures optoisolators, devices which contain at least one emitter that is optically coupled to a photodetector through an insulating medium. Products include variations in input/output configuration (i.e., Transistor Output, Darlington Output, Schmitt Trigger Output, AC Input, Random Phase and Zero Crossing Triac Drivers) as well as a variety of Power Opto configurations.

Power Transistors & Modules

Power transistor and module offerings include Power MOSFETs and bipolar power transistors. Product configurations include surface mount devices and packages, as well as high power modules and leaded devices.

Programmable Logic & Analog Devices

Motorola offers the MPA1000 family of programmable logic arrays – SRAM based devices which range from 3,500 to 22,000+ FPGA gates. These products are used in communications, industrial and computer interface circuit applications. They are manufactured using 0.55 micron CMOS technology. A variety of packaging configurations are available.

The MPAA series of Field Programmable Analog Arrays are re-programmable SRAM based devices that control the functionality and interconnect of an array of analog OpAmps which can be configured to implement a wide variety of analog signal conditioning and process monitoring/control functions.

Rectifiers

For small hand-held battery units to large industrial applications, Motorola rectifiers include Schottky, Ultrafast, Fast and Standard Recovery rectifiers in surface mount packages and leaded devices from 20-100 volts and current ratings of 0.5-100 amperes.

RF Transistors, Hybrids and Integrated Circuits (RFICs)

Motorola's RFICs are used in transmitter and receiver applications, two-way communication equipment, radar systems, and industrial and test equipment. These products utilize bipolar, silicon FET or GaAs FET technologies.

Sensors

Motorola sensor devices support a wide variety of applications including pressure, acceleration, and chemical sensing.

Small Signal Transistors, FETs and Diodes

Touted as one of the broadest signal device portfolios in the industry, Motorola offers bipolar transistors, JFETs, TMOS FETs, MOSFETs and tuning and switching diodes in single and multiple configurations, in a variety of miniature surface mount packages.

Special Function ICs

Motorola maintains the capability to design devices for specific applications, including data communications, integrated communication controllers, communication peripherals, physical interface products, LonWorks Technology, Set-Top Box applications, Wireless communications, Wireline communications, and multimedia.

Thyristors

Motorola thyristors include high performance TRIACs, SCRs, surge suppressors, PUTs and SBS in both leaded and surface mount packages. These products are primarily used in the appliance and protection markets.

Transient Voltage Suppressors (TVS)

Motorola's portfolio of TVS devices offer a variety of voltage/power combinations in old and new package configurations. TVS are used to suppress voltage transients.

Zener Diodes

Motorola's Zener regulators and reference diodes are offered in a wide range of voltage and power ratings, and come in a variety of new packages.

Semiconductor Fabrication Facilities

Motorola has several fab facility projects underway, including the construction of a new 200mm wafer fab (MOS 17) in Tianjin, China, where CMOS and BiCMOS ICs will be produced. Other projects include the construction of a new fab facility (MOS 19) near Richmond, Virginia, for the production of PowerPC chips; and an expansion of the Nippon Motorola fab in Aizu, Japan. In 1996, Motorola and Siemens began the construction of a jointly owned DRAM plant in Richmond, Virginia. The joint venture, which goes by the name White Oak Semiconductor, is scheduled to start initial production of 64M parts this year, 1998.

Motorola, Ltd.
Colvilles Road
Kelvin Estate, East Kilbride
Glasgow G75 0TG, Scotland
United Kingdom
Telephone: (44) (35) 52-39101
MOS 1
Cleanroom size: 30,000 square feet
Capacity (wafers/week): 11,000
Wafer size: 150mm
Processes: CMOS, HMOS
Products: MCUs, linear and logic ICs
Feature sizes: 0.8 μ m, 1.2 μ m

Motorola, Inc.
3501 Ed Bluestein Boulevard
Austin, Texas 78721
Telephone: (512) 928-6000
MOS 3
Cleanroom size: 20,000 square feet
Capacity (wafers/week): 12,000
Wafer size: 100mm
Processes: CMOS, MOS
Products: MCUs
Feature size: 1.2 μ m

Motorola, Inc.
2200 West Broadway Road
Mesa, Arizona 85202
Telephone: (602) 962-2011
MOS 5
Cleanroom size: 48,000 square feet
Capacity (wafers/week): 6,000
Wafer size: 125mm
Processes: CMOS, MOS, bipolar
Products: MCUs, logic, linear, and digital ICs
Feature size: 1.0 μ m

Motorola, Inc.
3501 Ed Bluestein Boulevard
Austin, Texas 78721
Telephone: (512) 928-6000
MOS 2
Cleanroom size: 30,000 square feet
Capacity (wafers/week): 10,000
Wafer size: 100mm
Process: CMOS
Products: Logic ICs, ASICs
Feature sizes: 1.2 μ m-2.0 μ m

Motorola, Inc.
5005 East McDowell Road
Phoenix, Arizona 85008
Telephone: (602) 244-6900
MOS 4
Capacity (wafers/week): 3,000
Wafer size: 150mm
Process: MOS
Products: Power MOS discretes
Feature sizes: 0.5 μ m-5.0 μ m

Motorola, Inc.
2200 West Broadway Road
Mesa, Arizona 85202
Telephone: (602) 962-2011
MOS 6
Cleanroom size: 150,000 square feet
Capacity (wafers/week): 3,500
Wafer size: 150mm
Processes: CMOS, BiCMOS,
Products: SRAMs, ASICs
Feature sizes: 0.8 μ m-1.2 μ m

Nippon Motorola, Ltd.
Aizu Facility
1 Oyagi, Kofune
Shiokawa-machi, Yama-gun
Fukushima-ken 969-35, Japan
Telephone: (81) (241) 27-2231
MOS 7
Cleanroom size: 30,000 square feet
Capacity (wafers/week): 10,000
Wafer size: 150mm
Process: CMOS
Products: MCUs, logic and smart power ICs
Feature sizes: 1.0 μ m, 1.2 μ m
(This fab is being upgraded to produce logic ICs with 0.5 μ m to 0.65 μ m feature sizes on 200mm wafers. Operations are planned to start in 1999).

Motorola, Ltd.
Colvilles Road
Kelvin Estate, East Kilbride
Glasgow G75 0TG, Scotland, UK
Telephone: (44) (35) 52-39101
MOS 9
Cleanroom size: 30,000 square feet
Capacity (wafers/week): 7,500
Wafer size: 150mm
Processes: CMOS, BiCMOS
Products: MPUs, MCUs, DSPs, SRAMs
Feature sizes: 0.5 μ m, 0.65 μ m, 0.8 μ m, 1.0 μ m

Motorola, Inc.
6501 William Canon Drive West
Austin, Texas 78735-8598
Telephone: (512) 891-2000
MOS 11
Cleanroom size: 70,000 square feet
Capacity (wafers/week): 4,000
Wafer size: 200mm
Processes: CMOS, BiCMOS
Products: MCUs, MPUs, SRAMs, DSPs
Feature sizes: 0.5 μ m-0.8 μ m

Motorola, Inc.
3501 Ed Bluestein Boulevard
Austin, Texas 78721
Telephone: (512) 928-6000
MOS 8
Cleanroom size: 100,000 square feet
Capacity (wafers/week): 7,000
Wafer size: 125mm
Process: CMOS
Products: MCUs, MPUs, SRAMs, DSPs
Feature sizes: 0.7 μ m-1.5 μ m

Motorola, Inc.
8105 Irvine Center Drive
Irvine, California 92718
Telephone: (714) 932-5000
MOS 10
Capacity (wafers/week): 1,500
Wafer size: 150mm
Process: CMOS
Products: DSPs, linear ICs
Feature size: 0.65 μ m
(Acquired from Western Digital).

Motorola, Inc.
1300 North Alma School Road
Chandler, Arizona 85224
Telephone: (602) 814-4691
MOS 12
Cleanroom size: 40,000 square feet (Class 1)
Capacity (wafers/week): 4,000
Wafer size: 200mm
Process: CMOS
Products: MCUs, DSPs, linear ICs
Feature sizes: 0.5 μ m-0.65 μ m

Motorola, Inc.
3501 Ed Bluestein Boulevard
Austin, Texas 78721
Telephone: (512) 928-6000
MOS 13
Cleanroom size: 45,000 square feet
Capacity (wafers/week): 5,000
Wafer size: 200mm
Process: CMOS
Products: MPUs, SRAMs
Feature sizes: 0.35 μ m-0.5 μ m (0.25 μ m capable)

Motorola, Inc.
West Creek, Virginia
MOS 19
Wafer size: 200mm
Process: CMOS
Products: MPUs
Feature sizes: 0.35 μ m, 0.25 μ m
(Currently on hold. Construction to start in late spring or early summer 1998).

Motorola, Inc.
2200 West Broadway Road
Mesa, Arizona 85202
Telephone: (602) 962-2011
BP 1
Cleanroom size: 20,000 square feet
Capacity (wafers/week): 10,000
Wafer size: 100mm
Processes: Bipolar, BiCMOS
Products: Linear and smart power ICs
Feature size: 3.0 μ m

Motorola, Inc.
3026 Cornwallis Road
Research Triangle Park, North Carolina 27709
Telephone: (919) 549-3100
MOS 15
Cleanroom size: 29,800 square feet (Class 10)
Capacity (wafers/week): 5,000
Wafer size: 150mm
Process: CMOS
Products: MCUs, logic ICs
Feature sizes: 0.8 μ m, 1.0 μ m
(Acquired from Harris Semiconductor.
Scheduled to close by end of 1998).

Motorola, Inc.
Development
5005 East McDowell Road
Phoenix, Arizona 85008
Center for Integrated Systems (formerly COM 1)
Wafer size: 150mm
Process: CMOS
Products: Communications ICs, MCUs, DSPs
Feature size: 0.65 μ m

Motorola, Inc.
2200 West Broadway Road
Mesa, Arizona 85202
Telephone: (602) 962-2011
BP 2
Cleanroom size: 80,000 square feet
Capacity (wafers/week): 10,000
Wafer size: 100mm
Processes: Bipolar, BiCMOS
Products: Linear ICs, ASICs
Feature sizes: 1.0 μ m-2.0 μ m

Motorola, Inc.
 2200 West Broadway Road
 Mesa, Arizona 85202
 Telephone: (602) 962-2011
 BP 3
 Cleanroom size: 20,000 square feet
 Capacity (wafers/week): 5,000
 Wafer size: 100mm
 Processes: Bipolar, BiCMOS`
 Products: ASICs, logic and linear ICs
 Feature size: 1.0µm

Motorola Semiconducteurs
 126 Avenue du General Eisenhower
 Le Mirail BP 1029
 31023 Toulouse Cedex, France
 Telephone: (33) (5) 61-41-11-88
 BP 4/Bipolar Power Fab
 Cleanroom size: 40,000 square feet
 Capacity (wafers/week): 7,500
 Wafer size: 100mm (moving to 150mm in 1995)
 Processes: Bipolar, MOS
 Products: Linear, smart power, RF ICs, discretes/opto
 Feature sizes: 1.0µm-3.0µm

Motorola, Inc.
 5005 East McDowell Road
 Phoenix, Arizona 85008
 Telephone: (602) 244-6900
 RF Power and Rectifier Fabs
 Cleanroom size: 80,000 square feet
 Capacity (wafers/week): 18,000
 Wafer sizes: 100mm, 125mm
 Processes: Bipolar, GaAs
 Products: Discretes, RF MMICs, optoelectronics
 Feature sizes: 1.5µm-10.0µm

Tohoku Semiconductor Corporation
 Izumi-ku, Sendai-shi,
 Miyagi Prefecture, Japan
 Capacity (wafers/week): 13,750
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, SRAMs, MPUs, MCUs, MPRs
 Feature sizes: 0.5µm-0.8µm
 (Joint venture with Toshiba).

White Oak Semiconductor
 White Oak Technology Park
 Richmond, Virginia
 Capacity (wafers/week): 5,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature sizes: 0.25µm, 0.35µm
 (Joint venture with Siemens. Currently under construction. Operations are planned to begin in the spring of 1998).

Alliances and Key Agreements

- In January of 1998, Siemens AG and Motorola Inc. announced a joint venture to develop 300mm wafer manufacturing in Dresden, Germany. They plan to jointly invest 1.5B DM (\$822.5M) to develop this technology. The larger silicon wafers will be processed using 0.25 micron technology. This move will provide a cost reduction equivalent to 30 percent per chip and a gain in production of 250 percent, assuming 256Mbit devices (a 2.5X increase in number of chips as compared to the existing wafer size of 200mm).

Research and development costs are expected to be over 1 billion DM (\$595M) with additional investments estimated around 450 million DM (\$268M). The start-up of the R&D project is supported by the German Federal Ministry of Education, Science, Research and Technology (BMBF) with 187 million DM (\$111M). The State of Saxony will support the investment with approximately 120 million DM (\$71M). The development project will occupy a 26,000 square foot area in Siemens Semiconductor's existing plant.

- In December of 1997, FlashPoint and Motorola announced a joint development strategy to extend digital photography. Under the terms of the agreement, FlashPoint will incorporate Motorola's PowerPC processor as the basis for its hardware and software reference design kits. By combining Motorola's semiconductor technology with FlashPoint's expertise in digital imaging software solutions the companies will be able to develop the next generation of intelligent digital imaging devices.
- In November of 1997, Motorola and Sarnoff announced the formation of a HDTV coalition to produce cost-effective semiconductor solutions for HDTV and other consumer entertainment products. The multi-year agreement provides for the licensing of digital television research and technology from Motorola to Sarnoff and extensive design assistance and product development resources from Sarnoff to Motorola.

Already in development through the alliance are: a digital standard definition television (SDTV) chipset for affordable, entry-level television sets providing digital display quality and movie-style aspect ratio; a converter-box chipset solution to allow today's analog televisions to display SDTV signals; and a functionally robust chipset solution for HDTV sets delivering five times the picture resolution of SDTV. All three solutions include 6-channel, Dolby™ Surround Sound. Development boards for SDTV chipset solutions will be available in 1Q98. Additional products under consideration will target both the DVD video disk and Digital Video Camcorder markets.

- In October of 1997, Mitsubishi and Motorola agreed to offer the first merchant market second source of customized solutions utilizing Motorola's ColdFire™ architecture. Integrating technologies of both companies signifies a commitment to provide the embedded market with system solutions incorporating processor and DRAM memory functions on a single chip. The agreement also enables open, synthesizable embedded processor and embedded DRAM cores that can be implemented with standard hardware and software development tools.

Under the terms of the contract, Mitsubishi receives Motorola's version 2 and 3 ColdFire™ architecture technologies, with the right to include encrypted synthesizable models and core views in its cell library for customers to design and develop products. Motorola will in turn receive Mitsubishi's 0.35 micron embedded DRAM technology and design tools for future products.

- In September of 1997, Kopin and Motorola signed an alliance to develop portable display products. The multi-year, multi-million dollar agreement outlines a plan under which the companies will develop, manufacture, and market low-cost, low power, portable communications, flat panel display products based on Kopin's Cyber Display™ active matrix LCK Technology. The Motorola alliance is a very significant business opportunity for Kopin because Motorola uses a huge volume of displays each year. In addition, Motorola is an excellent marketing partner for Kopin since they will be devoting communications and semiconductor efforts for Kopin's Cyber Display.

- In July of 1997, Motorola announced that it would leave the DRAM business permanently by the end of 1997. Motorola has maintained about a 2 percent market share of the DRAM market through its joint ventures with Toshiba and Siemens. It has since put in plans to phase out its limited participation in DRAMs so that resources can be focused on higher-margin businesses, like microprocessors, fast SRAMs and Flash EEPROMs.
- In May of 1997, Raychem Corporation and Motorola announced an agreement to jointly develop electronic devices for power control and circuit protection in computing, automotive, portable electronics, and telecommunications applications. The goal of the alliance is to introduce several families of devices that will offer enhanced functionality and economy to electronic equipment manufacturers and end users. Under the agreement, each company will market and sell the new products separately.

As a result, White Oak Semiconductor, the Richmond, VA, joint venture of Siemens Semiconductor Group and Motorola's Semiconductor Products sector, is changing its charter to allow a wider product mix. The facility has been under construction since 1996 and is scheduled to run production of 64Mb DRAMs starting in 1998. Siemens will sell Motorola's initial 50 percent share of DRAM output. Motorola's cut of the proceeds was not revealed. Once volume production is reached, Motorola plans to convert its share of capacity to produce proprietary fast static RAMs.

- In April of 1997, Motorola bought majority stakes in two semiconductor manufacturing plants within the Czech Republic, in Northern Monrovia. Combined, these factories employ approximately 1,000 employees. Motorola used a step-by-step approach to the investment. In the early 1990's it became the key customer to the two plants, and later became the sole customer of the two plants.
- In March of 1997, the Low Voltage Logic Alliance, consisting of Motorola SPS, Fairchild, and Toshiba, announced the first 2.5V CMOS logic standard with 3.6V tolerant inputs and outputs. Jointly developed by the three member companies, the new standard is also the fastest (2.0ns) 2.5V logic technology and provides designers with a flexible, multiple-sourced solution for their next-generation low-voltage designs.
- The Low Voltage Logic Alliance was created in July 1993, to standardize the next generation of high performance, low-voltage CMOS logic and to accelerate the market's acceptance of low-voltage logic products.
- In March 1997, Motorola acquired the PMeL business from Pilkington plc., a world leader in glass products. PMeL was absorbed into Motorola's Programmable Logic division and was renamed the Motorola Programmable Technology Center (MPTC).
- In February of 1997, Motorola SPS and Sourcecom announced a joint development project to develop and market a comprehensive highly-integrated hardware and software reference design for an Asymmetric Digital Subscriber Line (ADSL) Transmission Unit for the Remote End (ATU-R). This reference design will incorporate the standards-based Copper Gold, ADSL Transceiver chip, MPC8X0 Series processors, and Modem control software developed by Motorola, and Sourcecom's standards-based Innerware Internetworking software suite. By using the reference design, which includes all aspects of the ATU-R, equipment providers can address interoperability issues while optimizing for product cost and time-to-market without incurring heavy development expenditures.

