

ASAHI KASEI MICROSYSTEMS (AKM)

Asahi Kasei Microsystems Co., Ltd.
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 Japan
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 Fax: (81) (3) 3320-2074

U.S. Representative:
 AKM Semiconductor, Inc.
 2001 Gateway Place, Suite 650 West
 San Jose, California 95110
 Telephone: (408) 436-8580
 Fax: (408) 436-7591

IC Manufacturer

Financial History (\$M)

	<u>1993</u>	<u>1994</u>	<u>1995</u>
Sales	145	215	300
Employees			800

Company Overview and Strategy

Asahi Kasei Microsystems Co., Ltd. (AKM) was founded in 1983 as a joint venture between Asahi Chemical Industry Co., Ltd. and American Microsystems Inc. The venture became a wholly owned subsidiary of Asahi Chemical in 1986, though AKM and AMI still maintain a business relationship.

AKM designs and manufactures CMOS mixed-signal integrated circuits combining analog and digital functions on a single chip or chipset. Its devices are targeted at telecommunications, data acquisition, mass storage, audio, and multimedia applications. Approximately half of its IC sales are custom designed products.

Management

Asahi Kasei Microsystems Co., Ltd.

Hirotsugu Miyauchi	President
Kyoji Kurata	Director and GM, Technical Marketing and Application Engineering

AKM Semiconductor, Inc. (U.S.)

Yoshihisa Iwasaki	President
Edward Boule	Vice President, Sales
Koho Goto	Vice President, Marketing

Products and Processes

AKM specializes in custom and semicustom mixed-signal ASICs and ASSPs. When Asahi Kasei Microsystems was formed, AMI provided the mixed-signal design skills needed. In 1991, Hitachi transferred 0.8 μ m CMOS process technology to AKM.

AKM's product line includes:

Communication Products

- Analog cordless telephone ICs
- Digital cordless telephone ICs
- Two-way radio products
- Analog cellular telephone ICs
- Digital cellular telephone ICs
- Line telecommunication products
- Image processing ICs

Digital-to-Analog Converters

- Digital Audio DACs
- DACs with embedded EEPROM

CMOS Memories

- EEPROMs with densities ranging from 1K to 8K
- SRAMs with densities ranging from 256K to 4M
- Mask ROMs with densities ranging from 1M to 16M

Full-Custom IC Products

Semiconductor Fabrication Facilities

AKM opened its first wafer fab facility in 1987 in Atsugi, Japan. It was followed by an LSI research and development center in 1991. The company's Nobeoka submicron fab facility commenced operation in 1993.

Nobeoka LSI Plant

Nobeoka-shi, Miyazaki Prefecture, Japan
 Capacity (wafers/week): 7,700
 Wafer size: 150mm
 Process: CMOS
 Products: ASICs, ASSPs, and custom ICs
 Feature sizes: $\geq 0.8\mu$ m

Atsugi LSI Plant

Atsugi-shi, Kanagawa Prefecture, Japan
 Wafer size: 100mm
 Process: CMOS
 Products: EEPROMs, ASICs, ROMs, SRAMs
 Feature sizes: $\geq 0.8\mu$ m

Key Agreements

- In January 1996, AKM signed a six-year fab agreement with Peregrine Semiconductor Corporation (San Diego, California). AKM will provide wafer fabrication to Peregrine in exchange for process technologies. The two companies are also negotiating a joint development agreement for future products, combining their capabilities in design, manufacturing, and process technology.
- AKM is producing Hitachi's 1M SRAMs at its fab in Nobeoka on an OEM basis.
- AKM is licensed to use Advanced RISC Machines' ARM processor technology. AKM will embed the compact ARM7D 32-bit RISC processor design into its products.

FUJI ELECTRIC

Fuji Electric Co., Ltd.
12-1 Yurakucho 1-chome, Chiyoda-ku
Tokyo 100, Japan
Telephone: (81) (3) 3211-7111
Fax: (81) (3) 3215-8321

U.S. Representative:
Collmer Semiconductor, Inc.
14368 Proton Road
Dallas, Texas 75244
Telephone: (214) 233-1589
Fax: (214) 233-0481

IC Manufacturer

Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥592	¥639	¥633	¥582	¥561
Net Income	¥18	¥13	¥6	¥3	¥3
Semiconductor (\$M)*					
Sales	\$500	\$525	\$550	\$575	\$625
Discrete Sales	\$350	\$370	\$390	\$410	\$450
IC Sales	\$150	\$155	\$160	\$165	\$175

*Calendar Year

Company Overview and Strategy

Fuji Electric Co., Ltd., founded in 1923, develops, manufactures, and markets a wide range of power and electronics equipment and components. Although Fuji Electric does produce IC products, it is primarily known as a manufacturer of discrete power semiconductors. It is one of the world's largest producers of power transistor modules and other power discretes.

Fuji Electric's ASIC products are dedicated to certain Japanese manufacturers of products like cameras, VCRs, cellular telephones, and printers. The company is expanding its line-up of switching power supply controller ICs, which are used in a wide array of products such as personal computers, printers, and cellular telephones. Recent developments include products that employ advanced power semiconductor technology and IC technology, such as IGBT modules and intelligent power modules (IPMs) used in inverter and power supply units.

Management

Yoshihiko Nakazato President

Products and Processes

Fuji Electric manufactures power transistors, MOSFETs, IGBTs, high-voltage silicon diodes, high-speed silicon diodes, thyristors, ASICs, and custom ICs. Some of its custom IC products include auto-focusing chips for cameras and high-voltage driver ICs for flat-panel displays and thermal printheads.

Semiconductor Fabrication Facilities

Fuji Electric Co., Ltd.

Matsumoto Factory

Matsumoto-shi, Nagano Prefecture, Japan

Capacity (wafers/week): 5,000

Wafer sizes: 100mm, 150mm

Processes: CMOS, BiCMOS, bipolar

Products: ASICs, custom ICs, discretets

Feature sizes: 1.0 μ m-2.0 μ m

FUJITSU

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Electronic Devices Group
 1015, Kamikodanaka Nakahara-ku
 Kawasaki 211, Japan
 Telephone: (81) (44) 754-3753
 Fax: (81) (44) 754-3332
 Web Site: www.fujitsu.co.jp

U.S. Representative:
Fujitsu Microelectronics, Inc.
Semiconductor Division
 3545 North First Street
 San Jose, California 95134-1804
 Telephone: (408) 922-9000
 Fax: (408) 432-9044
 Web Site: www.fujitsu.com

IC Manufacturer

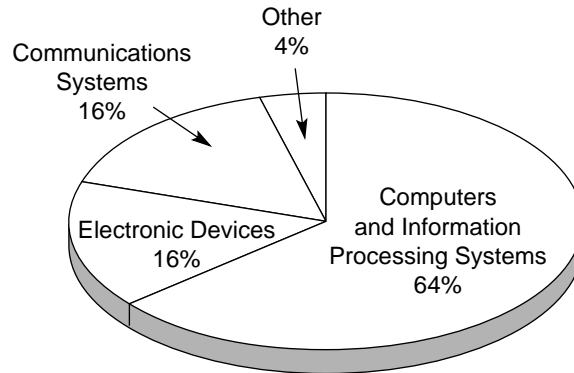
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥2,971	¥3,442	¥3,462	¥3,139	¥3,258
Net Income	¥83	¥12	¥(33)	¥(38)	¥45
Semiconductor (\$M)*					
Sales	\$2,600	\$2,550	\$2,930	\$3,335	\$4,440
IC Sales	\$2,430	\$2,320	\$2,630	\$2,975	\$4,010
Discrete Sales	\$170	\$230	\$300	\$360	\$430
Capital Expenditures	\$790	\$445	\$590	\$905	\$1,505

*Calendar Year

Company Overview and Strategy

Fujitsu Limited was founded in 1935 as a telecommunications equipment manufacturer. Today, it is not only one of Japan's leading telecommunications companies, but also one of the world's largest manufacturers of computers, semiconductors, and electronic components. The company's Electronic Devices Group is responsible for the manufacture and marketing of integrated circuits, discretets, hybrids, electromechanical devices, and plasma and liquid crystal displays.



1995 Corporate Sales by Business Group

Fujitsu's first semiconductor group was formed in the 1950's. In 1966, the company began volume production of integrated circuits. Today Fujitsu develops, manufactures, and markets a wide selection of semiconductors and other electronic components. Its semiconductor activities span a variety of advanced product and process technologies including high-performance ASICs, ASSPs, memory devices, microprocessors and microcontrollers, telecommunications and networking ICs, graphics chips, advanced Ethernet LAN devices, multichip module products, and flat-panel displays. Fujitsu Compound Semiconductor, Inc. (FCSI) develops and manufactures GaAs-based microwave and fiber-optic products.

Management

Fujitsu Limited

Tadashi Sekizawa	President
Mikio Ohtsuki	Executive Vice President
Kimio Yanagida	President, Fujitsu AMD Semiconductor Ltd.

Fujitsu Microelectronics, Inc. (U.S.)

Ken Katashiba	President and Chief Operating Officer
Hikotaro Masunaga	General Manager, Semiconductor Division
John Herzing	Vice President, Sales
Tom Miller	Vice President, Marketing

Products and Processes

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

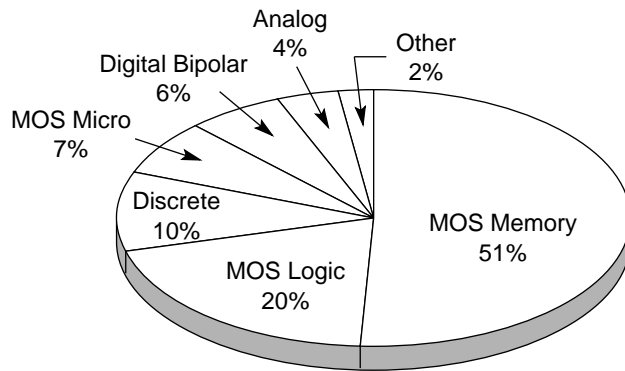
- ANALOG**
- Amplifier
 - Interface
 - Consumer/Automotive
 - Voltage Regulator/Reference
 - Data Conversion
 - Comparator
 - Other (Includes Telecom)

- 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



1995 Semiconductor Sales by Device Type (est)

ASICs

Fujitsu is among the world's leading producers of application-specific ICs (ASICs). The company's ASIC product line ranges from commodity gate arrays to sophisticated embedded arrays. In the gate array market, it was the world's leading supplier in 1995. Its gate array family consists of about 100 device types, including channelless "sea-of-gate" arrays and embedded gate arrays, with complexities ranging from 2,000 to 750,000 useable gates.

Fujitsu's ASICs family also includes standard cell products with up to 60,000 gates and functions not available in gate arrays, as well as very high speed ECL devices capable of operating at 100MHz to 3GHz. All of Fujitsu's ASIC devices are manufactured using 0.65 μ m or 0.5 μ m CMOS, ECL, BiCMOS, or GaAs process technologies. In addition, it has shipped samples of its 0.35 μ m ASIC family.

Microcomponents

Fujitsu's microcomponent family of products include general purpose 4-bit and 8-bit microcontrollers, 16-bit microprocessors, 32-bit microprocessors (Sparc MPUs), 32-bit RISC embedded controllers (Sparclite MPUs), and specialized ICs for peripheral control.

Memories

Fujitsu's memory ICs include dynamic RAMs (1M, 4M, and 16M), synchronous DRAMs (4M, 8M, and 16M), CMOS and BiCMOS static RAMs (up to 4M), ECL RAMs, flash devices (1M, 4M, and 16M), EPROMs (up to 4M), EEPROMs (up to 256K), mask ROMs (up to 16M), bipolar PROMs, and more. Application-specific memories, with an emphasis on graphic and cache applications, include video RAMs, tag memories, and STRAMs (self-timed RAMs).

Starting at the 64M density, the company plans to sell SDRAMs exclusively. Initial production samples of its 64M SDRAM are planned for 2H96. The 64M SDRAM is expected to be a mainstream product by 1998. Currently, Fujitsu is shipping volumes of its 4M, 8M, and 16M SDRAMs. Fujitsu's goal in the DRAM market is to double its share of the worldwide DRAM supply by 1999; placing it among the top five DRAM producers.

Fujitsu discontinued development of 8M and larger EPROMs, and will phase out its remaining EPROM business. Instead, the company will focus its efforts on developing flash memories with its partner AMD. In cooperation with AMD, it has developed single-voltage (5V and 3V) NOR flash devices for its customers. However, the company is not ignoring the non-NOR type of flash memory. It is working separate from, and together with, AMD on flash products based on other architectures.

ASSPs/Analog ICs

Fujitsu's application-specific standard products (ASSPs) include ICs for a variety of applications including telecommunications, local-area networks (LANs), magnetic disks, audio, power supply control, and image/graphics processing. Fujitsu also supplies general purpose analog ICs such as op-amps, comparators, converters, and analog switches.

Standard Logic

Fujitsu's standard ICs include TTL, LSTTL, ALSTTL, FAST, ECL, and CMOS families. These ICs range from simple gates to complex arithmetic logic circuits.

Discrete Devices

Fujitsu's vast discrete product line includes power and low-noise GaAs FETs ranging from 2GHz to 23GHz, as well as a wide selection of optical semiconductor devices such as laser diodes, LEDs, and photodiodes for fiber optic communications. This product line also includes high-speed switching power transistors (RETs) and darlington transistor arrays.

Semiconductor Fabrication Facilities

Fujitsu's plans to continue its spending for new or upgraded semiconductor fabrication facilities in 1996. It expects to invest \$2 billion in fiscal 1996 and \$2.5 billion in fiscal 1997 and 1998 on new equipment.

The one exception to its full-throttle spending plans was Fujitsu's decision to delay a 16M DRAM line at its Durham, UK facility. Construction of the UK building is not expected to begin until December 1996. Capacity will be 2,500 200mm wafers per week. By 1998, it is expected to be ready for volume production using a 0.28 μ m process to make shrink-versions of its 16M DRAMs and 64M DRAMs.

On the flash memory front, Fujitsu AMD Semiconductor Ltd. (FASL) broke ground on their second flash memory production facility in Aizu-Wakamatsu. The new facility will cost approximately \$1.2 billion (split 50-50 between the two firms) and will eventually produce at least 6,000 200mm wafers per week when fully ramped. Initial shipments should begin before the end of 1997.

An IC development fab is being built in Akigawa City, Japan. The company plans to use it to develop prototypes of 256M and larger memory and ASIC products. Scheduled to be in operation by 1996, the new facility will have 200mm wafer processing capabilities.

Fujitsu Limited, Iwate Plant
Kanegasaki-shi, Iwate Prefecture, Japan
Capacity (wafers/week): 25,000
Wafer sizes: 125mm, 150mm, 200mm
Processes: CMOS, MOS, bipolar
Products: DRAMs, SRAMs, ROMs, ASICs, MCUs
Feature sizes: 0.35 μ m-1.5 μ m

Fujitsu Limited, Mie Plant
Tado-shi, Mie Prefecture, Japan
Capacity (wafers/week): 5,000
Wafer size: 150mm
Processes: CMOS, MOS, bipolar
Products: DRAMs, SRAMs, MPUs, MCUs, ASICs
Feature sizes: 0.5 μ m-1.0 μ m

Fujitsu VLSI Ltd., Gifu Plant
Minokamo-shi, Gifu Prefecture, Japan
Capacity (wafers/week): 1,250
Wafer size: 150mm
Process: CMOS
Products: Prototype ICs

Kyushu Fujitsu Electronics, Ltd., Miyazaki Plant
Miyazaki Prefecture, Japan
Capacity (wafers/week): 1,250
Wafer size: 200mm
Products: DRAMs
Feature size: 0.5 μ m

Fujitsu Quantum Devices Ltd.
Nakakoma-gun, Yamanashi Prefecture, Japan
Capacity (wafers/week): 1,250
Wafer sizes: 3in, 100mm
Process: GaAs
Products: Analog and logic ICs, discrettes,
optoelectronics
Feature sizes: 0.5 μ m-0.8 μ m

Fujitsu Limited, Aizuwakamatsu Plant
Aizuwakamatsu-shi, Fukushima Prefecture, Japan
Capacity wafers/week: 38,000
Wafer sizes: 125mm, 150mm
Processes: CMOS, MOS, bipolar
Products: DRAMs, SRAMs, MPUs, MCUs, ROMs,
ASICs, logic and analog ICs, discrettes
Feature sizes: 0.35 μ m-2.0 μ m

Fujitsu Limited, Kanagawa Plant
Atsugi-shi, Kanagawa Prefecture, Japan
Capacity (wafers/week): 500
Wafer size: 100mm
Process: GaAs
Products: Discretes, R&D
Feature size: 0.5 μ m

Fujitsu Microelectronics, Ltd., Durham Plant
Newton Aycliffe
Durham, England
Capacity (wafers/week): 2,000
Wafer size: 150mm
Process: CMOS
Products: DRAMs, ASICs
Feature sizes: 0.5 μ m-0.8 μ m (0.35 μ m by 1Q96)

Fujitsu Microelectronics, Inc.
Gresham Manufacturing Division
21015 Southeast Stark
Gresham, Oregon 97030
Telephone: (503) 669-6000
Fax: (503) 669-6109
Capacity (wafers/week): 7,500
Wafer size: 150mm
Process: CMOS
Products: DRAMs, ASICs
Feature size: 0.8 μ m

Fujitsu-AMD Semiconductor Ltd. (FASL)
Aizuwakamatsu-shi, Fukushima Prefecture, Japan
Cleanroom size: 37,660 square feet
Capacity (wafers/week): 2,500
Wafer size: 200mm
Process: CMOS
Products: Flash memories
Feature size: 0.5 μ m
(Will invest \$350 million for a 1996-1997 second-phase expansion, which will add a 0.35 μ m line and nearly 33,000 square feet of cleanroom space. Total capacity will then be 5,000 wafers per week.)

