

ACAPELLA LTD.

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Fabless IC Supplier

Company Overview and Strategy

Founded in 1990, Acapella has three primary activities. Acapella is a designer and fabless manufacturer of ICs for fiber optic communication applications. Additionally, Acapella provides IC design consultancy services, (resulting from 1992 acquisition of Analogue Design Consultants - ADC), and serves as Tanner Research, Inc.'s (Pasadena, CA) European distributor for IC CAD tools.

Acapella's strategy is to target the fiber optic communications market because it fits their position as a small start-up company with limited resources. As the company grows in size and reputation, they plan to move more toward mainstream optical communications products.

Acapella markets its products worldwide and has a single regional distributor in Denmark, Germany, Israel, Italy, Japan, Portugal, Spain and Taiwan, as well as two distributors in both Switzerland and the U.S.

Management

Phil Tolcher Sales Manager

Products and Processes

Acapella's IC division focuses on the design and manufacture of ICs for Fiber Optic Communications. Their particular expertise is the merging of high performance analogue circuitry with intelligent digital interface and control technologies. Acapella claims this has made them the leading supplier of Ping Pong single fibre communications ICs. Acapella positions their Ping Pong ICs as providing full duplex links without the need for expensive WDM optics. Acapella also offers a single LED IC for both transmission and reception (low cost, normal link budgets), and single wavelength Laser Duplex Devices (for higher link budgets).

Following is a list of products available to date.

- ACS100: Asynchronous data transceiver for single fibre apps (Acapella's first product, but still in volume production due to its success and continued improvement).
- ACS101: Synchronous or asynchronous single fiber modem
- ACS102: Asynchronous single or dual fibre modem
- ACS103: Three Channel, synchronous or asynchronous single fibre modem
- ACS104: Data line-powered, asynchronous dual fibre modem
- ACS400: T-1/E-1 protocol single/dual fibre modem
- ACS401: 128kbps optical modem for long-haul transmission
- ACS405: 4 * T-1/E-1 or T-2/E-2 protocol single/dual fibre modem

The IC division also develops ASSPs for communications and other applications.

Acapella's Consultancy division specializes in custom mixed-signal CMOS IC design and large-scale digital system ASICs. Services generally fall into two main categories, Turnkey IC Design or Subcontract IC Design, with capabilities to include digital and analogue VHDL design and silicon foundry interfacing.

ALCATEL MICROELECTRONICS (AM)

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IC Manufacturer
 Founded: 1983

Regional Offices/Representative Locations

North America: Alcatel Microelectronics • Richardson, Texas
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Northern Europe: Alcatel Microelectronics • Bracknell – Berkshire, UK
 Telephone: (1344) 30 03 11 • Fax: (1344) 30 07 97

Southern Europe: Alcatel Microelectronics • Velizy Cedez, France
 Telephone: (01) 46-32-53-86 • Fax: (01) 46-32-55-68

Italy: Alcatel Microelectronics • Milan, Italy
 Telephone: (039) 686-4520 • Fax: (039) 686-6899

Benelux & Nordic Countries: Alcatel Microelectronics • Brussels, Belgium
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Financial History (\$M)

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	113	148	163	170	205	221
Capital Expenditures	65	17	24	87	37	40
Employees	500	540	560	635	723	779

Company Overview and Strategy

Alcatel is a leading designer, developer, and marketer of digital and mixed-signal ASICs for telecommunications, automotive, and industrial systems. The firm is Europe's leading digital and mixed-signal standard cell ASIC producer. Approximately 65 percent of its ASICs are for the parent company's use. The company is aiming to increase its merchant market sales from 35 percent to 50 percent, by expanding in Europe, the U.S., and Asia. In addition, Alcatel has been aggressively marketing its application-specific standard products (ASSPs), along with its intellectual property (IP) library. This library consists of 150 hard and soft cores developed internally and by a division of Mentor called Inventra.

Formerly Alcatel Mietec, Alcatel Microelectronics was formed in February 1998, to target the growing market for single-chip devices used to access data from wireless and wireline networks. Alcatel Mietec was formed as a joint venture between Bell Telephone Manufacturing Company (BTMC) of Belgium (then owned by ITT) and Gewestelijke Investerings Maatschappij voor Vlaanderen (GIMV), the Flanders regional investment company. The company's first wafer fab was at full production by 1985. In 1987, ITT's telecom activities were merged into Alcatel; thus BTMC became part of the Alcatel group and Alcatel became part owner of Mietec. In 1990, Alcatel purchased all of the shares in Mietec and renamed the operation Alcatel Mietec. In 1998, the company was renamed to Alcatel Microelectronics in order to show the expanded services of the company.

Management

Walter Mattheus	Managing Director
Leon Cloetens	Director, Product Development
Pieter Doms	Director, Operations
Jozef D'Haene	Director, Finance and Administration
Vincent Roland	Director, Sales and Marketing
Eric Schutz	Director, Quality, Research, and Technology
Jan Van Acoleyen	Director, Human Resources

Products and Processes

Alcatel Microelectronics focuses on the design and production of cell-based ASICs and ASSPs for telecommunications, consumer electronics, automotive, motor/motion control, and portable electronics applications. Its products are manufactured using primarily advanced submicron CMOS and high-voltage BiCMOS processes. Most processes feature accurate poly-to-poly capacitors and high ohmic poly resistors dedicated to the design of advanced analog front-ends. The company claims to be Europe's first to propose 0.5 μ m analog processing for manufacturing ASICs.

In 1996, Alcatel Microelectronics decided to focus its ASSP development on telecommunications products and more specifically on digital modems like XDSL. The company, who has been an early promoter of ISDN, revamped its ISDN offerings by using embedded processors (e.g., 16-/32-bit ARM7) and advanced 0.5 μ m CMOS analog technology to significantly reduce the cost of ISDN solutions. In addition, the company launched its first ADSL chipset. Also in 1996, Alcatel started production of an advanced smart power process called I²T offering high voltage DMOS transistors featuring 0.7 μ m CMOS technology.

A description of Alcatel's line of mixed-signal custom ASICs are outlined below.

Mixed-Signal ASICs and Telecom ASICs

Alcatel's long heritage of custom product development supports subscriber line interfaces, transmission and switching system components and both wireless and wireline access products.

Automotive ASICs

In the automotive markets, Alcatel Microelectronics' ASICs and ASSPs are used in multiplexed-bus communications, car-body systems and driver information and comfort modules, as well as in critical automotive diagnostic and safety systems such as ABS. Alcatel's communication background includes CAN, VAN, and other networks. High-voltage BiCMOS and submicron Intelligent Interface Technology offer the over-stress protection by the harsh automotive environment.

Access ASSPs

In wireline or wireless access to home, office or individual, Access Solutions on Silicon is a range of off-the-shelf, leading-edge ICs designed to drive all telecom access applications, from megabit ADSL modems through advance solutions for IDSL/ISDN, to modern solutions for short-haul POTS (Plain Old Telephone Service).

In communications, System-on-Chip solutions offer the world's first single-chip solution for the IDSL/ISDN NT for both 2B1Q and 4B3T line codes, which combines deep submicron digital and analog functions on one chip. The powerful ARM7TDMI embedded MCU core is an example of the world-class technology available to OEMs using its ASSPs.

Gate array or FPGA conversion to standard cell ASIC is one of Alcatel's special services.

Semiconductor Fabrication Facilities

Alcatel Microelectronics
Westerring 15
B-9700 Oudenaarde
Belgium
Fab 1
Cleanroom size: 21,530 square feet (Class 10)
Capacity (wafers/week): 2,500
Wafer size: 100mm
Processes: NMOS, CMOS, BiCMOS, BCDMOS
Products: Cell-based ASICs, ASSPs, custom ICs
Feature sizes: 1.2 μ m, 1.5 μ m, 2.0 μ m, 3.0 μ m

Alcatel Microelectronics
Westerring 15
B-9700 Oudenaarde
Belgium
Fab 2
Cleanroom size: 37,500 square feet (Class 1)
Capacity (wafers/week): 2,500
Wafer size: 150mm
Process: CMOS
Products: Cell-based ASICs, ASSPs, custom ICs
Feature sizes: 0.35 μ m, 0.5 μ m, 0.7 μ m, 1.2 μ m

Key Agreements

- In March 1998, Alcatel Microelectronics and InterDigital Communications Corporation signed a \$25 million agreement based upon InterDigital's proprietary Broadband Code Division Multiple Access (B-CDMA™) technology. The alliance will introduce wireless local loop systems, which B-CDMA technology delivers. Under the terms of the agreement, Alcatel will purchase InterDigital's B-CDMA ASICs, which will be embedded into the wireless platforms developed and marketed worldwide by Alcatel. Alcatel and InterDigital will work together to develop enhanced wireless data handling capabilities for B-CDMA technology.
- In early March 1998, Alcatel Microelectronics and two other companies, Texas Instruments and Analog Devices, plan to participate in interoperability testing for asymmetric digital subscriber line (ADSL) silicon. All three companies are all working on chips to conform to the American National Standards Institute (ANSI) T1.413 Issue 2 standard for ADSL and this will provide interoperability among current and future DSL standards for customers, equipment manufacturers and service providers.
- In February 1998, Alcatel Microelectronics and FlowPoint Corporation signed a Memorandum of Understanding under which Alcatel Microelectronics will supply their DynaMite Asymmetrical Digital Subscriber Line (ADSL) Discrete Multitone (DMT) chipset and firmware for use in FlowPoint's ADSL Router products.
- In February 1998, Alcatel Microelectronics and AMD agreed to collaborate in licensing and manufacturing Alcatel's ADSL (Asymmetric Digital Subscriber Line) DMT technology (Discrete Multitone) for both full-rate and upcoming ADSL lite solutions. This alliance increases the availability of Digital Subscriber Line (DSL) products for the global telecommunications market.
- In late 1997, Alcatel Microelectronics and Cayman Systems signed an MOU that has Alcatel to supply Dyna MiTe ADSL DMT chipset and firmware for use in Cayman Systems' RADSL Customer Premium product code named Kayak. This agreement involves Alcatel's third generation automatic Rate Adaptive Asymmetrical Digital Subscriber Line (R-ADSL) modem chipset MTK-20131.
- Alcatel Microelectronics established a license agreement with Advanced RISC Machines in the U.K. for the ARM7 Thumb RISC microprocessor core.
- Alcatel Microelectronics is working with IMEC, Belgium's microelectronics R&D center, to develop 0.35µm and finer geometry process technologies.
- Alcatel Microelectronics has had a technological partnership agreement with SGS-Thomson since 1987.

AUSTRIA MIKRO SYSTEME (AMS)

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IC Manufacturer

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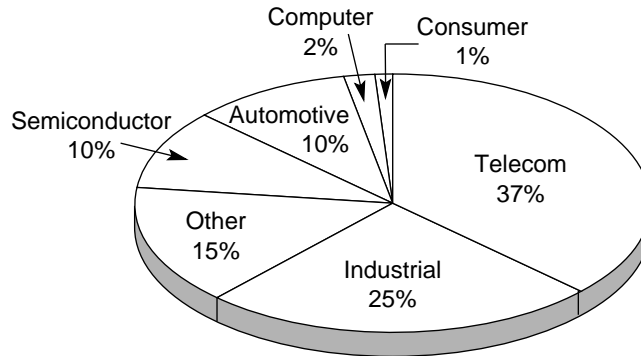
Financial History (\$M), Fiscal Year Ends December 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	59	68	95	175	173	94
Net Income	4	5	13	22	10	8
R&D Expenditures	9	12	13	25	21	17
Capital Expenditures	11	12	26	36	10	13
Employees	584	600	648	1,512	1,105	692

Company Overview and Strategy

Austria Mikro Systeme International, or AMS, was founded in 1981 as a joint venture between Voest-Alpine AG, the Austrian state-owned industrial group, and American Microsystems, Inc. of California. In 1987, AMS became jointly owned by Voest-Alpine and Austrian Industries Technologies, another state-owned company. The Austrian government remained in control until June 1993, when AMS became a public company.

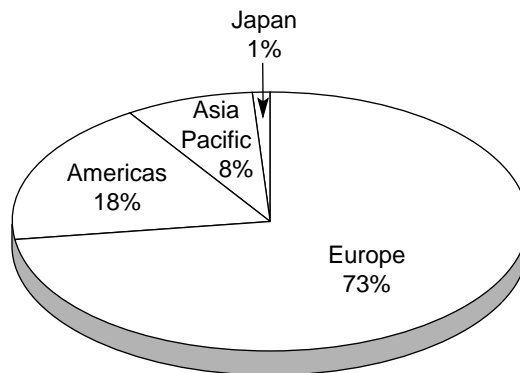
Initially, AMS focused on the manufacture of standard products, but financial troubles soon took hold of the company. In 1986, the company was streamlined and restructured to focus on its skills in mixed-signal technology. Today, the company specializes in the development and production of mixed-signal ASICs. It provides a range of custom and semicustom MOS/VLSI capabilities, including full custom circuits and high-performance analog and digital cells based on CMOS and BiCMOS process technologies. AMS's products and services target the communications, automotive, and industrial electronics market segments.



*Includes Thesys and SAMES.

1997 Sales by End-Use Market*

In recent years, AMS has embarked on an aggressive strategy to increase its penetration of international markets. The strategy of the newly formed Austria Mikro System Group under the slogan “vertical global,” (i.e., to work and communicate in the same time zone and therefore, to be present for the customer), provides the Austria Mikro System Group with the possibility of opening additional markets in Europe and other continents and to utilize its know-how worldwide.



1997 Sales by Geographic Region

Management

HonsJörg Kaltenbrinner	President and Chief Executive Officer
Hartwin Breitenbach	Director, Marketing
Michael Buchbauer	Director, Communications/Investor Relations
Volker Kempe, Ph.D.	Director, Engineering
Heribert Lecker	Director, Logistics
Walter Mentel	Director, Product Assurance
Karl Müller, Ph.D.	Director, Facility
Humbert Noll, Ph.D.	Director, Research and Development
Heimo Pirker, Ph.D.	Director, Human Resources
Gerhard Richter	Director, Manufacturing
Johann Stritzelberger	Member of the Board and Chief Financial Officer

Products and Processes

AMS specializes in the production and development of ASICs and provides a full range of custom circuits for communications, automotive, and industrial electronics applications. In addition, AMS provides silicon wafer foundry services for customer-designed ICs. The company's products and services are outlined below.

- Communication circuits include single-chip telephones, dialers, line adapters, modems, codecs, filters, ringers, and speech amplifiers.
- Automotive circuits include devices for ignition and motor controls, safety systems, airbags, and lighting.
- Industrial electronics circuits include ICs for analog and digital controls for civilian aviation, advanced instrumentation, enhanced robotics, and environmental protection.
- Display drivers.
- Foundry services.

The company's digital standard cells are available in extensive libraries in 0.6 μ m, 0.8 μ m, 1.0 μ m, 1.2 μ m, and 2.0 μ m double-metal CMOS and BiCMOS technologies. Over 70 percent of AMS designed custom circuits include analog circuitry. AMS provides a variety of analog functions in cell form using 1.2 μ m and 2.0 μ m double-metal, double-poly processes.

Semiconductor Fabrication Facilities

Austria Mikro Systeme International AG
Schloss Premstätten
A-8141 Unterpremstätten, Austria
Cleanroom size: 35,000 square feet (Class 1-10)
Capacity (wafers/week): 3,500
Wafer size: 100mm
Processes: CMOS, BiCMOS
Products: ASICs, design and foundry services
Feature sizes: 0.8 μ m-2.0 μ m BiCMOS; 0.6 μ m-1.2 μ m CMOS

The company has design centers in Paris, Milan, London, Munich, Hamburg, Dresden, Stockholm, and Budapest, as well as in Cupertino, California.

Key Agreements

- AMS has introduced a chip to the market for detecting magnetic fields which measures and evaluates the field of rotating magnets. The signals are converted by analog/digital technology into angle values from 0° to 360°. These magnetic sensor ICs replace mechanical systems. Applications: instrumentation, motor controls, position indicators, robotics, monitoring systems, etc.
- AMS has an international license and wafer foundry agreement with SAMES. Under the agreement SAMES produces and markets AMS single-chip telephone ICs in South Africa

- AMS and Thesys have a product development agreement. The agreement covers free process, design, and product technology transfers from AMS to Thesys, while BiCMOS and CMOS expertise at both companies is shared. AMS has a 51 percent controlling interest in Thesys.
- AMS joined the Esprit project to develop 8-bit, 16-bit, and 20-bit converters for telecommunications and data transmission applications.
- AMS is participating in a Eureka Fab 2000 project to develop an ASIC concept which allows the integration of high performance analog functions with complex logic elements.