- During FY1997, Motorola and Eastman Kodak announced they will jointly develop sensors for digital imaging using complementary metal oxide semiconductor (CMOS) technology. This advanced CMOS imager technology will enable the design of smaller, lighter cameras with longer battery life.
- During FY1997, Motorola and IBM announced a commitment to expand joint development of the PowerPC architecture to high-performance, 32-bit embedded solutions. Motorola and IBM delivered three new PowerPC microprocessors featuring next-generation design and 0.25 micron process technology. The PowerPC 604e processor, at 350 megahertz, is the fastest and highest performance volume desktop processor available.
- Motorola and Mitsubishi announced a couple of joint cooperation agreements in 1996. In October, Motorola agreed to exchange its 32-bit ColdFire RISC and 68EC000 embedded MPU technologies for Mitsubishi's M32R microprocessor with embedded DRAM technology. In December of 1996, the two companies agreed to jointly market MobileFlash™ memory devices based on the DINOR flash technology developed by Mitsubishi. Motorola and Mitsubishi have said that their alliance in flash memories may be expanded in the future to include a joint venture fab dedicated to the manufacture of flash chips.
- In October 1997, Matsushita and Motorola Inc. signed an agreement to develop semiconductors for high-performance noncontact-type smartcards. Under this agreement, Matsushita will license its production technology for the memory to Motorola. Both companies will jointly develop chips combining Matsushita's FeRAM with Motorola's microprocessors for use in noncontact-type smartcards and the two companies will have marketing rights. The global marketing of both the chips and the cards is to begin starting in 1999. With this agreement, Matsushita expects FeRAM products and its microprocessors to grow into a 100 billion Yen (\$826 million) business in 2005.
- Motorola has an RFID product agreement with Matsushita and ferroelectric memory pioneer Symetrix Corp. Motorola's subsidiary Indala Corp. agreed to jointly produce a family of read/write RFID chips with Matsushita incorporating Symetrix's ferroelectric memory technology (Matsushita has an equity stake in Symetrix and has the right to re-license its technology).
- Micron, Motorola, and AMD joined together with DuPont Photomasks Inc. (DPI) in 1996 to form a technology venture, called DPI Reticle Technology Center, to develop advanced mask technology and provide pilot line fabrication of leading-edge reticles.
- Motorola and Cherry Semiconductor work together to develop ASICs for the automotive industry. Their first agreement was in 1980.
- In July 1996, Omnirel Corporation and Motorola Semiconductor Products Sector announced an agreement to work on a new series of MIL qualified GaAs rectifier devices together. Under the agreement, Motorola will supply GaAs Schottky wafers to Omnirel who will assemble, test, qualify and market a full line of hermetic TO-257 and surface mount GaAs products.

- Omnirel Corporation and Motorola Commercial Plus Technologies Operation signed a sales agreement in May 1995. Under the agreement, Omnirel acquired Motorola CPTO Bipolar Power Discrete Transistor business, which transfers manufacturing and test equipment and finished goods inventory to Omnirel.

Noteworthy News

- In May 1998, Motorola announced plans to close its 6-inch wafer fab in Raleigh, NC, by year end, and transfer 8-bit microcontroller manufacturing to other locations as part of a new strategy to centralize production operations on large campuses. Motorola's MOS 15 fab was purchased in July 1994 from Harris Corporation's semiconductor subsidiary, which had acquired the plant from General Electric Co. in 1989.
- In the fourth quarter of FY1997, Motorola reported that through November 1997, Asia accounted for about 28 percent of Motorola's revenues. China contributed to 12 percent, Japan 5 percent and the rest of the region 11 percent. Given Motorola's high dependence on Asia, the 1997-98 Asia economic crisis is sure to have a marked effect on Motorola's 1998 sales. As a result, Motorola has reduced its overall estimate of the semiconductor industry growth downward to 13-15 percent from 15-17 percent.

Despite the Asia economic turmoil, and the burden of a list of special charges to exit non-strategic and unprofitable businesses, Motorola reported gains in its last quarter of 1997. For FY1997, Corporate sales grew 7 percent to \$29.8B from \$28B. Major charges stemmed from activities such as the phase-out of DRAMs (announced in July); sell-off of the low-end analog modem business (announced in October); exit from the MacOS-compatible computer systems business (announced in October); and the pending sale of the Ardis mobile data subsidiary (announced January 1998).

- In May 1997, Motorola announced a move to realign its chip business with high-growth markets to become more market-focused as opposed to product-focused. The Semiconductor Products Sector of Motorola moved its headquarters of two newly formed groups outside the U.S. and transferred more of the sector's management from Phoenix to Austin. The restructuring also included a reorganization of its manufacturing operations, moving from wafer fabs dedicated to specific products and to a more flexible worldwide fabrication network.
- In FY1997, the Semiconductor Products Sector announced porting of the JavaOS operating system to the MPC821 PowerPC microprocessor. This will allow system manufacturers to build hand-held, portable communication devices that can quickly perform compute-intensive applications for modems, imaging, and voice and handwriting recognition.
- In FY1997, Motorola acquired Pilkington Microelectronics Ltd., a designer of field programmable gate arrays and opened the Programmable Technology Center in the United Kingdom.
- In FY1997, Motorola SPS announced the industry's first 300MHz volume desktop and portable microprocessor. It is part of the PowerPC 603e microprocessor family.
- In FY1997, Motorola announced that it developed a process that uses copper interconnects rather than aluminum in integrated circuit manufacturing. The dual inlaid copper interconnect technology is designed to bring high-end computing power to products such as cellular phones and personal digital assistants.

NEC

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Electron Device Group
7-1, Shiba 5-chome, Minato-Ku
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Fax: (81) (3) 3798-1510/1519
Web Site: www.nec.co.jp

IC Manufacturer
Founded: 1950

Regional Offices/Representative Locations

North America: NEC Electronics, Inc. • Santa Clara, California
 Telephone: (408) 588-6000 • Fax: (408) 588-6130 • Web Site: www.nec.com

Europe: NEC Electronics (Germany) GmbH • Düsseldorf, Germany
 Telephone: (49) (221) 650302 • Fax: (49) (221) 6503490

Asia-Pacific: NEC Electronics Hong Kong Ltd. • Hong Kong
 Telephone: (852) 2886-9318 • Fax: (852) 2886-9022

Financial History, Fiscal Year Ends March 31

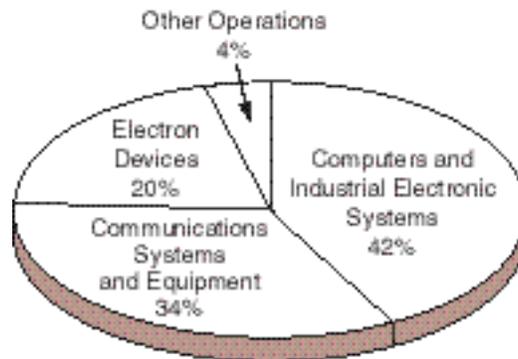
	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (¥B)						
Sales	¥3,774	¥3,515	¥3,580	¥3,769	¥4,397	¥4,948
Net Income	¥15	¥(45)	¥7	¥35	¥77	¥92
Semiconductor (\$M)*						
Sales	\$5,735	\$7,090	\$8,830	\$12,275	\$11,000	\$10,080
IC Sales	\$5,040	\$6,265	\$7,855	\$11,045	\$9,950	\$8,669
Discrete Sales	\$695	\$825	\$975	\$1,230	\$1,050	\$1,411
Capital Expenditures	\$620	\$705	\$1,115	\$2,010	\$1,700	\$1,512

*Calendar Year

Company Overview and Strategy

NEC is a leading international supplier of electronics products composed of computers (engineering workstations, supercomputers), telecommunications equipment (cellular phones, digital switching systems, mobile communications systems, radio transmission systems), and electronic devices.

Originally founded as Nippon Electric Company, Ltd. in 1899, the company officially changed its name to NEC Corporation in 1983.



1997 Corporate Sales by Product Group

NEC operates primarily in a single industrial segment that it calls "C&C," the integration of computers and communications. Semiconductors are an integral part of C&C because they serve as the building blocks for combining technological innovations and products derived from each of the computers and communications areas.

The company's semiconductor business was initiated in 1950 with the start of transistor research and development. A decade later, integrated circuit R&D began. Today, NEC is the world's second largest integrated circuit (and semiconductor) manufacturer with a product line-up that features memory ICs, microprocessors and controllers, application-specific ICs (ASICs), linear ICs, compound semiconductors, optoelectronic devices, and discrete semiconductors.

Management

NEC Corporation

- | | |
|-----------------|--|
| Hisashi Kaneko | President |
| Hajime Sasaki | Senior Executive Vice President, Electron Devices |
| Yuichi Haneta | Executive Vice President, Semiconductor Group |
| Kunishiro Saito | Vice President, Worldwide Semiconductor Operations |

NEC Electronics Inc. (U.S.)

- | | |
|---------------------|---|
| Shigeki Matsue | President and Chief Executive Officer |
| Sadayuki Kishi | Senior Vice President, Operations and Plant Manager |
| Kuniyoshi Noritsugu | Senior Vice President, Marketing and Legal |
| Mike Despotes | Vice President, Sales |
| J. Giovanola | Vice President, Administration |
| Shin Kurata | Vice President, Finance and Chief Financial Officer |
| John Marck | Vice President, Memory |
| Hidesato Tanaka | Vice President, Corporate Planning |

Products and Processes

- MOS MEMORY**
- DRAM
 - SRAM
 - Flash Memory
 - EPROM
 - ROM
 - EEPROM
 - Other (Including Non-Volatile RAM)

- ANALOG**
- Amplifier
 - Interface
 - Consumer/Automotive
 - Voltage Regulator/Reference
 - Data Conversion
 - Comparator
 - Other (Includes Telecom)

- MOS LOGIC**
- General Purpose Logic
 - Gate Array
 - Standard Cell
 - Field Programmable Logic
 - Other Special Purpose Logic

- DIGITAL BIPOLAR**
- Bipolar Memory
 - General Purpose Logic
 - Gate Array/Standard Cell
 - Field Programmable Logic
 - Other Special Purpose Logic
 - MPU/MCU/MPR

- MOS MICROCOMPONENT**
- MPU
 - MCU
 - MPR
 - DSP

- OTHER**
- Full Custom IC
 - Discrete
 - Optoelectronic

Memory Devices

The company's group of memory products includes: DRAMs (4M, 16M, and 64M); 4M, 16M EDO DRAMs; 16M and 64M synchronous DRAMs (SDRAMs); 8M and 16M Rambus DRAMs (RDRAMs); low-power CMOS SRAMs (256K, 1M and 4M); fast CMOS SRAMs (256K, 1M, 4M, and low-voltage); fast BiCMOS SRAMs (256K, 1M, 4M, and low-voltage); 1M synchronous SRAMs; mask ROMs (1M-32M and low-voltage), EPROMs (1M, 2M, 4M, 8M, and 16M), OTPROMs (4M and 8M), EEPROMs (64K and 256K parallel and 1K, 2K, 4K, and 8K serial); flash memories (1M, 4M, and 16M); dual-port RAMs; synchronous graphics RAMs; and FIFOs.

NEC is the world's second largest producer of memory devices. NEC was among the first companies to sample 64M DRAMs, one of the first to sample a 256M DRAM, and one of the first to announce it had developed a 1G DRAM. In early 1997, NEC announced it had developed a 4G DRAM prototype.

NEC announced in 1996 that it would terminate the development of next-generation EPROMs in order to concentrate on flash memories. The company will continue to produce its existing line of EPROMs as long as there are users.

Microcomponents

NEC is one of the world's largest suppliers of microcontrollers. It offers a wide variety of 4-bit, 8-bit, 16-bit and 32-bit microcontrollers, including controllers with on-chip flash memory. NEC also supplies 16-bit, 32-bit, and 64-bit RISC microprocessors and controllers: the VR-Series based on the MIPS Technologies' architecture and the original V-Series family. Microperipheral ICs are also offered.

ASICs

NEC offers CMOS gate arrays and embedded arrays with up to 1.2 million usable gates, BiCMOS gate arrays with up to 267,000 usable gates, ECL gate arrays, standard cell ASICs based on 0.35µm, 0.5µm, and 0.8µm CMOS technologies, FPGAs, and bipolar analog arrays.

NEC announced that in October 1997, it will begin commercial production of ASICs with 0.25µm drawn gate lengths. The new CMOS-10 family of ASICs, with up to 20 million gates and operating speeds of 300MHz, will be targeted at high-end workstations and cellular base stations.

Dedicated ICs

These products include voice synthesis ICs, DSPs, communication ICs, image processing ICs, MPEG ICs, GPS equipment ICs, 3D graphics processors, consumer electronics circuits, automotive ICs, data converters, and display drivers.

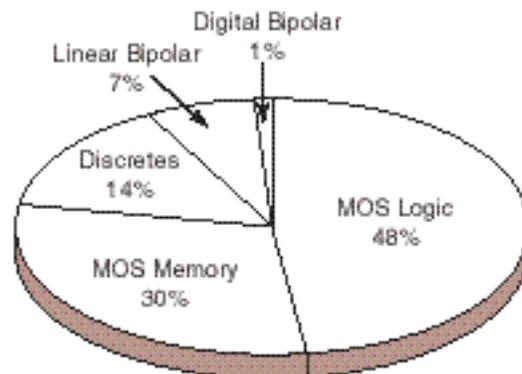
In early 1997, NEC unveiled its first IC to combine a microprocessor and a DRAM. The single-chip device has 16M of DRAM integrated with NEC's proprietary MicroPD microprocessor core. It is targeted at applications in PC graphics and high-end wireless communications systems.

General-Purpose Linear and Digital ICs

These products include operational amplifiers, comparators, voltage regulators, and standard logic ICs.

Other Semiconductors

NEC offers a range of other semiconductor products, including hybrid ICs, silicon discrete semiconductors, microwave ICs, power MOS ICs, GaAs ICs and discretes, and optoelectronic devices.



1997 Semiconductor Sales by Product Type

Semiconductor Fabrication Facilities

NEC's new fab facility activities include the construction of a 1G DRAM pilot production line capable of a 0.18 μ m process at its Sagamihara site. The plant will be built in three phases, the first of which is expected to begin operating in 1997, with a weekly capacity of 1,250 200mm wafers per week.

Additionally, NEC opened a new 400,000 sq. ft. fab in Roseville, California, in the spring of 1997. The new \$1.1 billion fab will initially fabricate 64M DRAMs, starting in 1999. The fab was originally expected to undergo construction in 1996, but was postponed because of slow DRAM market conditions.

In 2Q97, NEC announced an agreement with Shanghai's Huahong Microelectronics to build a \$700 million joint venture fab in China that will use 0.35 μ m-0.5 μ m technology to process 200mm wafers. Production is scheduled to be launched in 1998.

In September of 1997, NEC opened a new test and assembly plant in Malaysia, for memory products and linear ICs.

NEC Kyushu, Ltd.
Kumamoto-shi, Kumamoto Prefecture, Japan
Capacity (wafers/week): 26,600
Wafer sizes: 125mm, 150mm, 200mm
Processes: MOS, CMOS, BiCMOS
Products: DRAMs, SRAMs, EPROMs, ROMs,
MPUs, MCUs, ASICs, CCDs, flash, R&D.
Feature sizes: 0.25 μ m-1.5 μ m

NEC Yamaguchi, Ltd.
Asa-gun, Yamaguchi Prefecture, Japan
Capacity (wafers/week): 16,500
Wafer size: 150mm
Processes: CMOS, BiCMOS, MOS
Products: DRAMs, SRAMs, MPUs, MCUs, ASICs, flash
Feature sizes: 0.35 μ m-0.8 μ m

NEC Kansai, Ltd.
Otsu-shi, Shiga Prefecture, Japan
Capacity (wafers/week): 18,750
Wafer sizes: 100mm, 150mm
Processes: CMOS, MOS, bipolar
Products: Linear and logic ICs, CCDs, ASICs,
MPUs, MCUs, DRAMs, SRAMs.
Feature sizes: 0.8 μ m-4.0 μ m

NEC Yamagata, Ltd.
Tsuruoka-shi, Yamagata Prefecture, Japan
Capacity (wafers/week): 25,000
Wafer sizes: 100mm, 125mm, 150mm
(200mm in 1997).
Processes: CMOS, MOS, bipolar
Products: Logic and linear ICs, SRAMs, ASICs,
MPUs, MCUs, discretes.
Feature sizes: 0.5 μ m, 0.8 μ m, 2.0 μ m, 3.0 μ m

NEC Sagamihara Plant
Sagamihara-shi, Kanagawa Prefecture, Japan
Capacity (wafers/week): 11,875
Wafer sizes: 125mm, 150mm, 200mm
Processes: MOS, CMOS, BiCMOS
Products: DRAMs, EPROMs, SRAMs, ROMs,
MPUs, ASICs, R&D.
Feature sizes: 0.35 μ m-1.4 μ m

NEC Kagoshima, Ltd.
Izumi-shi, Kagoshima Prefecture, Japan
Capacity (wafers/week): 1,000
Wafer size: 100mm
Processes: Bipolar, GaAs
Products: Linear and telecom ICs
Feature size: 0.8 μ m

NEC Tamagawa Plant
 Kawasaki-shi, Kanagawa Prefecture, Japan
 Capacity (wafers/week): 1,450
 Wafer size: 150mm
 Process: CMOS
 Products: MPU and DRAM R&D
 Feature size: 0.55 μ m

NEC Kansai, Ltd.
 Otsu-shi, Shiga Prefecture, Japan
 Capacity (wafers/week): 600
 Wafer size: 100mm
 Process: GaAs
 Products: ICs and discretets

NEC Semiconductors (UK) Ltd.
 Carnegie Road, Deans West Industrial Estate
 Livingston, West Lothian
 Scotland EH54 8QX, United Kingdom
 Telephone: (44) (506) 41-0000
 Fax: (44) (506) 41-5317
 Capacity (wafers/week): 13,250
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, MCUs, ASICs, DSPs
 Feature sizes: 0.25 μ m-0.8 μ m

NEC Hiroshima, Ltd.
 Higa-shi, Hiroshima Prefecture, Japan
 Capacity (wafers/week): 12,500
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, SRAMs, ROMs, MPUs, flash
 Feature sizes: 0.25 μ m-0.8 μ m

NEC Electronics Inc.
 7501 Foothills Boulevard
 Roseville, California 95678
 Telephone: (916) 786-3900
 Cleanroom size: 400,000 square feet
 Capacity (wafers/week): 17,750
 Wafer sizes: 125mm, 150mm, 200mm
 Processes: MOS, CMOS, BiCMOS
 Products: SRAMs, DRAMs, ASICs, MCUs, logic ICs
 Feature sizes: 0.35 μ m-1.0 μ m

Shougang NEC Electronics Co., Ltd.
 Postcode 100041
 A3 Futiansi, Shijingshan
 Beijing, China
 Telephone: (86) (1) 512-2288
 Fax: (86) (1) 886-2648
 Capacity (wafers/week): 2,000
 Wafer size: 150mm
 Processes: CMOS, bipolar
 Products: MCUs, linear ICs, ASICs, DRAMs
 Feature sizes: 0.5 μ m-3.0 μ m

Key Agreements and Alliances

- NEC teamed up with Los Altos, California-based In-Chip Systems Inc. to develop a new gate array architecture with dramatically improved density. The resulting CMOS9HD process, which uses the In-Chip core cell architecture, has shown the ability to cut die cost by 20 to 50 percent compared with NEC's existing CMOS9 0.35 μ m arrays.
- NEC announced an agreement in early 1996, with Sun Microsystems to produce the U.S. company's UltraSPARC 64-bit RISC microprocessor on a contract basis. Later in 1996, NEC licensed Sun's Pico-Java chip core for use in multimedia chips for Internet-ready TV sets.
- NEC has been collaborating with Lucent on the development of advanced CMOS process technologies since 1991. The team completed development of a 0.25 μ m process flow in early 1997, and are currently working on a successor 0.18 μ m program, which is targeted for completion in 1999.