Key Agreements

- Fujitsu has a partnership with Hyundai for the joint manufacture of 4M and 16M DRAMs. In 2Q95, the partners agreed to cooperate in the development of 64M DRAMs.
- Fujitsu and AMD opened a large flash memory fabrication facility, called Fujitsu-AMD Semiconductor Ltd. (FASL), in Japan in September 1994. Production of flash memory chips began in 1Q95. FASL is currently building its second fab, also to be dedicated to flash memory production.

HITACHI

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Semiconductor and IC Division
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Telephone: (415) 589-8300
Fax: (415) 583-4207
Web Site: www.hitachi.com

IC Manufacturer

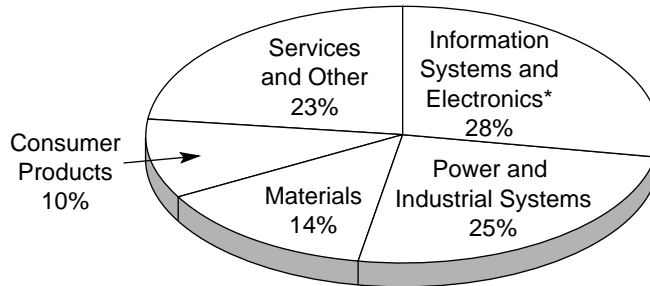
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥7,737	¥7,766	¥7,536	¥7,400	¥7,592
Net Income	¥230	¥128	¥77	¥65	¥114
Semiconductor (\$M)*					
Sales	\$4,080	\$4,150	\$5,100	\$6,960	\$9,825
IC Sales	\$3,490	\$3,600	\$4,430	\$5,940	\$8,630
Discrete Sales	\$590	\$550	\$670	\$1,020	\$1,195
Capital Expenditures	\$630	\$515	\$785	\$1,115	\$1,755
Employees					15,000

*Calendar Year

Company Overview and Strategy

Hitachi, Ltd. is one of the largest companies in the world with about \$85 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.



*Includes semiconductors

1995 Corporate Sales by Business Segment

Hitachi's semiconductor business emerged in the late 1950's when it started producing transistors. Production of integrated circuits followed in 1966. 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

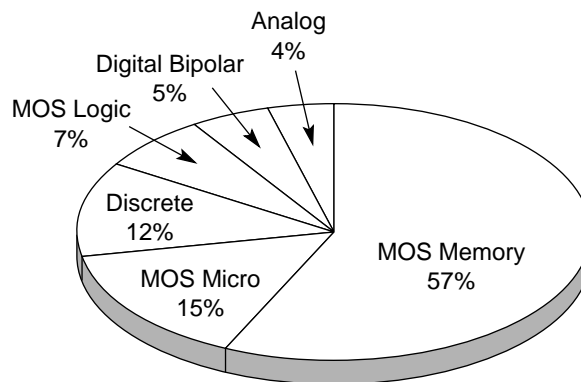
Hitachi, Ltd.

- | | |
|----------------|---|
| Tsutomu Kanai | President |
| Shinji Ohnishi | Deputy General Manager, Semiconductor and IC Division |
| Takeshi Sasaki | General Manager, Semiconductor and IC Division |

Hitachi America, Ltd.

- | | |
|------------------|--|
| H. Fukuda | President, Hitachi Semiconductor (America) Inc. |
| William L. Gsand | General Manager |
| Jim Hartman | Vice President, Operations, Hitachi Semiconductor (America) Inc. |

Products and Processes



1995 Semiconductor Sales by Device Type

MOS MEMORY		ANALOG	
<input checked="" type="checkbox"/>	DRAM	<input checked="" type="checkbox"/>	Amplifier
<input checked="" 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 checked="" type="checkbox"/>	ROM	<input checked="" type="checkbox"/>	Data Conversion
<input checked="" type="checkbox"/>	EEPROM	<input checked="" type="checkbox"/>	Comparator
<input 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 type="checkbox"/>	Gate Array/Standard Cell
<input checked="" type="checkbox"/>	Field Programmable Logic	<input type="checkbox"/>	Field Programmable Logic
<input checked="" type="checkbox"/>	Other Special Purpose Logic	<input type="checkbox"/>	Other Special Purpose Logic
<input type="checkbox"/>		<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 checked="" type="checkbox"/>	Optoelectronic
<input checked="" type="checkbox"/>	DSP		

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 0.16 μ m process and is not expected to enter production until around the year 2000.

- DRAMs—available in 1M, 4M, 16M, and 64M densities (5V and 3V versions).
- Synchronous DRAMs (SDRAMs)—available in 2M, 4M, and 16M densities (3V).
- Synchronous graphics RAMs (SGRAMs)—available in 8M density.
- Video RAMs (VRAMs)—available in 256K, 1M, 2M, and 4M densities.
- BiCMOS fast SRAMs—available in 64K to 4M densities with access times as low as 6ns (5V and 3V versions).
- CMOS fast SRAMs—available in 1M and 4M densities with access times as low as 8ns (5V and 3V versions).
- CMOS standard SRAMs—available in 64K to 4M densities with access times as low as 55ns (5V and 3V versions).
- Bipolar ECL SRAMs—available in 1K to 256K densities.

- Synchronous burst cache SRAMs—available in 1M to 4M densities with speeds as high as 167MHz (3V).
- Pseudo SRAMs (PSRAMs)—available in 256K to 4M densities (5V and 3V versions).
- Flash memories—available in 1M to 32M densities.
- EPROM/PROMs—available in 256K to 4M densities (5V and 3V versions).
- Mask ROMs—available in 256K to 16M densities (5V and 3V versions).
- EEPROMs—available in 64K to 1M densities (5V and 3V versions).
- Frame memories.

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 SH RISC engine series in 1992, the devices are claimed to have been designed into more than 500 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 100MIPS at 3.3V, with operation down to 1.8V.

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-1995, Hitachi unveiled a series of standard cell ICs, called MicroCore CBICs (HG72C series), that can incorporate a wide variety of cells, including the company's SH 32-bit RISC controller cores and high-speed, high-precision A/D and D/A converters.

In mid-1995, Hitachi announced in conjunction with VLSI Technology successful development of a 0.35 μ m five-layer-metal CMOS process for ASICs. The process is claimed to allow the integration of up to five million usable gates. The high-density ASICs are targeted at applications in workstations and communications.

Hitachi began marketing FPGAs based on Crosspoint Solutions Inc.'s one-time programmable architecture in October 1995. The company currently manufactures the FPGAs with 4K and 8K gates

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 early 1996, Hitachi announced it will spend about \$1.2 billion on a new DRAM production facility in Ibaraki. The plant, which is scheduled to open in the first half of 1998, will manufacture 64M DRAMs. In addition, Hitachi is said to be negotiating with LG Semicon to build a joint-venture DRAM fab in Malaysia.

In the U.S., Hitachi plans to build a \$400 million 32,000 square-foot cleanroom at its fab in Texas for the manufacture of its 32-bit RISC MPUs. The fab will initially use a 0.5 μ m process on 150mm wafers, but will have the capability of being converted to a 0.35 μ m process on 200mm wafers. Operations are expected to start in April 1997.

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

Hitachi, Ltd., Takasaki Works
 Takasaki-shi, Gunma Prefecture, Japan
 Cleanroom size: 80,000 square feet
 Capacity (wafers/week): 10,000
 Wafer sizes: 125mm, 150mm
 Processes: CMOS, MOS, bipolar, BiCMOS
 Products: Telecom and linear ICs, EPROMs, SRAMs, MCUs, power MOSFETs, lasers
 Feature sizes: 0.8 μ m-2.0 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, Ltd., Komoro Works
 Komoro-shi, Nagano Prefecture, Japan
 Capacity (wafers/week): 3,750
 Wafer size: 3in
 Processes: CMOS, GaAs
 Products: Telecom ICs
 Feature sizes: 0.5 μ m-1.5 μ m

Hitachi, Ltd.
 Katsuta-shi, Ibaraki Prefecture, Japan
 Cleanroom size: 20,000 square feet
 Capacity (wafers/week): 8,750
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, SRAMs
 Feature sizes: 0.5 μ m-0.8 μ m

Hitachi, Ltd., Musashi Works
 Kodaira-shi, Tokyo Prefecture, Japan
 Cleanroom size: 82,350 square feet
 Capacity (wafers/week): 25,750
 Wafer sizes: 100mm, 125mm, 150mm
 Processes: MOS, CMOS, bipolar
 Products: MPUs, MCUs, SRAMs, DRAMs, ASICs, logic and linear ICs
 Feature sizes: 0.5 μ m-2.0 μ m

Hitachi, Ltd., Kofu Works
 Nakakoma-gun, Yamanashi Prefecture, Japan
 Capacity (wafers/week): 38,750
 Wafer sizes: 100mm, 125mm, 150mm
 Processes: MOS, CMOS
 Products: SRAMs, DRAMs, EPROMs,
 MPUs, MCUs, logic ICs
 Feature sizes: 0.5 μ m-3.0 μ m

Hitachi, Ltd.
 Tateyama-shi, Chiba Prefecture, Japan
 Capacity (wafers/week): 5,000
 Wafer size: 125mm
 Process: CMOS
 Products: MCUs, logic ICs
 Feature sizes: 1.0 μ m, 1.2 μ m
 (Purchased from Nippon Steel in 1995)

Hitachi Semiconductor (Europe) GmbH
 Jenaer Strasse 1
 Landshut, Germany
 Telephone: (49) 871-8640
 Cleanroom size: 48,000 square feet
 Capacity (wafers/week): 4,000
 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 75063-2712
 Telephone: (214) 580-1514
 Cleanroom size: 41,800 square feet (expanding)
 Capacity (wafers/week): 8,000
 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

TwinStar Semiconductor Incorporated
 Richardson, Texas
 Cleanroom size: 48,000 square feet
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature size: 0.35 μ m
 (Joint venture with Texas Instruments. Scheduled
 to start production in mid-1996. See Key Agreements.)

Key Agreements

- Hitachi is cooperating with Rockwell in high-speed modem IC production. Under the partnership, Hitachi is producing 28.8kps modem ICs and supplying them to Rockwell on condition that it and its customers can preferentially procure such ICs, which have been in high demand.
- Hitachi licensed its H8/300H microprocessor core to Analog Devices, which will use it in GSM chipsets and other wireless communications products.
- Hitachi joined with Texas Instruments for 16M, 64M, and 256M DRAM development and production. The partners are building a joint 16M and 64M DRAM manufacturing facility in Texas. The factory, to be called TwinStar Semiconductor Inc., will begin producing 16M DRAMs in mid-1996 and 64M parts in 1997. The output will be shared equally by Hitachi and TI. Separately, the two companies, along with Philips, formed a pact in 1993 covering joint development and alternate sourcing of FutureBus and BiCMOS logic IC 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 1996.
- Hitachi and VLSI Technology renewed and expanded their 1988 standard cell and process technology exchange agreement. The new pact gives Hitachi access to VLSI's gate array technology, and the two companies are jointly developing gate array families. In mid-1995, the two companies announced successful development of a 0.35 μ m five-layer-metal CMOS process.
- National Semiconductor and Hitachi have a 10-year patent cross-licensing agreement.
- Nippon Steel is continuing cooperation with Hitachi, which had agreed to let Nippon Steel second source its 4M DRAMs starting in 2H93. Nippon Steel is producing DRAMs for Hitachi on an OEM basis. In late 1995, Hitachi purchased Nippon's 1.2 μ m-1.0 μ m CMOS line (M1) for processing 150mm wafers. Hitachi and Nippon Steel may build a joint-venture DRAM fab in Singapore.
- Hitachi codeveloped a 16M flash memory device with Mitsubishi that is based on Mitsubishi's divided bitline NOR (DINOR) design. The team will also work on a 64M version based on Hitachi's complementary AND cell.
- Hitachi and Ramtron are working together to develop ferroelectric RAMs (FRAMs), including parts with densities of 256K, 1M, and 4M.
- Hitachi expanded its OEM relationship with LG Semicon in 1994 by signing a new licensing pact that provides LG with Hitachi's 0.35 μ m process and 64M DRAM designs. LG Semicon is currently producing 16M DRAMs for Hitachi. In addition, Hitachi is negotiating with LG about transferring 32-bit SH Family RISC MPU technology to the Korean company.
- Hitachi will develop, manufacture, and market Hewlett-Packard's 32-bit RISC MPU (PA, precision architecture).
- Asahi Kasei Microsystems began OEM production of Hitachi's 1M SRAMs in late 1993 at its fab in Nobeoka, Japan.
- Hitachi teamed with Crosspoint Solutions in the production and marketing of FPGAs. Hitachi started selling FPGAs based on Crosspoint Solutions' architecture in 4Q95.

KAWASAKI STEEL

Kawasaki Steel Corporation
LSI Division
Makuhari Techno Garden B5
1-3 Nakase, Mihama-ku
Chiba 261-01 Japan
Telephone: (81) (43) 296-7411
Fax: (81) (43) 296-7419

U.S. Representative:
Kawasaki LSI U.S.A. Inc.
4655 Old Ironsides Drive
Suite 265
Santa Clara, California 95054
Telephone: (408) 654-0180
Fax: (408) 654-0198

IC Manufacturer

Financial History, Fiscal Year Ends March 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)				
Sales	¥1,208	¥1,092	¥1,005	¥946
Net Income	¥27	¥0.1	¥(39)	¥(28)
Semiconductor (\$M)*				
Sales	55	80	110	100
Employees	454	541	600	543

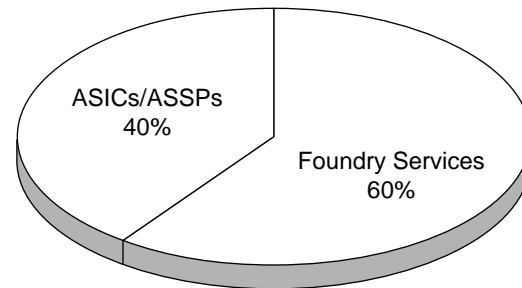
*Calendar Year

Company Overview and Strategy

Kawasaki Steel Corporation is one of the world's largest steel makers. It derives approximately three-fourths of its total sales from steel, and the rest from engineering/construction services, chemicals, LSI circuits, and integrated systems and electronics.

Kawasaki Steel organized its LSI Business Promotion Department in 1985 and established its LSI Research Center in 1986 to promote development of LSI devices, processes, and circuit design technology. In 1990, the company opened its LSI Design Center and completed construction of Utsunomiya Works. Commercial production of CMOS ASIC products began one year later.

In 1995, Kawasaki Steel shifted its LSI business strategy from foundry service to ASICs, and especially concentrated on the North American market through Kawasaki LSI U.S.A., Inc., a wholly owned subsidiary established in December 1994. In addition to its ASICs, the company offers ASSPs that are suited for application in a variety of end markets, including telecommunications, multimedia, and image processing.



**1995 Semiconductor Sales
by Product Type**

Prior to January 1995, Kawasaki Steel owned 45 percent of Nihon Semiconductor Inc., a Japanese joint manufacturing venture with LSI Logic. However, the company decided to depart from the venture and sold its interest to LSI Logic. The company decided to divert more operating resources toward its own in-house IC activities.

Management

Kanji Emoto	President
Kidehiko Kimishima	Executive Vice President, LSI Products
Masashi Tomishima	Managing Director and General Manager, LSI Division

Products and Processes

Kawasaki Steel's product offerings include:

- 0.8 μ m and 1.0 μ m CMOS gate arrays and embedded arrays with 2.5K to 172K usable gates.
- 0.8 μ m and 1.0 μ m mixed-signal CMOS standard cells.
- 0.5 μ m and 0.8 μ m CMOS cell-based arrays (CBAs) with up to 500K usable gates.
- ASSPs for image processing, telecommunications, and signal processing applications.
- Silicon foundry services.