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IC Manufacturer – Captive Only

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Financial History, Fiscal Year Ends December

	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997*</u>
Robert Bosch GmbH				
Sales (\$M)	22,251.1	24,929.8	2,692.2	—
Net Income (\$M)	330.4	382.5	324.4	—
R&D Expenses (DM M)	2,255	2,474	2,887	—
Employees	—	156,733	176,481	—
U.S. Sales (DM M)	—	—	4,500	—
Automotive Equipment Business Sector				
Worldwide Sales (DM M)	19,600	20,500	24,500	—
R&D Expenditures (DM M)	—	—	2,000	—
Employees	—	—	114,000	—

*Company did not disclose.

Company Overview and Strategy

Robert Bosch GmbH (a.k.a.: the Bosch Group) is the world's largest independent manufacturer of automotive equipment. The company is a privately-held company founded in 1886. The Robert Bosch Foundation holds 92 percent of the capital stock of the company. Aside from direct and affiliate operations in 47 countries, the company has a Service Agent network presence in 131 countries and formal joint ventures with 40 companies worldwide. Robert Bosch Corporation has distributors with 61 sales offices across the U.S.

Robert Bosch GmbH is organized into four Business Sectors, of which the Automotive Equipment Sector (hereafter called "Automotive") is the largest, accounting for nearly 60 percent of 1996 total worldwide sales. Automotive is further organized into 10 Divisions including Division 8, the Semiconductors and Electronic Controls Division.

Management

Robert Bosch GmbH

Dr. Marcus Bierich	Chairman, Supervisory Council
Hermann Scholl	Chairman and Chief Executive Officer
Heiner Gutberlet	Executive Member, Board of Management
Rainer Hahn	Executive Member, Board of Management
Tilman Todenhofer	Executive Member, Board of Management
Hubert Zimmerer	Executive Member, Board of Management
Jiri Marek	Manager, Automotive Sector, Semiconductor Division

Robert Bosch Corporation

Robert S. Oswald	Chairman, President and Chief Executive Officer
Gary M. Saunders	Executive Vice President and Chief Financial Officer
Frederick W. Hohage	Executive Vice President
Helmut Schwarz	Executive Vice President
Luke Baer	Vice President, Secretary and General Counsel

Products and Processes

Bosch's experience in automotive electronics goes back to its 1967 introduction of its Jetronic electronically controlled gasoline injection system. Increasingly deploying such technology in its products, Bosch was the first company in the world to introduce microhybrid technology in automotive electronic control units.

The Semiconductor Division's products include bodywork and engine controls-related devices such as power, silicon, switching and zener diodes. Analog and digital position servo controllers are also produced. The Division's products are centered on a micro-electromechanical systems (MEMS) technology base.

Bosch has a Division called Sagem Electronics, but the relationship to the Semiconductor Division, if any, and product offerings haven't been determined. Similarly, inter-unit research, development and sales efforts with the Blaupunkt car audio Division of the Consumer Sector is unknown, but appears significant.

The Semiconductor Division manufactures ASICs for such demanding customers as Mercedes. Some of their ASIC design work is contracted out.

Bosch is also known to be developing plasma source ion implantation (PSII) technology, spearheading a consortium of German companies.

Semiconductor Production Facilities

Robert Bosch GmbH has 180 production facilities worldwide including 50 in Germany and 13 in the U.S. The company's semiconductor production facility is located in Reutlingen, Germany, south of the headquarters.

In September 1996, Bosch announced it was opening a worldwide center in Melbourne, Australia for development and manufacturing of car body electronics, marking the first time Bosch has bestowed the status of "worldwide headquarters" for a specific product line for a company outside of Germany. The plant, located east of Melbourne, will employ 650 people and will cost \$70 million.

CHIPCON

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Fabless IC Supplier

Financial History (\$)

	<u>1997</u>	<u>1998 (est.)</u>
Sales	900,000	1,500,000
Employees	—	11

Company Overview and Strategy

Founded in 1996, Chipcon is an independent, fabless design house specializing in the development of ASICs, typically semi-custom. Chipcon also acts as “interface” to foundry for some customers, essentially becoming a component supplier in those cases.

Chipcon states that one of its key strengths is its design and layout strategy. Design services also include simulation. Customers include the Swedish company Telaide Europe, Atmel, Simrad, Fieldbus International AS (Norway) and car alarm leader, DEFA.

Management

Geir Forre	Managing Director
Sverre Dale Moen	Marketing Director

Products and Processes

Chipcon develops analog, digital and mixed-signal ASICs, including RF designs, in CMOS and BiCMOS. During 1997, Chipcon used CMOS and BiCMOS processes from 0.35 μ m to 0.8 μ m. Chipcon has its own design library, but also uses standard cells from foundries in semi-custom approaches. Chipcon designs full custom ASICs, when appropriate. Chipcon works with a variety of foundries, choosing the one optimal to a particular project.

Chipcon's application markets have included automotive, industrial, and telecommunications. Projects Chipcon has completed include a single-chip RF transceiver, a mixed-signal ASIC for car alarms, an ASIC for monitoring CO2 and temperature levels, a high-precision analog module for sonar applications, and a fieldbus ASIC for hazardous environments.

Key Agreements

- Chipcon has developed products for customers with the assistance of SINTEF, a Norwegian research institute. Details of this arrangement were not available.

DIALOG SEMICONDUCTOR

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Fabless IC Supplier

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 Telephone: (49) 7021-94140 • Fax: (49) 7021-941410

Financial History (\$M)

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	17	19	27	30	30	43
R&D Expenditures	1	1	1	2	3	3.5
Employees	55	65	68	90	93	94

Company Overview and Strategy

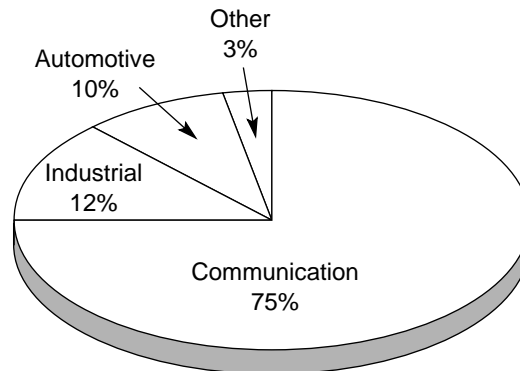
Dialog Semiconductor is a leader in the design and supply of mixed-signal ASICs. The company has design centers located in the UK, Germany, and the United States. Through the use of its proprietary cell-based design methods, and the extensive manufacturing resources of TEMIC, Dialog Semiconductor has the ability to suit a full range of technical requirements.

The company — originally known as IMP Europe — was founded in 1986, and became Dialog Semiconductor in 1990, after Ericsson Radio Systems and Deutsche Aerospace bought majority holdings. Through the Deutsche Aerospace ownership, Dialog Semiconductor was a part of the Daimler-Benz microelectronics group, TEMIC, formed in July 1992. The Semiconductor Division of TEMIC consisted of Dialog Semiconductor, Telefunken Semiconductors, Matra MHS, and Siliconix.

On March 30, 1998, Dialog Semiconductor announced its new status as an independent company. Following the transfer of TEMIC Semiconductor to Vishay and Atmel, Dialog has left the Daimler-Benz group.

Dialog Semiconductor is now financed by Apax Partners and Co. Ventures Ltd., who holds the majority of the equity. Adtran of Huntsville, U.S., has taken a 16 percent share of the business, and Ericsson of Stockholm, Sweden, retains its seven percent shareholding.

Dialog Semiconductor's design teams have extensive mixed-signal experience in telecom, datacom, computer, consumer, medical, automotive, and industrial applications. The company also has a subsidiary, Dialog Semiconductor GmbH, located in Nabern, Germany.



1997 Sales by End-Use Market

Management

Roland Pudelko	Managing Director
Gary Duncan	Vice President, Marketing
Peter Hall	Vice President, Manufacturing Operations
Richard Schmitz	Vice President, Engineering

Products and Processes

Dialog Semiconductor supplies mixed-signal ASICs using a range of (0.35 μ m to 0.7 μ m) double poly, double/triple metal CMOS processes to suit differing application needs. For special needs, BiCMOS, bipolar, and EEPROM processes are sourced according to requirement.

Dialog Semiconductor has used this technology to develop a large number of mixed-signal ASICs for use in a wide range of markets and applications as outlined below.

Communications

- Audio processing
- Line transceivers
- Modems
- Frequency synthesis
- Baseband interface
- Echo cancellation
- Control and monitoring
- Power supply management

Industrial

- Switch mode PSU
- Flow meter
- LCD decoder/driver
- Blood sugar measurement
- Bar code reader
- Heartrate analyzer
- Remote metering

Automotive

- Intruder alarms
- Acceleration sensors
- Pressure sensors
- Signal conditioning
- Active suspension control
- Throttle valve sensors

Computer and Consumer

- HDD spindle motor control
- Video DAC/ADC
- Audio DAC/ADC
- Music synthesizer
- HDD head park

ELMOS

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IC Manufacturer

Employees: 300

Company Overview and Strategy

Established in 1984, Elektronik in MOS-Technologie GmbH (Elmos) specializes in the design and production of analog, digital, and mixed-signal ASICs. The company is privately owned with BMW-subsiary Intech of Munich, Germany, being the largest shareholder (30 percent). The majority of Elmos' devices are sold to automotive-subsystem makers primarily in Europe, but also in North America and Japan. The remainder goes to consumer equipment companies and into industrial applications.

Management

Klaus Weyer	President
Eberhard Knapp	President and Chief Operating Officer
Knut Hinrichs	President and Chief Financial Officer

Products and Processes

Elmos uses proprietary N-well silicon-gate CMOS process technology in the design and fabrication of its ASIC products, which include analog, mixed-signal, and most recently digital devices. In late 1995, the company introduced its designs of 8-bit RISC microcontroller cores to provide intelligence to its mixed-signal automotive ASICs.

Semiconductor Fabrication Facilities

Elmos GmbH
Dortmund, Germany
Capacity (wafers/week): 1,500
Wafer sizes: 100mm, 150mm
Process: CMOS
Products: ASICs
Feature sizes: $\geq 1.0\mu\text{m}$

Elmos also uses Siemens as a foundry for the production of high-voltage automotive-related CMOS ASICs.

EM MICROELECTRONIC-MARIN

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IC Manufacturer

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Facilities also in Bangkok, Frankfurt, Paris and Colorado Springs.

Financial History (\$M)

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	45	55	65	84	91	98
Employees	283	285	285	290	330	390

Company Overview and Strategy

EM-Marin was founded in 1970 as a division of Ebauches Electronics SA to supply low power watch and clock ICs to the Swiss watchmaking industry. In the 1980s, the company was absorbed as a division of the then newly formed SMH Group, subsequently being formed into an independent subsidiary, EM Microelectronic-Marin SA in 1985.

EM-Marin produces low voltage (0.9V+) ultra low power mixed-signal integrated circuits, offering such options as EEPROM on chip and interconnection techniques such as gold and solder wafer bumping. EM develops and produces complex, multi-functional, efficiently produced circuits for user-specific, standard and customized for battery powered, portable and power management applications.

Today, 65 percent of unit output is for non-watch applications; the company has become a global player in the industry, having an assembly facility in Thailand, a design and technical support subsidiary in Colorado Springs and sales offices in Switzerland, U.S., Singapore, France and Germany.

Management

Mougahed Darwish	President
Paul Aebersold	Vice President, Finance and Administration
Peter Umminger	Director, Sales and Marketing
Manfred Meyer	Vice President, Purchasing

Products and Processes

EM-Marin manufactures and markets watch circuits, LCD drivers, real time clocks, power control ICs, 4- and 8-bit microcontrollers for embedded applications (1.2-5V), Radio Frequency Identification (RFID) circuits, as well as mixed-signal ASICs and full custom ICs. Typical applications include timing, security, access control, automotive, telecommunications, computer peripherals and other portable and instrumentation devices combining many functions so to minimize external components.

The company has adapted well-chosen CMOS processes for the ultra low-power, multifunctional and miniaturization requirements of the watch industry so as to operate at the lowest possible voltages (less than 1V). An EEPROM option was originally developed to trim oscillators on-chip, but today it is also used for memory functions and on-chip calibration.

EM-Marin's current CMOS technology portfolio includes a 3 μ m P-well single and double metal process which is still attractive for low cost applications. N-well processes include 2 μ m and 1 μ m single and double metal, double poly; a 0.5 μ m triple metal process commenced production in 2Q98 and an EEPROM option will be added by 1Q99. EM-Marin has successfully pioneered the SMIF (standard mechanical interface) technology for large scale production.

ISO 9001 certification was achieved in 1992. QS-9000 and VDA 601 (automotive industries) were certified in April 1998.

Semiconductor Fabrication Facilities

EM Microelectronic-Marin SA
CH-2074 Marin, Switzerland
Total facility area: 172,160 square feet
Cleanroom size: 35,000 square feet
Capacity (wafers/week): 1,600
Wafer size: 150mm
Process: CMOS

Products: Timing, RFID, microcontrollers, LCD drivers,
power management, real time clocks, ASICs and full custom ICs.

Key Agreements

- In April 1998, EM-Marin concluded a non-exclusive global distribution agreement with Munich-based EBV for standard products.
- In January 1998, EM-Marin and ATMI's (NASDAQ: ATMI) Emosyn division announced an agreement to design, develop, manufacture and distribute intelligent contact, contactless and combi-smartcard ICs.
- In December 1997, EM-Marin acquired Advanced Designs Inc. of Colorado Springs, a specialist mixed signal IC design company. This company is now known as EM (U.S.) Inc. and brings top class circuit design expertise and technical support to EM-Marin's growing North American business.

ERICSSON COMPONENTS

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 Fax: (46) (8) 757-47-76
 E-mail: m-info@eka.ericsson.se
 Web Site: www.ericsson.com

IC Manufacturer

Regional Headquarters/Representative Locations

North America: Ericsson Inc., Components Division • Richardson, Texas
 Telephone: (972) 583-5431 • Fax: (972) 583-5005

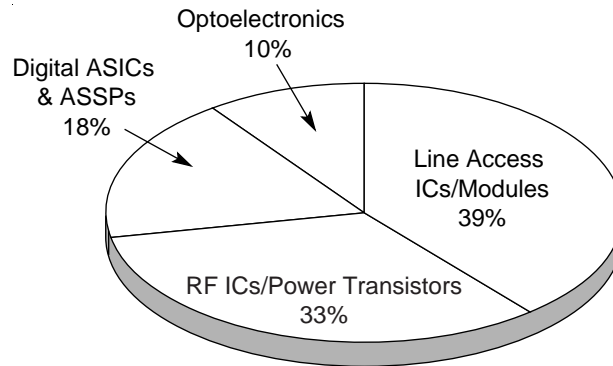
Financial History, Fiscal Year Ends December 31

	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (SEK millions)					
Sales	SEK62,654	SEK82,554	SEK98,780	SEK124,266	SEK167,740
Components*	SEK2,084	SEK2,620	SEK3,170	SEK3,758	SEK4,466
*Internal and External Sales					
Employees	—	—	—	—	1,300

Company Overview and Strategy

Ericsson Components is a part of the Ericsson Group, an \$18 billion world leading supplier in telecommunications. Ericsson Components develops, manufactures and markets advanced products in the areas of energy systems, microcircuits and optoelectronic components for the telecommunications market worldwide.

Integrated circuits have been an important part of Ericsson's operations since its first production unit was opened in the early 1970's. The company designs and manufactures radio frequency components (including ASICs, modules and power transistors), line access ICs, optoelectronic components, and digital and mixed mode ICs for telecommunications systems. Roughly half of its semiconductor production is built into Ericsson products and systems, the remainder is sold to other telecommunications system manufacturers.



1997 Corporate Sales by Product

Management

Lars Ramquist	President and Chief Executive Officer, Ericsson Group
Bert Jeppson	Senior Vice President and President, Ericsson Components AB
Bo Hedfors	President, Ericsson Components (U.S.)