- NEC linked up with Symetrix of Colorado to develop ferroelectric RAMs (FRAMs). NEC has already developed a 1M FRAM on its own.
- NEC licensed to Samsung its 78K series 16-bit microcontroller technology in October 1995. Samsung is now a second source for the devices and is allowed to use the 78K series as a 0.8 μ m 16-bit core.
- NEC jointly developed its high-performance PowerVR 3D graphics acceleration chip with VideoLogic Ltd. of the United Kingdom. The PowerVR enables 3D graphics games to be played on a PC.
- In September 1995, NEC licensed the ARM7 RISC microprocessor core of Advanced RISC Machines Ltd. NEC develops, manufactures, and markets ASICs based on the 32-bit RISC core.

Noteworthy News

- In February 1998, NEC announced the opening of a new design facility in Research Triangle Park, North Carolina. The facility is intended to complement the design efforts in the Silicon Valley office. It is chartered with driving product design and development for NEC's microcontroller products. The center will be capable of designing 0.35 and 0.25 micron microcontrollers that are primarily used in embedded markets, such as automotive applications, consumer electronics and handheld electronics. The facility is expected to be staffed with nearly 30 employees.
- In February 1998, NEC announced that it has effectively cut capital expenditures for fiscal year ending March 31, 1998 by roughly 3 percent, approximately 10 billion Yen. The cut will come from primarily the semiconductor sector, and is blamed on the decline in value of Asian currencies.
- In February 1998, NEC introduced a networking product that features Rambus DRAM technology. The company joins several other major networking companies that are trying to drive switch costs down by using DRAM-based designs instead of the more expensive SRAM.
- In January 1998, NEC announced plans to upgrade their microchip production lines, slated to start making DRAMs using 0.22 micron processes by the end of this year. NEC will begin producing microchips using a 0.22 micron design for their 64Mb DRAM and future 256Mb DRAM. This move is in attempt to extend the application of 200mm wafers and subvert cost increases that would be incurred using 300mm wafer technology. Despite the anticipated expense, NEC still plans to introduce equipment to manufacture 300mm wafers on a new development line at its Sagamihara plant in 1998, and start mass production in 1999.
- In January 1998, NEC announced its plans to spend about 20 billion Yen to form a semiconductor joint venture in Shanghai, China. NEC will hold 28.6 percent of the new company which is expected to start production in February 1999.
- In October of 1997, NEC and SanDisk introduced an 80Mbit flash memory device, which is said to be the industry's largest capacity. The device can store 2-bits in a cell, effectively doubling its memory capacity over conventional chips of the same size (versus current memory technology which relies on 1-bit per cell). The device is targeted at the portable equipment market where traditional hard disks are comparatively heavy.

SAMSUNG

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Fax: (82) (2) 753-0967
Web Site: www.sec.samsung.com

IC Manufacturer
Founded: 1969

Regional Headquarters/Representative Locations

North America: Samsung Semiconductor, Inc. • San Jose, California
 Telephone: (408) 544-4000 • Fax: (408) 544-4980

Europe: Samsung Europe plc, Semiconductor Division • Brentford, Middlesex, United Kingdom
 Telephone: (44) (181) 380-7132 • (44) (181) 380-7220

Japan: Samsung Electronics Japan Co., Ltd. • Chou-Ku, Tokyo, Japan
 Telephone: (81) (3) 5641-9850 • Fax: (81) (3) 5641-9851

Financial History (\$M)

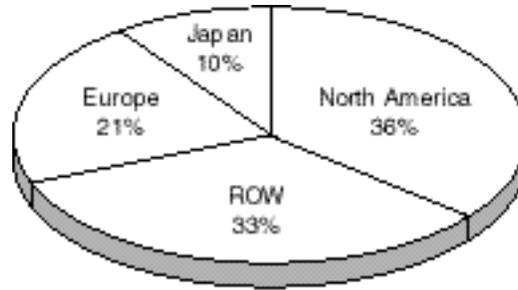
	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate						
Sales (SEC)	7,900	10,300	14,600	21,000	18,800	11,200
Semiconductor						
Sales	1,865	3,104	5,002	8,419	6,196	5,750
IC Sales	1,745	2,949	4,815	8,183	6,385	5,400
Discrete Sales	120	155	187	236	315	350
R&D Expenditures	190	240	464	560	415	500
Capital Expenditures	550	930	1,300	2,200	2,300	1,500
Employees	—	—	—	—	20,000	21,000

Ownership: Publicly held. NASDAQ: SESGF; Korea: 6405.

Company Overview and Strategy

Today, Samsung is the world's largest supplier of DRAM products. Additionally, it is the world's leading producer of SRAM devices, which places Samsung in the position as the world's leading supplier of MOS memory devices.

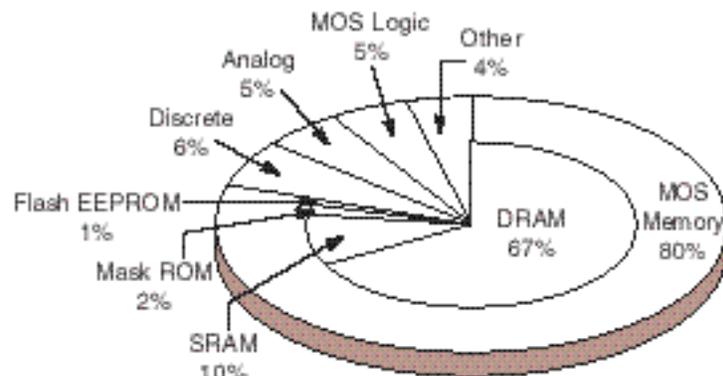
Although the core of Samsung Semiconductor's current business is memory products, the company is aggressively expanding its product offerings into other areas, such as microcontrollers, multimedia video and audio devices, ASICs, and power semiconductor devices. The company is working to achieve a 50:50 ratio of memory to non-memory device production.



1997 Electronics Sales by Geographic Region

Founded in 1969, Samsung Electronics Co. (SEC) is a business within The Samsung Group, an \$87 billion highly diversified Korean conglomerate involved in a range of industries including electronics, machinery, chemicals, finance and insurance, and other businesses. Samsung Electronics Co. is comprised of the Semiconductor Business segment along with the Consumer Electronics, Telecommunications Systems, and Information Systems Business units.

By 1983, the company had developed Korea's first domestic 64K DRAM. Samsung continued its rapid pace of product and process technology development. It quickly advanced its product offerings and brought numerous devices to market in a timely manner. Soon, rather than lagging the DRAM leaders in product development, Samsung was in step with them. In the early 1990's, Samsung passed the large Japanese memory suppliers in DRAM sales. In December 1994, Samsung announced it was the first to ship a fully functional 256M DRAM sample. Furthermore, the company succeeded in the development of a 1G DRAM (500mm² die) in 1996.



1997 Semiconductor Sales by Device Type

Management

Samsung Semiconductor (Korea)

Yoon-Woo Lee	President and Chief Executive Officer
Dae-Jae Chin	Executive Vice President and Chief Executive Officer, System LSI Division
Seung-Kyu Lee	Executive Vice President and General Manager, Manufacturing Division
Hyung-Kyu Lim	Senior Vice President and General Manager, Memory Division
Chang-Ho Choi	Senior Vice President and General Manager, Semiconductor Business Administration Offices
Chang-Gyu Hwang	Senior Vice President and General Manager, Research and Development
Sang-Wan Lee	Senior Vice President and General Manager, AM LCD Division
Ji-Sung Choi	Vice President and General Manager, Sales and Marketing
Johng-Sung Lim	Senior Vice President and General Manager, Kiheung Plant

Samsung Semiconductor (U.S.)

Young Bae Rha	President and Chief Executive Officer
W. Keith McDonald	Senior Vice President, Sales and Marketing
Avo Kanadjian	Vice President, Marketing, Memory Products
Jon Kang	Vice President and General Manager, Marketing Supporting Services
Noel Park	Vice President and General Manager, Marketing, System LSI
Mike Crawley	Vice President, Sales, General Accounts

Products and Processes

Samsung's semiconductor products include standard and specialty DRAMs, SRAMs, flash memories, mask ROMs, 4-/8-bit and 16-/32-bit MCUs, Alpha 64-bit RISC MPUs, MPRs, DSPs, RAMDACs, LCD drivers, ASICs, ASSPs (system logic and multimedia chipsets, set-top box ICs, and DVD ICs), smart power devices, general purpose linear ICs, multi-media, and discrete devices.

MOS MEMORY

<input checked="" type="checkbox"/>	DRAM
<input checked="" type="checkbox"/>	SRAM
<input checked="" type="checkbox"/>	Flash Memory
<input type="checkbox"/>	EPROM
<input checked="" type="checkbox"/>	ROM
<input type="checkbox"/>	EEPROM
<input checked="" type="checkbox"/>	Other (Including Non-Volatile RAM)

ANALOG

<input checked="" type="checkbox"/>	Amplifier
<input checked="" type="checkbox"/>	Interface
<input checked="" type="checkbox"/>	Consumer/Automotive
<input checked="" type="checkbox"/>	Voltage Regulator/Reference
<input checked="" type="checkbox"/>	Data Conversion
<input checked="" type="checkbox"/>	Comparator
<input checked="" type="checkbox"/>	Other (Includes Telecom)

MOS LOGIC

<input checked="" type="checkbox"/>	General Purpose Logic
<input checked="" type="checkbox"/>	Gate Array
<input checked="" type="checkbox"/>	Standard Cell
<input type="checkbox"/>	Field Programmable Logic
<input checked="" type="checkbox"/>	Other Special Purpose Logic

DIGITAL BIPOLAR

<input type="checkbox"/>	Bipolar Memory
<input type="checkbox"/>	General Purpose Logic
<input type="checkbox"/>	Gate Array/Standard Cell
<input type="checkbox"/>	Field Programmable Logic
<input type="checkbox"/>	Other Special Purpose Logic
<input type="checkbox"/>	MPU/MCU/MPR

MOS MICROCOMPONENT		OTHER	
<input checked="" type="checkbox"/>	MPU	<input checked="" type="checkbox"/>	Full Custom IC
<input checked="" type="checkbox"/>	MCU	<input checked="" type="checkbox"/>	Discrete
<input checked="" type="checkbox"/>	MPR	<input type="checkbox"/>	Optoelectronic
<input checked="" type="checkbox"/>	DSP		

All of Samsung's semiconductor devices are manufactured using primary CMOS process technology, but also include BiCMOS and bipolar technologies. The smallest design rule being used for CMOS and BiCMOS is 0.35 micron and 0.5 micron, respectively. The company plans for its CMOS technology to reach 0.25 micron in 1998 and 0.18 micron by 1999.

Samsung's major product lines are outlined below.

DRAMs

Samsung is one of the world's leading suppliers of DRAMs and graphic memory. They offer a broad range of DRAM products: standard DRAMs in a variety of organizations and densities, ranging from 4M to 64M; 16M and 64M synchronous DRAMs (SDRAMs) capable of reading and writing bursts of information at 195MHz speeds; extended data out (EDO) DRAMs; 16M Rambus DRAMs (RDRAMs); specialty graphics memories are designed specifically to meet the needs of graphical user interfaces; products include: EDO DRAM; synchronous graphics RAMs (SGRAMs); and concurrent RAMBUS DRAMs.

Samsung is developing what it calls a DDR-DRAM-II, which doubles the data-transfer rate of existing SDRAMs by presenting data on each edge of the memory clock. Samsung has working parts for the Sync DRAM DDR and will be available to customers early 1998.

SRAMs

Samsung is also one of the world leaders in SRAMs. They offer synchronous pipelined burst SRAMs for Pentium and PowerPC based PCs. Other SRAM products include CMOS fast SRAMs (1M and 4M), BiCMOS fast SRAMs (64K, 256K, and 1M), synchronous SRAMs, low-power SRAMs, and low-voltage SRAMs. The low-power SRAMs have an access time of 55ns, while the new CMOS technology for fast SRAMs features access times of 8ns, 10ns, 12ns for 1M and 4M densities. Samsung is offering in volume production "zero-power" SRAMs which can more than double the operating time of a battery powered cellular phone.

Mask ROMs

Samsung is one of the world's leading suppliers of mask ROMs, with parts available in densities ranging from 4M to 32M. Low-voltage (3.3V) ROMs are offered in 4M, 8M, 16M and 32M densities.

Flash Memories

The company's flash memory devices adhere to the NAND flash memory architecture standard and are second sourced by Toshiba and National Semiconductor. Samsung is currently shipping 4M, 16M, 32M, and 64M parts in volume. Also offered are SSFDC flash card memory devices.

In addition, the company offers audio flash memory devices, which are 4M flash memories designed specifically for voice storage applications such as digital telephone answering machines.

Video and Audio Multimedia Products

Samsung offers a highly integrated digital video chip for such applications as full motion video on PCs, video editing on PCs, teleconferencing, and set-top boxes. The company also offers its KD16902 Virtual Sound Processor allowing the average customer to enjoy surround sound Dolby™ effects without the cost of implementing a six speaker system.

ASICs

Samsung's comprehensive ASIC portfolio of Gate Array, Embedded Array, Standard cell, and Embedded DRAM ASIC technologies offers system designers a suite of alternatives to minimize system cost of ownership.

Samsung's ASICs feature 0.35 micron technology which support up to 4.4 million usable gates. Design kits are available for Mentor, Cadence, ViewLogic, Avanti, IKOS and Synopsys, including all core/cell libraries and block compilers for RAM, ROM and datapath functions.

Samsung's deliverables for embedded cores include items such as Verilog/VHDL models, synthesis models, and wire-bonded test chips, including packaged ARM7TDMI core, OakDSPCore, and video encoder/decoder. A software development toolkit, featuring an assembler, a debugger, a compiler, and a linker is also available.

Microcontrollers

The company's microcontroller portfolio consists of 4-bit, 8-bit, and 32-bit MCU CMOS products. Samsung's new OTP Technology allows for near price parity with masked devices providing customers with additional flexibility. Samsung is also one of the leaders in USB. The company also offers a line of digital signal processors for the audio and telecom markets.

CPUs

Through a license obtained from Digital Semiconductor in 1996, Samsung is in volume production of Alpha 64-bit RISC microprocessors. The Alpha 21164 chips are Samsung's first microprocessors. Samsung has also announced the world's first 700MHz Alpha processor and high performance ATX motherboards for the Alpha 21164 processor.

Power Devices

The company offers a broad range of power semiconductor products, including linear ICs, MOSFETs, IGBTs, and bipolar transistors for power monitoring in motor control, power supplies, ballasts, computer, and automotive applications.

Semiconductor Fabrication Facilities

Samsung has indicated its next three fab facilities will be located outside of South Korea — the first in the U.S. (under construction), the second in Europe (U.K. or Germany), and the third in Malaysia or Indonesia.

Samsung Semiconductor, Kiheung Plant
San 24, Nongsuh-Ri, Kiheung-Eup, Yongin-Kun
Kyungki-Do, Korea
Fab 2
Capacity (wafers/week): 8,750
Wafer size: 150mm
Processes: CMOS, BiCMOS
Products: ASICs, MCUs
Feature size: 1.0µm

Samsung Semiconductor, Kiheung Plant
Fab 3
Capacity (wafers/week): 8,750
Wafer size: 150mm
Processes: CMOS, BiCMOS
Products: SRAMs, ROMs, ASICs, MCUs,
flash memory.
Feature size: 0.8µm

Samsung Semiconductor, Kiheung Plant
Fab 4
Capacity (wafers/week): 8,750
Wafer size: 150mm
Process: CMOS
Products: DRAMs, SRAMs, ROMs, ASICs, MCUs,
flash memory.
Feature size: 0.6 μ m

Samsung Semiconductor, Kiheung Plant
Fab 6
Capacity (wafers/week): 7,500
Wafer size: 200mm
Process: CMOS
Products: DRAMs, SRAMs, graphic memory
Feature size: 0.4 μ m

Samsung Semiconductor, Kiheung Plant
Fab 8
Capacity (wafers/week): 6,300
Wafer size: 200mm
Process: CMOS
Products: DRAMs
Feature size: 0.35 μ m
(Operations to begin in 1998).

Samsung Austin Semiconductor, LLC
Austin, Texas
Cleanroom size: 125,000 square feet
Capacity (wafers/week): 3,600-10,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs, ASICs
Feature size: 0.35 μ m
(Scheduled to begin shipments in 1Q98).