The company provides a variety of macrocells such as JPEG, CAMs (Contents Addressable Memories), and a high-performance processor core, called the KC80, that can be incorporated in its ASICs. The KC80 processor core is based on the Zilog Z80 8-bit microprocessor. Additionally, Kawasaki and Zilog are developing ASSPs centered around the KC80.

Kawasaki Steel has developed its own leading-edge process technologies for use in the manufacture of its chips, including a 0.8 μ m CMOS process introduced in 1993 and a 0.5 μ m CMOS process introduced in early 1995. In 1996, Kawasaki Steel plans to add a 0.35 μ m process line at its Utsunomiya plant.

Semiconductor Fabrication Facilities

Kawasaki Steel Corporation
Utsunomiya Works
Tochigi Prefecture, Japan
Capacity (wafers/week): 2,300
Wafer size: 150mm
Process: CMOS
Products: ASICs, ASSPs, foundry services
Feature sizes: 0.5 μ m, 0.8 μ m, 1.0 μ m, (0.35 μ m available in 1996)

Key Agreements

- Kawasaki Steel has an agreement with Zilog, Inc. for the joint development of ASSPs based on Kawasaki Steel's KC80 microprocessor core.
- Kawasaki Steel has a license agreement with Silicon Architects. Under the agreement, Kawasaki Steel received a license to the CMOS cell based array (CBA) core technology of Silicon Architects.

MATSUSHITA

Matsushita Electronics Corporation
Semiconductor Group
 1, Kotari-yaki-machi
 Nagaokakyo-shi, Kyoto 617, Japan
 Telephone: (81) (75) 951-8151
 Web Site: www.mei.co.jp

U.S. Representative:
Panasonic Industrial Company
Matsushita Electric Corp. of America
Electronic Components Division
 1600 McCandless Drive
 Milpitas, California 95035
 Telephone: (408) 946-4311
 Fax: (408) 946-9063

IC Manufacturer

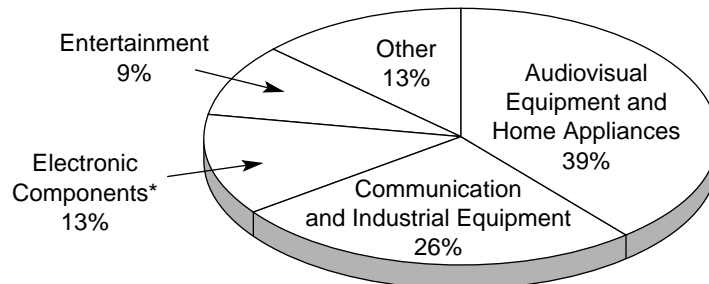
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (MEI, ¥B)					
Sales	¥6,599	¥7,450	¥7,056	¥6,624	¥6,948
Net Income	¥259	¥133	¥37	¥24	¥90
Semiconductor (\$M)*					
Sales	\$2,115	\$2,085	\$2,320	\$2,925	\$3,500
IC Sales	\$1,520	\$1,555	\$1,670	\$2,145	\$2,590
Discrete Sales	\$595	\$530	\$650	\$780	\$910
Capital Expenditures	\$625	\$265	\$185	\$520	\$965

*Calendar Year

Company Overview and Strategy

Matsushita Electronics Corporation (MEC) is a wholly owned subsidiary of Matsushita Electric Industrial Company (MEI), a \$78 billion conglomerate company involved in audiovisual equipment, home appliances, communication equipment, industrial equipment, semiconductors, electronic components, batteries, and entertainment.



*Includes IC, discretes, CCDs, picture tubes, tuners, speakers, and electric motors and lamps.

1995 Corporate (MEI) Sales by Business Segment

MEC was formed originally as a joint venture between MEI and Philips Electronics in 1952. In May 1993, Philips sold its 35 percent stake in MEC to MEI for \$1.67 billion. Its major products include integrated circuits, discrete devices, charge coupled devices (CCDs), cathode-ray tubes, image pickup tubes, and electric lamps. Semiconductor sales accounted for approximately 40 percent of MEC's total sales in the year ending March 31, 1995.

MEC has been an established leader in bipolar ICs and discrete devices used primarily in household equipment. However, the company's recent focus has been on the production of microcontrollers, image processing ICs, DSPs, and high-value-added memory products, such as flash memories and ferroelectric memory chips. MEC's semiconductor products are marketed in the U.S. under the name Panasonic Industrial Company.

Management

Matsushita Electronics Corporation

Kazuhiko Sugiyama	President
Koki Kato	Senior Managing Director, Semiconductor Group

Matsushita Semiconductor Corporation of America

Takashi Suyama	President
Frank Pfefferkorn	Vice President, Manufacturing and Engineering

Products and Processes

Matsushita's semiconductor products include analog ICs, DRAMs, mask ROMs, serial EEPROMs, MPUs, MCUs, DSPs, MOS logic ICs, ASICs, CCDs, and discrete and optoelectronic devices.

<p>MOS MEMORY</p> <input checked="" type="checkbox"/> DRAM <input type="checkbox"/> SRAM <input checked="" type="checkbox"/> Flash Memory <input type="checkbox"/> EPROM <input checked="" type="checkbox"/> ROM <input checked="" type="checkbox"/> EEPROM <input checked="" type="checkbox"/> Other (Including Non-Volatile RAM)	<p>ANALOG</p> <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)
<p>MOS LOGIC</p> <input checked="" type="checkbox"/> General Purpose Logic <input checked="" type="checkbox"/> Gate Array <input type="checkbox"/> Standard Cell <input checked="" type="checkbox"/> Field Programmable Logic <input checked="" type="checkbox"/> Other Special Purpose Logic	<p>DIGITAL BIPOLAR</p> <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 checked="" type="checkbox"/> Other Special Purpose Logic <input type="checkbox"/> MPU/MCU/MPR
<p>MOS MICROCOMPONENT</p> <input checked="" type="checkbox"/> MPU <input checked="" type="checkbox"/> MCU <input checked="" type="checkbox"/> MPR <input checked="" type="checkbox"/> DSP	<p>OTHER</p> <input checked="" type="checkbox"/> Full Custom IC <input checked="" type="checkbox"/> Discrete <input checked="" type="checkbox"/> Optoelectronic

Details concerning Matsushita's semiconductor products are provided below.

Memory ICs

- DRAMs in densities ranging from 1M to 16M.
- VRAMs in 256k, 512K, and 1M densities.
- Synchronous DRAMs (SDRAMs) in 16M density.
- Flash memories in 16M density.
- Mask ROMs in densities ranging from 1M to 16M.
- Serial EEPROMs in densities ranging from 512 bits to 4K.
- CMOS SRAMs in densities ranging from 64K to 512K.
- Ferroelectric memories.
- FIFO memories.

Microcomponent ICs

- 16-bit and 32-bit microprocessors.
- 4-bit, 8-bit, and 16-bit single-chip microcontrollers.
- Digital signal processors and audio signal processors.
- Microperipheral ICs, such as display drivers, disk drive controllers, clocks, memory controllers, and interface circuits.

Logic ICs

- General-purpose CMOS and bipolar logic ICs.
- CMOS and BiCMOS digital gate array ASICs with up to 259,800 usable gates.
- CMOS digital and mixed-signal standard cell ASICs.
- Full custom CMOS ASICs.

Dedicated Function ICs

- ICs for VCRs, cameras, televisions, audio equipment, industrial systems, home electronics, and communications equipment.

Analog ICs

- General-purpose linear devices, such as amplifiers, data converters, and voltage regulators, based on CMOS, BiCMOS, bipolar, and GaAs technologies.

Bipolar Digital ICs

- Driver Arrays.
- Hall-effect ICs.
- Prescalers.

Other Products

- CCDs.
- GaAs microwave monolithic ICs (MMICs).
- Discretes.
- Optoelectronic devices.

Matsushita's semiconductors are manufactured using CMOS, BiCMOS, bipolar, and GaAs process technologies. The company's CMOS technology has reached the 0.35 μ m geometry level, while its BiCMOS technology is at the 0.8 μ m level. The company is also highly committed to GaAs for its communications devices.

Semiconductor Fabrication Facilities

Matsushita Electronics, Nagaokakyo Facility
 Nagaokakyo-shi, Kyoto Prefecture, Japan
 Capacity (wafers/week): 17,000
 Wafer sizes: 100mm, 125mm
 Processes: MOS, CMOS, bipolar
 Products: ASICs, logic and power devices
 CCDs, discretes
 Feature sizes: 1.5 μ m-3.0 μ m

Matsushita Electronics, Tonami Facility
 Tonami-shi, Toyama Prefecture, Japan
 Capacity (wafers/week): 6,250
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: ASICs, MCUs, logic ICs, flash memories
 Feature sizes: 0.35 μ m, 0.5 μ m

Matsushita Electronics
 Utsunomiya-shi, Tochigi Prefecture, Japan
 Capacity (wafers/week): 2,000
 Wafer size: 100mm
 Process: MOS
 Products: Discretes

Matsushita Electronics, Nagaokakyo Facility
 Nagaokakyo-shi, Kyoto Prefecture, Japan
 Wafer size: 3in
 Process: GaAs
 Products: MMICs and other GaAs ICs, discretes

Matsushita Electronics, Arai Facility
 Aria-shi, Niigata Prefecture, Japan
 Capacity (wafers/week): 28,750
 Wafer sizes: 100mm, 125mm
 Processes: MOS, bipolar
 Products: DRAMs, SRAMs, ROMs, MPUs,
 logic and linear ICs, CCDs
 Feature sizes: 1.5 μ m-3.0 μ m

Matsushita Electronics, Uozu Facility
 Uozu-shi, Toyama Prefecture, Japan
 Capacity (wafers/week): 25,000
 Wafer sizes: 125mm, 150mm
 Processes: MOS, CMOS
 Products: DRAMs, EEPROMs, EPROMs
 ROMs, MPUs, MCUs, ASICs
 Feature sizes: 0.5 μ m-1.5 μ m

Matsushita Semiconductor Corp. of America
 1111 39th Avenue SE
 Puyallup, WA 98373-0900
 Telephone: (206) 841-6000
 Fax: (206) 841-6723
 Capacity (wafers/week): 8,000
 Wafer size: 150mm
 Processes: CMOS, bipolar, BiCMOS
 Products: DRAMs, ASICs, MCUs, foundry services
 Feature sizes: 0.6 μ m-1.0 μ m

Key Agreements

- Matsushita is marketing Actel's FPGAs in Japan and is also acting as a foundry for the U.S. company's FPGA products. In 1994, the partners expanded their relationship to include the joint development of advanced semiconductor process technologies.
- Matsushita is working with C-Cube Microsystems, JVC, and Sharp to jointly develop MPEG 1 and MPEG 2 decoders. Matsushita also provides C-Cube with preferential access to its 0.5 μ m and 0.35 μ m manufacturing processes, in return for the rights to use and sell a limited amount of the decoders.
- Matsushita is cooperating with National Semiconductor in the development of ICs for use in automobiles.
- Matsushita signed an RFID product agreement with Motorola and ferroelectric memory pioneer Symetrix Corp. Motorola's subsidiary Indala Corp. will jointly produce a family of read/write RFID chips with Matsushita that incorporate Symetrix's ferroelectric memory technology (Matsushita has an equity stake in Symetrix and has the right to relicense its technology). Matsushita and Symetrix are also working to develop other ferroelectric-based semiconductors.

MITSUBISHI

Mitsubishi Electric Corporation
2-3, Marunouchi 2-chome, Chiyoda-ku
Tokyo 100, Japan
Telephone: (81) (3) 3218-3313
Fax: (81) (3) 3218-2936
Web Site: www.mitsubishi.com

U.S. Representative:
Mitsubishi Electronics America, Inc.
Electronic Device Group
1050 East Arques Avenue
Sunnyvale, California 94086
Telephone: (408) 730-5900
Fax: (408) 732-9382

IC Manufacturer

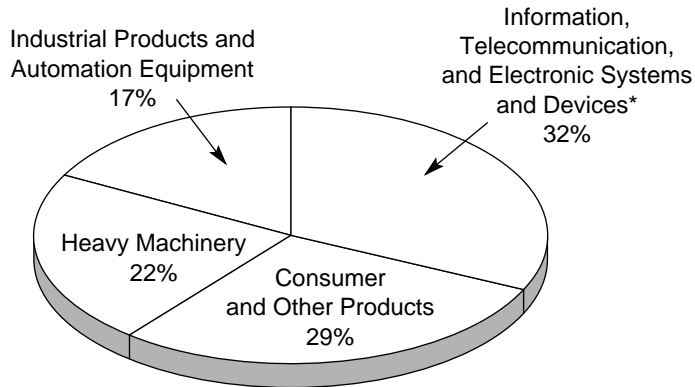
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥3,316	¥3,343	¥3,260	¥3,105	¥3,251
Net Income	¥80	¥36	¥29	¥21	¥42
Semiconductor (\$M)*					
Sales	\$2,420	\$2,490	\$2,958	\$3,874	\$5,062
IC Sales	\$2,020	\$2,068	\$2,405	\$3,286	\$4,432
Discrete Sales	\$400	\$422	\$553	\$588	\$630
Capital Expenditures	\$685	\$480	\$455	\$690	\$1,120

*Calendar Year

Company Overview and Strategy

Founded in 1921, Mitsubishi Electric is a leading manufacturer of electronic and electrical equipment with sales of about \$35 billion in 1995 (fiscal year ending March 1995) and some 112,000 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.



*Includes semiconductors

1995 Corporate Sales by Business Segment

Management

Mitsubishi Electric Corporation

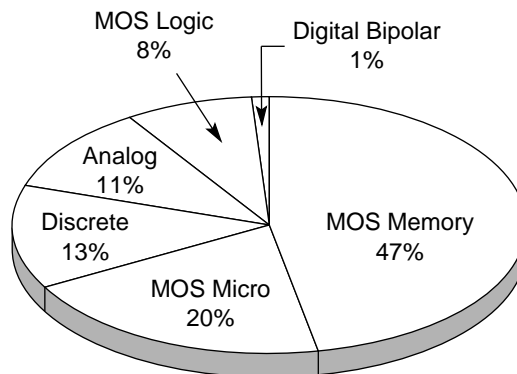
Takashi Kitaoka	President
Shoji Hirabayashi	General Manager, Semiconductor Group

Mitsubishi Electronics America Inc., Electronic Device Group

Akihiko Nishioka	President
Michael Bocian	Senior Vice President, Marketing

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.



1995 Semiconductor Sales by Device Type

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

Mitsubishi's top strategic semiconductor products are as follows:

Memory ICs

The company's DRAM product line includes 1M, 4M, 16M, and 64M DRAMs; 16M synchronous DRAMs; 256K, 1M, and 2M VRAMs; 10M 3D RAMs; and 4M and 16M cache DRAMs. Production capacities are being boosted in Germany and the U.S., as well as in Japan. Moreover, capacity will be gained through its ownership in the new Taiwanese company Powerchip Semiconductor (see Key Agreements).

In flash memories, the company's focus is mainly on devices with densities of 16M and greater and supported by alliances with Hitachi and SGS-Thomson. However, Mitsubishi also offers 1M and 4M flash parts.

Mitsubishi's SRAM products include CMOS standard SRAMs in 1M and 4M densities, BiCMOS fast SRAMs in 256K and 4M densities, and 1M synchronous pipeline burst SRAMs for high-speed cache applications (100MHz).

Microcomponents

Mitsubishi is a second source for Digital Semiconductor's Alpha RISC microprocessor and the company is raising its microcontroller output, with a focus on 16-bit and 32-bit parts (its MCU line-up also includes 4-bit and 8-bit parts). The company recently introduced a 32-bit RISC MCU that includes an 8M DRAM on-chip.

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).

GaAs ICs

Mitsubishi is experiencing strong demand for its gallium-arsenide mobile communications-related devices and optoelectronic products.