Products and Processes

Ericsson's microelectronics activities are focused on the development, manufacture and marketing of specialized components for telecommunications systems. The product range is line access ICs and modules, RF ICs and modules, RF power transistors, fiber optic transmitter and receiver modules, digital/mixed mode CMOS ICs, telephone ICs, and industrial ICs like stepper motor ICs.

Ericsson uses a variety of process technologies, including high-voltage silicon bipolar technologies for line interface circuits, high-frequency silicon process and assembly technology for RF power transistors, high frequency bipolar IC process for mobile phone and radio base station applications, and advanced sub-micron CMOS process for digital network access ICs. Also, indium phosphide processes for fiber optical components.

Semiconductor Fabrication Facilities

Ericsson Components
 Kista, Sweden
 Capacity (wafers/week): 4,000
 Wafer size: 100mm
 Processes: Bipolar, CMOS
 Products: Telecom ICs, RF circuits, discrettes, optoelectronics.
 Feature sizes: 1.2 μ m, 1.5 μ m

Ericsson Components
 Kista, Sweden
 Capacity (wafers/week): 350
 Wafer size: 150mm
 Processes: HF-bipolar, CMOS, BiCMOS
 Products: RF circuits, ASICs
 Feature size: 0.5 μ m

Key Agreements

- Ericsson has maintained a strategic partnership with Texas Instruments since 1987. The partners extended their alliance in 1992 when they announced plans to construct Ericsson's pilot production fab in Kista, Sweden. Under the agreement, TI installed its 0.5 μ m process technology in the plant in exchange for a greater share of Ericsson's semiconductor business. TI's 0.35 μ m technology will be installed in the future. The agreement also includes the cross-licensing of certain technologies and joint development of advanced ICs for telecommunications applications.

GEC-MARCONI MATERIALS TECHNOLOGY LIMITED

GEC-Marconi Materials Technology Limited
Caswell, Towcester
Northamptonshire, NN128EQ
United Kingdom
Telephone: 1327-356428 or 1327-350581
Fax: 1327-356775
Web Site: www.gmmt.co.uk

IC Manufacturer

GEC-Marconi Materials Technology Limited (GMMT), commonly referred to as the Caswell site, is one of two research sites within GEC-Marconi Ltd.; GEC-Marconi Research Centre being the other site. GEC-Marconi Ltd. itself is a "business area" within General Electric Company, p.l.c.'s Electronic Systems and Defense Group, one of the fiscal 1997 consolidation's five resulting groups.

Financial History

Sales from GEC-Marconi represented 32 percent of fiscal 1997 (6/30/97) total company sales of 11.147 billion Pounds Sterling. Defense and Aerospace, Marconi's primary businesses, is one of three areas GEC, p.l.c. has decided to focus upon for future growth. As a side note, GEC Plessey Semiconductor, divested in February 1998, was not part of the Electronic Systems and Defense Group. Group R&D expenditures for fiscal 1996 were 432 Pounds Sterling (up from 412 million in 1995), or 38.2 percent of total GEC R&D expenditures. However, as noted below under Products and Processes, GMMT was collaborating with GEC Plessey Semiconductor (now Mitel Semiconductor) on wireless LAN product development. The status of the GMMT-Mitel effort is undetermined at press time.

GEC-Marconi Materials Technology Limited sales are as follows (\$M):

	<u>1996</u>	<u>1997</u>
Sales	10	12

Company Overview and Strategy

GEC-Marconi Materials Technology Limited (GMMT) conducts research and development, as well as produces, electronic, optoelectronic and pyroelectric devices and subsystems, and radar absorbent and transparent materials. Products are used primarily in military and aerospace (satellite, avionics) applications, though wireless products for various commercial markets are in volume production and appear to be well-positioned. Whether this product portfolio will remain part of GEC-Marconi, versus also being sold to Mitel or perhaps being transferred to GEC's Telecommunications Group (e.g., GPT), is a rationalization matter GEC will likely have to deal with later in 1998. (GMMT's sister research site, GMRC, already supports product development for GPT in the Asynchronous Transfer Mode communications product arena).

Organizationally, GMMT is composed of three Divisions: Microwave & Solid State, Materials, and Optoelectronics & Modules. The Materials Division is involved in research and development of Radar Absorbing Materials (RAMs) and Radar Transparent Materials, and so will not be profiled in this directory. Products and Processes available from the other two Divisions are discussed below.

In addition to a direct sales organization for the UK and ROW, GMMT relies upon Daico Industries, Inc. for U.S. distribution and nine other distributors worldwide.

Management

Mike Geen	Manager , GaAs Component Product Line
Stuart Cornelius	Manager , Sales

Products and Processes

The Caswell site of GMMT conducts advanced development and production of GaAs semiconductors, optoelectronic devices (such as laser diodes) and sensor devices, including cooled infrared optical image detectors.

Among advanced technologies developed by GMMT is a micromachined, silicon-packaged optoelectronic transmit/receive terminal only 3mm thick for optical interconnections.

GMMT sees high performance radio networks as an important alternative technology to cable or fibre, especially where mobility is required. Hence, GMMT's Caswell laboratory collaborated with GEC Plessey Semiconductors (sold to Mitel in February 1998) to develop wireless LANs (Local Area Networks) using GaAs monolithic microwave integrated circuits operating at 5.2GHz and achieving 23.5Mbps/sec data transmission. This "HIPERLAN" system is emerging as a new European standard.

GMMT's latest wireless LAN is developed from a 2.4GHz transceiver now in volume production in the Caswell GaAs foundry. Applications include point-of-sale terminals and cordless bar-code readers.

GMMT's advanced applications of GaAs technology include thousands of components for a phased array synthetic aperture radar for the European resource monitoring satellite. Additionally, to meet the increasingly demanding needs of military radar and communication systems, a new GaAs production process commenced volume production in fiscal 1997, of devices operating in the 35 to 40GHz range.

Improving over conventional techniques used to generate high voltage at low current, Caswell laboratories has also developed miniaturized voltage transformers based on piezoelectric ceramic, with devices only 4mm x 2mm x 0.5mm generating 110 volts from a 3 volt source.

GMMT's Microwave & Solid State Division provides a complete Foundry Service and comprehensive Design Services, as well as supplying ASICs and a wide range of standard products including MMIC amplifiers, small signal and power FETs, switches and LAN transceivers.

GMMT has over 30 years of GaAs technology experience available to its GaAs Foundry services customers. The commercial GaAs Foundry itself was launched in 1985. It places great emphasis on process control and manufacturability to ensure high yielding, reliable and reproducible processes. Currently, GMMT's Foundry Service provides a MMIC process with two basic options:

- F20 employs 0.5 μ m gate length MESFETs with standard depletion mode, recessed gate transistors and through substrate vias for use to 20GHz. F20 offers both switch/medium power and standard gain implants.
- H40 employs 0.25 μ m gate length low noise Pseudomorphic HEMT technology with mushroom gate techniques for use to frequencies in excess of 40GHz.

The Microwave & Solid State Division is also developing new processes to further enhance existing technologies and to offer designers the latest MMIC technology. These include:

- H100 0.10 μ m Pseudomorphic HEMT for applications up to 100GHz;
- H40P Power HEMT process;
- B20 HBT High speed digital/small signal analogue process; and
- B20P HBT High power analogue process.

The Microwave & Solid State Division's consultancy and design service range from initial feasibility studies to full multifunction MMIC and Module Design, reverse engineering, fabrication and test. Capabilities include design of amplifiers, oscillators, mixers, phase shifters, attenuators and prescaler circuits for both microwave and millimeter-wave applications.

Microwave & Solid State Division's Standard Products includes a selection of 11 standard switches, amplifiers and attenuators. Both general purpose devices operating up to 6GHz and wide-band devices operating up to 42GHz are available.

Based upon what it claims as highly integrated IP building blocks, the Microwave & Solid State Division has developed a range of ASIC wireless components including transceivers, power amplifiers and switches suited to a number of wireless communications systems from 1.7 to 3GHz. These include DECT, DCS1800 and Wireless Local Loop GaAs MMICs designed for emerging high data rate communications systems such as HIPERLAN, LMDS/LMCS and MVDS. Although RF ICs for wireless applications are the current focus, the Division has also developed a CP-packaged VCO for SART Applications which operates at 9.2 to 9.5GHz, 26dBm.

GMMT's Optoelectronics & Modules Division, formed 26 years ago, made major investments in its infrastructure beginning in 1989. An ISO9001 accredited manufacturing facility with a substantial list of products in optoelectronics and GaAs microwave components was the result. The Division's particular expertise includes

- DFB multi-quantum well lasers at 1300nm and 1500nm;
- GaAs Mach-Zehnder Optical Modulators (DC - 50GHz);
- High Speed InP pin diodes;
- Broad Band LEDs;
- Fibre Gratings;
- Micro packaging;
- Tunable DBR lasers; and
- Microwave Fibre Optic Transmitters and Receivers.

HYPERSTONE ELECTRONICS GMBH

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D-78467 Konstanz
Germany
Telephone: 49 (7531) 98030
Fax: 49 (7531) 51725
Web Site: www.hyperstone.com

Fabless IC Supplier

Regional Offices/Representative Regions

U.S.: Hyperstone Electronics USA, Inc. • Cupertino, California
Telephone: (408) 257-1057 • Fax: (408) 257-0713

Company Overview and Strategy

Hyperstone Electronics specializes in microprocessors that integrate DSP-instructions into the Hyperstone RISC architecture. This new class of microprocessor can be applied in a variety of areas such as telecommunications, office automation products, automotive applications, in personal digital assistants, multimedia, and all kinds of PC-boards and PCMCIA-cards. Hyperstone products are sold via local distributors in the U.S., throughout Asia, the U.K. and Italy.

Products and Processes

The Hyperstone architecture is unique because dedicated DSP-instructions are fully integrated into the Hyperstone RISC architecture and no separate DSP is required.

The Hyperstone E1-32 / E-16 Microprocessors combine the technology of a RISC Processor with an additional DSP instruction set and on-chip microcontroller functions. This offers a powerful set of variable length instructions. Programs for the Hyperstone require less than half the memory size of most RISC μ Ps and most instructions execute within one clock cycle. The fast multiply unit at high clock frequency makes it one of the fastest CPUs on the market with regard to DSP functionality. The following are some specifications of these processors.

- Wide clock frequency range: 0.66MHz at 5V, 0.50MHz at 3.3V;
- Operating voltage from 3.3V to 5V;
- High performance: up to 30 MIPS with DRAMs, up to 66 MIPS with SRAMs;
- Most instructions execute within one clock cycle;
- Execution time for 1K Complex Fast Fourier Transform: 870 microseconds;
- Low power consumption: typ. 240mW at 50MHz (3.3V);
- Automatic power-down management;

- Address space: four memory areas of 1GB each;
- Low system cost and easy board design through integrated control logic;
- Built-in programmable bus controller;
- Memory or I/O can be connected directly to CPU without any additional logic;
- Bus widths: 8-, 16- or 32-bits, independent for each of the four memory areas;
- Built-in programmable DRAM controller including refresh logic and parity;
- Built-in timer;
- Powerful instructions with variable length of 16-, 32- and 48-bits;
- Compact program code requires just half the memory size of conventional RISCs;
- Separate address- and data-bus;
- On-chip RAM of 4Kbytes;
- Fast pipelined DSP-multiply: 16- x 16-bit: 1cycle, 32- x 32-bit: 4 cycles; and
- Multiply-accumulate within 1 cycle (pipelined).

Hyperstone also offers a complete set of development tools that consist of both software and hardware. Major components include the following.

- Programming Tools: C compiler, macro-assembler, linker with EPROM formatter and a library manager.
- Debugging Tools: Source-level debugger with profiler.
- Libraries: Full ANSI C run-time library and hyDSP DSP library.
- Operating system: Multitasking Real-time operating system.
- Hardware: PC-based development boards are available.

MATRA MHS

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 France
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 Fax: (33) (1) 30-60-71-11

IC Manufacturer
 Founded: 1979

Regional Offices/Representative Locations

North America: TEMIC/Matra MHS, Inc. • Santa Clara, California
 Telephone: (408) 970-3976 • Fax: (408) 988-3512

Financial History (\$M)

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	110	125	130	150	145	300
Employees	850	900	915	925	925	925

Company Overview and Strategy

Matra MHS designs and manufactures advanced digital CMOS and BiCMOS circuits for such industries as telecommunications, aerospace and defense, automotive, and computer peripherals. The company's main focus is on embedded controllers based on Intel-licensed 8-bit 80C51 and 80C251 microcontrollers. MHS' activities also include ASICs and ASSPs, CPLD/FPGA replacement, and specialty SRAMs.

Originally, Matra MHS was a member of TEMIC Semiconductors of the Integrated Circuits Division, which was the microelectronic branch of the Daimler-Benz Group. TEMIC Semiconductors was formed in July 1992, by Daimler-Benz combining the products, experience, and technologies of its many semiconductor businesses into one operation.

In December 1997, TEMIC Semiconductors, which includes Integrated Circuits and Discrete Active Components Divisions, was acquired by Vishay Intertechnology for \$500 million. Then in March 1998, Vishay sold the Integrated Circuits Division of TEMIC Semiconductors (Matra) to Atmel Corporation for \$140 million.

Management

Michael Desbard Chief Executive Officer

Products and Processes

Matra MHS manufactures low-power, fast SRAMs (64K to 1M); specialty memories, including dual-port RAMs, FIFOs, and radiation-tolerant memories; SPARClet™ 32-bit RISC microprocessors for embedded control; 4-bit and 8-bit MCUs; DSPs; ASICs; and ASSPs for data communication networks, automotive systems, and military and aerospace applications (dual-use concept).

Also, under a license agreement signed between TEMIC and Analog Devices in early 1997, Matra manufactures radiation-tolerant 32-bit floating-point DSPs for radiation-sensitive applications. The DSP is based on Analog Devices' high-performance ADSP-21020 architecture and is built using a 0.6µm rad-hard CMOS process.

Matra MHS uses advanced CMOS and BiCMOS technologies in the manufacture of its ICs, including a 0.6µm, three-layer-metal CMOS process and a 0.5µm CMOS process. A 0.35µm process is being developed.

Semiconductor Fabrication Facilities

Matra MHS

La Chanterie-Route de Gachet

CP 3008

44087 Nantes Cedex 03

France

Telephone: (33) (2) 40-18-18-18

Cleanroom size: 30,000 square feet (Class 1)

Capacity (wafers/week): 3,500

Wafer sizes: 125mm, 150mm

Processes: CMOS, BiCMOS, radiation-tolerant CMOS

Products: ASICs, ASSPs, MCUs, MPUs, SRAMs, DSPs

Feature sizes: 0.5µm, 0.6µm, 0.8µm, 0.85µm (0.35µm in development)

Key Agreements

- In December 1998, TEMIC Semiconductors, which includes Integrated Circuits and Discrete Active Components Divisions, was acquired by Vishay Intertechnology for \$500 million. Then in March 1998, Vishay sold the Integrated Circuits Division of TEMIC Semiconductors, Matra, to Atmel Corporation for \$140 million.
- Matra MHS has held a license for Intel's 80C51 MCU family since 1981. The license has been continued through the 80C251 family.
- Level One Communications and Matra MHS have a second-source agreement for on-line driver circuits.
- Matra MHS is a second source for Cypress Semiconductor's fast 16K, 64K, and 256K asynchronous SRAMs.
- Matra MHS holds a license from Sun Microsystems for the production of SPARC-based products.
- In May 1995, DSP Group licensed to Matra MHS the rights to use its Pine and Oak DSP cores.

MELEXIS

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IC Manufacturer

Regional Offices/Representative Locations

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Melexis UK Ltd. – Chasetown Staffs, United Kingdom
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Melexis Germany/XFAB • Erfurt, Germany
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Melexis France • Paris, France
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North America: Melexis USA • Sunnyvale, California
Telephone: (408) 749-1166 Fax: (408) 749-1718

Company Overview and Strategy

Melexis predominantly designs and produces ICs for automotive applications. This company with sales over \$22 million also produces ASICs, and supplies ICs to OEM customers.