Samsung Semiconductor, Kiheung Plant
Fab 5
Capacity (wafers/week): 5,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs, SRAMs, graphic memory,
MDLs, CPUs.
Feature sizes: 0.4 μ m, 0.5 μ m

Samsung Semiconductor, Kiheung Plant
Fab 7
Capacity (wafers/week): 5,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs, graphic memory
Feature size: 0.35 μ m

Samsung Semiconductor, Bucheon Plant
82-3, Dodang-Dong Bucheon
Kyungki-Do, Korea
Capacity (wafer/week): 40,500
Wafer sizes: 100mm, 125mm
Processes: CMOS, bipolar
Products: Linear ICs, small signal ICs, power TRs,
MOSFETs, MCUs, discretes, R&D.
Feature sizes: 1.4 μ m-2.4 μ m

Alliances and Key Agreements

- In May 1997, Samsung acquired the Semiconductor division of 3DO, a U.S. concern that is world famous for games and which possesses some of the best graphics technology in the business. With this acquisition, Samsung gained patents and technology for 3DO's MPEGII, which features outstanding picture quality, as well as MX, with Dolby Pro-logic AC-3 functions.

Samsung Electronics intends to fuse this technology with its own digital video disk system know-how to develop a DVD processor for next-generation video systems and computer support devices. To support this new acquisition, Samsung also announced that it has established a new company called Advanced Graphics Technology for the purpose of laying the groundwork for participation in a non-memory device business.

- In early 1997, Samsung became the fifth semiconductor manufacturer to license ferroelectric RAM (FRAM) technology from Ramtron.
- Intel announced in early 1997, that it would make an equity investment in Samsung's memory IC fabrication plant under construction in Austin, Texas. In exchange, Samsung will provide Intel with a reliable supply of DRAMs. Toshiba is also rumored to have taken a 20 percent stake in the fab facility.
- In mid-1996, Samsung signed a broad license for Digital Semiconductor's Alpha 64-bit RISC microprocessor architecture and is manufacturing Alpha microprocessors as an independent alternate source of Alpha technology. Samsung will also use the Alpha processors in its own systems.
- In May 1996, Trident Microsystems and Samsung announced a long-term partnership. Samsung will provide manufacturing capacity to Trident in exchange for mixed-signal, multimedia RAMDAC, and clock technology. Samsung will incorporate Trident's device technology into its ASIC library.
- Samsung licensed DSP core technology from SGS-Thomson in early 1996 as part of a second-sourcing and development agreement. At first, the licensing agreement included rights to SGS-Thomson's D950 16-bit fixed-point DSP core and a second-sourcing pact for ASICs based on the core. The partnership is eventually expected to include joint development of future product generations.
- In late 1995, Samsung announced it had licensed the PineDSPCore engine from DSP Group. Samsung said it would incorporate the 16-bit, general purpose, low-power, low-voltage, and high-speed engine in its ASIC library for 0.6 μ m- and 0.5 μ m-based multimedia and communications products.
- Samsung licensed Rambus' proprietary DRAM interface technology. The company introduced its first 16M Rambus DRAM (RDRAM) in 1996.
- Information Storage Devices (ISD) was granted access to Samsung's wafer fabrication capacity and a joint development agreement was made between the two companies for products based on ISD's multilevel storage technology for the recording and playback of voices.
- Samsung has licensed several of the ARM RISC processor cores from Advanced RISC Machines, Ltd., including the ARM6, ARM610, ARM7, and ARM7TDMI.

- Samsung and NEC agreed to share information concerning 256M DRAM cell technology. As part of another agreement, Samsung licensed NEC's 78K Series 16-bit microcontroller technology. Samsung is allowed to use the 78K series as a 0.8 μ m 16-bit core.
- Samsung reached an agreement with Texas Instruments in 1993 to jointly improve and operate TI's test and assembly plant in Portugal. Each company operates separate, dedicated lines, which Samsung uses to assemble and test DRAMs.
- Samsung and Toshiba agreed to an eight-year alliance in 1992 in support of Toshiba's NAND-type flash memory architecture. In 1993, Samsung began production of 8M and 16M flash devices that are pin-compatible with Toshiba's devices. Similarly configured 32M parts were first delivered in 1994. In addition, the two companies agreed to co-develop 64M NAND-type flash memories. As part of a separate agreement, Toshiba is providing Samsung with consumer bipolar IC and high-definition TV chip production technologies.
- Samsung has a second-source agreement with Mitsubishi for 4M and 16M Cache DRAMs. The two companies also agreed to co-develop future Cache DRAM products.
- Array Microsystems has a technology development pact with Samsung that provides Array with a strong foundry partnership. The two companies codeveloped the initial VideoFlow video compression technology. The deal provides Array with access to Samsung's advanced 0.5 μ m and 0.35 μ m CMOS fab capacity for the manufacture of its products. In 1993, Samsung secured a 20 percent equity ownership position in Array Microsystems, and in mid-1995, Samsung increased its stake to 37 percent.

Noteworthy News

- In March of 1998, Samsung announced that it had developed the first 128M Flash Memory. Mass production is to begin 3Q98. The device will use 0.27 micron technologies and operate at 2.7V. It has the capability to repeat the memorizing/erase cycle more than 1 million times. The 128Mbit Flash Memory will be used for computer, information and electronic home appliance applications.
- In March of 1998, Samsung was announced as one of eight companies to support the Double Data Rate (DDR) unification standard. DDR is a high-speed technology standard which can double the data transfer quantity. An agreement by eight companies, Hyundai, Samsung, Fujitsu, NEC, Toshiba, Hitachi, Mitsubishi and TI, to support DDR, directly opposes the Rambus standard which has been emerging as the next generation standard for high speed DRAM. The Rambus standard, which has been supported by Intel, requires users to pay a license fee to Rambus, the owner of the technology. Because of this fee, there has been growing interest in other, less costly, DRAM standards.
- In February 1998, Samsung Electronics Co., Ltd. pulled out of the Sematech-backed International 300mm Initiative (I300I) due to their current financial crisis. It isn't yet clear how much impact the departure of Samsung will have on the on-going I300I effort.
- In January of 1998, Samsung announced that it will close three regional headquarters — in New York, London and Singapore — and transfer their functions to the group headquarters in Seoul and individual affiliates. The regional offices controlled Samsung's operations in North America, Europe and Southeast Asia, respectively, a spokesman for the group said. He said the group is closing the regional headquarters as part of a restructuring program resulting from South Korea's International Monetary Fund-led Bailout.

- In January 1998, due to poor economic conditions in Asia, Samsung has scaled-back planned investments in non-memory chip areas in hopes of minimizing debt and allowing focused efforts to be placed on expanding export markets. A Samsung spokesman said these and other restructuring steps will help cut its debt-to-equity ratio from the current 267 percent to 160 percent. He added that the group will concentrate on boosting its exports to the level of \$28B in 1998 from \$21B in 1997, and slash imports from \$10B in 1997 to \$8B in 1998.
- In January 1998, Samsung Electronics Co., Ltd. sold Samsung Microwave Semiconductor Corporation (SMS), of the U.S., to Watkins-Johnson Co. SMS specializes in chemical-compound semiconductors for use in communication devices. It was originally acquired by Samsung in 1993. SMS's California headquarters employs more than 100 people and had annual sales of \$3M.
- In January of 1998, Samsung announced that it will expand its DRAM microchip plant in Austin, Texas. According to the Company's plan, the monthly production capacity of the plant will be increased by 10,000 to 15,000 - 200mm wafers per month. Its current capacity is 10,000 wafers per month. Finally, Samsung stated that the final expansion size would depend on economic conditions in Korea and microchip market trends.
- In November of 1997, Samsung Group management announced that it will continue overseas expansion and focus on core businesses such as semiconductors. But it will cut overall investment in 1998 by 30 percent and ask all its companies to curtail borrowing. In addition, Samsung will slash entertainment and travel costs and cut Korea-based executives' salaries by 10 percent. These efforts are in direct response to the IMF bailout requirements.
- In February 1997, Samsung, along with other South Korean memory houses announced plans to cutback planned capacity and curtail production of 16Mbit chips in favor of more lucrative products (i.e., 64Mbit DRAMs). This move was primarily motivated by a steep drop in DRAM prices.

SGS-THOMSON MICROELECTRONICS

SGS-Thomson Microelectronics
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165 rue Edouard Branly, BP 112
01630 Saint Genis Pouilly, France
Telephone: (33) (4) 50-40-26-40
Fax: (33) (4) 50-40-28-60
Web Site: www.st.com

IC Manufacturer
Founded: 1987

Regional Headquarters/Representative Locations

North America: SGS-Thomson Microelectronics Inc. • Carrollton, Texas
 Telephone: (214) 466-6000 • Fax: (214) 466-8130

Japan: SGS-Thomson Microelectronics K.K. • Minato-Ku, Tokyo, Japan
 Telephone: (81) (3) 3280-4121 • Fax: (81) (3) 3280-4131

Asia-Pacific: SGS-Thomson Microelectronics Asia Pacific Pte., Ltd. • Singapore
 Telephone: (65) 482-1411 • Fax: (65) 482-0240

Financial History (\$M), Fiscal Year Ends December 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	1,568	2,038	2,640	3,554	4,122	4,019
IC Sales	1,241	1,642	2,207	2,964	3,522	3,448
Discrete Sales	327	396	433	590	600	571
Net Income	3	160	362	526	625	407
R&D Expenditures	261	271	338	440	532	611
Capital Expenditures	196	446	780	1,002	1,125	1,035
Employees	17,000	20,000	21,000	25,000	26,000	28,000

Ownership: 31 percent Publicly held. NYSE: STM, Bourse de Paris. 34.5 percent Private Italian conglomerate (IRI, Corritato S/R); 34.5 percent Private French conglomerate (France Telecom; CEA Industries).

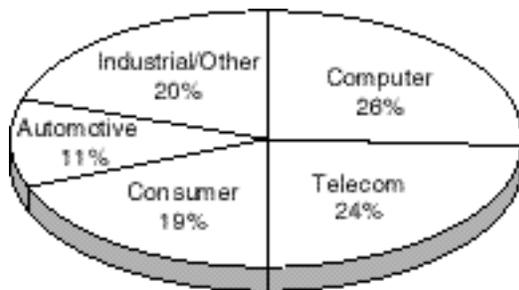
1998 Sales Forecast: \$4.4B

Company Overview and Strategy

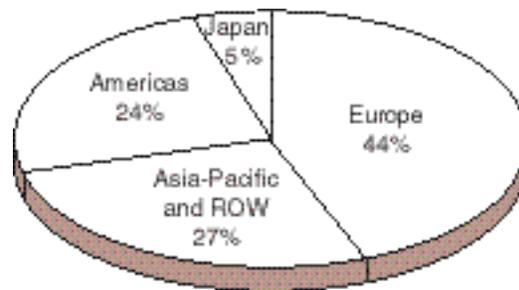
SGS-Thomson Microelectronics designs, develops, manufactures, and markets a broad range of integrated circuits and discrete devices for use in a wide variety of microelectronics applications, including telecommunications systems, computer systems, consumer products, automotive products, and industrial automation and control systems.

SGS-Thomson Microelectronics (ST) was established in 1987, as a result of the merging of SGS Microelectronica of Italy and Thomson Semiconducteurs of France, two companies that each had almost 30 years of experience in the field of semiconductors at the time of the merger.

SGS-Thomson is a leading supplier of analog ICs, mixed-signal ASICs, SmartCard ICs, non-volatile EPROM and EEPROM memories, special automotive ICs and MPEG-2 decoder ICs. In many semiconductor markets, including power ICs, analog and mixed-signal ICs, MPEG decoder ICs, SmartCard ICs, and EPROMs.

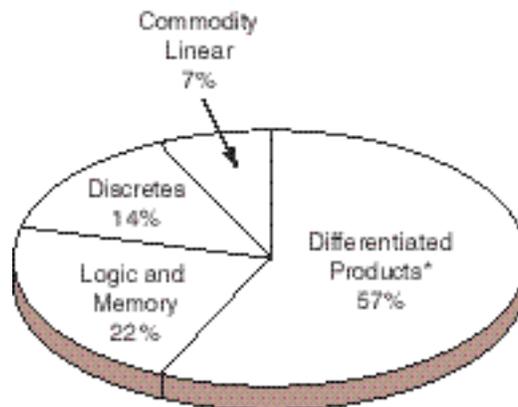


1997 Sales by End-Use Market



1997 Sales by Geographic Region

With respect to its products, ST is organized into five principal groups: the Dedicated Products Group (DPG), the Discrete and Standard ICs Group (DSG), the Memory Products Group (MPG), the Programmable Products Group (PPG), and the New Ventures Group (NVG).



*A combination of dedicated, semi-custom and programmable products designed to suit a specific customer application.

1997 Sales by Product Group

- The Dedicated Products Group produces application-specific semiconductor products using advanced bipolar, CMOS, BiCMOS, mixed-signal, and power technologies. These products include modem chips, digital set-top box chips, motor control circuits, audio amplifiers, image processing devices and telecommunications chips.
- The Discrete and Standard ICs Group produces discrete power devices, standard linear and logic ICs, and radio frequency (RF) products.
- The Memory Products Group produces a broad range of memory ICs, including EPROMs, flash memories, EEPROMs, SRAMs, and chips for smartcards.
- The Programmable Products Group produces microcomponents (including MCUs, MPUs, and DSPs), digital and mixed-signal semicustom devices, PC graphics chips, and multimedia acceleration ICs.
- The New Ventures Group identifies and develops new business opportunities to complement the company's existing businesses and exploit its technological know-how, manufacturing capabilities, and global marketing team. Its initial activities have been focused on the manufacture and sale of x86 MPUs designed by Cyrix Corporation.

Management

Pasquale Pistorio	President and Chief Executive Officer
Laurent Bosson	Vice President, Front End Manufacturing
Carlo Bozotti	Vice President, European Region and Headquarters
Salvatore Castorina	Vice President, Discrete and Standard ICs Group
Murray Duffin	Vice President, Total Quality Management
Alain Dutheil	Vice President, Strategic Planning and Human Resources
Ennio Filauro	Vice President, Memory Products Group
Phillippe Geyres	Vice President, Programmable Products Group
Maurizio Ghirga	Vice President and Chief Financial Officer
J.C. Marquet	Vice President, Asia/Pacific Operations
Pier Angelo Martinotti	Vice President, New Ventures Group
Joel Monnier	Vice President, Central Research and Development
Piero Mosconi	Vice President and Treasurer
Richard Pieranunzi	Vice President, Corporate Marketing and President, American Region
Aldo Romano	Vice President, Dedicated Products Group
Giordano Seragnoli	Vice President, Back End Manufacturing and Subsystems
Keizo Shibata	Vice President, Japan Region
Enrico Villa	Vice President, Region Five (E. European Countries, Africa, Latin America, India)

Products and Processes

SGS-Thomson produces a wide range of discrete semiconductor devices and integrated circuits using advanced bipolar, BiCMOS, CMOS, and mixed technologies. SGS-Thomson is particularly strong in the telecommunications, automotive, and industrial sectors, reflecting its strengths in power integrated circuits and power transistors.

Complementing its power products, SGS-Thomson offers a wide range of digital and mixed-signal circuits, including microcontrollers and processors, EPROMs, EEPROMs, flash memories, high-performance SRAMs, telecommunications circuits, graphics processors, and image compression devices.

In early 1997, the company introduced the first device from its Omega line of system-on-a-chip devices that will feature 1M of embedded DRAM at first, moving to 4M later. Using embedded DRAM technology licensed from U.S.-based Artisan Components, the introduction marks the first time SGS-Thomson has fabricated DRAM circuitry on ICs in any quantity. In a separate announcement, ST unveiled another device called the Chameleon.

<p>MOS MEMORY</p> <ul style="list-style-type: none"> <input type="checkbox"/> DRAM <input checked="" type="checkbox"/> SRAM <input checked="" type="checkbox"/> Flash Memory <input checked="" type="checkbox"/> EPROM <input type="checkbox"/> ROM <input checked="" type="checkbox"/> EEPROM <input checked="" type="checkbox"/> Other (Including Non-Volatile RAM) 	<p>ANALOG</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Amplifier <input type="checkbox"/> Interface <input checked="" type="checkbox"/> Consumer/Automotive <input checked="" type="checkbox"/> Voltage Regulator/Reference <input checked="" type="checkbox"/> Data Conversion <input checked="" type="checkbox"/> Compactor <input checked="" type="checkbox"/> Other (Includes Telecom)
<p>MOS LOGIC</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> General Purpose Logic <input checked="" type="checkbox"/> Gate Array <input checked="" type="checkbox"/> Standard Cell <input type="checkbox"/> Field Programmable Logic <input type="checkbox"/> Other Special Purpose Logic 	<p>DIGITAL BIPOLAR</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bipolar Memory <input checked="" type="checkbox"/> General Purpose Logic <input type="checkbox"/> Gate Array/Standard Cell <input type="checkbox"/> Field Programmable Logic <input type="checkbox"/> Other Special Purpose Logic <input type="checkbox"/> MPU/MCU/MPR
<p>MOS MICROCOMPONENT</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> MPU <input checked="" type="checkbox"/> MCU <input checked="" type="checkbox"/> MPR <input checked="" type="checkbox"/> DSP 	<p>OTHER</p> <ul style="list-style-type: none"> <input type="checkbox"/> Full Custom IC <input checked="" type="checkbox"/> Discrete <input type="checkbox"/> Optoelectronic

The Chameleon device is a 64-bit proprietary, multimedia microprocessor that will be used in an automotive system-on-a-chip device that will include navigation, global positioning system, GSM wireless phone, DVD audio, and radio-link data-system functions.

Details concerning STM's semiconductor products are given below.

Dedicated Products

- Telecom and Data Communications ICs – includes network ICs, modem ICs, switching ICs, and linear ICs.
- Automotive ICs – includes linear ICs, controllers, instrumentation circuits, and audio ICs.
- Industrial ICs – includes power controllers and motor drivers.
- Consumer ICs – includes audio ICs, digital compression circuits, and television circuits.
- Computer ICs – includes display circuits and PC graphics devices.