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 64M and 256M DRAM production facility at its Kochi plant by 2000. Construction of the \$1 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, Fukuoka Works
 Fukuoka-shi, Fukuoka Prefecture, Japan
 Capacity (wafers/week): 12,500
 Wafer sizes: 100mm, 150mm
 Process: Bipolar
 Products: Logic and analog ICs, ASICs, discretes
 Feature sizes: 2.0 μ m-3.0 μ m

Mitsubishi Electric, Saijo Factory
 Saijo-shi, Ehime Prefecture, Japan
 Capacity (wafers/week): 6,300
 Wafer sizes: 125mm, 150mm, 200mm
 Processes: CMOS, BiCMOS
 Products: DRAMs, SRAMs, MPUs, MCUs, ASICs,
 flash memories
 Feature sizes: 0.35 μ m-1.2 μ m

Mitsubishi Electric, Kita-Itami Works
 Itami-shi, Hyogo Prefecture, Japan
 Capacity (wafers/week): 7,300
 Wafer sizes: 100mm, 125mm
 Processes: GaAs, CMOS, MOS
 Products: GaAs devices, discretes

Mitsubishi Electric, Kumamoto Works
 Kikuchi-gun, Kumamoto Prefecture, Japan
 Capacity (wafers/week): 30,500
 Wafer sizes: 100mm, 125mm, 150mm, 200mm
 Processes: CMOS, MOS
 Products: EPROMs, EEPROMs, DRAMs, SRAMs,
 flash memories, ASICs, logic ICs
 Feature sizes: 0.4 μ m-2.0 μ m

Mitsubishi Semiconductor America, Inc.
 Three Diamond Lane
 Durham, NC 27704
 Telephone: (919) 479-3333
 Capacity (wafers/week): 2,000
 Wafer size: 125mm
 Process: CMOS
 Products: DRAMs, SRAMs
 Feature sizes: 0.8 μ m-1.0 μ m

Mitsubishi Semiconductor Europe GmbH
Konrad-Zuse Strasse 1
52477 Alsdorf, Germany
Capacity (wafers/week): 5,000
Wafer size: 200mm
Process: CMOS
Products: DRAMs

Powerchip Semiconductor Corporation
Hsinchu, Taiwan
Telephone: (886) (35) 783-344
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.
Scheduled to begin production in 4Q96.)

Key Agreements

- 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, which have been in high demand.
- 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 is under construction and volume production of 16M DRAMs will begin in the fourth quarter of 1996. Initial wafer capacity is planned to be 3,750 200mm wafers per week.
- Mitsubishi agreed to cooperate in development and production of DEC's Alpha 64-bit RISC MPU.
- SGS-Thomson signed on as a second source for Mitsubishi's flash memory products.
- Mitsubishi codeveloped a 16M flash memory device with Hitachi that is based on Mitsubishi's divided bitline NOR (DINOR) design. The team will also work on a 64M version based on Hitachi's complementary AND cell.

NEC

NEC Corporation
Electron Device Group
 7-1, Shiba 5-chome
 Minato-ku, Tokyo 108-01, Japan
 Telephone: (81) (3) 3454-1111
 Fax: (81) (3) 3798-1510/1519
 Web Site: www.nec.co.jp

U.S. Representative:
NEC Electronics Inc.
 475 Ellis Street
 Mountain View, California 94039-7241
 Telephone: (415) 965-6000
 Fax: (415) 965-6130
 Web Site: www.nec.com

IC Manufacturer

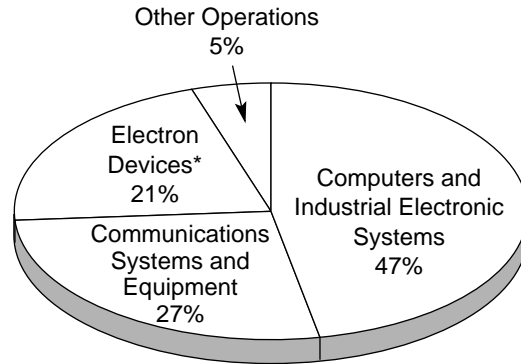
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥3,699	¥3,774	¥3,515	¥3,580	¥3,769
Net Income	¥54	¥15	¥(45)	¥7	¥35
Semiconductor (\$M)*					
Sales	\$5,170	\$5,735	\$7,090	\$8,830	\$12,275
IC Sales	\$4,430	\$5,040	\$6,265	\$7,855	\$11,045
Discrete Sales	\$740	\$695	\$825	\$975	\$1,230
Capital Expenditures	\$755	\$620	\$705	\$1,115	\$2,010

*Calendar Year

Company Overview and Strategy

Founded as Nippon Electric Company, Ltd. in 1899, the company officially changed its name to NEC Corporation in 1983. Today, NEC is a leading international supplier of electronics products that comprise primarily communications systems and equipment, computers, industrial electronic systems, and electron devices.



*Semiconductors and electronic components

1995 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	Executive Vice President, Electron Devices
Yuichi Haneta	Senior Vice President, Semiconductor Group

NEC Electronics Inc. (U.S.)

Kunishiro Saito	President and Chief Executive Officer
Shigeki Matsue	Executive Vice President, Operations
Sadayuki Kishi	Senior Vice President, Operations and Plant Manager
Kuniyoshi Noritsugu	Senior Vice President, Marketing and Legal
Mike Desportes	Vice President, Sales
Masayuki Komura	Vice President, Finance and Chief Financial Officer
N. Madea	Vice President, Marketing
John Marck	Vice President and General Manager, Memory Products

Products and Processes

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

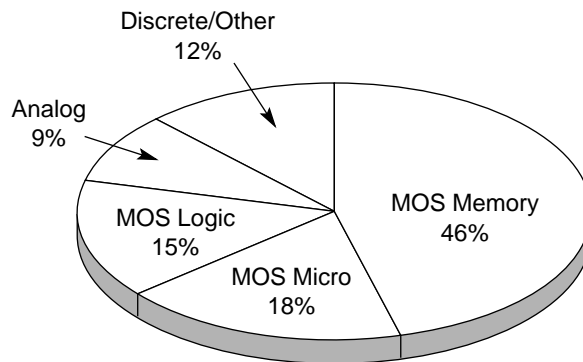
- ANALOG**
- Amplifier
 - Interface
 - Consumer/Automotive
 - Voltage Regulator/Reference
 - Data Conversion
 - Comparator
 - Other (Includes Telecom)

- 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



1995 Semiconductor Sales by Device Type (est)

Memory Devices

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 the first to develop a prototype 64M flash memory. 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 0.25µm process and is not expected to enter production before the year 2000.

The company's group of memory products includes: DRAMs (4M, 16M, 64M, and low-voltage); 16M synchronous DRAMs (SDRAMs); 8M Rambus DRAMs (RDRAMs); low-power CMOS SRAMs (256K and 1M); fast CMOS SRAMs (1M, 4M, and low-voltage); fast BiCMOS SRAMs (256K, 1M, and low-voltage); 1M synchronous SRAMs; mask ROMs (1M-32M and low-voltage), EPROMs (1M, 2M, 4M, and 8M), 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.

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. 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 with up to 1.2 million usable gates, BiCMOS gate arrays with up to 165,000 usable gates, ECL gate arrays, standard cell ASICs based on 0.35 μ m, 0.5 μ m, and 0.8 μ m CMOS technologies, FPGAs, and bipolar analog arrays.

Dedicated ICs

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

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.

Semiconductor Fabrication Facilities

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

Additionally, NEC expected to begin the construction of a second wafer fab in Roseville, California, in the spring of 1996. The new \$1.1 billion fab will initially fabricate 64M DRAMs, starting in 1998.

NEC Kyushu, Ltd.
 Kumamoto-shi, Kumamoto Prefecture, Japan
 Capacity (wafers/week): 26,250
 Wafer sizes: 125mm, 150mm, 200mm
 Processes: MOS, CMOS, BiCMOS
 Products: DRAMs, SRAMs, EPROMs, ROMs,
 MPUs, MCUs, ASICs, CCDs, R&D
 Feature sizes: 0.35µm-1.5µm

NEC Kansai, Ltd.
 Otsu-shi, Shiga Prefecture, Japan
 Capacity (wafers/week): 18,500
 Wafer sizes: 100mm, 150mm
 Processes: MOS, CMOS, bipolar
 Products: Linear and logic ICs, CCDs, ASICs,
 MPUs, MCUs, DRAMs, SRAMs
 Feature sizes: 0.8µm-4.0µm

NEC Sagami Plant
 Sagami-shi, Kanagawa Prefecture, Japan
 Capacity (wafers/week): 11,375
 Wafer sizes: 125mm, 150mm, 200mm
 Processes: MOS, CMOS, BiCMOS
 Products: DRAMs, EPROMs, SRAMs, ROMs,
 MPUs, MCUs, ASICs
 Feature sizes: 0.5µm-1.4µm

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: 0.55µm

NEC Kansai, Ltd.
 Otsu-shi, Shiga Prefecture, Japan
 Capacity (wafers/week): 500
 Wafer size: 100mm
 Process: GaAs
 Products: ICs and discretes

NEC Yamaguchi, Ltd.
 Asa-gun, Yamaguchi Prefecture, Japan
 Capacity (wafers/week): 16,500
 Wafer sizes: 150mm, 200mm
 Processes: CMOS, MOS
 Products: DRAMs, SRAMs, MPUs, ASICs
 flash memories
 Feature sizes: 0.5µm, 0.8µm, 1.0µm
 (Half of the existing lines will be replaced with 0.35µm
 production lines by the end of 1998)

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

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: 0.8µm

NEC Hiroshima, Ltd.
 Higa-shi, Hiroshima Prefecture, Japan
 Capacity (wafers/week): 15,000
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, SRAMs, ROMs, MPUs
 Feature sizes: 0.35µm-0.8µm

NEC Corporation
 Yokkaichi-shi, Mie Prefecture, Japan
 Capacity (wafers/week): 5,000
 Wafer size: 100mm
 Process: Bipolar
 Products: Discretes
 Feature size: 5.0µm

NEC Electronics Inc.
7501 Foothills Boulevard
Roseville, California 95678
Telephone: (916) 786-3900
Cleanroom size: 400,000 square feet
Capacity (wafers/week): 14,500
Wafer sizes: 125mm, 150mm
Processes: MOS, CMOS, BiCMOS
Products: SRAMs, DRAMs, ASICs, MCUs
Feature sizes: 0.35 μ m-1.0 μ m

NEC Semiconductors (UK) Limited
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): 8,250
Wafer size: 150mm
Process: CMOS
Products: DRAMs, SRAMs, MCUs, ASICs, DSPs
Feature sizes: 0.35 μ m-0.8 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: 0.7 μ m-3.0 μ m

Key Agreements

- 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.
- 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.
- In September 1995, NEC licensed the ARM7 RISC microprocessor core of Advanced RISC Machines Ltd. NEC will develop, manufacture, and market ASICs based on the 32-bit RISC core.
- NEC announced the continuation of its IC process technology development alliance with Lucent Technologies to the 0.25 μ m level. The deal is based on a similar agreement signed in 1991 in which the companies set out to develop a 0.35 μ m CMOS process.
- NEC has an agreement with Mips Technologies to second source all Mips RISC microprocessor architectures, including the R3000A, the R4000, the R4400, the R5000, the R4200, and the ECL version. The two firms are working closely to develop RISC devices for future needs.

- Samsung forged an alliance with NEC to exchange information about 256M DRAM cell technology. The companies have another agreement under which NEC supplies Samsung with 4M DRAMs in wafer or die form from its fab in Scotland. Samsung packages and tests the devices at a site in Portugal and then sells them to European PC manufacturers.
- NEC has a sourcing and joint-development pact with National Semiconductor for devices targeting the Japanese Ethernet market.
- NEC established a relationship with flash memory developer SanDisk Corporation to manufacture 256M flash devices using NEC's 0.35 μ m process technology. NEC also purchased a one percent share of ownership in SanDisk.
- TSMC signed on as a foundry for NEC's ASICs. NEC transferred its 0.8 μ m CMOS technology to the Taiwanese firm for the manufacture of gate arrays and other ASICs.

NIPPON STEEL SEMICONDUCTOR (NPNX)

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 1580 Yamamoto
 Tateyama, Chiba 294, Japan
 Telephone: (81) (470) 23-3121
 Fax: (81) (470) 23-9285

U.S. Representative:
Nippon Steel Semiconductor
U.S.A. Corporation
 2900 Gordon Avenue, Suite 206
 Santa Clara, California 95051
 Telephone: (408) 524-8000
 Fax: (408) 524-8040

IC Manufacturer

Financial History (\$M)

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Sales	138	160	257	305	600
Capital Expenditures	163	76	69	73	110
Employees	728	778	814	850	921

Company Overview and Strategy

Nippon Steel Semiconductor (NPNX) was founded as NMB Semiconductor in 1984 by Japan's Minebea Group. Suffering from huge losses and a lack of funding, Minebea decided that the rescue of NMB was too big a job and began searching for potential buyers. In early 1993, NMB was purchased by Nippon Steel Corp., the world's largest steel maker, who was looking to diversify its business by entering new markets such as electronics and data communications. Nippon Steel purchased 56 percent of NMB for \$44 million and took on NMB's \$240 million in debt. The operation was then renamed Nippon Steel Semiconductor Corp.

When Nippon Steel took over NMB, its business strategy was OEM oriented. With the termination of its contract with Intel for flash memory, its focus on its own DRAM products strengthened. In 1995, Nippon Steel sold its M1 fab which produced MCU and LCD driver ICs, and a new fab for 16M DRAM production is currently under construction.

Management

Hidehiko Iwasaki President

Products and Processes

Nippon Steel Semiconductor produces high-speed 1M and 4M CMOS DRAMs, developed with United Memories Inc. (UMI) of Colorado, a joint venture formed by NPNX and Ramtron, but now wholly owned by NPNX. In late 1996, the company will begin mass production of 16M DRAMs at its facility.

The company is developing synchronous and graphics DRAMs, as well as ASSPs for audio/visual, communications, and information equipment applications.

Semiconductor Fabrication Facilities

Nippon Steel Semiconductor Corp.

Tateyama Facility

Tateyama-shi, Chiba Prefecture, Japan

Cleanroom size: 100,000 square feet

Capacity (wafers/week): 8,750

Wafer size: 150mm

Process: CMOS

Products: DRAMs (ASSPs in 2H97)

Feature sizes: 0.5 μ m, 0.6 μ m

Nippon Steel is currently building a new 200mm, 0.35 μ m manufacturing line to produce 16M DRAMs. Construction is currently in process and production is planned to begin in the second half of 1997. The fab will have a capacity of 2,500 wafers per week.

Nippon Steel Corporation also has a semiconductor R&D center located in Sagami-hara, Kanagawa Prefecture, near Tokyo.

Key Agreements

- In 1992, Nippon Steel Semiconductor (NMB Semiconductor at the time) and Ramtron established a joint venture, called United Memories, Inc., which designs and develops DRAMs and other memories for both companies. The two companies have worked together in the development of DRAMs since 1988. In 1995, NPNX bought the remaining shares of UMI from Ramtron.
- Nippon Steel is continuing cooperation with Hitachi, which had agreed to let NMB second source its 4M DRAMs starting in 2H93. NPNX is producing DRAMs for Hitachi on an OEM basis. In late 1995, Hitachi purchased Nippon's 1.2 μ m-1.0 μ m CMOS line (M1) for processing 150mm wafers. Hitachi and Nippon Steel may build a joint-venture DRAM fab in Singapore.

NIPPONDENSO

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1-1, Showa-cho, Kariya
Aichi Prefecture 448, Japan
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Fax: (81) (566) 25-4537

U.S. Representative:
Nippondenso America, Inc.
24777 Denso Drive
Southfield, Michigan 48086-5133
Telephone: (810) 350-7500
Fax: (810) 350-7772

IC Manufacturer

Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥1,481	¥1,524	¥1,428	¥1,412	¥1370
Net Income	¥61	¥42	¥27	¥37	¥38
Semiconductor (\$M)*					
IC Sales			\$125	\$135	\$155

*Calendar Year

Company Overview and Strategy

Nippondenso, which has an association with Toyota Motor Corporation, has grown to become one of the world's leading manufacturers of automotive components and systems. Its automotive components business is supplemented by a growing line of diversified products, including factory automation systems, portable telephones, and hand-held bar-code readers.

Nippondenso established its IC Research Center in 1968. Today, the company manufactures a variety of ICs for automotive applications, including fuel injection, braking control, and navigation systems. Approximately 70 percent of the ICs used by Nippondenso are developed and manufactured internally.

Management

Tsuneo Ishimaru	President
Kazuhiro Ohta	Executive Vice President
Chosei Ujiiie	Executive Vice President

Products and Processes

Nippondenso manufactures CMOS and bipolar ICs and sensors for automobile electronic equipment. Its IC product line consists of microcontrollers, gate arrays, logic chips, and full custom devices.