Products and Processes

Melexis services include product development, program development, testing, fabrication, and packaging. They also design and produce Integrated Systems, which comprise of logic and analog circuitry, power devices, memories, micro-controller cores and power supply regulators. Melexis uses a mixed mode test system, since their devices have analog and digital parts.

Products are categorized as follows:

Analog

Interface

Consumer/Automotive MOS Microcomponent

MPR

ASICs

Mixed Signal Automotive ASICs

Semiconductor Fabrication Facilities

Melexis Germany/XFAB

HaarbergstraBe 61

D-99097 Erfurt

Deutschland

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MEMORY CORPORATION

Memory Corporation
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United Kingdom
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Fax: (44) 131-654-0835
Web Site: www.memcorp.com

Fabless IC Supplier
Founded: 1993

Regional Offices/Representative Locations

U.S.: Memory Corporation, Inc. • Sunnyvale, California
 Telephone: (408) 524-8741 • Fax: (408) 524-8749

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

	<u>1996</u>	<u>1997</u>
Sales	989	3,700
Net Income	(2,624)	(1,600)
Employees	—	40

Company Overview and Strategy

Memory Corporation licenses and sells design ASIC controllers used in the manufacture of DRAM modules and FLASH memory cards. The Company had focused its first efforts on applying its technology to the DRAM market. The first commercial application of Memory's technology, called Variance Controlled Memory (VCM), has been in the production of 16Mb memory modules with follow-on technology available or planned to support 64Mb and their variants such as EDO and SDRAM. Current DRAM support technologies include the following.

- a custom ASIC, encompassing the Partial Memory Engine;
- memory test hardware optimized for defect capture; and
- the software for testing and control of the production process and the test procedures.

Memory Corporation continues to develop new flash products, with the primary focus on software and a controller ASIC for use in the emerging file storage applications such as digital cameras and window CE computers, and a product introduction is scheduled for mid-1998.

Memory's technologies are well protected through a total of 20 patent applications to date, which together with copyright over the Company's proprietary software, provide powerful and wide-ranging intellectual protection over both the Company's products and its production processes.

Memory's potential customer base are the world's leading semiconductor and memory module manufacturers, such as Texas Instruments, Hitachi, Toshiba, and IBM.

Management

David Savage	Chief Executive Officer
Bill Hipp	Chairman
Alan Sinclair	Chief Technical Officer
Mark Dougherty	Finance Director
Arun Kamat	Vice President, Marketing

Products and Processes

Memory's primary products include their VCM technology, and ASIC controllers – Advanced Partial Memory Engine, MicroLock, and Flash Memory Controllers. Variance Controlled Memory (VCM) is a process allowing DRAMs with randomly distributed non-functioning cells to be utilized in full-function memory modules. The first stage of this VCM process is the testing of DRAMs to find the locations of the non-functioning cells. The second stage is programming out the defective cells and replacing them with “good” cells from the substitute DRAM, all of which involves intensive use of proprietary software, custom designed test equipment and redundancy controller ASIC.

Advanced Partial Memory Engine (APMEV4) is an ASIC controller used in a standard 72-pin SIMM, partially defective DRAM chips. The ASIC routes data to/from defective memory locations to alternative storage locations. The Controller uses 32-bits of main data memory and can also use 4-bits of replacement memory to implement a fully functional SIMM. The number and type of DRAMs used to build the SIMM is flexible and the DRAMS used are selected to ensure that the total number of defects is within the mapping capabilities of the controller. The controller also incorporates a built-in user programmable security feature and operates on a 3.3V power supply.

MicroLock is a custom electronic device fitted to memory modules, typically SIMMs. The device will disable the SIMM if it does not receive a security code within an allotted time. MicroLock is programmable and can be configured to operate in different applications.

Memory Corporation offers a range of DRAM SIMMs at 16 and 32Mb densities with parts manufactured based on VCM technology.

FlashSystem (FSM) is a proprietary controller architecture providing defect tolerance in Flash memories which is independent of both the location and density of defects present in the memory components. It can support both linear and ATA Flash cards.

Key Agreements

- In March 1998, Memory Corporation signed a license agreement with MicroLogic. Memory's patented Wide Word Defect Management technology will be incorporated into MicroLogic's DRAM based solid state disk drives. Memory will receive an unspecified royalty for every megabyte of memory shipped by MicroLogic.
- In February 1998, Memory Corporation and Datrontech Group formed a joint venture company, Dtec Memory Corporation Limited (DMC). The new venture will be owned 51 percent by Memory and 49 percent by Datrontech. Dtech Memory Corporation will focus on the delivery of memory products and differentiated computer memory solutions in the UK and Europe, using Memory's technology in the latter.
- In late October 1997, Memory Corporation signed its first licensing agreement for MicroLock™ with Hsin-Lin Computer. Memory sold and shipped to Hsin-Lin U.S. \$500,000 of its chips, and Hsin Lin will pay a U.S. license fee for Microlock™ technology. Hsin-Lin will manufacture and sell Microlock™ application ASICs based on Microlock™ technology and Microkey™ software.
- In August 1997, Memory Corporation signed a letter of intent with Micron Quantum Devices that forms a framework for an agreement on technology exchange and cross licensing. This allows Memory to access Micron's Flash Memory controller designs and for Micron to be granted the right to integrate Memory's FlashSystem Manager™. The Letter-of-Intent grants Memory the rights to sell Micron Quantum Devices' controllers and is able to modify the controller design to target specific end-use applications. The agreement allows Memory and Micron to sell card manufacturers a FLASH memory controller for use with FLASH memory chips in an industry standard, such as PC card or Compact Flash Card for digital cameras.
- In July 1997, Memory Corporation signed a memorandum of understanding with Hsin Lin Computer Co. Ltd. of Taiwan. This agreement allows both companies to jointly design and develop new memory products, which they will then jointly own and market. This alliance will focus on extending Memory's partial memory technologies, including manufacturing process development, and in the next generation of memory security devices. The companies will also assist in the distribution of each other's products in their geographical region.

MICRO CIRCUIT ENGINEERING

Micro Circuit Engineering
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United Kingdom
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Web Site: www.mce-asic.co.uk

IC Manufacturer
Founded: 1981

Employees: 35

Company Overview and Strategy

Micro Circuit Engineering (MCE) designs and manufactures custom and standard products for a variety of applications and industry segments. MCE evolved from a group within Smiths Industries Aerospace in the late 1960s and started trading under its own name in 1981. In 1997, total sales for MCE were \$4.6 million.

With more than 500 years of semiconductor industry experience, MCE offers a full design and production service for custom ICs and remains a wholly-owned subsidiary of Smiths Industries Aerospace. Although an important strategic supplier to Smiths Industries, more than 75 percent of MCE's sales are generated from outside the group, of which 20 percent is exported to USA, Western Europe and Japan.

MCE offers a wide range of CMOS and bipolar processes. Linear functions are available in CMOS, bipolar and BiCMOS technologies. The company provides gate arrays, mixed-signal arrays, digital and mixed-signal standard cells in technologies ranging from 5 micron to 0.5 micron. In addition to manufacturing ASICs, MCE also manufactures and supplies a range of standard products for MIL-STD-1553, MIL-STD-1760, Stanag 3910, ARINC 429 and ARINC 629 data bus systems. Recently, MCE has introduced designing and manufacturing of MCMs (Multi-Chip Modules).

Management

John Shepherd	General Manager
John Rayns	Finance Manager
Ian White	Engineering Manager
Colin Wadsworth	Production Manager
Mike Wopshott	Quality Manager
Stuart Gruszka	Commercial & Marketing Manager

Products and Processes

MOS MEMORY

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

ANALOG

<input type="checkbox"/>	Amplifier
<input type="checkbox"/>	Interface
<input checked="" type="checkbox"/>	Consumer/Automotive
<input type="checkbox"/>	Voltage Regulator/Reference
<input type="checkbox"/>	Data Conversion
<input type="checkbox"/>	Comparator
<input checked="" 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 checked="" 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 type="checkbox"/>	MPU
<input type="checkbox"/>	MCU
<input type="checkbox"/>	MPR
<input type="checkbox"/>	DSP

OTHER

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

Standard Products

MCE offers a range of components and modules for MIL-STD-1553, MIL-STD -1760, Stanag 3910, ARINC 429 and ARINC 629 data bus standards.

MCMs

MCE provides designing and manufacturing capability for both passive and active silicon substrate MCMs.

ASICs

MCE offers digital gate arrays from 300 to 80K gates in a range of CMOS from 5 to 0.8 micron and mixed-signal arrays in 3 micron CMOS. Standard cell and full custom ASICs can mix analog, memory and fuses with conventional digital circuitry, and can be fabricated down to 0.5 micron.

Semiconductor Fabrication Facilities

In addition to MCE's manufacturing capabilities, MCE has access to a number of world class silicon foundries in North America and Western Europe.

The company uses sub-contract assembly houses in the Pacific Rim and in Europe. MCE maintains a military qualified ceramic assembly and test facility at Tewkesbury, UK headquarters.

MICRONAS

Micronas Semiconductor
World Trade Center
Leutschenbachstrasse 95
CH-8050 Zurich, Switzerland
Telephone: (41) (1) 308-3923
Fax: (41) (1) 308-3500

IC Manufacturer

Financial History (\$M)

	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997*</u>
Sales	37	74	84	—
Capital Expenditures	1	5	4	—
Employees	169	334	399	400

*Company did not disclose.

Company Overview and Strategy

Micronas specializes in the design, development, and production of high-precision analog and mixed-signal ICs, digital signal processors (DSPs), surface acoustic wave (SAW) filters, microsensors, Hall sensors and systems. With this interdisciplinary knowledge, the company develops both application-specific and custom-designed products for telecommunications, consumer and automotive electronics applications.

The multinational Micronas Group concentrates on market-driven solutions that offer cost savings and miniaturization of functions. Micronas maintains several wafer fabrication facilities in Europe, as well as collaborating with a large foundry in Asia.

Management

Jürgen Kurb	Chief Executive Officer
Gery Oberrauter	Manager, Telecom Business
Thomas Fischer	Manager, Consumer Business

Products and Processes

Micronas provides a wide range of products, including mixed-signal ICs, multi-technology modules (MTMs), hybrid systems and SAW filters for telecommunications applications (e.g., cellular phones and base stations). The company also supplies mixed-signal ASICs, DSPs, microcontrollers, high-accuracy pressure sensor systems, protection circuitry and Hall sensors for consumer and automotive applications.

Micronas uses a modular molybdenum gate bipolar-enhanced complementary metal oxide semiconductor (BeCMOS) technology, in conjunction with the ability to integrate thin-film resistors and capacitors, to meet the needs of accurate and stable mixed-signal applications. This process supports nominal power supply voltages between 1.2V and 40V for low power consumption.

A recently acquired division, Micronas Intermetall GmbH, produces DSPs, MPUs, MCUs, video and audio encoders/decoders, signal converters and Hall-effect sensors. These products are manufactured in a range of CMOS process technologies with feature sizes of 1.0 μ m to 0.5 μ m. Technologies include advanced mixed-signal capability and flash memories.

Semiconductor Fabrication Facilities

Micronas Oy
P.O. Box 51
FIN-02771 Espoo, Finland
Telephone: (358) (9) 80521
Cleanroom size: 4,300 square feet
Capacity (wafers/week): approx. 2,000
Wafer size: 100mm
Process: Moly-gate CMOS
Products: Mixed-signal and analog ICs, foundry services

Micronas Semiconductor SA
Ch. Chapons-des-Pres
CH-2022 Bevaix, Switzerland
Telephone: (41) (32) 847-0111
Cleanroom size: 21,500 square feet
Capacity (wafers/week): approx. 2,000
Wafer size: 100mm
Processes: Bipolar, moly-gate CMOS, lift-off and dry etch processes
Products: Hybrids, SAW filters, pressure sensors, foundry services

Micronas Intermetall GmbH
P.O. Box 840, D-79008 Freiburg, Germany
Telephone: (49) 761-5170
Cleanroom size: 33,000 square feet
Capacity (wafers/week): 4,000
Wafer size: 150mm
Process: CMOS
Products: ICs, digital signal processors, microcontrollers, Hall sensors

Key Agreements

- In April 1998, Genesis and Micronas Intermetall announced they are using each other's chips to produce a unique set of video processing reference designs.

NEWPORT WAFER-FAB (NWL)

Newport Wafer-Fab Limited
Cardiff Road
Duffryn, Newport
NP9 1YJ, South Wales
United Kingdom
Telephone: (44) (1633) 810121
Fax: (44) (1633) 810820
Email: kwong@newportwaferfab.com
Web Site: www.newportwaferfab.com

IC Manufacturer

Employees: 575

Regional Headquarters/Representative Locations

North America: Newport Wafer Fab Ltd. • San Jose, California
Telephone: (408) 436-3053 • Fax: (408) 436-0246

Company Overview and Strategy

NWL (Newport Wafer-Fab Limited) is Europe's leading dedicated silicon wafer foundry. As a "pure-play" foundry, NWL focuses on providing leading-edge digital and mixed-signal technology, customer specific processes including BiCMOS, high voltage and a variety of digital imaging applications.

NWL operates three manufacturing facilities offering 6- and 8-inch wafers at their headquarters in Wales, United Kingdom. NWL process offerings include 1.5 micron to 0.5 micron capabilities. Their newest facility, Fab 3 provides customers access to 0.35 micron technology. In 1999, the company will offer customers 0.25 micron technology production.

Established in 1992, NWL is a subsidiary of Hong Kong based QPL International Holdings Limited and a sister company of ASAT which offers assembly and test capabilities. Located near ASAT UK, the organization offers total turnkey services to the semiconductor industry.

Management

Steve Byars	Chief Executive Officer
John Elder	Director, Operations
Gareth Jones	Director, Sales and Marketing
Steve Della Rocchetta	Executive Vice President, COO U.S. Branch

Products and Processes

NWL's foundry services consist of two dedicated fabs with double- and triple-level metal, single- and double-level poly CMOS wafer fabrication down to 0.5 μ m feature sizes. With the completion of Fab 3, which is just coming on-line this year (1998), the company will offer 200mm wafer capacity in 0.5 μ m CMOS, moving to 0.35 μ m.

Semiconductor Fabrication Facilities

During 1996, NWL completed the conversion from 100mm to 150mm wafer production at its Fab 1 facility. Also during 1996, NWL completed construction of Fab 2 and began construction on Fab 3. Fab 3 is a \$350 million 200mm wafer fab.

Newport Wafer-Fab Limited
Cardiff Road
Duffryn Newport
NP9 1YJ South Wales
United Kingdom

FAB 1

Capacity (wafers/week):	5,000
Wafer size:	6 inches
Process:	Digital CMOS, Mixed-signal CMOS, HV CMOS, BiCMOS, LCD
Products:	None
Feature sizes:	0.7 μ m - 1.5 μ m

FAB 2

Capacity (wafers/week):	1,250
Wafer size:	6 inches
Process:	Digital CMOS, Mixed-signal CMOS, HV CMOS, BiCMOS, Digital Imaging
Products:	None
Feature sizes:	0.35 μ m - 0.7 μ m

FAB 3

Capacity (wafers/week):	3,750
Wafer size:	8 inches
Process:	Digital CMOS, Mixed-signal CMOS, BiCMOS
Products:	None
Feature sizes:	0.25 μ m - 0.5 μ m

Key Agreements

- March 1998, Newport Wafer-Fab Limited has licensed SGS-Thomson Microelectronics' process technology for the production of 0.35 micron and 0.25 micron digital logic and mixed-signal devices.

The process technology will initially be transferred to NWL's Fab 3 in Wales, U.K.

- Newport Wafer-Fab Limited announced that it has selected Artisan Components Inc. to provide Process Perfect™ Standard Cell Libraries, I/O Libraries and embedded SRAM generators for NWL's 0.5 micron and 0.35 micron CMOS technologies.

In a multi-million pound deal between the two companies, NWL has received the distribution rights to these libraries and generators.

- Catalyst signed on Newport Wafer-Fab Ltd. in May 1995 for the manufacture of its EEPROMs and for Process technology development.