Standard Circuits

- Processors and Peripherals – includes the Cyrix-designed ST486, ST5x86, and ST6x86 families of MPUs; microcontrollers in 4-bit, 8-bit, 16-bit, and 32-bit configurations; DSPs; fuzzy logic processors; peripheral protection circuits; Transputer processors; and video compression circuits.
- Memories and SmartCard Products – includes UVEPROMs and OTPROMs in densities from 16K to 16M; flash memories in densities from 256K to 16M; 16K and 64K parallel EEPROMs; serial EEPROMs in densities from 256bit to 256K; synchronous and asynchronous fast CMOS SRAMs; timekeeper and zeropower SRAMs; and memory-based smartcard ICs. Low voltage versions of many of the memory ICs are available.
- Standard Linear ICs – includes voltage regulators, comparators, amplifiers, timers, data converters, and other standard linear ICs in advanced bipolar, CMOS, and BiCMOS technologies.
- Logic Circuits – includes CMOS, high-speed CMOS, and low-power Schottky general-purpose logic ICs.

Semicustom Circuits

- Digital Circuits – includes high-performance CMOS standard cell ASICs, sea-of-gates structured arrays, sea-of-gates arrays with embedded functions, and sea-of-gates continuous arrays.
- Analog and Mixed-Signal Circuits – includes analog and mixed-signal CMOS and BiCMOS standard cells.

Discrete Devices

- Transistors, thyristors, diodes, and protection devices.

RF and Microwave Devices

- Silicon power transistors and hybrid power modules.

Semiconductor Fabrication Facilities

SGS-Thomson announced plans to open one new 200mm wafer production facility each year between 1996 and 2000. Following its plan, the Company's Phoenix, Arizona facility began volume production in 1996, and its Catania facility began volume production in 1997. The R1 facility in Agrate is currently being upgraded from a 150mm to 200mm fab.

Two new 200mm fabs are now under construction in Rousset, France, and Singapore. The site in Rousset will focus on the production of microcontrollers, non-volatile memories, and other devices with geometries of 0.5 μ m and below. This facility, known as the "Rousset 2000 plant," will have the capacity to process 5,000 wafers per week, with the first chips scheduled for early 1998. The 200mm fab in Singapore is expected to be up and running by 1999 with a throughput of 6,250 wafers per week produced in 0.25 μ m technology.

SGS-Thomson Microelectronics S.A.
3 rue de Suisse, BP 4199
35041 Rennes Cedex, France
Telephone: (33) (2) 99-26-4800
Cleanroom size: 27,500 square feet
Capacity (wafers/week): 3,500
Wafer size: 125mm (upgrade to 150mm in 1997)
Processes: Bipolar, BiCMOS
Products: Hi-Rel/aerospace and other ICs
Feature size: 2.5 μ m

SGS-Thomson Microelectronics S.A.
Zone Industrielle Peynier-Rousset, BP 2
13790 Rousset, France
Telephone: (33) (4) 42-25-8800
Cleanroom size: 50,500 square feet
Capacity (wafers/week): 6,500
Wafer size: 150mm
Processes: CMOS, NMOS
Products: Microcomponents, EPROMs, EEPROMs
Feature sizes: 1.0 μ m-1.5 μ m

SGS-Thomson Microelectronics S.A.
Zone Industrielle Pré Roux, BP 16
38190 Crolles, France
Telephone: (33) (4) 76-08-9859
Cleanroom size: 21,340 square feet (Class 1)
Capacity (wafers/week): 5,000
Wafer size: 200mm
Processes: CMOS, BiCMOS
Products: ASICs and ASSPs for telecom,
consumer, and auto applications, R&D.
Feature sizes: 0.25 μ m-0.8 μ m

SGS-Thomson Microelectronics S.p.A.
Via C Olivetti 2
20041 Agrate (Brianzi), Italy
Telephone: (39) (60) 35-040
Cleanroom size: 114,400 square feet
Capacity (wafers/week): 16,000
Wafer size: 150mm (upgrade to 200mm by 1998)
Processes: CMOS, BiCMOS, bipolar, BCD
Products: Memories, ASICs, mixed-signal ICs,
dedicated bipolar ICs, VLSI R&D.
Feature sizes: 0.5 μ m-2.5 μ m (0.35 μ m in 1998)

SGS-Thomson Microelectronics S.A.
17 Avenue des Martyrs, BP 217
38019 Grenoble Cedex, France
Telephone: (33) (4) 76-58-5000
Cleanroom size: 26,400 square feet
Capacity (wafers/week): 5,000
Wafer size: 100mm
Processes: Bipolar, MOS
Products: Audio, telecom, and video ICs
Feature sizes: 1.2 μ m-3.0 μ m

SGS-Thomson Microelectronics S.A.
Zone Industrielle Peynier-Rousset, BP 2
13790 Rousset, France
Telephone: (33) (4) 42-25-8800
Capacity (wafers/week): 5,000
Wafer size: 200mm
Process: CMOS
Products: MCUs, EEPROMs
Feature sizes: 0.35 μ m, 0.5 μ m (0.25 μ m capable)
(Scheduled to begin production in early 1998).

SGS-Thomson Microelectronics S.A.
16, rue Pierre et Marie Curie, BP 0155
37001 Tours Cedex, France
Telephone: (33) (2) 47-42-4000
Cleanroom size: 36,300 square feet
Capacity (wafers/week): 15,000
Wafer size: 100mm (upgrading to 125mm)
Processes: Planar and mesa
Products: Discretes
Feature size: 20 μ m

SGS-Thomson Microelectronics S.p.A.
Via Tolomeo 1
Casella Postale n.176
20100 Cornaredo Milano
Castelletto, Italy
Telephone: (39) (29) 33-30
Cleanroom size: 25,300 square feet
Capacity (wafers/week): 1,250
Wafer size: 150mm
Processes: Bipolar, BCD (bipolar/CMOS/DMOS)
Products: Smart power devices, BCD R&D
Feature sizes: 1.2 μ m-6.0 μ m

SGS-Thomson Microelectronics S.p.A.
 Stradale Primosole 50
 95121 Catania, Italy
 Telephone: (39) (95) 59-9111
 Cleanroom size: 44,000 square feet
 Capacity (wafers/week): 8,000
 Wafer size: 125mm (upgrading to 150mm)
 Processes: CMOS, MOS, bipolar
 Products: Logic and linear ICs, discretes
 Feature sizes: 3.5 μ m-7.0 μ m

SGS-Thomson Microelectronics Inc.
 1310 Electronics Drive
 Carrollton, Texas 75006-5039
 Telephone: (214) 466-8844
 Cleanroom size: 15,000 square feet
 Capacity (wafers/week): 3,500
 Wafer size: 150mm
 Processes: CMOS, BiCMOS
 Products: ASICs, MPUs, graphics ICs, foundry
 Feature sizes: 0.5 μ m-2.0 μ m

SGS-Thomson Microelectronics Inc.
 16350 West Bernardo Drive
 San Diego, California 92127
 Telephone: (619) 485-8900
 Capacity (wafers/week): 3,600
 Wafer size: 100mm
 Processes: NMOS, CMOS, BiCMOS
 Products: Mixed-signal telecom ICs
 Feature sizes: 0.8 μ m-5.0 μ m

SGS-Thomson Microelectronics S.p.A.
 Stradale Primosole 50
 95121 Catania, Italy
 Cleanroom size: 22,000 square feet
 Capacity (wafers/week): 5,000
 Wafer size: 200mm
 Process: CMOS
 Products: Logic ICs
 Feature sizes: 0.35 μ m, 0.5 μ m
 (Volume production scheduled for 1997).

SGS-Thomson Microelectronics Inc.
 1000 East Bell Road
 Phoenix, Arizona 85022
 Telephone: (602) 485-6100
 Cleanroom size: 75,000 square feet
 Capacity (wafers/week): 3,500
 Wafer size: 200mm
 Process: CMOS
 Products: MPUs, MPRs, EPROMs
 Feature sizes: 0.35 μ m, 0.5 μ m

SGS-Thomson Microelectronics Pte. Ltd.
 28 Ang Mo Kio Industrial Park 2
 Singapore 1955
 Telephone: (65) 482-1411
 Cleanroom size: 55,400 square feet
 Capacity (wafers/week): 32,000
 Wafer size: 125mm
 Processes: Bipolar, CMOS, NMOS, MOS
 Products: ICs and discretes
 Feature sizes: 1.0 μ m-3.0 μ m
 (Adding a 32,000 square foot cleanroom for the fabrication of ICs on 200mm wafers. Scheduled to be completed in 1999).

ST has semiconductor assembly and test facilities in Malaysia, Singapore, Morocco, Malta, and China.

Alliances and Key Agreements

- March 1998, Newport Wafer-Fab Limited has licensed SGS-Thomson Microelectronics' process technology for the production of 0.35 micron and 0.25 micron digital logic and mixed-signal devices.
- In February 1998, Mitsubishi and SGS-Thomson Microelectronics (STM) announced an agreement to extend their cooperation in Flash memories. They have decided to join their efforts and resources to develop a new generation of Flash memory products, starting with multi-level 64Mbit, which will include the advantages of both DINOR and NOR architectures as well as associated advanced processes from 0.20 through 0.18 micron.
- In December 1997, Hitachi and STM announced an agreement in principle to join forces and collaborate on the development of next-generation SuperH microprocessors (Hitachi's SH-5/STMs ST50) for consumer electronics and multimedia applications. The two companies will together develop the new 64-bit SH-5/ST50 series based upon Hitachi's original SuperH architecture and STM's known-how in 64-bit microprocessors for interactive set-top boxes, digital video products, car multimedia systems and other consumer-oriented products. The agreement also allows STM to have access through specific licenses to Hitachi's S-3 and SH-4 series. By combining their efforts, the two companies' goal is to deliver high-performance, low-cost processors to the market more quickly and create an architectural standard for consumer multimedia systems. The architecture from the joint development is expected to be disclosed in 1998.
- In March 1997, France Telecom and STM signed a cooperative agreement to create a joint IC design team. In Q4 1997, SGS-Thomson announced an agreement with Hitachi Ltd., to develop a 64-bit microprocessor for consumer electronics and multimedia applications.
- In November 1997, Daewoo Electronics and STM announced an agreement to establish a joint design center company in Seoul, Korea. The center will develop ICs for existing consumer electronics applications and future products for digital and high definition TV, digital VCR and DVD, telecommunications, computing and other products jointly selected by the two companies. The design center, located in Daewoo's premises in Seoul, will be initially staffed by 20 people. When fully operational, the venture will have approximately 60 design engineers.
- In September 1997, Philips Semiconductors and STM announced the renewal and extension of the Technology Cooperation Agreement between the two companies. Under the new agreement, the two companies will jointly develop advanced semiconductor manufacturing processes. The new Agreement runs for three years from 1 January 1998. It will cover both process development and work on Computer Aided Design libraries for the next generations of processes—0.18 micron and smaller technologies—providing the two companies with technology that can be used to create highly integrated ICs for applications such as computer equipment, telecoms, and consumer electronics.

Under the original Agreement, announced in 1992, the two companies have cooperated on process technology and library development at the SGS-Thomson site in Crolles, near Grenoble, France, sharing the costs of research and development, combining technical resources and accelerating development times. This cooperation between the companies resulted in the joint development of a 0.5 and 0.35 micron CMOS family of processes, together with pilot production, at Crolles, and the transfer of the processes to Philips Semiconductors' Nijmegen fab. The present generation, 0.25 micron, was a product from this Agreement and additional collaborations with France Telecom and GRESSI.

- In August of 1997, STM and Philips Semiconductor announced an agreement to combine their efforts in the development and promotion of a front-end chipset for Digital Video Broadcast-Terrestrial (DVB-T) digital television receivers. The purpose of this cooperation is to quickly bring to market a chipset fully compliant with the DVB-T recommendations, which allows the reception of all European 2K and 8K standards. The chipset consists of four integrated circuits. Three are designed and manufactured by STM: the FFT processor, channel estimate/corrector, and error correction circuit. The fourth device designed and manufactured by Philips Semiconductors, is the synchronization circuit.
- In July 1997, Motorola Semiconductor Products Sector and STM announced a new alliance to ensure the companies' contactless smartcard microcontroller products are compatible and interoperable. In a move designed to drive the adoption of open standards, the agreement will offer organizations looking to implement contactless smartcard-based systems a choice of products from either supplier that will operate together. The companies' technical collaboration will cover contactless communications for both smartcards and smartcard terminals.
- In May 1997, STM announced the acquisition of a majority stake in Metaflow Technologies Incorporated, a specialist developer of advanced microprocessor architectures, based in San Diego, CA. Metaflow has been working in the area of new concepts and designs for microprocessors for the past 10 years and has forged a strong reputation, particularly in the areas of sub-micron VLSI physical design, microprocessors architecture and floating point calculations, which are essential computer applications. Metaflow's design group is also considered to be highly efficient, having successfully and effectively completed major projects. The acquisition by STM follows nearly two years of activities between the two companies.
- In May 1997, Alcatel and STM announced an agreement to promote, manufacture and sell high-speed communications systems that enable the transmission of video, Internet data and other high-bandwidth services over conventional telephone lines. Alcatel has signed an agreement with STM to license its chipset of integrated circuits for implementing ATM over Asymmetrical Digital Subscriber Line (ADSL) technology with rate adaptive capability, which increases data transmission over existing telephone subscriber loop networks by up to a few hundred times.
- In April 1997, STM and NVIDIA Corporation jointly introduced RIVA 128, the first 128-bit 3D multimedia accelerator to support Intel Corporation's Visual Computing Initiative. RIVA 128 provides state-of-the-art 3D, 2D, video and imaging capabilities that enable visual computing platforms to deliver a new class of interactive, intuitive and life-like computing experiences to users.
- In March 1997, France Telecom and STM signed a cooperative agreement to create a joint IC design team. This team, based in the CNET site in Meylan, near Grenoble, will consist of 20 designers provided by the partners. The team will develop a library of advanced, leading edge functions and ICs used in telecommunications systems, with an emphasis on radio frequency for wireless communications or high bit rate transmission. As a result, CNET will obtain fast access to the functions and circuits needed to develop and trial the future services and networks of France Telecom. This agreement will also give STM immediate access to results on the research circuits developed by CNETS.

- In February 1997, SGS-Thomson established a relationship with Ramtron covering FRAM production. The agreement calls for SGS-Thomson to provide CMOS wafers to Ramtron, who will return the wafers to ST as finished 64K FRAMs. The two companies may extend this relationship in the future to include joint foundry or technology licensing agreements.
- In Q1 1997, SGS-Thomson established a licensing agreement with Rambus Inc. that gives ST access to Rambus' high-speed memory interface technology.
- Samsung licensed DSP core technology from SGS-Thomson in early 1996 as part of a second-sourcing and development agreement. At first, the licensing agreement will include rights to SGS-Thomson's D950 16-bit fixed-point DSP core and a second sourcing pact for ASICs based on the core. The partnership is eventually expected to include joint development of future product generations.
- In 1994, SGS-Thomson and Siemens announced an extension to their cooperation on Siemens' 16-bit microcontrollers.
- SGS-Thomson and AMD signed an agreement in 1994 to cooperate on the definition of future flash memory products based on AMD's architecture.
- Cyrix extended its wafer supply agreement with SGS-Thomson in 1994. Under the new arrangement, SGS-Thomson increased the number of wafers it produces for Cyrix and is allowed to make a certain percentage of those same wafers for itself. In addition, Cyrix granted SGS-Thomson the right to use certain Cyrix-designed chips as part of SGS-Thomson's ASIC libraries. SGS-Thomson is allowed to produce and sell such ASIC products under its own name in unlimited quantities, with Cyrix receiving royalties from the sale of the devices. Also, Cyrix has the right to sell the SGS-Thomson-designed ASICs under its own name.
- General Instrument signed a licensing agreement with ST in 1994 for GI's DigiCipher II video compression technology. The pact allows SGS-Thomson to develop "dual-mode" video decoder chips capable of processing both DigiCipher and MPEG 2 video signals.
- Mitsubishi and SGS-Thomson established an agreement in 1993 on developing 16M flash memories.
- SGS-Thomson and Sanyo Electric reached an agreement in 1993 to jointly develop video compression and modem chips for multimedia use.
- SGS-Thomson transferred its 1.2 μ m BiCMOS process technology to Seagate Microelectronics' fab facility in Livingston, Scotland, in 1993. SGS-Thomson's fab in Grenoble, France, became a foundry for device designs covered under the agreement with Seagate.
- SGS-Thomson entered into a strategic alliance with Northern Telecom in 1993 involving technology development and manufacturing of custom telecommunications ICs. As part of the alliance, SGS-Thomson acquired Northern Telecom's fab facility in San Diego, California.

Noteworthy News

- September 1997, STM introduced the world's first Flash memory chip that can operate at 1.8V. While other Flash memory chips require higher voltages, STM's new Flash memory technology brings significant power saving advantages in portable embedded applications such as cellular phones, pagers, modems personal digital assistants, handheld global positioning systems, digital cameras and similar applications where battery life is a key issue.
- September 1997, STM was awarded the winner of the 1997 European Quality Award for Business Excellence in the category of large businesses by the European Foundation for Quality Management (EFQM). This award is granted each year after a rigorous selection process by an independent jury of experts.
- September 1997, STM's plants in Cornaredo, Milano and Agrate Brianza were the first two sites in Italy to be recognized by an internationally accredited organization to meet the requirements of both the European Eco-Management and Audit Scheme (EMAS regulation) as well as the internationally recognized ISO 14001 environmental standard. To meet its corporate goal of being one of the most progressive companies in the field of environmental protection, STM is working to obtain validation to the EMAS regulation for all its sites worldwide.
- In a third quarter 1997 earnings release, an STM spokesman said they expect the industry-wide excess capacity to extend through the first half of 1998. The financial situation in Asia is not helping to improve visibility on market requirements and its full impact on the industry is not yet clear. They acknowledged that the Asia situation is creating additional pricing pressure and to a lesser extent, a negative impact on unit demand. As a result, STM expects their revenues for the first quarter to only modestly surpass \$1B. They also stated that STM's gross profit margin for the first quarter is likely to approximate second half 1997 levels.
- In the third quarter of 1997, SGS-Thomson introduced the first in a family of memory products that integrate both Flash and EEPROM non-volatile memory on the same chip, to offer space and performance advantages.
- In June 1997, STM announced that its sales of smartcard ICs were \$171M in 1996, contributing to the company's officially audited sales of \$4.1B. The products contributing to this level of sales comprise of secure memory, security controller and cryptocontroller ICs. Based on this volume of sales, statements to the press by competitors and the assessments of industry analysts, STM has concluded that it was reconfirmed as the world's leading supplier of smartcard ICs in 1996.
- In May 1997, STM announced the formation of a business unit to address the emerging market for smartcards in North and South America. Located in Lincoln, MA, the American arm of the SmartCard Division aims to secure a substantial share of this market which is expected to grow to around \$500M in North America in 2001.
- In April 1997, STM received a certificate of environmental management from the French Minister for the Environment. This distinction is awarded to companies that have incorporated environmental protection into their company strategy.