Semiconductor Fabrication Facilities

Nippondenso Co., Ltd.
Kariya Plant
1-1, Showa-cho, Kariya
Aichi 448, Japan
Telephone: (81) (566) 25-5511
Capacity (wafers/week): 3,000
Wafer sizes: 100mm, 125mm
Processes: Bipolar, CMOS
Products: MCUs, logic and custom ICs
Feature sizes: 1.5 μ m-3.0 μ m

Nippondenso Co., Ltd.
Kota Plant
5, Maruyama, Ashinoya, Kota-cho,
Nukata-gun, Aichi 444-01, Japan
Telephone: (81) (564) 56-7711
Capacity (wafers/week): 2,500
Wafer size: 150mm
Process: MOS
Products: MCUs, custom ICs

NKK

NKK Corporation
LSI Division
1-1-2 Marunouchi
Chiyoda-ku, Tokyo 100
Japan
Telephone: (81) (3) 3217-3119
Fax: (81) (3) 3217-3148

U.S. Representative:
NKK America
2350 Mission College Boulevard
Santa Clara, California 95054
Telephone: (408) 982-8277
Fax: (408) 982-9809

IC Manufacturer

Company Overview and Strategy

NKK Corporation, a leading steel manufacturer with annual sales of more than \$9 billion, began expanding its business into electronic devices in late 1989. To do so, NKK established technology partnership and development agreements with Paradigm Technology for SRAMs, IDT for RISC MPUs, and Macronix International for mask ROMs and flash memories.

The company's LSI Research Center in Ayase was completed in November 1992. The facility is a base for the company's technology development.

Management

Yoshiharu Miyawaki Managing Director

Products and Processes

NKK's Ayase LSI Research Center is capable of producing 0.5 μ m CMOS devices on 200mm wafers. Products that have been developed by the company include:

- High-speed SRAMs (256K, 512K, 1M, and 4M in density)
- High-speed processor-specific SRAMs (Intel, Sparc, Mips)
- Mask ROMs (1M, 2M, 4M, 16M, and 32M in density)
- Flash memories (1M, 4M, and 16M in density)
- 32-bit and 64-bit RISC MPUs based on the Mips R3000 and R4000 architectures
- PCI bus controller and memory controller chipsets
- ASSPs and ASICs (sea-of-gates arrays and standard cells) incorporating the Mips cores

Semiconductor Fabrication Facilities

NKK Ayase LSI Research Center

2596, Yoshioka

Ayase, Kanagawa Prefecture, Japan

Telephone: (81) (476) 70-5009

Cleanroom size: 35,500 square feet (Class 1)

Capacity (wafers/week): 1,500

Wafer size: 200mm

Process: CMOS

Products: ROMs, SRAMs, flash memories, MPUs, ASICs, ASSPs

Feature sizes: 0.5 μ m-0.8 μ m

Key Agreements

- NKK Corporation jointly developed 4M and 16M flash memory devices and 4M ROMs with its Japanese partner Macronix. NKK expanded its partnership with Macronix International to include codevelopment of 16M flash memory technology.
- NKK licensed Mips Technologies' RISC microprocessor architecture. With it, NKK is developing a 150MHz enhanced floating point version of the R4600 (Orion) processor.

OKI

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 Sunnyvale, California 94086-2909
 Telephone: (408) 720-1900
 Fax: (408) 720-1918
 Web Site: www.okisemi.com

IC Manufacturer

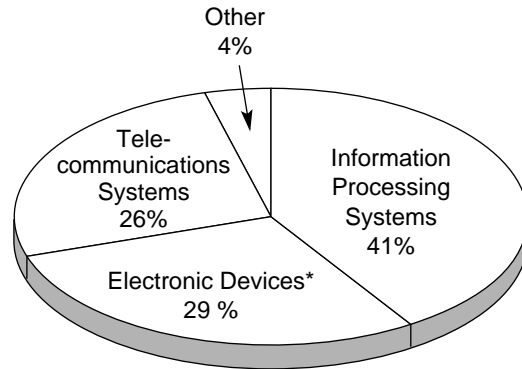
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥661	¥681	¥640	¥652	¥657
Net Income	¥10	¥(0.5)	¥(33)	¥(2)	¥32
Semiconductor (\$M)*					
Sales	\$1,120	\$1,155	\$1,380	\$1,680	\$2,045
IC Sales	\$1,100	\$1,135	\$1,365	\$1,665	\$2,030
Discrete Sales	\$20	\$20	\$15	\$15	\$15
Capital Expenditures	\$315	\$150	\$125	\$205	¥395

*Calendar Year

Company Overview and Strategy

Oki Electric Industry Co. is a global manufacturer of telecommunication systems, information processing systems, and electronic devices. Oki manufactured its first integrated circuit devices in the late 1960's. Since then, its semiconductor product portfolio has grown to include a full range of memory, logic, ASIC, and custom integrated circuits. These devices are sold primarily to customers in the computer, automotive, telecommunications, and consumer products industries.



*Includes ICs, optoelectronic devices, relays, switches, and solid-state disk cards.

1995 Corporate Sales by Business Group

Management

Oki Electric Industry Company

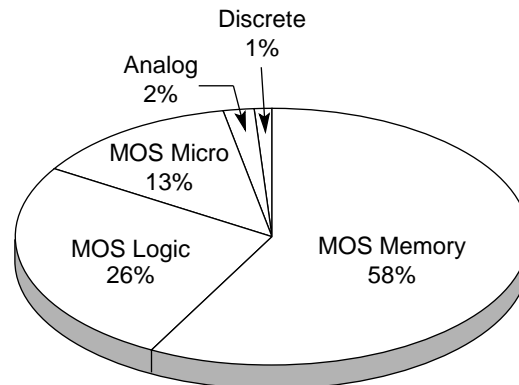
Jun Jinguji	President and Chief Executive Officer
Kazuhiko Shimizu	Senior General Manager, Electronic Devices Sales and Marketing Group

Oki Semiconductor Group (U.S.)

Seiichi Aratani	President and Chief Executive Officer
Larry Chalfan	Executive Vice President, Manufacturing
Joe Baranowski	Vice President, Sales and Marketing
Andy Davis	Vice President, Engineering
Bharate Gupte	Associate Vice President, Marketing Development

Products and Processes

Oki manufactures a broad line of VLSI devices and board-level products. A leader in CMOS memory and ASICs, Oki's product line also includes speech synthesis circuits, microcontrollers, and advanced communications devices for wireless and fiber optic applications. The company provides system level solutions by combining sophisticated technologies with semiconductor and board-level integration.



1995 Semiconductor Sales by Device Type (est)

MOS MEMORY		ANALOG	
<input checked="" type="checkbox"/>	DRAM	<input checked="" type="checkbox"/>	Amplifier
<input checked="" type="checkbox"/>	SRAM	<input type="checkbox"/>	Interface
<input checked="" type="checkbox"/>	Flash Memory	<input type="checkbox"/>	Consumer/Automotive
<input type="checkbox"/>	EPROM	<input type="checkbox"/>	Voltage Regulator/Reference
<input checked="" type="checkbox"/>	ROM	<input checked="" type="checkbox"/>	Data Conversion
<input checked="" type="checkbox"/>	EEPROM	<input 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 type="checkbox"/>	Bipolar Memory
<input checked="" type="checkbox"/>	Gate Array	<input type="checkbox"/>	General Purpose Logic
<input checked="" type="checkbox"/>	Standard Cell	<input type="checkbox"/>	Gate Array/Standard Cell
<input type="checkbox"/>	Field Programmable Logic	<input type="checkbox"/>	Field Programmable Logic
<input checked="" type="checkbox"/>	Other Special Purpose Logic	<input type="checkbox"/>	Other Special Purpose Logic
<input type="checkbox"/>		<input type="checkbox"/>	MPU/MCU/MPR
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		

Oki's 1995 memory activities capitalized on the great demand for 4M DRAM devices. In 1996, Oki plans to slash 4M DRAM production by 60 percent and nearly triple production of its 16M DRAMs. Its first 16M synchronous DRAMs (SDRAMs) are expected to ship in 3Q96. Furthermore, it will increase capacity for 64M DRAMs at its Miyagi Oki facility. Oki also signed agreements with two Taiwan-based companies to receive 30 percent of their production of Oki-brand memories in exchange for technical support of plant construction and technology transfers.

Oki's other memory IC products include mask ROMs up to 16M in density, CMOS SRAMs up to 1M, serial EEPROMs, 1M VRAMs, and flash memories in 1M and 4M densities.

The company's MOS microcomponent IC products include microcontrollers (4-bit, 8-bit, and 16-bit), microprocessors (8-bit, 16-bit, and 32-bit), digital signal processors (16-bit and 32-bit), and a wide range of telecom ICs for digital cordless telephones and telecommunications circuits for data modems. New chips based on its voice synthesis technology continue to be developed and the production of GaAs ICs for personal communications systems has been increased significantly.

Oki offers sea of gates (SOG) and customer structured array (CSA) ASIC families in double- and triple-layer metal silicon-gate CMOS processes. These devices are available in 0.5 μ m and 0.8 μ m geometries.

Semiconductor Fabrication Facilities

Miyazaki Oki Electric Co., Ltd.
 Miyazaki-gun, Miyazaki Prefecture, Japan
 Cleanroom size: 30,142 square feet
 Capacity (wafers/week): 16,250
 Wafer sizes: 125mm, 150mm
 Process: CMOS
 Products: DRAMs, SRAMs, EEPROMs, ROMs,
 MPUs, ASICs, linear and logic ICs
 Feature sizes: 0.5 μ m-1.5 μ m

Miyagi Oki Electric Co., Ltd.
 Kurokawa-gun, Miyagi Prefecture, Japan
 Capacity (wafers/week): 15,000
 Wafer sizes: 150mm, 200mm
 Process: CMOS
 Products: DRAMs, VRAMs, SRAMs, ASICs, flash ICs
 Feature sizes: 0.3 μ m-0.8 μ m

Oki Electric Industry Co., Ltd., Hachioji Plant
 Hachioji-shi, Tokyo, Japan
 Capacity (wafers/week): 22,000
 Wafer sizes: 100mm, 200mm
 Processes: CMOS, BiCMOS, bipolar
 Products: DRAMs, MPUs, ASICs, linear ICs
 Feature sizes: 0.35 μ m-1.0 μ m

Oki Electric Industry Co., Ltd., Hachioji Plant
 Hachioji-shi, Tokyo, Japan
 Capacity (wafers/week): 1,000
 Wafer size: 3in
 Process: GaAs
 Products: GaAs ICs

Oki Semiconductor Group
 Manufacturing Division
 11155 Southwest Leveton Drive
 Tualatin, Oregon 97062
 Telephone: (503) 692-9100
 Fax: (503) 692-0967

(Currently used for test and assembly of Oki DRAMs. However, Oki is investing \$700 million to build a 0.35 μ m, 200mm wafer fab at the site for the production of 16M and 64M DRAMs.)

Key Agreements

- Oki is helping Nan Ya Plastics, Taiwan's largest printed-circuit board supplier, construct a 200mm wafer plant and start up its DRAM business. Oki's 16M DRAM technology will be transferred to the new fab, which is scheduled to begin making DRAMs in 1996.
- Oki and Samsung entered a five-year technology exchange agreement for synchronous DRAMs.
- Entered an agreement with design house Mosaid Technologies of Ontario, Canada to jointly develop a 64M synchronous DRAM. Oki expects to start sampling the SDRAMs in mid-1996.
- Oki has developed 1M, 2M, 4M, and 8M flash memory devices with California-based design firm Nexcom Technology. Oki also produces flash memory ICs for Catalyst Semiconductor.

- Oki signed a 32-bit RISC microprocessor code licensing agreement with Advanced RISC Machines (ARM) of the U.K. Under terms of the agreement, Oki will develop, manufacture, and sell ASICs based on the ARM core.
- HP licensed Oki to build an embedded-control version of its PA-RISC 32-bit microprocessor.
- Oki has a second-source agreement with Matra MHS for telecommunications ICs.
- Oki entered into a technology license agreement with Rambus in 1993 and is developing a 64M Rambus DRAM based on that technology.
- Looking to reduce costs, Oki and Sony linked together to jointly develop a 0.25 μ m process. Their goal is to finish development by 1998 so that each company can apply the process to memory and logic (including ASIC) products.

RICOH

Ricoh Co., Ltd.
15-5 Minami Aoyama, 1-chome
Minato-ku, Tokyo 107, Japan
Telephone: (81) (3) 3479-3111
Fax: (81) (3) 3403-1578

U.S. Representative:
Ricoh Corporation
Electronic Devices Division
3001 Orchard Parkway
San Jose, California 95134
Telephone: (408) 432-8800
Fax: (408) 432-8375

IC Manufacturer

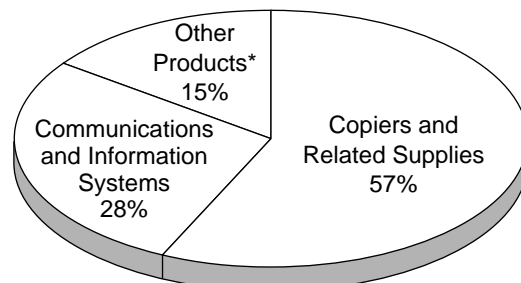
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥1,003	¥1,017	¥1,022	¥968	¥1,020
Net Income	¥14	¥2	¥5	¥10	¥19
Semiconductor (\$M)*					
IC Sales	\$190	\$200	\$230	\$295	\$355

*Calendar Year

Company Overview and Strategy

Established in 1936, Ricoh Company is one of the world's top suppliers of office automation equipment, including copiers, facsimiles, and data processing systems. The company is also a leader in state-of-the-art electronic devices and is renowned for its photographic equipment. Ricoh's digital and color technologies are increasingly incorporated in multifunctional image processing equipment and systems used by businesses worldwide.



*Includes cameras, disk drives, thermal labels, and ICs.

1995 Corporate Sales by Business Segment

Ricoh began developing and producing semiconductors specifically for its own products in 1981. One year later, the company began selling ICs to external customers. Today, Ricoh's semiconductor efforts are focused primarily on image processing applications, in support of its corporate strategy called Image Processing Systems (IPS) integration. Its prominent ICs include controllers and digital signal processors for facsimile machines, JPEG image processors, and PCMCIA controllers.

Management

Hiroshi Hamada	President
Taisaburo Homae	Managing Director, Electronic Devices Division

Products and Processes

Ricoh manufactures ASICs and ASSPs, as well as other standard ICs and full custom devices.

Gate Array ASICs

- 5GU Series—0.8 μ m CMOS process, up to 194,400 gates and 384 I/Os, and gate delays of 0.38ns.
- 5GL Series—1.2 μ m CMOS process, up to 10,000 gates and 236 I/Os, and gate delays of 0.8ns.
- 5GV Series—1.2 μ m CMOS process, up to 16,100 gates and 204 I/Os, and gate delays of 0.8ns.
- 5GF Series—1.5 μ m CMOS process, up to 8,200 gates and 168 I/Os, and gate delays of 1.0ns.

Standard Cell ASICs

- RSC-08 Series—0.8 μ m CMOS process.
- RSC-12 Series—1.2 μ m CMOS process.
- RSC-15 Series—1.5 μ m CMOS process.
- Ricoh's cell library includes 8-bit, 16-bit, and 32-bit microcontrollers, peripherals, DSP cores, memory cells, and analog cells.

Programmable Logic Devices

- CMOS EPLDs.

Application Specific Standard Products

- Image compression/decompression chipsets compliant with JPEG standard. MPEG image processing chips are being developed.
- Image filtering processors.
- Sound generators.
- Voice recognition ICs.
- Real time clocks.
- PC card controllers.
- CD-R system ICs.
- PWM generators.

Other Standard ICs

- Mask ROMs with densities of 64K, 128K, 256K, and 1M in NMOS technology and 256K, 1M, 2M, 4M, and 16M in CMOS technology.
- Single-chip 8-bit and 16-bit microcontrollers.
- Power management ICs based on CMOS technology.
- FIFO memories.

Semiconductor Fabrication Facilities

Ricoh Co., Ltd.

Ikeda Plant and LSI R&D Center

13-1 Himemuro-cho

Ikeda-shi, Osaka 563, Japan

Telephone: (81) (727) 53-1111

Capacity (wafers/week): 5,500

Wafer sizes: 100mm, 150mm

Processes: CMOS, BiCMOS

Products: Mask ROMs, MCUs, ASICs, ASSPs,
linear ICs, foundry servicesFeature sizes: 0.8 μ m, 1.2 μ m

Ricoh Co., Ltd.