OXFORD SEMICONDUCTOR

Oxford Semiconductor Limited
68 Milton Park
Abingdon, Oxon OX144RX
United Kingdom
Telephone: (44) 1235-861461
Fax: (44) 1235-821141
Web Site: www.oxsemi.com

Fabless IC Manufacturer
Founded: 1992

Regional Headquarters/Representative Locations

Europe: Alt Technologies Ltd. • Hampshire, United Kingdom
Telephone: (44) 1256-81640 • Fax: (44) 1256-811876

Company Overview and Strategy

Oxford Semiconductor is dedicated to the design and supply of ASICs. They offer comprehensive expertise in Gate Array, Field Programmable Gate Array, Standard Cell and Full Custom solutions. ASICs can be designed from the customer's system specification, as a turnkey project, or can be handed-over as a previously completed design, to be fabricated by one of Oxford's foundry partners. ALT Technologies operates as a sales representative for Oxford Semiconductor. The Company's ASICs and ASSPs combine reliability and high performance with highly integrated functionality to provide low component count, and cost effective solutions.

Management

James Lewis	Sales and Marketing Director
Jalil Oraee, Ph.D.	Technical Director
Tim Cook, Ph.D.	Managing Director
Nick Cross	Finance Director

Products and Processes

Oxford Semiconductor offers complete flexibility in interfacing with customers. ASIC design services fall into four categories, as described below.

- Full-turnkey ASIC Design – the customer provides a complete specification. Oxford then carries out the entire development. VHDL synthesis techniques are used.
- Netlist Hand-over – The customer develops their ASIC in-house using schematic entry VHDL, Verilog, etc., and then Oxford completes the ASIC development.

- FPGA Conversion – The customer develops and evaluates their design using FPGA or DPLDs. Oxford then re-targets the design into a suitable ASIC technology to enable the customer to take advantage of beneficial volume pricing.
- Silicon processing – The customer has completed as ASIC development and then Oxford carries out design rule check and fault grading before fabricating ASIC devices.

Examples of some of the Oxford ASIC designs are:

- Data communication ASICs - highly programmable asynchronous data communications engines, Octal UART, PC communication port chips;
- ASICs for PCs and peripherals – graphics tablet ICs, PC chipsets, data storage devices, software security key; and
- ASICs for Other Markets – control chips for industrial control, weapons systems actuator control, safety systems, and global positioning systems.

Semiconductor Fabrication Facilities

Oxford Semiconductor has access to several silicon foundries located in the Far East, Europe and the U.S. Manufacturing processes use 0.6 micron and 0.8 micron CMOS technology for dual or triple layer metal designs.

PHILIPS SEMICONDUCTORS

Philips Semiconductors BV
 Building BAE2 19
 P.O. Box 218
 5600MD Eindhoven, The Netherlands
 Telephone: (31) (40) 723-520
 Fax: (31) (40) 723-085
 Web Site: www.semiconductors.philips.com

IC Manufacturer

Regional Headquarters/Representative Locations

North America: Philips Semiconductors • Sunnyvale, California
 Telephone: (408) 991-2000 • Fax: (408) 991-2311

Japan: Philips Semiconductors • Minato-ku, Tokyo, Japan
 Telephone: (81) (3) 3740-5130 • Fax: (81) (3) 3740-5077

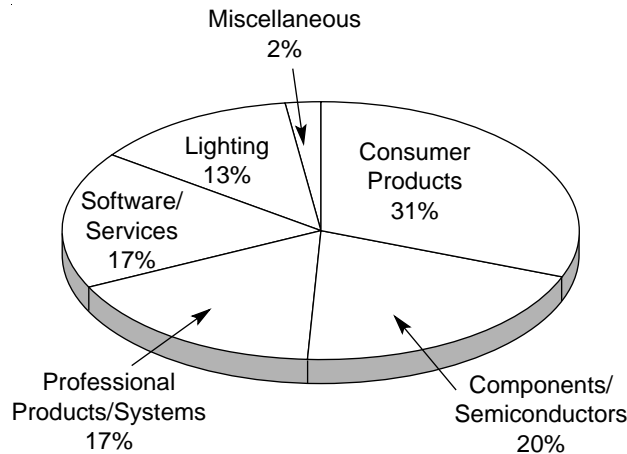
Asia-Pacific: Philips Taiwan Ltd. • Taipei, Taiwan
 Telephone: (886) (2) 382-4443 • Fax: (886) (2) 382-4444

Financial History, Fiscal Year Ends December 31

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (NLG in millions)						
Sales	NLG58,527	NLG58,825	NLG60,977	NLG64,462	NLG69,195	NLG76,453
Net Income	NLG(900)	NLG1,965	NLG2,049	NLG2,684	NLG723	NLG3,291
Semiconductor Business (\$M)						
Sales	2,055	2,250	2,866	3,994	4,196	4,451
IC Sales	1,480	1,640	2,106	2,936	3,253	3,447
Discrete Sales	575	610	760	1,058	943	1,004
R&D Expenditures				450	555	505
Capital Expenditures	140	134	320	750	720	385
Employees	20,000	19,000	21,000	26,000	26,000	27,000

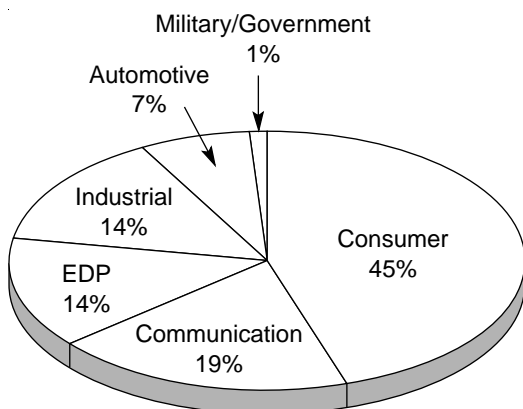
Company Overview and Strategy

Philips Semiconductors is a division of Philips Electronics NV, one of the world's largest electronics companies, with sales of about \$44 billion (1997) and over 270,000 employees worldwide. Philips Electronics was founded in 1891 to manufacture and market the newly invented electric light bulb. The company has expanded widely since then and today the breadth and diversity of its activities is clear from the names of its product divisions: Lighting, Sound, and Vision; Domestic Appliances and Personal Care; Communication Systems; Industrial Electronics; Medical Systems; and Components and Semiconductors.

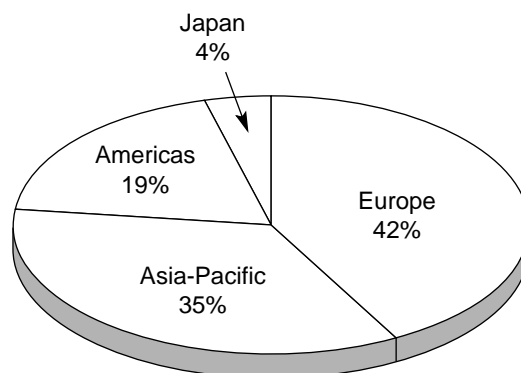


1997 Corporate Sales by Business Sector

Philips began manufacturing electronic components in 1921 for in-house use. External component sales began in the late 1940's and in 1964, the Components Division was formed. Philips Semiconductors was created out of Philips Components in 1991 as a separate product division to bring greater focus to Philips' integrated circuit and discrete semiconductor businesses. Today, Philips Semiconductors ranks among the world's largest semiconductor producers, providing a wide range of commodity products (standard logic ICs, microcontrollers, and discrettes) and advanced application-specific devices for the communications, multimedia, consumer electronics, identification, and automotive markets.



1997 Semiconductor Sales by End-Use Market



1997 Semiconductor Sales by Geographic Region

Philips Semiconductors is structured into four business groups: Consumer ICs, Communications and Multimedia, Auto/ID/Storage and Logic ICs, and Discrete Semiconductors. Approximately 15 percent of Philips Semiconductors' devices are sold to other business sectors within Philips.

Building on its strategy to establish itself as a leader in the multimedia market, Philips Semiconductors acquired the multimedia IC business of Western Digital Corporation in November 1995. Under terms of the agreement, Philips acquired all of the assets of Western Digital's Multimedia Products Unit, which included the RocketCHIP family of ICs and the Paradise graphics accelerator cards (Philips shut down the card business in 1996). In addition, Philips and German software vendor Spea Software AG forged an agreement aimed at jointly developing high performance 3D multimedia ICs for PCs and game equipment.

Management

Arthur van der Poel	Chairman and Chief Executive Officer, Philips Semiconductors
Stuart McIntosh	Chief Operations Officer
Scott McGregor	Senior Vice President and GM, Emerging Business Unit
Ross Anderson	Vice President and GM, Auto/ID/Storage and Logic IC Business Group
Guenther Dengel	Vice President and GM, Consumer IC Business Group
Leon Husson	Vice President and GM, Discrete Semiconductor Business Group
Cees Jan Kooman	Vice President and GM, Communications and Multimedia Business Group
Walter Conrads	Vice President and GM, International Sales and Marketing

Products and Processes

Philips' semiconductor products are split up by business group below.

Consumer IC Group

- digital audio circuits
- radio/TV/VCR signal processing ICs
- motor drive/control circuits
- data conversion devices
- monitor ICs

Auto/ID/Storage and Logic IC Group

- automotive circuits
- data communications chips
- RF/telecom ICs
- standard logic devices
- PLDs

Communications and Multimedia Group

- microcontrollers
- telecommunications devices
- digital video/audio circuits

Discrete Semiconductors Group

- power MOSFETs
- power transistors
- amplifiers

MOS MEMORY

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

ANALOG

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

MOS LOGIC

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

DIGITAL BIPOLAR

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

MOS MICROCOMPONENT

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

OTHER

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

Multimedia ICs

Philips sees multimedia as a key growth area. The company began marketing MPEG-1 and MPEG-2 audio/video compression chips in 1995. Through its acquisition of Western Digital's multimedia IC business, Philips now offers leading-edge 3D graphics coprocessors and full-motion video/graphics accelerators. For CD systems, Philips provides devices for high-speed CD-ROM drives and Video-CD and CD-Recordable/Erasable systems.

Philips also began selling its powerful programmable digital signal processor, named TriMedia, in late 1996. The first generation single-chip TriMedia media processor has the power (up to four billion operations per second) to process audio, video, graphics, and communications data concurrently. Specifically designed for multimedia processing, the TriMedia processor uses a VLIW (very long instruction word) architecture and innovative scheduling compiler to process multiple operations in a single clock cycle. The TriMedia family of processors also offers an open development environment.

Audio and Video ICs

Philips offers over 200 ICs for television and video applications, such as wide-screen TVs, surround-sound functions, video cameras, VCRs, and monitors. The company also offers a wide range of digital-to-analog (D/A) and analog-to-digital (A/D) converters, power amplifiers, and DSPs for audio processing.

Telecommunications ICs

The company's telecommunications products are focused on five key segments — multimedia communications, cellular and cordless telephones, portable mobile radios, pagers, and satellite communications. Philips also provides 8-bit and 32-bit microcontrollers and other ICs for data communications applications.

Identification ICs

For identification applications, Philips' core skills are in encryption coding, sensor interfaces, RF coupling, and smartcards.

Automotive ICs

Philips' automotive semiconductors include devices for ABS, airbag, traction control, comfort control, engine management, in-car information, communication, and entertainment applications.

Microcontrollers

Philips is a leader in the 80C51 microcontroller business with devices operating down to 1.8V. In 1994, the company extended the venerable 80C51 to the 16-bit level. The 16-bit 80C51XA microcontrollers are said to provide up to 10 times the performance of the 8-bit 80C51.

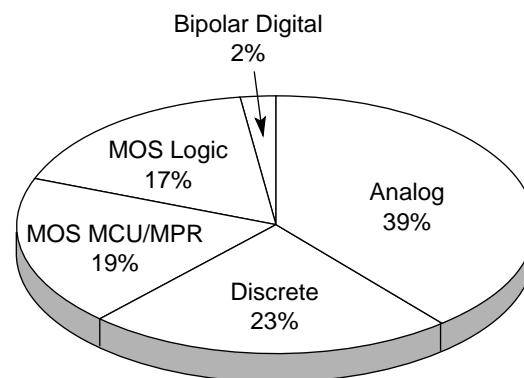
In April 1998, Philips introduced the new family "FlexiUSB" architecture for USB peripherals. This new family provides complete system solutions across the range for customers' USB hub needs. FlexiUSB covers the medium-to-high-end applications and is complemented by Philips 80C51-based microcontrollers.

Logic ICs

Philips is one of the world's leading suppliers of general-purpose logic ICs, with a variety of 3V, 5V, mixed-voltage, high-speed, CMOS, bipolar, and BiCMOS devices. The company has also been a long-time participant in the PLD market. It offers simple PLDs (SPLDs) and complex PLDs (CPLDs), including its new CoolRunner™ line of low-power (3.3V), high-performance CPLDs based on a design technique Philips calls Fast Zero Power (FZP).

Discrete Semiconductors

Philips is one of the world's largest producers of discrete semiconductors with its products including small signal diodes and transistors, power transistors, RF and microwave diodes, transistors and modules, and sensors.



**1997 Semiconductor Sales
by Device Type**

The technologies used in the manufacture of Philips' semiconductors include advanced bipolar, CMOS, BiCMOS, and BCDMOS including submicron. Philips' leading edge CMOS process technologies include its 0.5 μ m three-layer-metal C100 process and its 0.35 μ m C075 process, which is available with four or five layers of metal. Many new, advanced product lines are based on the company's proprietary QUBiC BiCMOS process, which is currently at the 0.8 μ m geometry level.

Semiconductor Fabrication Facilities

Philips Semiconductors

Gerstweg 2

Building ANO 121

6534 AE Nijmegen, The Netherlands

MOS2

Telephone: (31) (80) 532-544

Cleanroom size: 34,440 square feet (Class 10)

Capacity (wafers/week): 10,250

Wafer size: 100mm

Processes: CMOS, DMOS

Products: Logic ICs

Feature sizes: 1.2 μ m, 2.0 μ m, 3.0 μ m

Philips Semiconductors

Gerstweg 2

Building ANO 121

6534 AE Nijmegen, The Netherlands

MOS3

Telephone: (31) (80) 532-544

Cleanroom size: 32,300 square feet (Class 10)

Capacity (wafers/week): 5,000

Wafer size: 150mm

Processes: CMOS, BiCMOS

Products: Logic and analog ICs, MCUs

Feature sizes: 0.6 μ m, 0.7 μ m, 0.8 μ m

Philips Semiconductors

Gerstweg 2

Building ANO 121

6534 AE Nijmegen, The Netherlands

Telephone: (31) (80) 532-544

MOS4YOU (Yield Output Utilization)

Cleanroom size: 74,270 square feet (Class 0.1-1)

Capacity (wafers/week): 4,600

Wafer size: 200mm

Process: CMOS

Products: Consumer and communications ICs

Feature sizes: 0.35 μ m, 0.5 μ m

Philips Semiconductors

Gerstweg 2

Building ANO 121

6534 AE Nijmegen, The Netherlands

Telephone: (31) (80) 532-544

CIC/AN Fab

Cleanroom size: 48,440 square feet (Class 10)

Capacity (wafers/week): 7,500

Wafer size: 125mm

Processes: Bipolar, BiCMOS

Products: Digital bipolar and analog ICs

Feature sizes: 1.75 μ m, 3.0 μ m

Philips Semiconductors

Gerstweg 2

Building ANO 121

6534 AE Nijmegen, The Netherlands

Telephone: (31) (80) 532-544

Cleanroom size: 32,300 square feet (Class 1,000)

Capacity (wafers/week): 3,750

Wafer size: 100mm

Processes: MOS, bipolar

Products: Discrettes

Feature sizes: 0.7 μ m-100 μ m

Philips Semiconductors

P.O. Box 10

Electronicaweg 1

9500AA Stadskanaal, The Netherlands

Telephone: (31) (599) 032330

Cleanroom size: 26,900 square feet (Class 10,000)

Capacity (wafers/week): 17,500

Wafer size: 100mm

Process: Bipolar

Products: Discrettes

Feature sizes: 1.0 μ m, 3.0 μ m

Philips Semiconductors
2, rue de la Girafe, BP 5120
14043 Caen Cedex, France
Telephone: (33) (2) 31-45-2114
Fab 1
Cleanroom size: 37,675 square feet
Capacity (wafers/week): 6,250
Wafer size: 125mm
Processes: Bipolar, BiMOS, MOS
Products: Discrettes
Feature size: 1.2 μ m

Philips Semiconductors
P.O. Box 54 02 40
Stresemannallee 101
20043 Hamburg, Germany
Telephone: (49) (40) 32960
CIC Fab
Cleanroom size: 11,840 square feet (Class 100)
Capacity (wafers/week): 3,125
Wafer size: 125mm
Processes: CMOS, bipolar, BiCMOS
Products: MCUs
Feature size: 1.5 μ m

Philips Semiconductors
P.O. Box 54 02 40
Stresemannallee 101
20043 Hamburg, Germany
Telephone: (49) (40) 32960
Cleanroom size: 7,300 square feet (Class 1,000)
Capacity (wafers/week): 5,500
Wafer size: 100mm
Process: Bipolar
Products: Discrettes
Feature size: 2.5 μ m

Philips Semiconductors
Microelectronic Center
2, rue de la Girafe, BP 5120
14043 Caen Cedex, France
Telephone: (33) (2) 31-45-2114
Fab 2
Cleanroom size: 24,750 square feet
Capacity (wafers/week): 2,500
Wafer size: 150mm
Process: BiCMOS
Products: Consumer, telecom, and logic ICs
Feature size: 0.8 μ m

Philips Semiconductors
P.O. Box 54 02 40
Stresemannallee 101
20043 Hamburg, Germany
Telephone: (49) (40) 32960
I&A Fab
Cleanroom size: 12,920 square feet (Class 10)
Capacity (wafers/week): 4,500
Wafer size: 125mm
Processes: CMOS, NMOS, BiCMOS
Products: Consumer ICs
Feature sizes: 0.8 μ m-1.2 μ m

Philips Semiconductors
Bramhall More Lane
Hazel Grove, Stockport
SK7 5BJ England, United Kingdom
Telephone: (44) (61) 48 30 011
Powerfab 1 and PowerMOS
Cleanroom size: 45,210 square feet (Class 10-100)
Capacity (wafers/week): 14,000
Wafer size: 125mm
Processes: MOS, bipolar
Products: Discrettes
Feature sizes: 4.0 μ m-35 μ m

Crolles Joint Research Center
 Crolles, France
 Cleanroom size: 21,340 square feet
 Wafer size: 200mm
 Processes: CMOS, BiCMOS
 Products: R&D
 Feature sizes: 0.25 μ m-0.8 μ m
 (R&D facility jointly operated by Philips,
 SGS-Thomson, and CNET).