- In April 1997, STM opened their new 200mm fab and pilot line in Catania, Italy. This new facility, known as M5, will have the capacity to process millions of sub-micron, non-volatile memories for applications such as mobile phones, PCs industrial applications and consumer entertainment systems. STM's Catania site was already home to the largest high-technology research and development site in the south of Italy.

TEXAS INSTRUMENTS (TI)

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Semiconductor Group
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Dallas, Texas 75265
Telephone: (214) 995-2011
Fax: (214) 997-5250
Web Site: www.ti.com/sc

IC Manufacturer
Founded: 1930

Regional Offices/Representative Locations

Japan: Texas Instruments Japan Ltd. • Minato-Ku, Tokyo, Japan
 Telephone: (81) (3) 3457-0972 • Fax: (81) (3) 3457-1259 • Web Site: www.tij.co.jp

Europe: Texas Instruments France S.A. • Saulnier, Velizy-Villacoublay Cedex, France
 Telephone: (33) (1) 30-70-11-65 • Fax: (33) (1) 30-70-10-32

Asia-Pacific: Texas Instruments Taiwan Ltd. • Taipei, Taiwan
 Telephone: (886) (2) 377-1450 • Fax: (886) (2) 377-2718

Financial History (\$M), Fiscal Year Ends December 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate						
Sales	7,440	8,523	8,608	11,409	9,940	9,750
Net Income	247	472	691	1,088	63	1,805
R&D Expenditures	—	—	578	842	1,181	1,536
Semiconductor						
Sales	3,080	4,100	5,550	7,850	6,750	8,093
IC Sales	3,000	4,040	5,500	7,800	6,700	8,093
Discrete Sales	80	60	50	50	50	--
Capital Expenditures	315	525	860	1,170	2,063	1,238
Employees	60,577	59,048	56,333	59,574	59,927	44,140

Ownership: Publicly held. NYSE: TXN.

1998 Corporate Sales Forecast: > \$10.6B

1998 Capital Expenditures Forecast: \$1.4B

Company Overview and Strategy

Texas Instruments (TI) is one of the leading high-technology companies in the U.S. and one of the top ten semiconductor manufacturers in the world. The Company develops, manufactures and sells a variety of products used in the commercial electronic and electrical equipment industry, primarily for industrial and consumer markets. The company's principal businesses are based on TI's broad semiconductor technology and application of this technology to digital solutions for the networked society. One of TI's main strategic thrusts is to maintain its leadership in digital signal processing (DSP); a market anticipated to grow at a compounded rate of more than thirty percent per year. As of 1997, TI was recognized as the world leader in DSPs and mixed-signal/analog device technology.

TI has three principal businesses: Semiconductor, Materials and Controls, and Educational and Productivity Solutions. Each of these is a business segment, with its respective financial performance detailed in this report.

The Semiconductor business consists of digital signal processors, mixed-signal/analog devices, application-specific integrated circuits, reduced instruction-set microprocessors, microcontrollers, standard logic, and memories. These semiconductors are sold primarily to original equipment manufacturers (OEMs) and through distributors. In 1997, the DRAM business represented roughly ten percent of TI's overall revenues.

Materials and Controls consists primarily of electrical and electronic control devices, electronic connectors and clad metals. These are sold primarily to original equipment manufacturers and through distributors.

Educational and Productivity Solutions, which includes educational and graphing calculators are marketed primarily through retailers and to schools through instructional dealers.

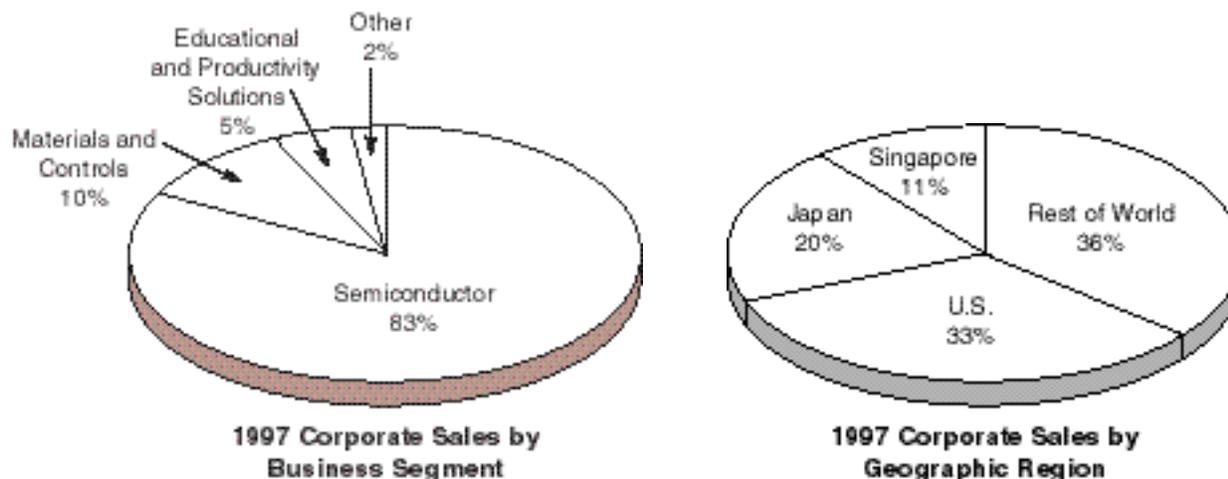
TI was founded in 1930, as Geophysical Service, to provide geophysical exploration services to the petroleum industry using reflection seismographs. In 1946, the company formally added electronic systems manufacturing to its operations, and in 1951, adopted its current name.

In 1996, TI sold its printed circuit board contract manufacturing operation to Solectron Corp. TI also sold its mobile computing business to Acer Group, its printer business to Genicom Corp., and signed a definitive agreement to sell its defense systems and electronics business to Raytheon Company. In April 1997, TI sold its software business to Sterling Software Inc.

In mid-1996, TI acquired Silicon Systems, Inc., a company whose expertise is in mixed-signal/analog circuits. Tustin, California-based, Silicon Systems is operating as a wholly owned subsidiary of TI.

In July 1997, TI sold its Defense Systems and Electronic business for \$2.95B to Raytheon Company.

In November of 1997, TI announced the acquisition of Amati Communications, a world leader in Digital Subscriber Line technology which will revolutionize access to the Internet.



Texas Instruments' business is based principally on its broad semiconductor technology and application of that technology to selected electronic end equipment markets. The company's participation in semiconductors dates back to the emergence of the industry in the early 1950's. It began the research and development of semiconductor devices in 1952. Two years later, the company commercialized the transistor and in 1958, invented the integrated circuit.

Although the company is a leading producer of DRAMs, much of its semiconductor emphasis is focused on differentiated products like digital signal processors (DSPs), microcomponents, and mixed-signal interface devices. TI is the world's leading supplier of DSPs and the second largest supplier of analog/mixed-signal ICs. DSPs, microcomponents and mixed-signal interface devices represented approximately 45 percent of the company's semiconductor revenues in 1997. DRAMs accounted for approximately ten percent of TI's overall 1997 revenues.

The majority of the DRAMs TI sells are sourced from the joint venture companies in which it holds a majority interest, including TI-Acer* in Taiwan, KTI Semiconductor in Japan, TECH Semiconductor in Singapore, and TwinStar* Semiconductor Inc. in Texas. In addition, TI announced a new joint venture with the Italian government to construct a fab facility in Italy for the manufacture of flash memories and another with Anam Industrial Co. to build DSPs at a new fab in South Korea. To date, TI and its partners have invested more than \$3 billion in capital expenditures in the joint ventures. See the Semiconductor Fabrication Facilities and Key Agreements sections below for more information on these ventures.

Management

James R. Adams	Chairman
Thomas J. Engibous	President and Chief Executive Officer
William P. (Pat) Weber	Vice Chairman
Gary D. Clubb	Executive Vice President
David D. Martin	Executive Vice President
Richard K. Templeton	Senior Vice President

*As of 1997, TI pulled out of the TI-Acer and Twinstar joint ventures, see Key Agreements section.

Richard J. Agnich	Senior Vice President, Secretary, and General Counsel
William A. Aylesworth	Senior Vice President, Treasurer, and Chief Financial Officer
Charles F. Nielson	Vice President
Elwin L. Skiles, Jr.	Vice President
Kevin McGarity	Senior Vice President, Semiconductor Group and Manager, Worldwide Semiconductor Group Marketing
John Scarisbrick	Senior Vice President, Semiconductor Group and Manager, Worldwide Application Specific Products
Del Whitaker	Senior Vice President, Semiconductor Group and Manager, Worldwide Mixed-Signal and Logic Products
Rick Goerner	Vice President, Semiconductor Group and President, Silicon Systems
Mike Hames	Vice President, Semiconductor Group and Manager, Worldwide DSP Products

Products and Processes

TI's principal semiconductor products include DSPs, CISC and RISC microprocessors and controllers, graphics ICs, networking chips, ASICs, memory ICs, and mixed-signal devices. Details concerning these products are provided below.

Digital Signal Processors

TI offers a variety of general-purpose DSP chips, including nine generations of dedicated and programmable 16-bit fixed-point and 32-bit floating-point DSPs; customizable and application-specific DSPs. In October 1997, TI announced the development of the TMS320C67x — a DSP chip that can achieve 1 GFLOPS at 167MHz. TI plans to triple the 'C67x performance to 3 GFLOPS by the end of the decade. This enhancement will drastically reduce system chip count from as many as 10 DSP chips down to one 'C67x. Sampling of these devices, manufactured with 0.18 micron technology, is planned for the second half of 1998. TI's DSPs are used for applications including data conversion, wireless communications, data communications, mass storage, multimedia, audio/ video processing, and image processing.

Wireless Communications

TI offers a wide range of mixed-signal and standard analog semiconductor products, including Data Transmission Products, Infrared (IrDA) devices, 1394 High performance Serial Bus ICs, PCI bus solutions, Universal Serial Bus ICs, ADCs/DACs, Power Supply Products, Amplifiers and Comparators, Optoelectronics, Clock Distribution Circuits, 3D Graphics chips, Video Products, Digital Audio Converters, Speech Synthesis Processors, Digital Image Sensor Products, Mass Storage ICs, and MSP430 Low Power MCUs.

Logic Products

TI offers a full portfolio of logic function ICs from advanced high-speed CMOS devices to the classic TTL line of products. Logic products use bipolar, CMOS, and BiCMOS process technologies. Product families include Advanced high-speed CMOS Logic, Advanced BiCMOS Technology, BiCMOS technology/enhanced transceiver logic, low voltage BiCMOS, low voltage Schottky, low voltage CMOS logic, FIFOs, GTLs, and HC/HCTs.

Application-Specific ICs (ASICs)

TI was the third largest North American ASIC vendor in 1996. Its application-specific IC products include high-speed bipolar and CMOS PLDs and CMOS and BiCMOS gate arrays, embedded arrays, and standard cells. The majority of the Company's ASICs are manufactured with a four-level-metal CMOS process, enabling performance of up to 2.5 giga-bit-per-second I/O speeds, supporting microprocessor speeds in excess of 500MHz. The TGC6000 Series CMOS embedded array and TSC6000 Series CMOS standard cell families are built using 0.18 micron, 125 million transistor Timeline Technology.

Networking

TI's networking products provide tailored end-to-end solutions for both the Intranet and Internet Points of Presence. These solutions enable Networking OEMs to lower their total cost of ownership through a line of complete chipsets and software products.

Microcontrollers

The TMS470 8-bit microcontroller family has recently grown to 135 devices distributed over 13 sub-families. The TMS370 family of microcontrollers can provide solutions for a range of applications including industrial, telecommunications, computer peripheral, consumer and automotive systems. Integrated functional modules for the TMS370 family include ROM, RAM, EPROM and EEPROM memories, serial communications interfaces, I/O functions, A/D converters, several timer options, and a memory expansion bus.

Programmable Logic Devices

TI is committed to supporting Programmable Logic products. Their portfolio consists of a high speed bipolar technology implemented in the universal 22v10, 20xx and 16xx architectures (xx = L8, R4, R6, R8), and a CMOS 22v10 with a zero-power option (I_{cc} , 100 μ A).

Memory ICs

TI's extensive line of memory ICs includes a broad family of DRAMs (16M and 64M), synchronous DRAMs (16M and 64M), DRAM-based Field memories, flash memories (512K to 16M), EPROMs (128K to 4M), and synchronous and asynchronous FIFOs.

Storage Products

TI's Storage Products Group serves the mass storage market through the combined resources of Silicon Systems, Intersect Technologies and Texas Instruments. It provides advanced semiconductors for high performance desktop and mobile hard disk drives as well as removable drives. TI's read channels and DSP solutions are complemented by its innovative servo/spindle, interface, preamp and ASIC solutions. These solutions are designed and manufactured for hard disk drives, tape drives, high density floppy disk drives, optical disk drives and DVD.

Military Semiconductors

TI's family of Military Semiconductors include DSPs, mixed-signal ICs, multichip modules, ASICs, PALs and PROMs, logic and memory ICs.

Digital Image Sensors

TI's digital image sensor products include CCD area array image sensors and advanced solid-state CCD TV cameras.

MOS MEMORY		ANALOG	
<input checked="" type="checkbox"/>	DRAM	<input checked="" type="checkbox"/>	Amplifier
<input type="checkbox"/>	SRAM	<input checked="" type="checkbox"/>	Interface
<input checked="" type="checkbox"/>	Flash Memory	<input checked="" type="checkbox"/>	Consumer/Automotive
<input checked="" type="checkbox"/>	EPROM	<input checked="" type="checkbox"/>	Voltage Regulator/Reference
<input type="checkbox"/>	ROM	<input checked="" type="checkbox"/>	Data Conversion
<input type="checkbox"/>	EEPROM	<input checked="" type="checkbox"/>	Comparator
<input checked="" type="checkbox"/>	Other (Including Non-Volatile RAM)	<input checked="" type="checkbox"/>	Other (Includes Telecom)
MOS LOGIC		DIGITAL BIPOLAR	
<input checked="" type="checkbox"/>	General Purpose Logic	<input checked="" type="checkbox"/>	Bipolar Memory
<input checked="" type="checkbox"/>	Gate Array	<input checked="" type="checkbox"/>	General Purpose Logic
<input checked="" type="checkbox"/>	Standard Cell	<input checked="" type="checkbox"/>	Gate Array/Standard Cell
<input checked="" type="checkbox"/>	Field Programmable Logic	<input checked="" type="checkbox"/>	Field Programmable Logic
<input checked="" type="checkbox"/>	Other Special Purpose Logic	<input type="checkbox"/>	Other Special Purpose Logic
MOS MICROCOMPONENT		OTHER	
<input checked="" type="checkbox"/>	MPU	<input type="checkbox"/>	Full Custom IC
<input checked="" type="checkbox"/>	MCU	<input checked="" type="checkbox"/>	Discrete
<input checked="" type="checkbox"/>	MPR	<input checked="" type="checkbox"/>	Optoelectronic
<input checked="" type="checkbox"/>	DSP		

Semiconductor Fabrication Facilities

Texas Instruments has several major wafer fab projects underway. At the company's main campus in Dallas, Texas, \$2 billion has been spent to put up a new DSP production facility (DMOS-6) and an R&D development fab (R&D-I). The R&D-1 facility is used for work on 0.18 μ m and 0.12 μ m device generations and for the company's development of 300mm wafer technology.

In early 1997, TI announced that it had signed an agreement with the Italian government to build a second fabrication facility and an R&D center in Avezzano, Italy. The \$1.2 billion fab will have the capability to process ICs on 300mm wafers, with geometries of 0.28 μ m and below, when operations start in 1999. Current plans call for the production of flash memories and DRAMs at the facility.

In May 1997, Texas Instruments pulled out of a \$1.4 billion Thailand joint DRAM venture with the Alphatec Group. Under the deal, two companies were to be formed: Alpha-TI Semiconductor, a \$1.2 billion 16M and 64M DRAM fab; and Alpha Memory, a \$200 million assembly and test facility. Reasons cited for TI's withdrawal include weakness in the DRAM market and a poor Thai economy. Construction of both facility shells has been completed, but no capital equipment orders were ever placed.

In March 1998, TI pulled out of their DRAM joint venture with the Acer Group. TI is allowing the Acer Group to buy out its 33 percent stake in the Taiwan-based TI-Acer, the DRAM joint venture established in 1989. TI plans to continue purchasing 16Mbit and 64Mbit memory chips during a one year transition period. TI-Acer represented about 20 percent of TI's DRAM revenues.

In February 1998, TI and Hitachi jointly agreed to scrap their two-year-old partnership called Twinstar Semiconductor, Inc., a DRAM venture. The Twinstar company will be dissolved by the end of the first quarter 1998, and TI will form a wholly owned subsidiary to operate the Richardson, Texas fab. Twinstar represented about ten percent of TI's DRAM revenues. The \$500 million factory began producing 16M DRAMs in July 1996, and production of 64M parts in 1997.