Yasiro Plant

30-1 Saho, Yashiro-cho

Kato-gun, Hyogo 673-14, Japan

Telephone: (81) (795) 42-6111

Capacity (wafers/week): 2,500

Wafer size: 150mm

Process: CMOS

Products: ASICs, ASSPs

Feature sizes: 0.8 μ m, 1.2 μ m

ROHM

Rohm Co., Ltd.
21 Saiin Mizosaki-cho
Okyo-ku, Kyoto, Japan
Telephone: (81) (75) 311-2121
Fax: (81) (75) 315-0172
Web Site: www.rohm.co.jp

U.S. Representative:
Rohm Corporation
2150 Commerce Drive
San Jose, California 95131
Telephone: (408) 432-0500
Fax: (408) 434-6444

IC Manufacturer

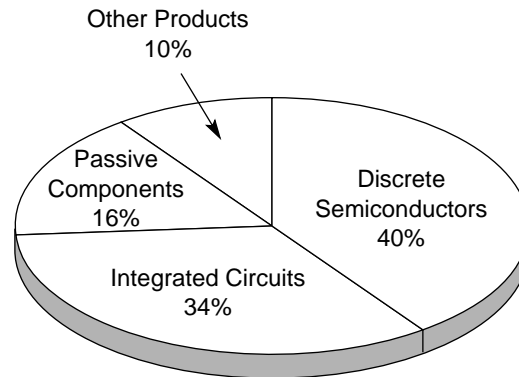
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥189	¥205	¥187	¥199	¥241
Net Income	¥5	¥7	¥8	¥12	¥22
Semiconductor (\$M)*					
Sales	\$1,345	\$1,520	\$1,455	\$1,610	\$2,070
IC Sales	\$485	\$565	\$565	\$645	\$830
Discrete Sales	\$860	\$955	\$890	\$965	\$1,240
Capital Expenditures	\$220	\$140	\$125	\$190	\$310

*Calendar Year

Company Overview and Strategy

Rohm was originally called R. Ohm, with the R standing for resistor (the original product the company was based on). The company began developing ICs in 1969 and has since evolved into a major designer and manufacturer of ICs. Today, ICs, primarily large-scale integration (LSI) devices, have grown into one of the company's core businesses, accounting for more than 30 percent of sales. Approximately 70 percent of Rohm's IC sales are custom products.



1995 Corporate Sales by Product Type

Management

Ken Sato	President
Yukikazu Fujiwara	Senior Managing Director, Administration Headquarters
Junichi Hikita	Managing Director, LSI Products Headquarters
Kozo Sato	Managing Director, International Operations Headquarters
Takaaki Shigemitsu	Managing Director, Manufacturing Headquarters I
Tokusaburo Hirata	Director, Eastern Japan Sales Headquarters
Akitaka Idei	Director, Marketing Division
Harukito Suematsu	Director, Western Japan Sales Headquarters
Shunichi Yamanura	Director, Strategic Information Systems Division

Products and Processes

The following is a breakdown of Rohm's semiconductor portfolio.

Integrated Circuits

Memory ICs (EEPROMs, SRAMs, FRAMs), microcontrollers, cell-based ICs, CMOS gate arrays, FPGAs, standard ICs, motor drivers, ICs for industrial equipment, ICs for audio applications, ICs for video applications, and hybrid ICs.

Rohm continues to expand its presence in bipolar and CMOS devices, but is also developing BiCMOS devices and multi-time programmable (MTP) microcontrollers that utilize flash memory technology.

Discrete Semiconductors

Rohm produces a wide variety of transistors, diodes, resistors, capacitors, and light emitting diodes.

Rohm also manufactures and markets sensors, laser diodes, liquid crystal displays, and printheads.

Semiconductor Fabrication Facilities

Rohm Co., Ltd.

21 Saiin Mizosaki-cho

Ukyo-ku, Kyoto 615, Japan

Cleanroom size: 27,000 square feet

Capacity (wafers/week): 10,000

Wafer sizes: 100mm, 150mm (200mm in 1996)

Processes: Bipolar, CMOS, BiCMOS,

Products: SRAMs, MCUs, ASICs,

EEPROMs, flash, FRAMs

Feature sizes: 0.35 μ m-1.2 μ m

Rohm Corporation

2150 Commerce Drive

San Jose, California 95131

Cleanroom size: 18,000 square feet (Class 10)

Capacity (wafers/week) 2,500

Wafer size: 125mm

Processes: CMOS, bipolar

Products: EEPROMs, MCUs, foundry services

Feature sizes: 1.0 μ m-2.0 μ m

Plans for 1996 include strengthening its IC plants in the United States and Japan. At the Kyoto facility, Rohm added an FRAM wafer process line to support the expanded agreement between the company and Ramtron (see Key Agreements below). In addition, the company plans to increase the fab's capacity to 12,000 wafers per week by adding an additional 0.35 μ m, 200mm wafer line.

Key Agreements

- Rohm joined Zycad Corporation's Gatefield Division to jointly develop FPGAs using Rohm's flash memory technology.
- Rohm signed a joint manufacturing, development, and marketing deal with Ramtron in 1993 that gave Rohm the right to produce and market Ramtron's line of ferroelectric memory (FRAM) products. In addition, the companies will jointly develop new ferroelectric-based devices, including microcontrollers. In 1995, the agreement was expanded to allow Rohm to redesign and modify Ramtron-designed FRAMs.
- Rohm formed a strategic agreement with Alliance Semiconductor Corporation. Under the deal Rohm is furnishing Alliance with 0.5 μ m wafer fab capacity for the production of SRAM devices. In return, Alliance is helping Rohm develop high-performance, low-power SRAMs.
- Rohm teamed up with Oak Technology, Inc. of Sunnyvale, California, to develop a next-generation video processor IC for multimedia applications.

SANYO

Sanyo Electric Co., Ltd.
Semiconductor Business Headquarters
 180 Sakata Oizumi-Machi
 Oura-gun, Gunma, Japan
 Telephone: (81) (276) 61-8049
 Fax: (81) (276) 61-2807
 Web Site: www.sanyo.co.jp

U.S. Representative:
Sanyo Semiconductor Corp.
 80 Commerce Drive
 Allendale, New Jersey 07401
 Telephone: (201) 825-8080
 Fax: (201) 825-0163

IC Manufacturer

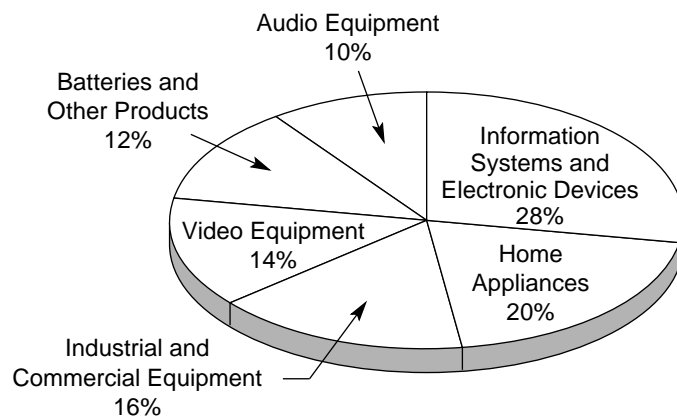
Financial History, Fiscal Year Ends November 30

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥1,587	¥1,537	¥1,527	¥1,660	¥1,707
Net Income	¥17	¥(1)	¥(2)	¥11	¥16
Semiconductor (\$M)*					
Sales	\$1,320	\$1,495	\$1,720	\$2,070	\$2,520
IC Sales	\$820	\$1,030	\$1,270	\$1,530	\$1,880
Discrete Sales	\$500	\$465	\$450	\$540	\$640
Capital Expenditures	\$275	\$275	\$350	\$365	\$615

*Calendar Year

Company Overview and Strategy

Founded in 1950, Sanyo Electric Co., Ltd. manufactures a broad range of electronic products, including video equipment, audio equipment, home appliances, industrial and commercial equipment, information systems, integrated circuits and discrete devices, and batteries.



1995 Corporate Sales by Business Segment

Sanyo entered the semiconductor business in 1958 with the initiation of transistor production. Development of ICs began in 1965 leading to mass production three years later. The company's semiconductor product portfolio has grown to include analog ICs, ASICs, memories, microcontrollers, CCDs, and discretes.

Management

Yasuaki Takano	President
Sadao Kondo	General Manager, Semiconductor Division
Motoharu Iue	President, Sanyo North American Corporation
Akifumi Goto	President, Sanyo Semiconductor Corporation (U.S.)

Products and Processes

Sanyo manufactures and markets a variety of semiconductor products, including CMOS gate array and standard cell ASICs, microcontrollers, MPRs, DRAMs, SRAMs, flash memories, ROMs, general-purpose logic and linear devices, LCD controllers and drivers, modem ICs, CD-ROM LSIs, audio/visual ICs, communications circuits, CCDs, sensors, discretes, and optoelectronics.

MOS MEMORY		ANALOG	
<input checked="" type="checkbox"/>	DRAM	<input checked="" type="checkbox"/>	Amplifier
<input checked="" 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 checked="" type="checkbox"/>	ROM	<input checked="" type="checkbox"/>	Data Conversion
<input checked="" 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 type="checkbox"/>	Bipolar Memory
<input checked="" type="checkbox"/>	Gate Array	<input type="checkbox"/>	General Purpose Logic
<input checked="" type="checkbox"/>	Standard Cell	<input type="checkbox"/>	Gate Array/Standard Cell
<input type="checkbox"/>	Field Programmable Logic	<input type="checkbox"/>	Field Programmable Logic
<input checked="" type="checkbox"/>	Other Special Purpose Logic	<input type="checkbox"/>	Other Special Purpose Logic
<input type="checkbox"/>		<input type="checkbox"/>	MPU/MCU/MPR
MOS MICROCOMPONENT		OTHER	
<input 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		

Sanyo's primary semiconductor products are discussed below.

ASICs

Sanyo continues to widen its portfolio of gate array and standard cell ASIC products. Its cell libraries include clocks, comparators, data converters, operational amplifiers, microcontroller and DSP cores, and memories. Sanyo also offers ASSPs, such as multimedia-related circuits, modem ICs, and communications chips.

Memories

Memory devices now in production include 16K to 1M standard SRAMs; 256K and 1M high-speed CMOS SRAMs; 256K pseudo-SRAMs; 1M to 16M flash memories; 1M and 4M mask ROMs; 256K to 4M EPROMs, and serial EEPROMs. The company is significantly expanding its flash memory output capacity, but currently most of the devices are supplied to Sanyo's partner Silicon Storage Technology.

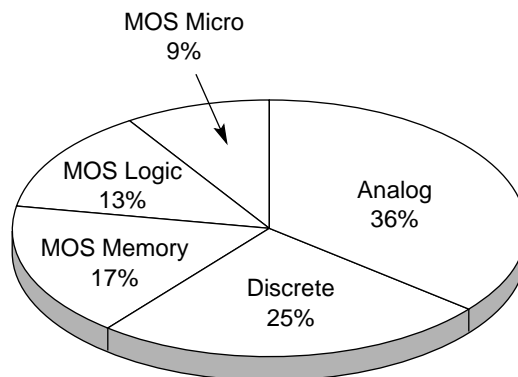
The company's current DRAM production is mostly 1M and 2M parts, targeted at makers of CD-ROM and hard disk drives. Although the company has decided against committing funds for the commercial production of next-generation DRAMs, it will keep pace in the development of 64M DRAMs.

Analog ICs

Sanyo is one of the largest analog IC manufacturers in Japan and the world. Its A/D and D/A converters support a wide range of applications, including audio and video. Its other analog IC products include amplifiers, comparators, and voltage regulators.

Microcontrollers

Since starting to fabricate microcontrollers in 1980, Sanyo has expanded its line-up of 4-bit, 8-bit, and 16-bit single-chip microcontrollers for use in a wide range of industrial and consumer equipment. In 1995, Sanyo introduced an 8-bit microcontroller with integrated flash memory.



**1995 Semiconductor Sales
by Device Type (est)**

Semiconductor Fabrication Facilities

Sanyo Electric Co., Ltd., Oura-gun Facility
 Oura-gun, Gunma Prefecture, Japan
 Cleanroom size: 123,797 square feet
 Capacity (wafers/week): 18,750
 Wafer sizes: 100mm, 125mm, 150mm
 Processes: Bipolar, CMOS
 Products: Analog and logic ICs, DRAMs, SRAMs, discretes
 Feature sizes: 0.8 μ m-2.0 μ m

Niigata Sanyo Electronic Co., Ltd.
 Niigata-shi, Niigata Prefecture, Japan
 Cleanroom size: 113,033 square feet
 Capacity (wafers/week): 28,750
 Wafer sizes: 125mm, 150mm
 Processes: CMOS, bipolar, BiCMOS
 Products: DRAMs, SRAMs, MCUs, DSPs, ASICs analog and logic ICs, flash memories
 Feature sizes: 0.6 μ m-2.0 μ m
 (Installing a 0.35 μ m production line for flash devices.)

Sanyo Electric Co., Ltd., Tottori Facility
 Tottori-shi, Tottori Prefecture, Japan
 Cleanroom size: 32,295 square feet
 Capacity (wafers/week): 5,000
 Wafer size: 3in
 Processes: GaAs, GaP
 Products: Discretes, optoelectronics
 Feature size: 5.0 μ m

Sanyo VLSI Engineering Co., Ltd.
 Anpachi-gun, Gifu Prefecture, Japan
 Capacity (wafers/week): 10,000
 Wafer size: 125mm
 Process: CMOS
 Products: CCDs, SRAMs, ASICs
 Feature sizes: 1.0 μ m-2.0 μ m

Key Agreements

- Sanyo formed an alliance in 1993 with U.S. ASIC design firm Aspec Technology with the goal of establishing a large-scale business supplying ASICs based on the U.S. firm's 0.8 μ m technology.
- Sanyo is working with Silicon Storage Technology Inc. of Sunnyvale, California, to develop flash memories. As part of the alliance, Sanyo is producing flash chips for SST.

SEIKO EPSON

Seiko Epson Corporation
Semiconductor Operation Division
 281 Fujimi-machi, Suwa-gun
 Nagano-ken 399-02, Japan
 Telephone: (81) (266) 61-1211
 Fax: (81) (266) 61-1270

U.S. Representative:
S-MOS Systems, Inc.
 2460 North First Street
 San Jose, California 95131-1002
 Telephone: (408) 922-0200
 Fax: (408) 922-0238

IC Manufacturer

Financial History (\$M)

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Semiconductor				
Sales	\$485	\$600	\$760	\$950

Company Overview and Strategy

Seiko Epson Corporation, a part of Japan's Seiko Group, commenced operations in 1942 as a watch manufacturer. Today, Seiko Epson has over \$4 billion in annual sales not only from watches but also from printers, personal computers, semiconductor devices, liquid crystal displays, manufacturing robots, and corrective lenses.

Seiko Epson's participation in semiconductor devices can be traced to the late 1960's with the development of small, energy-saving ICs for watches. The company commenced commercial production of semiconductors in 1980 at its Fujimi plant.

S-MOS Systems, Inc. in the U.S. and Epson Semiconductor GmbH in Munich, Germany, are subsidiaries of Seiko Epson's Semiconductor Operation Division.

Management

Hideaki Yasukawa	President
Nobuo Hashizume	General Manager, Semiconductor Operation Division

Products and Processes

Using mainly CMOS technology, Seiko Epson has a broad product portfolio including: ROMs, EEPROMs, SRAMs (densities up to 1M), 4-bit and 8-bit MCUs including a new 32-bit RISC MCU, power ICs, LCD driver ICs, and ASICs.

Seiko Epson is also heavily involved in the foundry industry. In 1994, Brooktree, Lattice, and Xilinx announced they would provide Seiko-Epson with funds to help in the construction of a new wafer fab the company is building at its Sakata, Japan, site. In return, Seiko-Epson will guarantee a certain amount of future wafer capacity to each of the companies.

Semiconductor Fabrication Facilities

Seiko Epson Corporation, Fujimi Plant
Suwa-gun, Nagano Prefecture, Japan
Cleanroom size: 83,000 square feet
Capacity(wafers/week): 16,250
Wafer sizes: 100mm, 125mm, 150mm
Process: CMOS
Products: SRAMs, EPROMs, EEPROMs,
ROMs, ASICs, foundry services
Feature sizes: 0.5 μ m-1.5 μ m

Tohoku Epson Corporation, Sakata Plant
Sakata-shi, Yamagata Prefecture, Japan
Cleanroom size: 100,000 square feet (Class 1)
Capacity (wafers/week): 5,000
Wafer size: 150mm
Processes: CMOS, BiCMOS
Products: ASICs, SRAMs, logic ICs, foundry services
Feature sizes: 0.5 μ m-0.8 μ m

Plans for 1996 include the construction of additional cleanroom space at the Sakata plant, raising its capacity up to 7,500 wafers per week. The new line will be used for the fabrication of ASICs and high-speed SRAMs, with 0.35 μ m to 0.5 μ m geometries.

Key Agreements

- Seiko Epson and Chip Express signed a foundry and technology exchange agreement in early 1996. Under the agreement, Chip Express will transfer its laser programming technology to Seiko. Seiko will use the technology for high volume gate array manufacturing for Chip Express as well as for prototyping its own ASIC products.
- Seiko Epson established a pact with SGS-Thomson that called for the cross licensing of each other's patents.