Philips Semiconductors
 9201 Pam American Expressway N.E.
 Albuquerque, New Mexico 87184
 Telephone: (505) 822-7000
 Fab 22
 Cleanroom size: 32,300 square feet (Class 100)
 Capacity (wafers/week): 8,250
 Wafer sizes: 100mm
 Processes: CMOS, bipolar
 Products: MCUs
 Feature size: 1.0 μ m

SubMicron Semiconductor Technologies GmbH (SMST)
 Schoenaicherstrasse 220
 Boeblingen Hulb, Germany
 Cleanroom size: 107,640 square feet, Class 1
 Capacity (wafers/week): 4,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs, logic ICs
 Feature size: 0.65 μ m
 (Joint venture with IBM Microelectronics,
 see Key Agreements).

Philips also owns 34 percent of Taiwan Semiconductor Manufacturing Co. (TSMC) and 38 percent of Advanced Semiconductor Manufacturing Corp. of Shanghai (ASMC). For data on the fab facilities of ASMC and TSMC, see the profiles of each in this publication.

Philips has 11 assembly/test facilities located around the world. These are located in The Netherlands, England, Belgium, France, Germany, Thailand, China, Malaysia, Hong Kong, Korea, and the Philippines.

Philips Semiconductors
 811 East Arques Avenue
 Sunnyvale, California 94088-3409
 Telephone: (408) 991-2000
 Fab 1
 Cleanroom size: 32,300 square feet (Class 100)
 Capacity (wafers/week): 5,750
 Wafer size: 100mm
 Process: Bipolar
 Products: Linear ICs
 Feature sizes: 2.0 μ m-4.0 μ m

Philips Semiconductors
 9201 Pan American Expressway N.E.
 Albuquerque, New Mexico 87184
 Telephone: (505) 822-7000
 Fab 23
 Cleanroom size: 43,050 square feet (Class 10)
 Capacity (wafers/week): 4,175
 Wafer size: 150mm
 Processes: CMOS, BiCMOS
 Products: MCUs, PLDs, ASICs
 Feature sizes: 0.65 μ m, 0.8 μ m (0.5 μ m in 1997)

Key Agreements

- In March 1998, Genesis Microchip and Philips Semiconductors announced that its Z1MP and Z1CMP reference designs for LCD applications will use Philips' TDA 8752 triple high-speed analog-to-digital converter (ADC) chip.
- In February 1998, Philips Semiconductors and Hitachi Ltd. announced an agreement to cooperate in the development of contactless smartcard ICs utilizing Philips Semiconductors' MIFARE® Technology. After an in-depth evaluation of available technologies, Hitachi has chosen to take a technology transfer contract from Philips Semiconductors.
- In November 1997, Philips Semiconductors' Handheld Computing Group announced that Samsung had chosen its TwoChipHCG* Plus processor for Samsung's new Smartphone SCS-100 Infomobile, the first Windows CE 2.0-based device which combines a mobile computer and a CDMA/AMPS cellular phone into a single portable unit.
- In November 1997, Philips Semiconductors and NEC Corporation signed a partnership agreement targeting advanced consumer applications with the MIPS® microprocessor architecture. In the initial stage of the agreement, NEC will provide its VR4300™ series 64-bit processor core, and Philips Semiconductors will work with NEC on chip integration and support technologies to make MIPS® the global standard platform for the consumer area.
- Philips licensed the ARM7 32-bit microprocessor core from Advanced RISC Machines in early 1997.
- In April 1996, Philips announced a wafer sourcing agreement with TriQuint Semiconductor. Under the agreement, GaAs ICs developed at Philips Microwave Limeil, France, will be produced by TriQuint and then marketed only by Philips.
- Philips revealed in 1995, a partnership with German software vendor Spea Software AG to jointly develop high performance 3D multimedia ICs for PC and game equipment applications.
- In 1994, Philips agreed with IBM Microelectronics to form a joint venture to manufacture ICs at IBM's fab facility in Boeblingen Hulb, Germany. Philips holds 51 percent and IBM 49 percent of the new company, called SubMicron Semiconductor Technologies GmbH (SMST). SMST is supplying products solely to IBM and Philips, manufacturing DRAMs for IBM and logic ICs for Philips. Separately, Philips acquired the rights to IBM's 16M DRAM technology for embedded applications. Embedded DRAM products will also be produced by SMST.
- Philips formed a joint venture in China in 1994 with Northern Telecom and the Chinese government. The new company, called Advanced Semiconductor Manufacturing Corp. (ASMC), took over Philips' wafer fab in China. In 1996, the partners completed the installation of a new 150mm wafer line for processing 0.8µm BiCMOS and 1.0µm CMOS circuits.
- Philips Semiconductors has a technology partnership with TI-subsiary Silicon Systems concerning disk drive ICs.

- Philips, TI, and Hitachi formed a pact in 1993 covering joint development and alternate sourcing of FutureBus and BiCMOS logic IC products.
- Philips extended its patent cross-license agreement with Intel to include all of each other's semiconductor devices except certain proprietary Intel MPUs and Philips' video products. The agreement is now valid through the year 2000. In addition, the two companies established an agreement to develop a new family of 8-bit MCUs, based on an upgraded 80C51 core.
- Philips has a license from Silicon Graphics for 32-bit and 64-bit MIPS RISC core microprocessor technologies. Philips is embedding the MIPS R4000 cores in chips for communications and multimedia applications. Philips obtained MIPS R3000 microprocessor technology in 1994, when it acquired HDL Systems.
- LSI Logic signed an agreement with Philips to collaborate on developing video compression ICs for HDTV applications.

Noteworthy News

- Atmel has a cross-licensing and product exchange agreement with Philips Semiconductors covering several of each company's proprietary PLDs.
- In March 1998, Philips Semiconductors, Texas Instruments, Hitachi, IDT and Pericom stated their support for the ALVC (Advanced Low-Voltage CMOS) logic standard. The announcement comprises the largest multiple-source supply for any low-voltage logic family. Since its inception in 1994, ALVC has been the industry standard for high-performance 3.3V CMOS logic.

POWER INNOVATIONS LTD.

Power Innovations Ltd.
Manton Lane
Bedford MK417BJ, United Kingdom
Telephone: (44)12 34 223-022
Fax: (44)12 34 223-000
Web Site: www.powinv.com
Email: info@powinv.com

IC Manufacturer
Founded: 1997

Ownership: Privately held.

Company Overview and Strategy

Power Innovations Ltd. designs, develops, and manufactures primary and secondary overvoltage protection devices for the telecommunications equipment market. They also supply fast, high voltage transistors for use in high frequency electronic ballasts for lighting equipment applications. The company designs products in conjunction with major equipment manufacturers worldwide.

Originally the "Power Department" of Texas Instruments (TI), the Power Innovation founders bought-out their department in 1997. This acquisition included technology, employees and the wafer fabrication plant. Power Innovations has benefited from TI's Sales Representative and Distributor connections, and consequently, is supported by an extensive network of over 90 sales and distribution offices worldwide.

Products and Processes

Power Innovations products include —

- Primary/secondary overvoltage Protection ICs
- NPN/PNP lighting transistors
- NPN/PNP switching transistors
- NPN/PNP Darlington ICs
- SCRs
- Silicon controlled rectifiers
- Triacs

Semiconductor Fabrication Facilities

Power Innovations manufactures semiconductors at their facility, in Bedford, U.K. Test and assembly is performed at Texas Instruments qualified test and assembly houses.

PREMA

PREMA
Prazisionselektronik GmbH
Robert-Bosch-Str. 6
D-55129 Mainz, Germany
Telephone: (49) (61) 315062-0
Fax: (49) (61) 315062-22

IC Manufacturer
Founded: 1970

Company Overview and Strategy

PREMA was founded in 1970, and today the Company has total sales (1997) of \$13 million. In 1970, PREMA had developed and produced its own patent of digital multimeters. By 1977, they had established a semiconductor division, and today the company specializes in ASICs.

Based in Germany, PREMA designs, produces, and tests ASICs, all within one facility. Their custom specific ICs have been applied in the following industries: telecommunications, automotive, consumer products, measurement and control instruments, and sensor technology.

Management

Dr. Hartmeit Grudtzdiek	Chairman, President, and Chief Executive Officer
Werner D. Peuekert	Vice President, Finance, and Chief Financial Officer

Product and Processes

PREMA's semiconductor products include analog, ICs, consumer/automotive, comparator, and full custom ICs in analog and mixed signals. PREMA offers three design paths for a customer's ASIC design — PREMA can design the IC; the customer can design the IC with PREMA as support; or PREMA can cooperate with a design house to design the IC.

Semiconductor Fabrication Facilities

PREMA's wafer facility manufactures prototypes to large volumes.

PREMA Prazisionselektronik GmbH
D-55129 Mainz, Germany
Telephone: (49) (61) 315062-0
Wafer size: 150mm
Process: Bipolar, CMOS, MOS
Products: ASICs, analog and mixed signal ICs

**ROOD TESTHOUSE INTERNATIONAL N.V.
A.K.A.
RTI AND ROOD TECHNOLOGY**

**ROOD TESTHOUSE INTERNATIONAL N.V., a.k.a.: RTI and
ROOD TECHNOLOGY**

Johanniterlaan 4, NL-3841 DT
Harderwijk, The Netherlands
Telephone: (31) (0) 341-437171
Fax: (31) (0) 341-431606
Web Site: www.roodtechnology.com

Fabless IC Supplier

Regional Headquarters/Representative Locations

Rood Technology Deutschland GmbH + Co • Germany
Telephone: (49) (0) 9081-804-141 • Fax: (49) (0) 9081-804-153

Rood Technology Deutschland GmbH + Co • Germany
Telephone: (49) (0) 2871-181018 • Fax: (49) (0) 2871-184042

Rood Technology U.K. Ltd. • England
Telephone: (44) (0) 1420-89191 • Fax: (44) (0) 1420-87259

Rood Technology U.K. Ltd. • Scotland
Telephone: (44) (0) 1506-468600 • Fax: (44) (0) 1506-468622

Rood Technology Ireland Ltd. • Ireland
Telephone: (353) (0) 1-4080190 • Fax: (353) (0) 1-4504313

Rood Technology France (Division Edgetek) S.A. • France

Rood Testhouse Limburg B.V. • The Netherlands

Financial History (Dfl. '000s), Fiscal Year Ends December 31

	<u>1995</u>	<u>1996</u>	<u>1997</u>
Net Sales	122,166	107,911	68,442
Joint Venture Net Income	1,741	394	3,032
Net Profit	3,689	162	93
Capital Expenditures	19,543	3,735	4,699
Employees	343	356	328

Ownership: Publicly held.

Rood Testhouse International N.V. is registered in Amsterdam, The Netherlands. The shares are traded on the Amsterdam and the Munich Stock Exchanges.

Company Overview and Strategy

Founded in 1976, Rood Testhouse International N.V. is the Dutch holding company of four European operating subsidiaries which trade under the name of Rood Technology, as well as three Asian joint ventures described under the Key Agreements section below.

Through its operating units, Rood Technology is a fabless semiconductor supplier and provider of an integrated set of semiconductor services and products including: design, wafer test, die processing and supply, assembly, software and hardware engineering, burn-in, testing, production support services, (programming, marking/labeling, scanning, straightening, tape and reel and dry pack), as well as qualifications, failure analysis, engineering support to IC manufacturers and design and manufacture of IC handling and conditioning equipment.

Management

Dr. Ir. L.J.M. Nelissen	Chairman, Supervisory Board
Ing. L.J. van Bree	President and Chief Executive Officer
B. Brouwer	Vice President
J.M. Muller	Managing Director, Rood Technology France
I.P. Reid	Managing Director, Rood Technology UK
W. Wagner	Managing Director, Rood Technology Germany

Products and Processes

Overall, Rood Technology's assembly capabilities include Chip-On-Board (COB), ceramic and metallic packaging and subcontract plastic packaging. Rood Technology is approved to BS ISO-9000, CECC 90000 and ISO-9002. Rood supplies memory modules with up to a 32-bit data bus capability and to full military standards. In microprocessors, Rood has expertise up to 16-bit CMOS microprocessors and chipset technology levels. Rood also has specialty expertise in redesign and assembly of obsolete products including ASICs and silicon banking and form, fit and functional replacements. These services are especially targeted to manufacturers requiring hi-rel devices.

Rood Technology's Design Groups offer both array based and custom bipolar processes which it especially targets for the replacement of discrete analogue circuits. Design experience has ranged from custom replacement for an obsolete op-amp chip to devices operating in the GHz range. In CMOS processes, Rood offers a range of array based and custom processes, including non volatile memory and standard analogue and digital functions. CMOS expertise is especially targeted for FPGA conversions, high complexity digital designs, those requiring basic analogue functions and where low operating voltage and power are required. In BiCMOS, Rood targets applications where more analogue performance or higher voltages is required. For silicon on insulator (SOI) processes, applications targeted include ultra low power and rad hard, most typically medical and satellite systems, respectively.

Rood Technology offers the capability to supply high quality semiconductors in wafer or bare die form to the hybrid, SMT and MCM manufacturers. These capabilities include testing and programming performed under clean room conditions. Rood also supports Known Good Die (KGD) programs at various levels.

Rood Technology has developed and patented a single-correction station IC conditioning system, the LeadStar 800, for correcting coplanarity, stand-off, bent lead, pitch, and sweep in packages with pitches as low as 0.4mm. This system is used internally, as well as sold as a product line. The patented aspect is the computer-controlled three dimensional bending process. The system is used on PQFP, TQFP, TSOP, SSOP and SOJ devices.

Rood Technology also claims to be the world's largest independent testhouse, with more than 25 years experience in wafer probing. Capabilities here include fully automated probing for Analog, Digital, Memory or Mixed Signal devices at temperatures ranging from ambient to +150°C across a range of pin counts. Rood also has Silicon, GaAs, SOS and other sawing expertise.