Texas Instruments
 13500 North Central Expressway
 Dallas, Texas 75243
 Telephone: (214) 995-2001
 DMOS 4
 Cleanroom size: 50,000 square feet (Class 1)
 Capacity (wafers/week): 21,000
 Wafer size: 150mm
 Process: CMOS
 Products: DRAMs, EPROMs, logic ICs
 Feature sizes: 0.5 μ m-0.8 μ m

Texas Instruments
 13500 North Central Expressway
 Dallas, Texas 75243
 Telephone: (214) 995-2001
 DMOS 5
 Cleanroom size: 35,000 square feet (Class 1)
 Capacity (wafers/week): 6,000
 Wafer size: 200mm
 Process: CMOS
 Products: DSPs, MPUs
 Feature sizes: 0.35 μ m-0.5 μ m

Texas Instruments
 13500 North Central Expressway
 Dallas, Texas 75243
 Telephone: (214) 995-2001
 DMOS 6
 Cleanroom size: 118,000 square feet
 Capacity (wafers/week): 7,500
 Wafer size: 200mm
 Process: CMOS
 Products: DSPs
 Feature sizes: 0.25 μ m, 0.35 μ m

Texas Instruments
 13500 North Central Expressway
 Dallas, Texas 75243
 Telephone: (214) 995-2001
 R&D 1
 Cleanroom size: 51,000 square feet
 Wafer size: 200mm
 Process: CMOS
 Products: R&D
 Feature sizes: 0.12 μ m-0.25 μ m

Texas Instruments
13500 North Central Expressway
Dallas, Texas 75243
Telephone: (214) 995-2001
DFAB
Cleanroom size: 60,000 square feet (Class 1)
Capacity (wafers/week): 5,375
Wafer sizes: 100mm, 150mm
Processes: Bipolar, MOS, GaAs
Products: Analog and memory ICs, discretes
Feature size: 0.8 μ m

Texas Instruments
2301 North University
Lubbock, Texas 79415
Telephone: (806) 741-2000
LMOS Fab
Cleanroom size: 45,000 square feet
Capacity (wafers/week): 8,600
Wafer size: 125mm
Processes: CMOS, NMOS
Products: EPROMs, ASICs
Feature sizes: 0.8 μ m-2.0 μ m

Texas Instruments
32201 Southwest Freeway
Stafford, Texas 77477
Telephone: (281) 274-2000
HFAB
Cleanroom size: 27,000 square feet
Capacity (wafers/week): 8,600
Wafer size: 125mm
Processes: CMOS, NMOS
Products: EPROMs, ASICs
Feature sizes: 0.8 μ m-2.0 μ m

Texas Instruments
13500 North Central Expressway
Dallas, Texas 75243
Telephone: (214) 995-2001
DP1
Cleanroom size: 17,000 square feet (Class 1)
Capacity (wafers/week): 1,000
Wafer size: 100mm
Process: GaAs
Products: Analog and digital ICs
Feature sizes: 0.5 μ m-2.8 μ m

Texas Instruments
Highway 75 South
Sherman, Texas 70590
Telephone: (214) 868-5980
SFAB
Cleanroom size: 50,000 square feet (Class 1)
Capacity (wafers/week): 10,000
Wafer size: 125mm
Process: Bipolar
Products: Logic ICs, MPRs
Feature size: 2.0 μ m

Texas Instruments Japan Ltd.
18-36, Minami 3-chome
Hatagoya-shi, Saitama Prefecture 334
Japan
Telephone: (81) (48) 282-2211
HATO Fab
Capacity (wafers/week): 4,000
Wafer size: 125mm
Processes: CMOS, NMOS
Products: Logic ICs, ASICs
Feature size: 1.0 μ m

Texas Instruments Japan Ltd.
 2355 Kihara Miho-Mura
 Inashiki-gun, Ibaraki Prefecture
 Miho 300-04, Japan
 Telephone: (81) (29) 885-3311
 MIHO 5
 Capacity (wafers/week): 5,750
 Wafer size: 125mm
 Processes: CMOS, MOS
 Products: ASICs, ASSPs, MCUs, DSPs
 Feature sizes: 0.5 μ m-1.0 μ m

Texas Instruments Japan Ltd.
 4260 Aza-Takao
 Oaza-Kawasaki
 Hiji-Machi, Hayami-gun
 Oita Prefecture 979-15, Japan
 Telephone: (81) (97) 772-111
 HIJI Fab
 Capacity (wafers/week): 4,500
 Wafer size: 150mm
 Processes: CMOS, BiCMOS, bipolar
 Products: Logic and analog ICs, DRAMs
 Feature sizes: 0.5 μ m-1.0 μ m

Texas Instruments Italia S.p.A.
 Via Antonio Pacinotti 5/7
 Nucleo Industriale
 I-67051 Avezzano, Italy
 Telephone: (39) 863-4321
 AMOS 2
 Capacity (wafers/week): 7,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature size: 0.5 μ m
 (Joint venture with the Italian government).

Texas Instruments Japan Ltd.
 2355 Kihara Miho-Mura
 Inashiki-gun, Ibaraki Prefecture
 Miho 300-04, Japan
 Telephone: (81) (29) 885-3311
 MIHO 6
 Capacity (wafers/week): 6,250
 Wafer size: 150mm
 Process: CMOS
 Products: DRAMs, MPUs,
 Feature sizes: 0.35 μ m-0.5 μ m

Texas Instruments Italia S.p.A.
 Via Antonio Pacinotti 5/7
 Nucleo Industriale
 I-67051 Avezzano, Italy
 Telephone: (39) 863-4321
 AMOS 1
 Cleanroom size: 45,000 square feet
 Capacity (wafers/week): 5,000
 Wafer size: 150mm (plans for 200mm conversion)
 Process: CMOS
 Products: DRAMs
 Feature size: 0.8 μ m
 (Joint venture with the Italian government).

Texas Instruments Italia S.p.A.
 Via Antonio Pacinotti 5/7
 Nucleo Industriale
 I-67051 Avezzano, Italy
 Telephone: (39) 863-4321
 AMOS 3
 Capacity (wafers/week): 1,650
 Wafer size: 300mm
 Process: CMOS
 Products: Flash memories, DRAMs
 Feature size: 0.28 μ m
 (Joint venture with the Italian government.
 Operations scheduled to begin in 1999).

Texas Instruments Deutschland GmbH
 Haggertystrasse 1
 Freising, Germany
 Telephone: (49) 816-1801
 FFAB
 Capacity (wafers/week): 7,500
 Wafer size: 150mm
 Processes: CMOS, BiCMOS
 Products: Logic and analog ICs, ASSPs
 Feature sizes: 0.6 μ m-0.8 μ m

Silicon Systems, Inc. (subsidiary of TI)
 2300 Delaware Avenue
 Santa Cruz, California 95060
 Cleanroom size: 52,000 square feet
 Capacity (wafers/week): 6,500
 Wafer size: 150mm
 Processes: Bipolar, CMOS, BiCMOS
 Products: Mixed-signal ICs
 Feature sizes: 1.0 μ m-3.0 μ m

TECH Semiconductor Singapore Pte Ltd.
 P.O. Box 2093, SE 9040
 990 Bendemeer Road
 Singapore 1233
 Telephone: (65) 298-1122
 Fab 1
 Cleanroom size: 40,000 square feet
 Capacity (wafers/week): 6,250
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature sizes: 0.35 μ m, 0.5 μ m
 (Joint venture with the Economic Development Board of Singapore, Canon, and HP).

TECH Semiconductor Singapore Pte Ltd.
 P.O. Box 2093, SE 9040
 990 Bendemeer Road
 Singapore 1233
 Telephone: (65) 298-1122
 Fab 2
 Capacity (wafers/week): 10,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature size: 0.25 μ m
 (Joint venture with the Economic Development Board of Singapore, Canon, and HP. Operations scheduled to begin in 1998).

KTI Semiconductor Ltd.
 189-1 Hirano-cho
 Nishiwaki City
 Hyogo Prefecture 677, Japan
 Cleanroom size: 48,400 square feet
 Capacity (wafers/week): 6,250
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs, ASICs, MPUs, DSPs
 Feature sizes: 0.35 μ m-0.8 μ m
 (Joint venture with Kobe Steel).

Key Agreements and Alliances

- In March 1998, TI, Analog Devices and Alcatel announced plans to participate in interoperability testing for asymmetric digital subscriber line (ADSL) silicon. The companies hope to finish joint compatibility tests by the end of the second quarter 1998, and expect their efforts to help accelerate deployment of ADSL systems and service.

- In March 1998, TI pulled out of their DRAM joint venture with the Acer Group. TI is allowing the Acer Group to buy out its 33 percent stake in the Taiwan-based TI-Acer, the DRAM joint venture established in 1989. TI plans to continue purchasing 16Mbit and 64Mbit memory chips during a one year transition period. TI-Acer represented about 20 percent of TI's DRAM revenues.
- In March 1998, five leading logic suppliers stated their support for the ALVC (Advanced Low-Voltage CMOS) logic standard. The announcement by Philips Semiconductors, Texas Instruments, Integrated Device Technology, Hitachi and Pericom comprises the largest multiple-source supply for any low-voltage logic family. Since its inception in 1994, ALVC has been the industry standard for high-performance 3.3V CMOS logic. To address the increasing systems demand for lower voltages and provide reliable multi-sourcing of fully interchangeable parts, Philips Semiconductors, TI, Hitachi, and IDT have concurred on the ALVC specifications. Today, the ALVC family encompasses a variety of bus interface functions: transceivers, multiplexers, drivers and flip-flops.
- In February 1998, TI and Deutsche Telekom signed an agreement to develop a Digital Media Infotainment Center as a reference platform for the provision of multimedia applications. The basis of this is a future generation of high-performance digital signal processors (DSPs), which will make it possible to considerably increase the flexibility in the use of different applications.
- In February 1998, TI and Hitachi jointly agreed to scrap their two-year-old partnership called Twinstar Semiconductor, Inc., a DRAM venture. The Twinstar company will be dissolved by the end of the first quarter 1998, and TI will form a wholly owned subsidiary to operate the Richardson, Texas fab. Twinstar represented about ten percent of TI's DRAM revenues. The \$500 million factory began producing 16M DRAMs in July 1996, and production of 64M parts in 1997.
- In January 1998, TI announced a definitive agreement to purchase the principal assets and operations of Spectron Microsystems, a wholly owned subsidiary of Dialogic Corporation. While specific terms are subject to closing adjustments, it is expected that the purchase price will be in the range of \$20 to \$26 million. The acquisition further enhances TI's extensive digital signal processing (DSP) solutions offering, enabling its customers to shorten their time to market and to focus on features that differentiate their products. Spectron Microsystems, located in Santa Barbara, California, develops and markets advanced system software, such as real-time operating systems (RTOS) for use in digital signal processing applications.
- In December 1997, TI announced that it has entered into an agreement to purchase GO DSP Corporation, a leading provider of digital signal processing (DSP) software tools. This acquisition helps TI further expand its extensive software offering to provide customers with more complete digital signal processing solutions. GO DSP, headquartered in Toronto, Canada, is a privately held company that specializes in advanced, fully integrated software tools, which allow DSP system developers to improve productivity and reduce time to market.

- In December 1997, TI and Wolfson Microelectronics announced a joint product development program targeted at a wide range of data conversion products. The program accelerates the expansion of Wolfson's product catalog of leading-edge data converters and supports TI's strategy to maintain a leadership position in DSP technology. Under the agreement, both Wolfson and TI will contribute marketing and engineering resources to the program with TI providing manufacturing facilities. The resulting products will be sold by both companies as part of their respective data conversion product portfolios. Additionally, Texas Instruments has taken a five percent equity position in Wolfson Microelectronics.
- In November 1997, TI entered into an agreement to acquire digital subscriber line (xDSL) technology pioneer, Amati Communications. The purchase price of \$395M is nearly 30 times the company's fiscal 1997 revenues of \$13.2M. Amati is a supplier of DSL digital modems for both the consumer and central office ends of the data pipe and is known for developing many of the key software applications which drive asymmetrical DSL systems.
- In November 1997, TI and HotHaus Technologies Inc. announced a teaming arrangement to offer new DSP designers a Digital Signal Processing (DSP) solution for applications that require telecommunications features. HotHaus' HausWare telephony software will be distributed by Texas Instruments for use on its TMS320C2xx family of DSPs, reducing system-cost through integration and increasing ease-of-use for customers unfamiliar with DSPs. This solution significantly reduces system-cost by replacing up to five chips — a microcontroller, two memory chips, a fax chip and a modem chip — with two devices, the TI DSP and codec.
- In October 1997, TI signed an agreement with Sun Microsystems, Inc. to license the EmbeddedJava and PersonalJava environments. The agreement will allow TI to deliver Java™ capabilities on any Texas Instruments' processor platform, including TI's industry-leading TMS320 family of digital signal processors (DSPs), for end equipments such as digital cellular phones, pagers and wireless local loop terminals.
- In September 1997, Philips Semiconductors and Texas Instruments announced a cooperative arrangement to provide a source for PicoGate Logic products. This announcement marks the first cooperative source for PicoGate Logic, the industry's smallest IC package. Applications for this small packaging span the areas of telecommunications, computer and consumer products. More specifically, tomorrow's sub-sub notebook computers, handheld TVs, video games, cameras and more, will require the small size and functionality the PicoGate Logic provides. Philips Semiconductors will provide a full range of PicoGate Logic functions in 5V HC/HCT and 3V CMOS; Texas Instruments will provide the same functions in the AHC/AHCT families.
- In July 1997, TI and Rambus Inc. announced that TI has taken a broad license for Rambus Inc.'s high-bandwidth memory-interface technology. TI will incorporate the technology into several next-generation products including digital signal processors (DSPs), communications ASICs, and dynamic random access memories (DRAMs).
- TI is the first to announce a Rambus license for DSP ICs and communications ASICs. Initial products implementing Rambus technology are scheduled to sample early in 1998. On the memory side, TI plans to use the Direct Rambus™ interface in the company's 64-megabit and higher density DRAM devices. The Direct Rambus interface is designed to support the higher bandwidth applications that will be required to keep up with the increased processor and logic performances of the future.

- In May 1997, TI pulled the plug on a \$1.4B deal to form a DRAM joint venture in Thailand. TI's partner was the Alphatec Group. Reasons cited for TI's withdrawal include weakening in the DRAM market and a poor Thai economy.
- In March 1997, TI announced the acquisition of Intersect Technologies, Inc. (ITI), a technology provider engaged in the design and development of software, firmware and hardware for the mass storage market. This acquisition is a demonstration of TI's commitment to extend its leadership in digital signal processing solutions for high-growth markets. ITI will operate as a wholly owned subsidiary of TI and will remain in Longmont, Colorado, reporting to TI's Storage Business Unit. Intersect Technologies, Inc. was established in February, 1995, and employs 13 professionals. The majority of ITI's experience has been dedicated to the creation of advanced storage architectures and applications.
- It was announced in early 1997, that Hitachi, Mitsubishi, and Texas Instruments will co-develop the cell architecture for a 1G DRAM as well as the process technology needed to manufacture it. Hitachi has a long-standing relationship with TI to jointly develop and produce DRAMs.
- TI formed an alliance with Anam Industrial Co. in South Korea calling for Anam to build an IC fabrication facility in Korea and TI to provide technical support during construction of the fab and supply the 0.35 μ m CMOS manufacturing technology. TI will receive, in return, a guaranteed portion of the wafer capacity for the production of DSPs. Operations at the fab are expected to begin in the first half of 1998.
- Samsung, Oki, Fujitsu, and Matsushita renewed their semiconductor patent cross-licensing agreement with TI that expired the end of 1995, by signing a 10-year deal that extends through 2005. TI has similar existing licensing agreements with LG Semicon, Micron, Hyundai, Mitsubishi, and Toshiba.
- TI is collaborating with IMEC of Leuven, Belgium, on the research of advanced lithography processes to achieve 0.18 μ m capabilities for manufacturing 1-gigabit-class semiconductors.
- Texas Instruments and Ericsson have a long-standing alliance in which TI has provided the Swedish company with its leading edge process technologies for wireless communications.

Noteworthy News

- In December 1997, TI announced that they had successfully demonstrated the combination of copper wiring with an insulating material called xerogel in an integrated circuit. This breakthrough approach to chip manufacturing will lead to future DSPs and microprocessors that are at least 10 times faster and use much less power than today's most powerful chips. Xerogel has the lowest dielectric constant of any dielectric material currently in development.
- In November 1997, TI announced the development of the industry's first 1394 Open Host Controller Interface (OHCI) device and a new family of 400-megabit per second (Mb/s) physical layer interface chips conforming to the IEEE 1394-1995 and 1394, a specification for high-speed PC I/O (input/output) subsystems. The OHCI specification is an industry standard whereby the operating system environment can communicate through a universal software driver instead of implementing an individualized driver for each particular piece of 1394 host silicon.

- In November 1997, expanding its technology leadership in the analog market, Texas Instruments announced the industry's first 2.5V supply voltage supervisor. This device, which operates from only 16 micro-amps of supply current, will enable more advanced DSP-based systems, such as cellular telephones, and a variety of other battery-powered systems. The device, which is designated the TLC7725, monitors and controls power supply lines during both power-up and power-down.
- In October 1997, TI announced the world's most powerful floating-point digital signal processor (DSP) CPU core with up to 10 times that of today's floating-point performance at 1 billion floating-point operations per second (GFLOPS). This performance will bring faster speed, precision and dynamic range to applications including wireless local loop base stations, beam-forming base stations, virtual reality 3-D graphics, voice mail, speech recognition, audio, radar, industrial control, atmospheric modeling, finite element analysis and imaging such as fingerprint recognition, ultrasound and MRI.
- In October 1997, TI announced a \$25 million investment to support applications for high performance digital signal processors (DSPs) at universities around the world. The creation of this DSP University Research Fund is the latest in a series of actions to widen the company's lead in digital signal processing solutions. It complements TI's establishment of a \$100 million venture capital fund and the opening of a major new research facility, both supporting future DSP applications development.
- In September 1997, TI announced a new CCD Digital Imaging Sensor – one of the First Full Resolution (1K x 1K) and High-speed Video (30 frames per second) CCDs. The TC281 is one of the few CCD digital imaging sensors available today that doesn't sacrifice resolution for speed, or vice versa. Machine vision or medical imaging systems that combine both high resolution and full-speed video will have competitive advantage in the marketplace.
- In TI's 1997 Year-end report, TI stated that they believe the 1998 worldwide semiconductor market will grow at about ten percent. In the non-memory areas of the market, TI expects to see faster growth than the total market, led by about 30 percent growth for DSPs and mixed-signal devices.