SEIKO INSTRUMENTS

Seiko Instruments Inc.
1-8, Nakase 1-chome
Mihama-ku, Chiba-shi
Chiba 261, Japan
Telephone: (81) (43) 211-1213
Fax: (81) (43) 211-8035

U.S. Representative:
Seiko Instruments USA Inc.
Electronic Components Division
2990 West Lomita Boulevard
Torrance, California 90505
Telephone: (310) 517-7771
Fax: (310) 517-7792

IC Manufacturer

Company Overview and Strategy

Seiko Instruments manufactures a wide variety of products, including watches and watch components, liquid crystal displays (LCDs), CAD/CAE/CAM systems, analytical and measuring instruments, intelligent robots, and integrated circuits. Established in 1937, Seiko Instruments is part of the Seiko Group, which also includes Seiko Epson Corporation and Nippon Precision Circuits Ltd.

Seiko Instruments' semiconductor products include a variety of ASSPs based on its technological and developmental capabilities cultivated with watch ICs, which require precision performance, accuracy, and low power consumption. The company's low-power CMOS ICs have applications in office and factory automation equipment, communications equipment, video and audio systems, and portable products.

Management

Seiko Instruments USA Inc.	
Akira Shiraishi	Chief Executive Officer
Greg Franklin	Vice President, Administration
Laura Martinez	Controller

Products and Processes

Seiko Instruments' manufactures and markets a variety of low-power CMOS integrated circuits.

Power Semiconductors

- Voltage detectors
- Voltage regulators
- Battery backup ICs
- Switching/inverting regulators
- DC-DC converters
- Power management ICs

Telecommunications Circuits

- Paging decoders
- Tone generators
- Tone squelch ICs

Microcomputers

- 4-bit microcontrollers
- 8-bit microcontrollers

Drivers

- LCD drivers
- Thermal print-head drivers

Timers

- Serial output timers
- Real time clocks
- CR timers

Memory Products

- Nonvolatile RAMs (NVRAMs)—64bit to 1K densities
- Serial EEPROMs—128bit to 4K densities
- Parallel EEPROMs—16K and 64K densities
- Fuse and mask ROMs—Up to 4M density
- SRAMs

Seiko Instruments also produces temperature sensors and lithium-ion battery protection ICs.

Semiconductor Fabrication Facilities

Seiko Instruments Inc.

Matsudo-shi, Chiba Prefecture

Capacity (wafers/week): 3,200

Wafer sizes: 100mm, 150mm

Process: CMOS

Feature sizes: 1.25 μ m-2.0 μ m

SHARP

Sharp Corporation
Integrated Circuits Group
 1 Asahi, Daimon-cho
 Fukuyama, Hiroshima 721, Japan
 Telephone: (81) (849) 43-3131
 Web Site: www.sharp.co.jp

U.S. Representative:
Sharp Electronics Corporation
Microelectronics Group
 5700 Northwest Pacific Rim Boulevard
 Camas, Washington 98607
 Telephone: (206) 834-2500
 Fax: (206) 834-8903
 Web Site: www.sharpmeg.com

IC Manufacturer

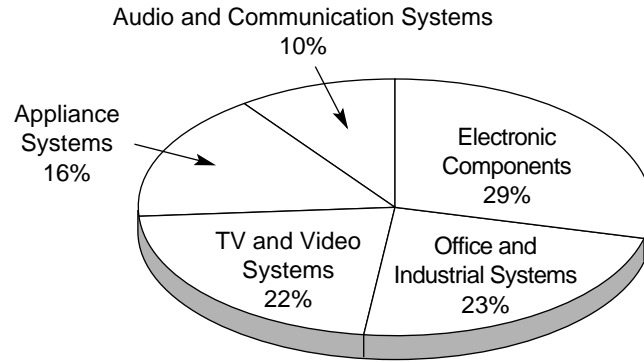
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥1,533	¥1,555	¥1,508	¥1,518	¥1,618
Net Income	¥47	¥39	¥30	¥32	¥45
Semiconductor (\$M)*					
Sales	\$1,560	\$1,465	\$1,890	\$2,095	\$2,625
IC Sales	\$1,145	\$1,105	\$1,430	\$1,545	\$1,950
Discrete Sales	\$415	\$360	\$460	\$550	\$675
Capital Expenditures	\$235	\$230	\$270	\$340	\$385

*Calendar Year

Company Overview and Strategy

Sharp Corporation was established as a metal works operation in Tokyo in 1912. The company's name was derived from the Ever-Sharp mechanical pencil, invented by the founder in 1915. Today, Sharp is the world's largest producer of liquid crystal displays (LCDs), and uses advanced technology in many of its more than 45 product lines. The product lines include audio and video systems, electronic organizers, notebook computers and peripherals, copiers, calculators, integrated circuits, and optoelectronic devices.



1995 Corporate Sales by Business Group

Sharp began the mass production of LSIs in 1970. System applications for its semiconductor devices include PCs, office automation systems, telecommunications equipment, test and measurement products, industrial control systems, audio/visual and multimedia equipment, and consumer electronics products.

Management

Sharp Corporation

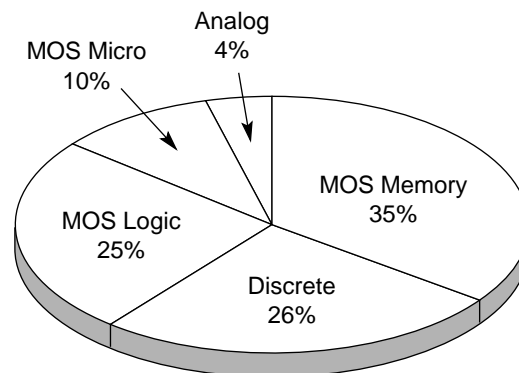
- | | |
|---------------|---|
| Haruo Tsuji | President |
| Hiroshi Inoue | Executive Director and General Manager, Integrated Circuits Group |

Sharp Microelectronics Technology, Inc. (U.S.)

- | | |
|-----------------|----------------|
| John Shroyer | President |
| Frank Schneider | Vice President |

Products and Processes

Sharp's semiconductor products include: SRAMs; flash memories; high-performance microprocessors for high-volume data handling and image processing fields such as HDTV, digital camcorders, and multimedia and virtual reality systems; LCD driver ICs; and discrete devices. It is a leading supplier of optoelectronics, mask ROMs, and RF tuner components. Also, Sharp is the premiere supplier of three technologies that represent 95 percent of the flat panels displays now in use: active matrix color LCDs, passive matrix color LCDs, and electroluminescent (EL) displays.



1995 Semiconductor Sales by Device Type (est)

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 type="checkbox"/>	Other (Includes Telecom)

MOS LOGIC	
<input 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	
<input checked="" type="checkbox"/>	MPU
<input checked="" type="checkbox"/>	MCU
<input checked="" type="checkbox"/>	MPR
<input type="checkbox"/>	DSP

OTHER	
<input type="checkbox"/>	Full Custom IC
<input checked="" type="checkbox"/>	Discrete
<input checked="" type="checkbox"/>	Optoelectronic

Memories

- Mask ROMs—NMOS and CMOS parts with 256K to 64M capacities
- SRAMs—CMOS low-power and high-speed versions with 16K to 1M capacities
- Pseudo SRAMs—256K to 1M capacities
- Flash memories—4M, 8M, and 16M densities
- DRAMs—256K to 16M densities
- FIFOs—High-speed
- SF-ASIC RAM—Memory device containing a user-defined mix of RAM and ROM
- IC memory cards

Microcomponents

- 4-bit, 8-bit, and 16-bit single-chip microcontrollers (many with LCD interface)
- 32-bit RISC microprocessors

Single-Chip Systems

- Embedded arrays with Z80 and V Series microprocessor cores
- Cell-based ICs with Z80, V Series, and RISC ARM7D microprocessor cores

ASICs

- Gate arrays—Broad range, including sea-of-gates types and low-voltage CMOS versions, with 300 to 200,000 available gates
- Cell-based ICs—CMOS and BiCMOS versions, as well as mixed-signal types

Special Function ICs

- CCD area sensors and CCD peripheral ICs
- LCD drivers
- ICs for audio and visual equipment, IR remote controls, laser diode drivers, and motor drivers
- Voice synthesis and recording/playback ICs
- ICs for telecommunications, facsimiles, and modems
- ICs for calculators and data banks

Industry Standard Bipolar ICs

- Current drivers
- Operational amplifiers and comparators
- Regulators and V/F converters
- LED/LCD level meter drivers

In 1993, Sharp announced it would withdraw from DRAM development because of a growing divergence between production technology for DRAMs and its other products. Sharp never mass produced 4M DRAMs or a 16M DRAM prototype that it developed.

To establish its presence in the flash memory market, Sharp entered a joint R&D, production, and marketing agreement with Intel. Sharp is currently shipping Intel's 16M and smaller flash devices on an OEM basis, and the two firms developed a 16M part that Sharp markets under its own brand name.

In 1995, Sharp was able to expand into the lucrative U.S. market after its initial licensing agreement with Intel, which restricted it to the flash market in Japan, expired. Sharp sells both its Intel-compatible dual-voltage NOR flash memory and its own single-voltage flash.

Semiconductor Fabrication Facilities

In response to a growing need for additional facilities, Sharp announced that it would build several new facilities. Among them is a fabrication line for expanded flash memory and mask ROM production at its Fukuyama No. 3 plant in Hiroshima. Currently, the line is used as a foundry for some of Intel's high-density flash products, as well as Sharp's own Intel-compatible flash products. The new line, which will operate using 0.35 μ m and 0.4 μ m technology and 200mm wafers, is slated to be fully operational by the end of 1996.

Also at the Fukuyama site, Sharp announced that it would begin constructing a fourth facility for future 0.25 μ m flash production. The company has outlaid \$1 billion for the fab, which will initially produce 2,500 200mm wafers per week, and later ramp to 5,000 wafers per week. Sharp hopes to begin flash production using this line in early 1998.

Sharp Corporation
Fukuyama Plant, Hiroshima, Japan
Capacity (wafers/week): 20,750
Wafer sizes: 125mm, 150mm, 200mm
Process: CMOS
Products: Memories, MPUs, MCUs, ASICs
Feature sizes: 0.6 μ m, 0.8 μ m, 1.0 μ m

Sharp Corporation
Yamato-Koriyama, Nara, Japan
Capacity (wafers/week): 5,000
Wafer size: 3in
Process: GaAs
Products: Discretes

Sharp Microelectronics Technology, Inc.
5700 NW Pacific Rim Boulevard
Camas, Washington 98607
(Outfitted for IC design, assembly, and test, but
may serve as a possible future fab site. Also serves
as a LCD manufacturing site)

Sharp Corporation
Tenri, Nara, Japan
Capacity (wafers/week): 13,000
Wafer sizes: 125mm, 150mm
Processes: MOS, CMOS, bipolar
Products: ASICs, logic, linear, and memory ICs
Feature sizes: 0.8 μ m-3.0 μ m

Sharp Corporation
Kita-Katsuragi, Nara, Japan
Capacity (wafers/week): 6,250
Wafer size: 100mm
Products: Discretes

Key Agreements

- Signed a pact with Quality Semiconductor to second-source and jointly develop application-specific FIFOs.
- Sharp has a patent cross-licensing agreement with Standard Microsystems Corporation.
- Intel signed an agreement with Sharp under which the companies will jointly develop future generations of flash memory.
- In 1994, Sharp licensed the technology to produce the ARM 32-bit RISC microprocessor.

SONY

Sony Corporation
Semiconductor Company
 4-14-1, Asahi-cho
 Atsugi-shi, Kanagawa 243, Japan
 Telephone: (81) (462) 30-5111
 Fax: (81) (462) 30-5160
 Web Site: www.sony.co.jp

U.S. Representative:
Sony Semiconductor Co. of America
 3300 Zanker Road
 San Jose, California 95134-1940
 Telephone: (408) 955-6572
 Fax: (408) 955-5116

IC Manufacturer

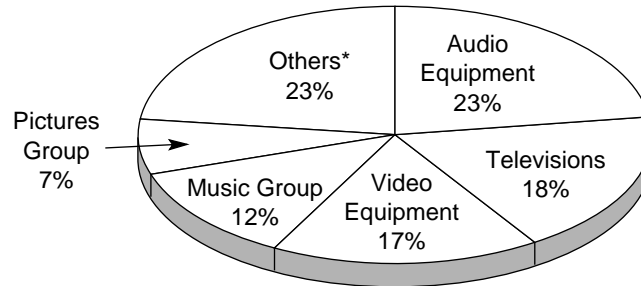
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥3,696	¥3,929	¥3,993	¥3,734	¥3,983
Net Income	¥117	¥120	¥36	¥15	¥(293)
Semiconductor (\$M)*					
Sales	\$1,305	\$1,460	\$1,750	\$1,850	\$2,250
IC Sales	\$920	\$1,100	\$1,370	\$1,475	\$1,875
Discrete Sales	\$385	\$360	\$380	\$375	\$375
Capital Expenditures	\$510	\$385	\$365	\$390	\$475

*Calendar Year

Company Overview and Strategy

Sony Corporation is one of the world's leading manufacturers of audio and video equipment, televisions, displays, semiconductors, computers, and information-related products, such as CD-ROMs and micro floppy disk systems. Sony is comprised of the following eight independent "companies": the Consumer A&V Products Company, the Components Company, the Recording Media & Energy Company, the Broadcast Products Company, the Business & Industrial Systems Company, the InfoCom Products Company, and the Semiconductor Company.



*Includes semiconductors, electronic components, and info-related equipment.

1995 Corporate Sales by Product Group

Sony produced its first transistors, back in 1954. Its first integrated circuits were produced in the mid-1960's. Sony has since grown into a leading supplier of semiconductors, including SRAMs, charge-coupled devices (CCDs), data converters, television and audio ICs, digital filters, communications ICs, and multimedia devices. The company's discrete components include laser diodes, variable capacitance diodes, and silicon and GaAs transistors.

The focus of Sony Semiconductor is currently on computer memory devices, bipolar and MOS ICs for home-use audiovisual (AV) equipment, and CCDs for camcorders and broadcast- and industrial-use video cameras. More than half (55 percent) of Sony's semiconductor sales in 1995 were to outside customers.

Management

Sony Semiconductor Company

Seiichi Watanabe President, Sony Semiconductor Company, and Director, Sony Corporation

Sony Semiconductor Co. of America

Travis White President, Sony Semiconductor Co. of America,
and Senior Vice President, Sony Semiconductor Company

Louis Chetaud Vice President, Central Operations

Todd Oseth Vice President, Business Development

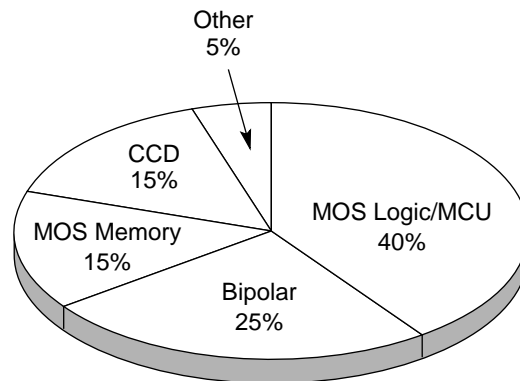
Osamu Yokoyama Vice President, Finance

Products and Processes

Sony manufactures SRAMs (64K to 4M), cache SRAMs, 1M synchronous burst SRAMs, charged-coupled devices (CCDs), LCD drivers, bipolar and CMOS data converters, MCUs (4-bit, 8-bit, and 16-bit), and ASICs and ASSPs for applications such as image sensing, multimedia, audio-video, and digital cellular communications.

Sony, which has been focusing on SRAM production to advance its processing technology, predicts that demand for SRAMs will peak at the 16M level, and therefore plans to use non-memory products such as ASICs to drive technology development. The company is also placing greater emphasis on application-specific memory devices such as high-speed cache memories.

In addition, the company is actively pursuing the bipolar IC market with its advanced A/D and D/A converters and communications ICs.



1995 Semiconductor Sales by Device Type

<p>MOS MEMORY</p> <ul style="list-style-type: none"> <input type="checkbox"/> DRAM <input checked="" type="checkbox"/> SRAM <input type="checkbox"/> Flash Memory <input type="checkbox"/> EPROM <input type="checkbox"/> ROM <input 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 checked="" type="checkbox"/> Interface <input checked="" type="checkbox"/> Consumer/Automotive <input type="checkbox"/> Voltage Regulator/Reference <input checked="" type="checkbox"/> Data Conversion <input type="checkbox"/> Comparator <input checked="" type="checkbox"/> Other (Includes Telecom)
<p>MOS LOGIC</p> <ul style="list-style-type: none"> <input type="checkbox"/> General Purpose Logic <input checked="" type="checkbox"/> Gate Array <input type="checkbox"/> Standard Cell <input type="checkbox"/> Field Programmable Logic <input checked="" type="checkbox"/> Other Special Purpose Logic 	<p>DIGITAL BIPOLAR</p> <ul style="list-style-type: none"> <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
<p>MOS MICROCOMPONENT</p> <ul style="list-style-type: none"> <input 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 checked="" type="checkbox"/> Optoelectronic

Semiconductor Fabrication Facilities

Sony announced in late 1995 that it would install its first 200mm wafer line at its Kagoshima fab site. The new line will be ready for operations late in 1996 and will produce 16-bit MCUs, digital AV equipment logic ICs, and CCDs using 0.35 μ m technology. The line will have a production capacity of 2,500 wafers per week.