Located in both Noerdlingen and Bocholt, Rood Technology Germany was founded in 1969, and joined with Rood Technology in 1991. The subsidiary offers sophisticated burn-in services; logistics, assembly and test (LAT) services (wafer probing, mixed signal, analog, digital memories and ASICs), engineering and qualification services, technological and failure analysis, and production support services. IC manufacturer support services include assembly, COB, MCM. The company also designs and manufactures IC handling and conditioning equipment.

Alton, England- and Livingston, Scotland-based Rood Technology UK provides a range of services from design, wafer processing, die processing and supply, subcontract ceramic assembly and own products, burn-in, test and production support services as well as quality assessment services. Alton's design expertise is with ASICs, high speed bipolar, BiCMOS, CMOS and SOS. Standard Products expertise includes MIL, BS ISO-9000 and obsoletes. Electrical testing capability includes digital, linear, mixed signal, memory and microprocessor devices.

The Livingston facility focuses on programming services for PROMs, EPROMs, EEPROMs, ID PROMs, PALs, GALs, FPGAs, CPLDs, EPLAs, microprocessors, sequencers, flash memories and memory cards. They also offer marking, lead scanning and conditioning, tape and reel and dry pack services.

Located in Dublin, Rood Technology Ireland was founded in 1997 to provide semiconductor production support services. The unit offers programming of EPROMs, EEPROMs, ID PROMs, PALs, GALs, microprocessors and flash memories, as well as providing tape and reel services.

Key Agreements

- Rood Technology has strategic joint ventures with a Singapore company called Sunright. Sunright has operations in several countries and is listed on the Singapore stock exchange. These joint ventures operate under the name KES Rood Technology. Founded in 1992, KES Rood Technology Pte. Ltd., Singapore (KRTS), (49 percent owned), provides software and hardware engineering, burn-in, memory testing, marking, inspection, lead scanning and conditioning, tape & reel and dry pack services. Founded in 1994, KES Rood Technology Taiwan Ltd., (49 percent owned), operating out of the Hsin-Chu Science Park, provides similar services to the Singapore facility, as well as vapor phase reflow services. KESM Rood Technology (Malaysia) Sdn Bhd, (22 percent owned), was formed in 1995. They provide high volume burn-in, test and production support services.

SEAGATE MICROELECTRONICS

Seagate Microelectronics Limited
Macintosh Road
Kirkton Campus
Livingston EH54 7BW, Scotland
Telephone: (44) (1506) 416416
Fax: (44) (1506) 413526

Captive IC Manufacturer

Regional Headquarters/Representative Locations

North America: Seagate Technology • Scotts Valley, California
Telephone: (408) 438-6550

Company Overview and Strategy

Seagate Microelectronics was established in 1987 to supply integrated circuits to its parent Seagate Technology, an \$8 billion supplier of computer disk drives and related products.

Management

Gordon Hutchison	Managing Director
Adolf Belka	Senior Director, Technology
Chris Gater	Senior Director, Design & Development
John Chisholm	Director, Quality
Alan Spiers	Director, Manufacturing
Margaret Henaughen	Manager, Human Resources
Bill Somerville	Manager, Facilities
Alistair Dick	Director, Finance

Products and Processes

Seagate Microelectronics Limited designs, develops, and manufactures mixed-signal ICs for signal processing, power management, and power control using bipolar and BiCMOS process technologies with minimum design rules down to 1.0µm.

Semiconductor Fabrication Facilities

Seagate Microelectronics Ltd.

Macintosh Road

Kirkton Campus

Livingston EH54 7BW, Scotland

Cleanroom size: 18,000 square feet

Capacity (wafers/week): 2,000

Wafer size: 100mm, 150mm in 3Q98

Processes: Bipolar, BiCMOS, DMOS

Products: Mixed-signal ICs

Feature sizes: 1.0 μ m-3.0 μ m, 0.8 μ m BiCMOS in 3Q98

SEMEFAB (SCOTLAND) LIMITED

Semefab (Scotland) Ltd.
Neward Road North
Eastfield Industrial Estate
Glenrothes
Fife, KY7 4NT
Scotland
United Kingdom
Telephone: (44) (0) (1592) 630630
Fax: (44) (0) (1592) 775265
Web Site: www.semefab.co.uk
Email: Sales@semefab.co.uk

IC Manufacturer
Founded: 1986

Employees: 85

Company Overview and Strategy

Semefab was established in 1986, as an independent, privately owned wafer fabrication facility, to provide silicon foundry support for other divisions within the Semelab PLC Group and full custom ASIC solutions direct to volume OEM clients. Semefab supports a wide range of bipolar and MOS technologies for analog, mixed-signal, and medium scale complexity digital applications. Besides manufacturing wafers, the company provides wafer probe and final testing capability for full custom ASICs.

During 1989, the first full custom ASIC products were produced and shipped in volume to customers based in the U.S., Europe and the Far East. By 1997, total sales accrued to \$8.7 million and ASIC business had risen by 40 percent in volume and 60 percent in revenue.

Management

C. Richardson	Chairman
A. James	Joint Managing Manager (Sales and Marketing)
J. Bruce	Joint Managing Manager (Technical and Operations)
T. Thornton	Financial Director

Products and Processes

Semefab has created a range of both high and low voltage CMOS, MOS and Bipolar technologies for such applications as integration of optical detectors or in full custom ASIC products. There are also a range of high voltage and current Bipolar and power MOSFET technologies for the manufacture of discrete devices. Semefab's key process technologies are as follows.

- Bipolar transistor
- RF MOS transistor
- Photodiode
- PMOS lateral FET
- NMOS lateral FET
- Power MOS VTM (Introduction in 1998)
- Linear Bipolar
- Metal Gate CMOS
- Silicon Gate CMOS
- Dielectrically Isolated CMOS

Semefab ASICs normally are within the following criteria: mixed-signal, medium-scale complexity (less than 10K gates), operating voltage range between 1 and 40 volts depending on the chosen technology, and medium to high volume runs (greater than 100K units per annum). Semefab's ASIC applications can be found in home automation, consumer and industrial, security, safety, PC, industrial, and automotive.

Semiconductor Fabrication Facilities

Semefab's 4-inch wafer fab supports a range of bipolar and MOS technologies at 2.5 μ m or greater line widths for analogue, mixed-signal and medium-scale complexity digital devices.

Semefab (Scotland) Limited
Glenrothes, Scotland
Telephone: (44) (0) (1592) 630630
Fax: (44) (0) (1592) 775265
Process: Bipolar, CMOS, MOS
Products: ASICs, analog, digital, and mixed-signal ICs

SEMIKRON INTERNATIONAL

Semikron International
Sigmundstrasse 200
90253 Nurnberg
Germany
Telephone: (49) 911-65590
Fax: (49) 911-6559262
Web Site: www.semikron.de

IC Manufacturer

Regional Headquarters/Representative Locations

Germany: Dr. Fritz Martin GmbH & Co. KG • Nurnberg, Germany
Telephone: (49) 911-6559-0

North America: Semikron USA, Incorporated • Hudson, New Hampshire
Telephone: (603) 883-8102 • Fax: (603) 883-8021

Regional sales offices are located in Boxford, Massachusetts; Laguna Niguel, California; Elk Grove Village, Illinois; Kennesaw, Georgia; North Royalton, Ohio; and Plano, Texas.

Employees: 1,300

Company Overview and Strategy

SEMIKRON has 20 subsidiaries worldwide, each with production facilities, including Semikron USA and operations in Mexico, Brazil, Australia, Belgium, Spain, Italy, Austria, Sweden, Finland, England, The Netherlands, Switzerland, France, South Africa, Japan and Korea.

Founded in 1951, SEMIKRON was originally a manufacturer of selenium semiconductors. It has now diversified to become a leading independent supplier of power semiconductors and power electronics. The company is an independent, private partnership. A key differentiator for SEMIKRON's power semiconductors are current core product line. SEMIKRON achieved ISO 9001 certification in 1996 for facilities in Australia, Brazil, France, Germany (EN ISO 9001), Italy, Spain, UK and USA.

SEMIKRON believes that its local production presence worldwide ensures that it is able to quickly respond to customer product development and service needs, as well as serve as a second sourcing measure. This "network" of facilities includes an Application Services organization with seven application laboratories for evaluation of customer-specific solutions.

SEMIKRON invests an average of nine percent of turnover in research and development.

Management

Peter R. W. Martin	Chairman of the Board, SEMIKRON International
Heinrich Heilbronner	President, SEMIKRON International
Richard Griessel	General Manager, SemiKron USA (Hudson, NH)
Phil Descoteaux	Sales Manager, SemiKron USA (Hudson, NH)
R. Herzer	IGBT Research, Semikron Elektronik GmbH

Products and Processes

At the 1976 Electronica show, SEMIKRON introduced its SEMIPACK product, which it claims to be the first power semiconductor module. In 1996, the successor products were introduced: the SKiiP and MiniSKiiP. SEMIKRON's latest product is an advanced driver ASIC solution, the SKIC 2001. The product integrates the primary side of a halfbridge MOSFET/IGBT driver with capabilities including variable interlock time, short pulse suppression, undervoltage monitoring, and error processing.

SEMIKRON currently manufactures over 1500 different power modules comprising of diode, thyristor, MOS and IGBT technologies. Power levels range from 1kW to 1MW. Specific product lines are as follows.

- Power Semiconductor Chips (SEMICELL®)
- MiniSKiiP Power Semiconductor Product Line
- Thyristor/Diode Modules (SEMIPACK®)
- Fast Thyristor/Diode Modules (Fast SEMIPACK®)
- Thyristors
- Antiparallel Thyristors for Water Cooling
- Power MOSFET Modules (SEMITRANS® M)
- IGBT Modules (SEMITRANS® M)
- SKiiP SEMIKRON integrated intelligent Power PACK
- Rectifier Diodes, Avalanche Diodes
- Fast Rectifier Diodes
- High Voltage Rectifiers
- Moulded Bridge Rectifiers (SEMIPONT®)
- Thyristor/Diode/IGBT Assemblies (SEMISTACK®)
- Heatsinks
- Accessories: SEMIDRIVER®s, Varisotors etc.

The MiniSKiiP products use ceramic substrates to match the thermal expansion of silicon and to obtain the lowest possible thermal resistance. Pressure contact is also used in place of soldered joints (connections) or PCB wave soldering. Low switching loss, 600V or homogeneous 1200V IGBT chips with fast and supersoft low loss free-wheeling CAL-diodes as well as high surge input diodes and thyristors can be incorporated into MiniSKiiP.

SEMIKRON uses a concept of production teams working on segmented production lines in order to achieve quicker time-to-market.

SEMIKRON's main R&D facility is at the headquarters and is co-located with its chip diffusion and assembly facilities.

Key Agreements

- SEMIKRON participates in the Institut fuer Werkstoffe der Elektrotechnik Fachbereich Elektrotechnik's (Berlin) Industrial Cooperation research program.

SGS-THOMSON MICROELECTRONICS

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

IC Manufacturer
Founded: 1987

(See Top Ten)

SIEMENS SEMICONDUCTOR

Siemens AG
Semiconductor Group
Balanstrasse 73
D-81541 Munich, Germany
Telephone: (49) (89) 636-20
Fax: (49) (89) 636-2-4694
Web Site: www.siemens.de/Semiconductor

Semiconductor Manufacturer

Regional Headquarters/Representative Locations

North America: Siemens Components, Inc. • Cupertino, California
 Telephone: (408) 777-4500 • Fax: (408) 777-4977

Japan: Siemens Components Ltd. • Chiyoda-ku, Tokyo, Japan
 Telephone: (81) (3) 3201-2401 • Fax: (81) (3) 3201-6809

Asia-Pacific: Siemens Components Pte. Ltd. • Singapore
 Telephone: (65) 777-0813 • Fax: (65) 775-4504

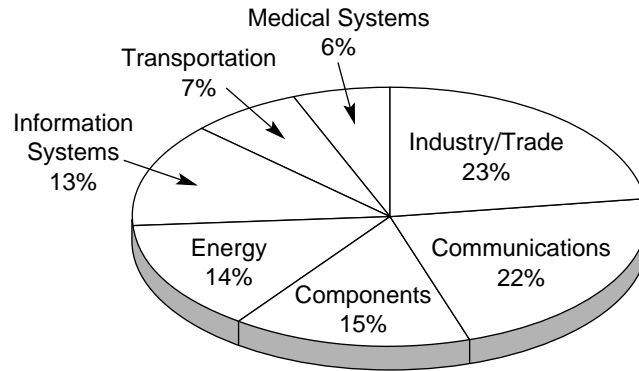
Financial History, Fiscal Year Ends September 30

	<u>1992</u>	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Corporate (DM in millions)						
Sales	DM78,509	DM81,648	DM84,598	DM88,763	DM94,180	DM106,900
Net Income	DM1,955	DM1,982	DM1,993	DM2,084	DM2,491	DM2,608
Semiconductor Business (\$M)*						
Sales	\$1,220	\$1,524	\$2,089	\$3,063	\$3,048	\$3,475
IC Sales	\$835	\$1,124	\$1,584	\$2,313	\$2,257	\$2,537
Discrete Sales	\$385	\$400	\$505	\$750	\$791	\$938
Capital Expenditures	\$294	\$353	\$407	\$850	\$1,300	\$1,732
Employees	13,000	12,700	14,000	15,900	19,316	22,600

*Calendar Year

Company Overview and Strategy

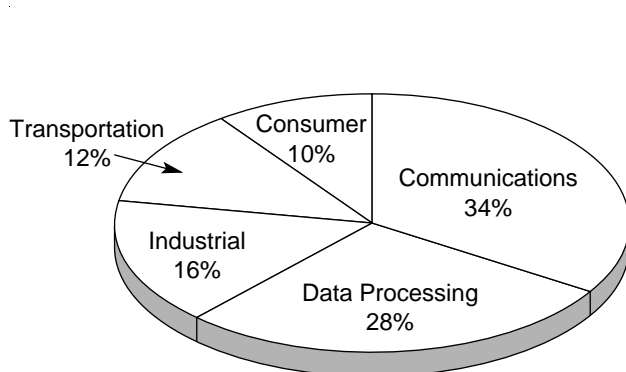
Siemens AG is one of the world's major electrical and electronics companies, with sales of about \$64 billion and 379,000 employees in 1996. Its strength lies in its comprehensive range of products: from electronic components to office and telecom systems; production equipment, power and medical engineering to transportation systems and automotive electronics.



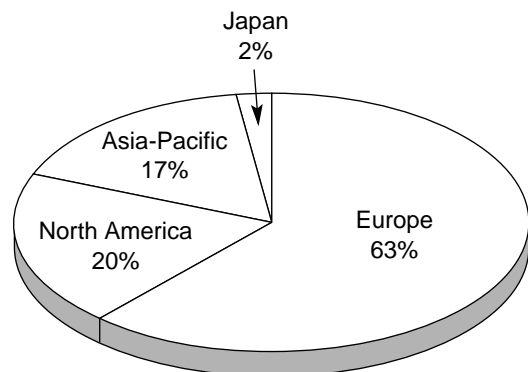
1997 Corporate Sales by Business Segment

Siemens began the research and development of semiconductors in 1949, producing its first monolithic ICs in 1963. In 1988, Siemens Semiconductor Group was established as a self-balancing group within Siemens AG. Siemens Semiconductor's products cover a wide range of application-oriented ICs for the telecommunications, automotive, transportation, industrial, and consumer electronics markets.

The Semiconductor Group is organized into seven business units: Memory Products, High Frequency Products, Power Semiconductors, Opto Semiconductors, Data Processing and Control, Signal Processing, and Security and Chip Card ICs. The Signal Processing Group focuses on such devices as digital transceivers, analog transceivers, analog and speech ICs, image and video ICs, and analog and DSP cores. The Opto Semiconductor Group focuses on LEDs, IR-components, optocouplers, intelligent displays and fiber optics. The High Frequency Products Group focuses on discretes, RF ICs and sensors.



1997 Semiconductor Sales by End-Use Market



1997 Semiconductor Sales by Geographic Region

Management

Siemens Semiconductor Group (Germany)

Dr. Ulrich Schumacher	President
P. Bauer	Sales and Solution Centers
U. Hamann	Security and Chipcard ICs
Dr. Mehrgardt	Signal Processing
Dr. Neppi	Data Processing and Control
Dr. V. Zitzewitz	Memory Products
Dr. Weinberger	High Frequency Products
Dr. Walker	Power Semiconductors
Dr. R. Müller	Opto Semiconductors
Dr. K. Platzöder	Business Administrator, Backends
Dr. Mohr	Business Administrator, Frontends 5"/6"

Siemens Components, Integrated Circuits Division (U.S.)