TOSHIBA

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Minato-Ku, Tokyo 105-01, Japan
Telephone: (81) (33) 457-4511
Fax: (81) (33) 456-1631
Web Site: www.toshiba.co.jp

IC Manufacturer

Regional Headquarters/Representative Locations

North America: Toshiba America Electronic Components, Inc. • Irvine, California
 Telephone: (714) 455-2000 • Fax: (714) 859-3963 • Web Site: www.toshiba.com/taec

Europe: Toshiba Electronics Europe GmbH • Düsseldorf, Germany
 Telephone: (49) (211) 5296-0 • Fax: (49) (211) 5296-400

Asia-Pacific: Toshiba Electronics Asia, Ltd. • Kowloon, Hong Kong
 Telephone: (852) 2375-6111 • Fax: (852) 2375-0969

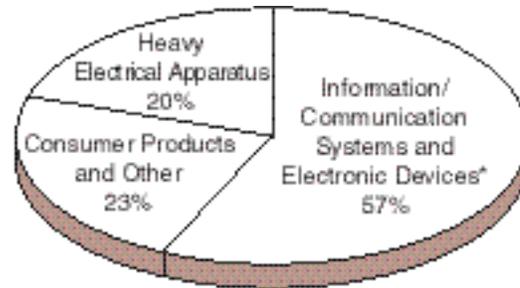
Financial History, Fiscal Year Ends March 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (¥B)						
Sales	¥4,722	¥4,628	¥4,631	¥4,791	¥5,120	¥5,453
Net Income	¥39	¥21	¥12	¥45	¥90	¥67
Semiconductor (\$M)*						
Sales	\$5,365	\$6,260	\$8,085	\$10,680	\$8,725	\$7,175
IC Sales	\$4,170	\$4,860	\$6,415	\$8,615	\$6,970	\$5,595
Discrete Sales	\$1,195	\$1,400	\$1,670	\$2,065	\$1,755	\$1,580
Capital Expenditures	\$680	\$725	\$930	\$1,545	\$1,560	\$1,370

*Calendar Year

Company Overview and Strategy

Toshiba Corporation is committed to the key fields of electronics and energy. Through these two fields, Toshiba brings its integrated capabilities to bear on a broad range of businesses, comprising of Information and Communications Systems, Information Media and Consumer Products, Power Systems and Industrial Equipment, and Electronic Components and Materials.



*Includes semiconductor devices.

1997 Corporate Sales by Business Segment

Toshiba entered the semiconductor business in the mid-1960's. In 1983, the company made semiconductors a mainstay of its activities, and in 1985, became the first company to mass produce 1M DRAMs. In 1995, Toshiba was the world's third largest merchant producer of semiconductors, offering a wide range of device types, including audio/video ICs, bipolar linear ICs, CMOS logic ICs, microprocessors and controllers, ASICs, DRAMs, SRAMs, ROMs, flash memories, discrete devices, CCDs, and optoelectronics.

Toshiba believes that the convergence of communications, audio visual and computers is making system LSIs increasingly critical to the operation of many products. For this reason, Toshiba is concentrating resources in several key areas: memory-embedded logic ICs; chipsets for mobile phones; LSIs for PCs and peripherals; and media processors capable of handling audio and video signals. It is Toshiba's basic strategy to align their activities so that they are not heavily reliant on memory devices.

Management

Toshiba Corporation

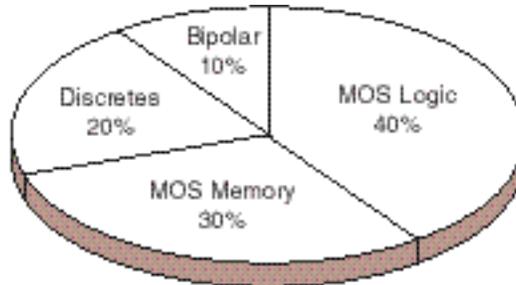
Taizo Nishimuro	President and Chief Executive Officer
Atsumi Uchiyama	Senior Executive Vice President and Director
Masanobu Ohyama	Senior Executive Vice President and Director, Semiconductor Group
Koichi Suzuki	Vice President and Group Executive, Semiconductor Group
Susumu Kohyama	Vice President and Deputy Group Executive, Semiconductor Group

Toshiba America Electronic Components, Inc.

Hideo Ito	Chairman and Chief Executive Officer
Bob Brown	President and Chief Operating Officer
Larry T. Jordan	Senior Vice President and General Manager, Systems IC Division
Stephen McMinn	Vice President, Semiconductor Sales
Ted Franceschi	Vice President, Business Operations

Products and Processes

Toshiba places a balanced focus on four key areas of the semiconductor market: MOS memories, MOS logic ICs (including microcomponents), bipolar ICs, and discrete devices.



1997 Semiconductor Sales by Device Type

- MOS MEMORY**
- DRAM
 - SRAM
 - Flash Memory
 - EPROM
 - ROM
 - EEPROM
 - Other (Including Non-Volatile RAM)

- ANALOG**
- Amplifier
 - Interface
 - Consumer/Automotive
 - Voltage Regulator/Reference
 - Data Conversion
 - Comparator
 - Other (Includes Telecom)

- MOS LOGIC**
- General Purpose Logic
 - Gate Array
 - Standard Cell
 - Field Programmable Logic
 - Other Special Purpose Logic

- DIGITAL BIPOLAR**
- Bipolar Memory
 - General Purpose Logic
 - Gate Array/Standard Cell
 - Field Programmable Logic
 - Other Special Purpose Logic
 - MPU/MCU/MPR

- MOS MICROCOMPONENT**
- MPU
 - MCU
 - MPR
 - DSP

- OTHER**
- Full Custom IC
 - Discrete
 - Optoelectronic

Memory ICs

Toshiba is a leader in the memory IC business. In DRAMs, Toshiba is focusing on high value-added models such as high speed and multi-bit versions. Approximately 60 percent of its DRAM line-up is multi-bit type models and the rest fast type versions, including synchronous and Rambus DRAMs.

Toshiba was one of the pioneers of flash memory in the early 1980's, but the company chose to focus most of its efforts on DRAMs. Now, the company is placing a great deal of effort on the flash memory business, offering both the original NAND-type and NOR-type flash devices. The company is also a major player in the solid-state file (SSF) business.

- DRAMs in 4M, 16M, and 64M densities.
- Synchronous DRAMs (SDRAMs) in 16M and 64M densities.
- Rambus DRAMs (RDRAMs) in 8M, 16M, and 18M densities.
- Video RAMs (VRAMs) in 2M density.
- Standard SRAMs in 256K, 1M, and 4M densities with access times as low as 55ns.
- High-speed SRAMs in 64K, 256K, 1M, and 4M densities with access times as low as 12ns.
- Synchronous pipeline burst SRAMs in 1M density with speeds as fast as 7.5ns (133MHz).
- Pseudo-static RAMs (PSRAMs) in 1M and 4M densities.
- Flash memories in 1M, 4M, 16M, 32M, and 64M densities.
- EPROMs in 256K, 1M, 4M, and 16M densities.
- Mask ROMs in 1M, 2M, 4M, 8M, 16M, and 32M densities.

Logic ICs

In ASICs, Toshiba offers a full range of advanced gate arrays, embedded arrays, and standard cell devices. Its highest performance gate arrays (TC220 Family) utilize triple-layer metal 0.3 μ m CMOS technology to provide up to two million usable gates.

In 1996, Toshiba unveiled its second generation of embedded DRAM ASIC (dDRAMASIC™) products. The 0.25 μ m TC230D (3.3V) and TC240D (2.5V) families utilize the same one-transistor DRAM cell used in the company's fourth-generation 64M DRAM products. Toshiba claims that the technology of the 230D and 240D families allows for the integration of up to 128M of memory. In addition to high-density DRAM, the company's ASIC core library includes CISC and RISC microprocessor cores, high density SRAM, MPEG decoder circuits, communications devices, and advanced I/O interfaces.

Toshiba is one of the world's largest suppliers of general purpose logic products for computing, telecom, and industrial applications. These devices include CMOS and BiCMOS technologies applied to families of 3V and 5V products. Technologies for advanced low-voltage logic products are developed jointly with Motorola and Fairchild Semiconductor.

Microcomponent ICs

For quite some time, Toshiba has been licensed to develop, manufacture, and sell MIPS' RISC microprocessors. The company's line of 32-bit and 64-bit MIPS RISC-based processors include the 50MHz R3900, the 200MHz R4400, and the 133MHz R4600.

Toshiba also offers its TLCS series of 4-bit, 8-bit, and 16-bit CMOS microcontrollers, Zilog-licensed Z80 microprocessors and controllers, CMOS peripheral circuits, and neuron chips.

Multimedia and Networking ICs

Through a close alliance with Chromatic Research, Toshiba offers the Mpack™ media processor. The Mpack™ engine provides up to 3,600 MOPS (millions of operations per second) peak performance. Some of the functions the Mpack™ processor can handle are 2D and 3D graphics, MPEG video, audio, fax/modem, and telephony. Toshiba's other multimedia ICs include MPEG-2 video and audio decoders for set-top boxes and DVD systems.

For ATM networking applications, Toshiba offers physical layer controllers and SAR products.

Bipolar ICs

Toshiba has developed several original process technologies for its linear and digital bipolar ICs, which are primarily used in audio-video and other consumer products. These devices include audio power ICs, linear CCD image sensors, and telephone circuits.

Discrete Devices

Toshiba is a world leader in discrete devices and optoelectronics. These products embrace high power, optoelectronic, small-signal, microwave, and RF devices.

Semiconductor Fabrication Facilities

Toshiba announced in late 1995, that it will invest \$1.3 billion to construct a 0.25µm logic IC fab at its Iwate site in Northern Japan. Production of ASICs and ASSPs (and possibly 64M DRAMs) at the fab is expected to begin in the spring of 1998. Capacity will be about 7,500 200mm wafers per week.

Building 4 at Toshiba's site in Oita is being completely converted from DRAM to system-on-a-chip production with 0.25µm geometries. Starting in October 1997, the lines will process chips integrating 32-bit MPUs with 64M of DRAM and a 3D image processing engine. In addition, Toshiba plans to start construction of a new Oita fab in 1998. The \$1.4 billion facility will process 256M DRAMs and system-on-a-chip ICs using a 0.25µm process.

Iwate Toshiba Electronics Co., Ltd.
 Kitakami-shi, Iwate Prefecture, Japan
 Capacity (wafers/week): 22,000
 Wafer sizes: 125mm, 150mm
 Processes: CMOS, BiCMOS
 Products: ASICs, logic ICs, EPROMs, ROMs,
 flash memories, MPUs, MCUs,
 CCDs, custom ICs.
 Feature sizes: 0.35µm-1.5µm

Toshiba Corporation, Kitakyushu Works
 Kitakyushu-shi, Fukuoka Prefecture, Japan
 Capacity (wafers/week): 23,000
 Wafer sizes: 3 in., 125mm, 150mm
 Processes: Bipolar, BiCMOS, GaAs
 Products: Analog and logic ICs, ASICs, discretes
 Feature sizes: 1.0µm-3.0µm

Toshiba Corporation, Oita Works
Oita-shi, Oita Prefecture, Japan
Capacity (wafers/week): 56,000
Wafer sizes: 100mm, 125mm, 150mm
Processes: CMOS, MOS
Products: DRAMs, SRAMs, EPROMs, ROMs,
flash memories, MPUs, MCUs,
ASICs, logic ICs.
Feature sizes: 0.35 μ m-2.0 μ m

Toshiba Corporation, Tamagawa Works
Kawasaki-shi, Kanagawa Prefecture, Japan
Capacity (wafers/week): 6,325
Wafer sizes: 125mm, 150mm, 200mm
Processes: CMOS, bipolar
Products: R&D and pilot production
Feature sizes: 0.35 μ m-2.0 μ m

Toshiba Corporation, Ishikawa Works
Nomi-gun, Ishikawa Prefecture, Japan
Capacity (wafers/week): 10,000
Wafer size: 125mm
Process: Bipolar
Products: Discretes

Toshiba Corporation
Advanced Microelectronics Center
Yokohama-shi, Kanagawa Prefecture, Japan
Capacity (wafers/week): 450
Wafer size: 200mm (300mm by 1999)
Process: CMOS
Products: R&D
Feature size: 0.25 μ m

Toshiba Corporation, Yokkaichi Works
Yokkaichi-shi, Mie Prefecture, Japan
Capacity (wafers/week): 12,500
Wafer size: 200mm
Process: CMOS
Products: DRAMs
Feature sizes: 0.35 μ m-0.7 μ m

Toshiba Corporation, Himeji Semiconductor Works
Himeji-shi, Hyogo Prefecture, Japan
Capacity (wafers/week): 18,500
Wafer sizes: 100mm, 125mm
Processes: CMOS, bipolar
Products: Discretes
Feature sizes: 0.8 μ m, 1.0 μ m

Toshiba Components
Kimitsu-shi, Chiba Prefecture, Japan
Capacity (wafers/week): 10,000
Wafer sizes: 100mm, 125mm
Process: Bipolar
Products: Discretes

Tohoku Semiconductor Corporation
Izumi-ku, Sendai-shi,
Miyagi Prefecture, Japan
Capacity (wafers/week): 13,750
Wafer sizes: 150mm, 200mm
Processes: CMOS, BiCMOS
Products: DRAMs, SRAMs, MPUs, MCUs, MPRs
Feature sizes: 0.5 μ m-0.8 μ m
(Joint venture with Motorola).

Dominion Semiconductor LLC
9600 Godwin Drive
Manassas, Virginia 22110
Telephone: (703) 367-3280
Fax: (703) 367-3271
Cleanroom size: 90,000 square feet
Capacity (wafers/week): 7,500
Wafer size: 200mm
Process: CMOS
Products: DRAMs
Feature size: 0.35 μ m
(Joint venture with IBM. Scheduled to begin production in early 1998, see Key Agreements).

Key Agreements

- In June 1997, Toshiba and Chartered Semiconductor Manufacturing entered into a five-year partnership that calls for technology and manufacturing cooperation on embedded DRAMs. Under the terms of the agreement, Toshiba will license its embedded DRAM technology to Chartered, beginning first with 0.35 micron and migrating to 0.25 micron technology. A trench-capacitor technology will be used as opposed to the stacked structure for embedded applications. After process qualification, Chartered will manufacture embedded DRAM products for Toshiba and other customers. The agreement allows Chartered to enter the fast growing embedded DRAM market and enables Toshiba to secure a reliable second source for embedded DRAM based on Toshiba's technology. Production is expected in 1998.
- In April 1997, Toshiba announced that it has extended its technology license with MIPS Group, a division of Silicon Graphics, Inc. by acquiring a license for the MIPS16 instruction set architecture, MIPS16 applications specific extension (ASE). This will allow Toshiba to become the first MIPS chip supplier to provide a full line-up of RISC cores which execute the complete set of MIPS instruction set architectures.
- In February 1997, Toshiba announced the purchase of a 20 percent stake in the Samsung Electronics Co. U.S. subsidiary, Samsung Austin Semiconductor Inc. The joint venture will manage a chip plant that Samsung Electronics Co. is building in Austin, TX. In exchange for their investment, Toshiba will receive 20 percent of the 64Mb DRAM chips produced at the Austin facility.
- Motorola, Toshiba, and Fairchild Semiconductor announced in early 1997, they would jointly develop next-generation high-speed CMOS logic ICs. The three companies will work to develop 2.5V and 3.3V devices with a propagation delay time of 2ns.
- Winbond and Toshiba entered into an alliance in late 1995, for the manufacture and cooperative development of leading-edge semiconductor memory products. The agreement called for Toshiba to provide Winbond with production technologies for 16M DRAMs and next generation 1M high-speed SRAMs. In addition, Toshiba is using Winbond as a foundry for a portion of its 16M and 64M DRAM capacity. Winbond will market the DRAMs under its own logo, beginning in 1997 or 1998. In 4Q96, Toshiba and Winbond extended their partnership to the 64M level.

- Toshiba established a pact with Samsung concerning Toshiba's NAND-flash architecture. Under the agreement, Toshiba transferred the technology to Samsung, which is designing and making devices compatible with those of Toshiba. In April 1995, the two companies expanded the alliance to the 64M level.
- Toshiba is jointly developing with IBM and Siemens, 0.25 μ m technology for shrink-version 64M DRAMs and 256M DRAMs. Additionally, in 3Q96, Toshiba, IBM, and Siemens agreed to jointly develop system-on-a-chip devices.

Noteworthy News

- In January 1998, Toshiba, a long time partner of Siemens AG on DRAM development, was noted to have voiced concerns over the near term benefits of developing 300mm process technology for the 1Gbit generation devices and hence separating itself from the benefits of the 300mm pilot line that Siemens will build with Motorola in Dresden, Germany. IBM, which has worked with Siemens and Toshiba on 64Mb and 256M DRAMs, will have access to the results. There is reportedly some doubt over whether Toshiba's next generation devices will be built on 300mm wafers versus 200mm wafers.
- In September 1997, Toshiba and IBM officially opened a new joint venture DRAM fab with IBM Corporation named Dominion Semiconductor, L.L.C., based in Manassas, Virginia. Originally conceived in 1995, the facility will initially produce 64Mb DRAMs using 0.35 micron technology. From the second half of fiscal 1998 onward it will migrate processes to 0.25 micron technology. Each joint venture partner owns 50 percent of the capital stock. The number of employees, currently 470, is expected to reach 1,200 by 1999.
- In April 1997, Toshiba announced plans to release a 128M embedded DRAM ASIC beginning 1998.
- In February 1997, Toshiba introduced the first samples of a 64M synchronous DRAM. Reported to be the first of its kind, this DRAM has a data transfer rate high enough to meet the demands of 100MHz main memory buses.