Sony Nagasaki Corporation
Isahaya-shi, Nagasaki Prefecture, Japan
Cleanroom size: 25,000 square feet
Capacity (wafers/week): 20,000
Wafer size: 150mm
Process: CMOS
Products: ASICs, SRAMs, R&D
Feature sizes: 0.35 μ m-1.0 μ m

Sony Kokubu Corporation
Kokubu-shi, Kagoshima Prefecture, Japan
Capacity (wafers/week): 27,500
Wafer sizes: 100mm, 125mm, 150mm
Processes: CMOS, BiCMOS, bipolar, CCD
Products: ASICs, MPUs, CCDs, logic and linear ICs, discretes, R&D
Feature sizes: 0.5 μ m-2.0 μ m

Sony Corporation, Atsugi Technology Center
Atsugi-shi, Kanagawa Prefecture, Japan
Wafer size: 3in
Process: GaAs
Products: Discretes, MMICs

Sony Corporation, Atsugi Technology Center
Atsugi-shi, Kanagawa Prefecture, Japan
Wafer size: 150mm
Processes: CMOS, bipolar
Products: R&D

Sony Semiconductor Co. of America
San Antonio Operations
8611 Military Drive West
San Antonio, Texas 78245
Telephone: (512) 681-9000
Cleanroom size: 20,000 square feet
Capacity (wafers/week): 7,000
Wafer sizes: 125mm, 150mm
Processes: CMOS, bipolar
Products: SRAMs, logic ICs, R&D
Feature sizes: 0.35 μ m-1.5 μ m

Sony's semiconductors are assembled at several factories in Japan and at a plant in Thailand.

Key Agreements

- In December 1995 it was announced that Sony and Oki would begin joint development of 0.25 μ m CMOS manufacturing technology that can be used for both ASICs and 256M DRAMs. Their goal is to finish development by 1998.
- Sony is producing bipolar ICs for AMD at its fab in San Antonio, which it bought from AMD in 1990.
- Through an architecture license from Mips Technology, Sony is designing an R3000 processor core to be embedded in its own multimedia and interactive consumer electronics systems.

- Sony licensed its 16-bit microcontroller core to TI Japan. In return, TI is expected to provide Sony with ASICs based on the core for use in Sony's video products. The companies will also work to adapt the core for office-automation and telecommunications equipment.

TOHOKU SEMICONDUCTOR

Tohoku Semiconductor Corporation
3-3-1 Akedori, Izumi-ku, Sendai
Miyagi Prefecture, 981-31, Japan
Telephone: (81) (22) 378-8000
Fax: (81) (22) 378-8588

IC Manufacturer

Employees 1,500

Company Overview and Strategy

Tohoku Semiconductor Corp. (TSC) was set up in 1987 as an equally-owned joint venture between Motorola and Toshiba to manufacture memory and microcomponent devices for the two partners. It became operational in April 1988.

Management

Hidenori Kajiyama President
 Takashi Kitagawa Vice President

Products and Processes

Memories	Microprocessors	Microcontrollers	Peripherals
1M DRAMs	8-bit MPUs	8-bit MCUs	(FDD) MPRs
4M DRAMs	16-bit MPUs	16-bit MCUs	(HDD) MPRs
16M DRAMs	32-bit MPUs		
256K SRAMs			

Semiconductor Fabrication Facilities

Tohoku Semiconductor Corp.
 Sendai-shi, Miyagi Prefecture, Japan

Fab I

Capacity (wafers/week): 8,750
 Wafer size: 150mm (two lines)
 Processes: CMOS, BiCMOS
 Products: DRAMs, SRAMs, MPUs, MCUs, MPRs
 Feature sizes: 0.5 μ m-0.8 μ m

Fab II

Capacity (wafers/week): 5,000
 Wafer size: 200mm
 Process: CMOS
 Products: 16M DRAMs
 Feature size: 0.5 μ m

TOSHIBA

Toshiba Corporation
1-1, Shibaura 1-chome
Minato-ku, Tokyo 105-01
Japan
Telephone: (81) (3) 3457-4511
Fax: (81) (3) 3456-1631
Web Site: www.toshiba.co.jp

U.S. Representative:
Toshiba America Electronic Components, Inc.
9775 Toledo Way
Irvine, California 92718
Telephone: (714) 455-2000
Fax: (714) 859-3963
Web Site: www.toshiba.com/taec

IC Manufacturer

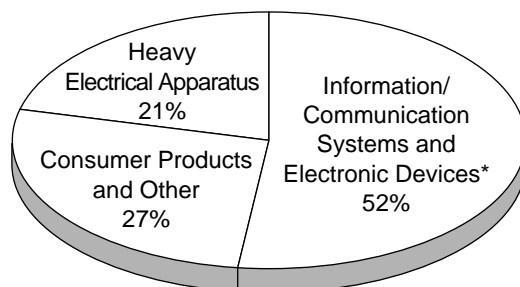
Financial History, Fiscal Year Ends March 31

	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>
Corporate (¥B)					
Sales	¥4,695	¥4,722	¥4,628	¥4,631	¥4,791
Net Income	¥121	¥39	¥21	¥12	¥45
Semiconductor (\$M)*					
Sales	\$5,160	\$5,365	\$6,260	\$8,085	\$10,680
IC Sales	\$4,010	\$4,170	\$4,860	\$6,415	\$8,615
Discrete Sales	\$1,150	\$1,195	\$1,400	\$1,670	\$2,065
Capital Expenditures	\$785	\$680	\$725	\$930	\$1,545

*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 Information and Communications Systems, Information Media and Consumer Products, Power Systems and Industrial Equipment, and Electronic Components and Materials.



*Includes semiconductor devices

1995 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 has been a leader in the strategy of forming complementary strategic alliances with international companies. Toshiba believes such collaborations encourage technological innovation through exchanges of world-class capabilities, share enormous investments, and dilute the risk inherent in developing advanced technologies and products (see Key Agreements).

Management

Toshiba Corporation

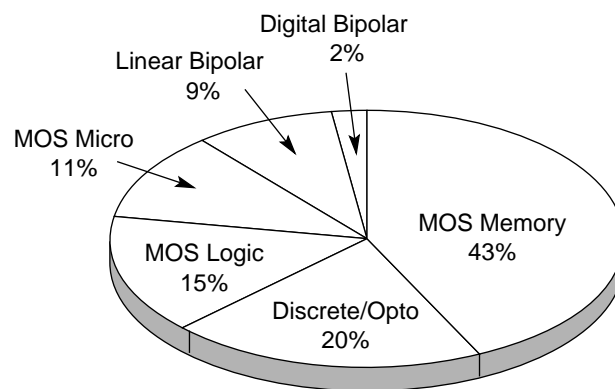
Fumio Sato	President and Chief Executive Officer
Atsumi Uchiyama	Senior Executive Vice President and Director
Hideharu Egawa	Senior Executive Vice President and Director
Masanobu Ohyama	Senior Vice President and Group Executive, Semiconductor Group
Susumu Kohyama	General Manager, Logic IC Operations, Semiconductor Group
Kanto Sato	General Manager, Memory Operations, Semiconductor Group

Toshiba America Electronic Components, Inc.

Takeshi Nakagawa	Chief Executive Officer
Bob Brown	President and Chief Operating Officer
Stephen McMinn	Vice President, Semiconductor Sales

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.



**1995 Semiconductor Sales
by Device Type**

MOS MEMORY		ANALOG	
<input checked="" type="checkbox"/>	DRAM	<input checked="" type="checkbox"/>	Amplifier
<input checked="" type="checkbox"/>	SRAM	<input checked="" type="checkbox"/>	Interface
<input checked="" type="checkbox"/>	Flash Memory	<input type="checkbox"/>	Consumer/Automotive
<input checked="" type="checkbox"/>	EPROM	<input type="checkbox"/>	Voltage Regulator/Reference
<input checked="" type="checkbox"/>	ROM	<input checked="" type="checkbox"/>	Data Conversion
<input type="checkbox"/>	EEPROM	<input checked="" type="checkbox"/>	Comparator
<input 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 type="checkbox"/>	Bipolar Memory
<input checked="" type="checkbox"/>	Gate Array	<input 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 type="checkbox"/>	Field Programmable Logic
<input checked="" type="checkbox"/>	Other Special Purpose Logic	<input type="checkbox"/>	Other Special Purpose Logic
<input type="checkbox"/>		<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 checked="" type="checkbox"/>	Optoelectronic
<input checked="" type="checkbox"/>	DSP		

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 70 to 80 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 and 16M densities.
- Synchronous DRAMs (SDRAMs) in 16M density.
- Video RAMs (VRAMs) in 2M density.
- Rambus DRAMs (RDRAMs) in 8M, 16M, and 18M densities.
- 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 15ns.
- Synchronous pipeline burst SRAMs in 1M density with speeds as fast as 15ns.
- Pseudo-static RAMs (PSRAMs) in 1M and 4M densities.
- Flash memories in 1M, 4M, 16M, and 32M 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 Series) utilize triple-layer metal 0.3 μ m CMOS technology to provide up to 1.3 million usable gates. The company's ASIC core library includes CISC and RISC microprocessor cores, high density DRAM and SRAM, MPEG decoder circuits, communications devices, and advanced I/O interfaces.

Toshiba offers a wide selection 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.

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.

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. Its discrete products embrace high power, optoelectronic, small-signal, and microwave devices.

Semiconductor Fabrication Facilities

Toshiba announced in late 1995 that it will invest \$1.3 billion to construct a 0.25 μ m 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.

In addition, Toshiba is installing a 200mm wafer line at its new R&D facility in Yokohama for pilot and volume production of 256M and 1G DRAMs. At a cost of about \$500 million, the new 0.25 μ m-0.15 μ m line is expected to be ready for operations in 1997.

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, CCDs, MPUs,
 MCUs, custom ICs
 Feature sizes: 0.35 μ m-1.5 μ m

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: 0.5 μ m-2.0 μ m

Toshiba Corporation
 Tamagawa Works (Microelectronics Center)
 Kawasaki-shi, Kanagawa Prefecture, Japan
 Capacity (wafers/week): 6,250
 Wafer sizes: 125mm, 150mm, 200mm
 Processes: CMOS, bipolar
 Products: DRAMs, logic and analog ICs, discretes
 Feature sizes: 0.8 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): 1,800
 Wafer size: 200mm (300mm by 1998)
 Process: CMOS
 Products: R&D
 (Opened in March 1996)

Toshiba Corporation, Kitakyushu Works
 Kitakyushu-shi, Fukuoka Prefecture, Japan
 Capacity (wafers/week): 18,000
 Wafer sizes: 3in, 125mm, 150mm
 Processes: Bipolar, BiCMOS, GaAs
 Products: Analog and logic ICs, discretes
 Feature sizes: 2.0 μ m, 3.0 μ m

Toshiba Corporation, Yokkaichi Works
 Yokkaichi-shi, Mie Prefecture, Japan
 Capacity (wafers/week): 8,750
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature sizes: 0.5 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

Toshiba America Electronic Components, Inc.
 Microelectronics Center
 1220 Midas Way
 Sunnyvale, California 94086
 Telephone: (408) 739-0560
 Fax: (408) 746-0577
 Products: DRAM and bipolar IC assembly and
 ASIC prototype production

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. An individual
 profile of Tohoku is provided in this publication.)

Dominion Semiconductor LLC
 Manassas, Virginia
 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

- Winbond and Toshiba entered into an alliance in late 1995 for the manufacture and cooperative development of leading-edge semiconductor memory products. The agreement calls for Toshiba to provide Winbond with production technologies for 16M DRAMs and next generation 1M high-speed SRAMs. In addition, Toshiba will use Winbond as a foundry for a portion of its 16M and 64M DRAM capacity. Production will take place in Winbond's new 200mm, 0.35 μ m fab, which is under construction and will begin operations in 2H96. Winbond will market the DRAMs under its own logo, beginning in 1997 or 1998.
- In August 1995, IBM and Toshiba announced they would build 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. First silicon is expected from the fab in late 1997 with production beginning in 1998.
- Toshiba signed an agreement in August 1995 with Ramtron to jointly develop and manufacture ferroelectric RAMs (FRAMs) in densities of 256K and above. Toshiba will have the right to make and sell the devices under its own brand name.
- Toshiba licensed some of its older 1M DRAM technology to China Huajing Electronics Group Corp. Toshiba and China Huajing also established a joint venture in China to develop and market ICs.
- Toshiba provided Chartered Semiconductor Manufacturing with 0.5 μ m CMOS logic IC production technology and made an equity investment in the Singapore-based firm.
- 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 to those of Toshiba. In April 1995, the two companies expanded the alliance to the 64M level.
- Toshiba recruited National Semiconductor as a second source for its 16M and 32M NAND-type flash memories. National also received a license for the production of Toshiba's NOR-type 1M and 4M devices. As part of a separate alliance, the companies codeveloped a family of very high-speed CMOS logic devices.

- Toshiba is jointly developing with IBM, Siemens, and Motorola, 0.25 μ m technology for shrink-version 64M DRAMs and 256M DRAMs. In addition, Toshiba and Siemens have been collaborating in various other semiconductor areas, including standard cells and gate arrays.
- Toshiba acquired a small equity stake in Synergy Semiconductors as part of an alliance for the development of ECL arrays. Toshiba will also act as a foundry for the bipolar and BiCMOS ASICs to be designed.

YAMAHA

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IC Manufacturer

Financial History (\$M)

	<u>1993</u>	<u>1994</u>	<u>1995</u>
Semiconductor			
Sales	\$245	\$345	\$515

Company Overview and Strategy

Yamaha Corporation produced its first integrated circuits in 1971 for use in its musical instruments and audio equipment. In the intervening years and as technology developed, Yamaha expanded this to include LSI circuits for other consumer electronics applications. In 1983, Yamaha further expanded its IC production to include devices for CD players, computers, and color graphics products.

Today, using its own sound-oriented semiconductor technology, Yamaha provides sophisticated integrated circuits for CD players, digital audio, graphics processing, communications, and custom applications. Sales of sound and image processing ASICs and ASSPs accounted for about 60 percent of Yamaha's total IC sales in 1995.

Products and Processes

ICs for Digital Audio

Yamaha offers a complete line of ICs for CD players and a variety of digital audio ICs such as digital filters, digital audio interface receivers, and D/A converters. Out of the company's search for a signal processor for CD players emerged a single-chip digital video IC.

ICs for Audio Visual Systems

Yamaha has developed a wide range of programmable digital surround processors to improve the sound of audio visual systems. Yamaha also offers ICs for new media such as CDV, CDI, CD-ROM, and CDG.

ICs for Graphics Processing

Graphics processing technologies developed for MSX, IBM-compatible PCs, and graphics terminals have enabled Yamaha to offer common use video display processors for various applications. Yamaha plans to introduce new video display processors for specialized applications such as game machines and navigation systems.

ICs for Communication

The combination of Yamaha's digital signal processing technology and experience in MIDI (musical instrument digital interface) circuits has created ICs for communication applications. New fax/data/voice modem-combined chipsets offer a complete solution for modems.

ICs for Multimedia PC Sound

All sound parts for multimedia PCs are available from Yamaha including sound synthesizers, ADPCM/PCM voice record/play-back devices, MIDI chips, CD-ROM controllers, and digital audio interface receiver/transmitters.

Semiconductor Fabrication Facilities

Yamaha Kagoshima Semiconductor Inc.
 Aira-gun, Kagoshima Prefecture, Japan
 Capacity (wafers/week): 4,000
 Wafer sizes: 100mm, 150mm
 Processes: CMOS, MOS
 Products: ASICs, ASSPs, ROMs, linear ICs, MPRs
 Feature sizes: 0.5 μ m-1.2 μ m

Yamaha Corporation
 Iwata-gun, Shizuoka Prefecture, Japan
 Capacity (wafers/week): 1,500
 Wafer size: 150mm
 Process: CMOS
 Products: ROMs, ASICs, ASSPs
 Feature size: 0.8 μ m

In 1996, Yamaha released plans to build a 200mm 0.35 μ m plant in Hamamatsu, Japan, for the production of ASSPs for PCs, game machines, cellular phones, and other communications equipment. Production at the fab will begin in April 1998 with a capacity of 2,500 wafers per week.