Alex M. Leupp	President and Chief Executive Officer
Josef Kaeser	Executive Vice President and Chief Financial Officer
Rainer Goetze	Vice President, Sales
David Sealer	Vice President, Key Accounts and Business Development

Products and Processes

Siemens manufactures a wide range of semiconductors, including DRAMs, smartcard ICs, telecommunications ICs, 8-bit and 16-bit MCUs, fuzzy logic coprocessors, discretcs, and optoelectronics. This broad product line serves a wide range of customers active in data processing, telecommunications, automation, automotive electronics, and consumer electronics.

MOS MEMORY

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

ANALOG

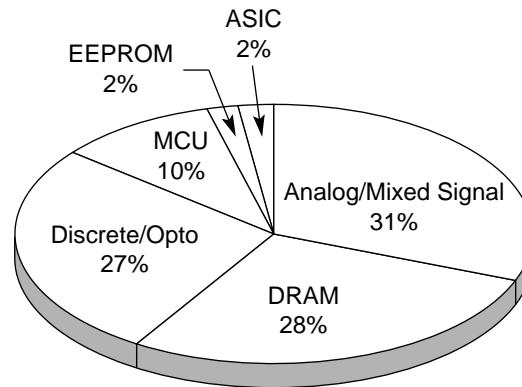
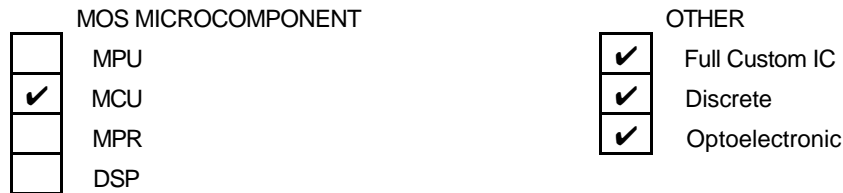
<input checked="" type="checkbox"/>	Amplifier
<input checked="" type="checkbox"/>	Interface
<input checked="" type="checkbox"/>	Consumer/Automotive
<input checked="" type="checkbox"/>	Voltage Regulator/Reference
<input checked="" type="checkbox"/>	Data Conversion
<input type="checkbox"/>	Comparator
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

MOS LOGIC

<input type="checkbox"/>	General Purpose Logic
<input 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 checked="" 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



1997 Semiconductor Sales by Device Type

The company's major semiconductor products are outlined below.

- Microcontrollers—8-bit and 16-bit CMOS MCUs, including some with embedded flash memory.
- Smartcard ICs—Crypto-controller ICs, controller ICs, intelligent memory ICs, and ICs for contactless cards and identification systems.
- Communication ICs—Digital terminal ICs, data communications controllers, wireless communications ICs, PBX chips, and PRI/Switching ICs.
- Automotive ICs—Hall-effect ICs, motor drivers, intelligent power switches, and low-drop voltage regulators.
- Power/Smart SIPMOS ICs and discretes.
- Industrial ICs and sensors.
- DRAMs—1M, 4M, 16M, and 64M DRAMs, including synchronous DRAMs (SDRAMs) and multibank DRAMs (MDRAMs, based on technology licensed from MoSys Inc.). In addition, Siemens is developing synchronous graphics RAMs and other specialty memory technologies, including ferroelectric technology. Siemens expects to have a ferroelectric product by 2002. The company is also considering entering the flash memory market.

Semiconductor Fabrication Facilities

Much of Siemens' semiconductor-related capital spending in 1996 was for the construction of a \$1.9 billion fabrication facility in North-Tyneside, Newcastle, England. Production of communication and consumer ICs at the Newcastle fab will begin in 3Q97.

It has been said that Siemens wants to outsource as much as 20 percent of its total semiconductor output in order to reduce capital investment and increase flexibility in adjusting to market cycle swings. As part of this strategy, the company has entered strategic alliances with Mosel-Vitelco and Motorola to jointly produce DRAM chips (see Key Agreements).

The company's partnership with Mosel-Vitelco involves a recently-opened joint venture fab in Taiwan, called ProMOS Technologies, where DRAMs (initially 64M parts) are being produced using technology transferred from Siemens. Meanwhile, Siemens and Motorola are building a joint venture fab in Richmond, Virginia. Called White Oak Semiconductor, the fab is scheduled to begin producing DRAMs in 1998.

Siemens Bauelemente OHG
Siemensstrasse 2
Postfach 173
A-9500 Villach, Austria
Telephone: (43) (42) 33660-0
Cleanroom size: 51,000 square feet
Capacity (wafers/week): 14,000
Wafer size: 125mm, 150mm
Processes: CMOS, bipolar, power MOS, NMOS
Products: MPUs; MCUs; digital, analog, and mixed-signal ICs; discretes
Feature sizes: 0.8 μ m-3.0 μ m

Siemens Semiconductor
Balanstrasse 73
D-81541 Munich, Germany
Telephone: (49) (89) 636-0
Cleanroom size: 43,000 square feet
Capacity (wafers/week): 6,600
Wafer sizes: 100-125mm (silicon), 3-4 in. (GaAs)
Processes: MOS, bipolar, GaAs
Products: GaAs FETs and MMICs, sensors, discretes, optoelectronics, ASICs
Feature sizes: 0.7 μ m-3.0 μ m (silicon), 0.25 μ m-1.5 μ m (GaAs)

Siemens Semiconductor
Bauelementewerk Regensburg
Wernerwerkstrasse 2, Postfach 2
Regensburg 2, Germany
Telephone: (49) 941-2120
Cleanroom size: 75,000 square feet
Capacity (wafers/week): 12,000
Wafer size: 150mm
Process: CMOS
Products: DRAMs, logic ICs
Feature sizes: 0.5 μ m, 0.7 μ m

Siemens Semiconductor
Integrated Submicron Technology Center (ISTC)
Perlach Facility
Munich, Germany
Cleanroom size: 26,000 square feet
Capacity (wafers/week): 4,500
Wafer size: 150mm
Process: CMOS, Bipolar, BiCMOS
Products: Logic ICs (digital and analog), RF
Feature sizes: 0.3 μ m-0.8 μ m

Siemens Microelectronics Center Dresden (SIMEC)
Dresden, Germany
Cleanroom size: 155,000 square feet
Capacity (wafers/week): 7,500
Wafer size: 200mm
Process: CMOS
Products: DRAMs, logic ICs
Feature sizes: 0.35 μ m-0.5 μ m (0.25 μ m capable)

Siemens Microelectronics at North-Tyneside
North-Tyneside, Newcastle, England
Cleanroom size: 43,000 square feet
Capacity (wafers/week): 4,500
Wafer size: 200mm
Process: CMOS
Products: DRAM
Feature sizes: 0.35 μ m-0.5 μ m (0.25 μ m capable)

Siemens/IBM
 Corbeil-Essonnes Cedex
 France
 Cleanroom size: 140,000 square feet
 Capacity (wafers/week): 3,600
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs (logic ICs in future)
 Feature sizes: 0.35 μ m-0.5 μ m

ProMOS Technologies, Inc.
 Hsinchu, Taiwan
 Cleanroom size: 66,000 square feet
 Capacity (wafers/week): 5,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature size: 0.35 μ m (0.25 μ m capable)
 (Joint venture with Mosel-Vitellic. Operations started in mid-1997.)

White Oak Semiconductor
 White Oak Technology Park
 Richmond, Virginia
 Capacity (wafers/week): 5,000
 Wafer size: 200mm
 Process: CMOS
 Products: DRAMs
 Feature sizes: 0.25 μ m, 0.35 μ m
 (Joint venture with Motorola. Operations to start in the spring of 1998).

Siemens has IC assembly and test facilities in Singapore, Indonesia, and Malaysia. The new backend fab in Portugal is already in a test phase. Full production will be in 1998.

Key Agreements

- Siemens joined the SLDRAM consortium (initially known as SyncLink) in early 1997. Seeking a successor to synchronous DRAMs, the SLDRAM consortium is developing an open DRAM architecture capable of enabling data transfer rates of 500MBytes- to 3.2GBytes-per-second. SLDRAM tape out at Siemens is scheduled for March 1998.
- Siemens is acting as a foundry for Elmos GmbH, a manufacturer of ASICs for the automotive market. Elmos' high-voltage CMOS technology was transferred to Siemens' fab in Villach, Austria.
- Siemens has formed a joint venture with Elmos called EPOS. The new fabless company develops and sells ICs combining microcontrollers and power on one chip for target markets. The ICs are manufactured by Siemens and Elmos.
- Siemens formed a joint venture company with Mosel-Vitellic to manufacture advanced high-density DRAMs, beginning with the 64M generation. The new fab and headquarters for ProMOS Technologies is in Hsinchu, Taiwan. Siemens holds a 38 percent share in ProMOS and Mosel-Vitellic holds the remaining 62 percent. The total venture investment is estimated to be \$1.7 billion.

- Siemens and Motorola are building a \$1.5 billion DRAM fab near Richmond, Virginia. The jointly-owned facility, named White Oak Semiconductor, is scheduled to enter production in the spring of 1998. After volume production is reached, Motorola will convert its share of capacity to produce proprietary Fast Static RAMs (FSRAMs).
- Siemens has a second-source agreement with SGS-Thomson for Siemens' 16-bit MCUs, including those with embedded flash memory.
- Siemens, IBM and Toshiba are exploring further joint DRAM projects. As part of a separate agreement, Siemens and IBM are jointly producing 16M DRAMs in Corbeil-Essonne, France. Additionally, Siemens and IBM are discussing an expansion of their cooperative relationship.
- Siemens is a licensee of DSP Semiconductors' Pine and Oak DSP cores, as well as its TrueSpeech compression technology.
- Siemens and Sun Microsystems signed an agreement to embed Java technology into chips for smartcards.

SILICIUM MICROELECTRONIC INTEGRATION (SMI) (FORMERLY SYSTEM MICROELECTRONIC INNOVATION)

Silicium Microelectronic Integration GmbH
Wildbahn, 15236 Frankfurt (Oder)-Markendorf
Postfach 379
15203 Frankfurt (Oder)
Germany
Telephone: (49) (335) 546-2005
Fax: (49) (335) 546-3251

IC Manufacturer
Founded: 1993

Regional Offices/Representative Locations

Europe: Advanced Microelectronics Ltd. • Neuchatel, Switzerland
 Telephone: (41) 32-7299-405 • Fax: (41) 32-7258-185

Financial History (\$M)

	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	15	29	45	45	18
Employees	—	—	—	365	150

Ownership: Privately held - 51 percent Synergy Semiconductor, 49 percent Government of Brandenburg.

Company Overview and Strategy

Silicium Microelectronic Integration (SMI) is focused on supplying high-performance ICs for telecommunications, consumer, computer, industrial, and automotive markets throughout Europe. Currently, about two-thirds of SMI's total revenues are represented by foundry services.

SMI manufactures logic, memory and linear ICs. The company also produces ASICs, DMOS transistors, HF and IF circuits.

Silicium Microelectronic Integration is a joint venture formed by Synergy Semiconductor, the former East German bipolar semiconductor manufacturer VEB Halbleiterwerk Frankfurt on-der-Oder (HFO), and the government of Brandenburg (the German state in which the facility is located). Today, Synergy has a 51 percent controlling interest in SMI while the government of Brandenburg holds the remaining 49 percent.

The large HFO fab facility was established in 1960, and is the oldest in what used to be East Germany. At its peak in 1989, HFO employed 8,000 people and was almost totally self-sufficient. It produced its first IC in 1971, and focused on consumer, computer, industrial, and telecommunications markets exclusively in the Soviet Union and other Eastern Bloc countries.

Products and Processes

SMI's semiconductor products include: bipolar linear and mixed-signal gate arrays; telecommunications ICs; smart power switches; ICs for watches, clocks, and televisions; Hall-effect ICs, DMOS transistors, HF and IF circuits for radio and audio applications; and ICs for audio power applications.

SMI's semiconductors are based on either the company's established bipolar and MOS process technologies or Synergy's proprietary ASSET bipolar technology, which was transferred to SMI's fab in 1993.

Summary of SMI's types of technologies.

- SMI Master Families
- ECL Products
- Telecom ICs
- ICs for High Speed Data Communication
- Smart Power Switches
- ICs for Radio Controlled Watches and Clocks
- ICs for Lighting Applications
- ICs for Audio Power and Automotive Applications
- ICs for Proximity Switches
- ICs for Radio and Television Applications
- Miscellaneous
- Supplement

Semiconductor Fabrication Facilities

SMI GmbH

Frankfurt (Oder), Germany

Capacity (wafers/week): 2,400 (10,500 max.)

Wafer size: 100mm

Processes: Bipolar, BiCMOS, MOS

Products: Logic, memory, and linear ICs; ASICs

Feature sizes: 1.2 μ m

Key Agreements

- Synergy and SMI are co-developing new products aimed at high-performance telecommunications and computational markets.

SWINDON SILICON SYSTEMS LIMITED

Swindon Silicon Systems Limited
Radnor Street
Swindon SN1 3PR, United Kingdom
Telephone: (44) 1793-614039
Fax: (44) 1793-616215

Fabless IC Supplier

Employees: 13

Ownership: Privately held.

Company Overview and Strategy

Swindon Silicon Systems Limited was formed in 1978 to design and supply high performance integrated circuits. SSSL's activities now include the design and supply of ASICs and standard products. Markets include: communications; automotive; and military.

Products and Processes

Available technologies include:

- Bipolar
- CMOS
- BiCMOS

Swindon Silicon Systems is ISO 9001 certified.

Swindon has developed relationships with the following wafer vendors.

- Austria Micro Systems
- IBM
- Alcatel Mietec
- Maxim
- SGS-Thomson Microelectronics
- UMC
- Chartered Semiconductor

THESYS MICROELECTRONICS

Thesys Microelectronics GmbH
 Haarbergstrasse 61
 99097 Erfurt, Germany
 Telephone: (49) (361) 427-6000
 Fax: (49) (361) 427-6161
 Web Site: www.thesys.de

IC Manufacturer
 Founded: 1968

Regional Offices/Representative Locations

North America: Austria Mikro Systeme International GmbH • Cupertino, California
 Telephone: (408) 865-1217 • Fax: (408) 865-1219

Financial History (\$M)

	<u>1993</u>	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	18	33	60	60	36
Net Income					(11)
Capital Expenditures	9	10	12	18	5
Employees	480	480	500	480	425

Ownership: Privately held - 51 percent AMS; 49 percent German State of Thuringia.

Company Overview and Strategy

Thesys Microelectronics specializes in application-specific semiconductors and offers capabilities ranging from FPGA to ASIC conversions, mixed-signal ASICs and ASSPs to foundry services. Thesys' mixed-signal technologies provide unique solutions for traditional telecommunication, automotive, and industrial applications, as well as for evolving wireless communication and multimedia markets.

Thesys Microelectronics was originally known as VEB Karl Marx, and was founded in 1968 as the Eastern Bloc center of excellence for microelectronics. VEB specialized in microelectronic technology and product development, manufacturing a broad range of products ranging from discrete diodes to complex LSIs. Of the latter, VEB supplied EPROMs, dynamic and static RAMs, and microprocessors that fulfilled Z80, 80286, and 32-bit VAX functions.

After the reunification of Germany, VEB was taken over by the Treuhand, an organization responsible for the privatization of former East German companies. In October 1992, VEB, in a first step of privatization, became Thesys Gesellschaft für Mikroelektronik GmbH with 80.2 percent of the company owned by the German State of Thuringia and 19.8 percent by U.S.-based semiconductor manufacturer, LSI Logic Corporation.

In mid-1995, Austria Mikro Systeme AG (AMS) acquired a majority interest (51 percent) in Thesys. The German State of Thuringia divested 31 percent of its holding, retaining a 49 percent share. LSI Logic relinquished its shares in the company.

Through the ownership by AMS, Thesys receives free process, design, and product/technology transfers from AMS. In addition, the design and production capabilities of Thesys' fab facility is being upgraded and expanded.

Management

Hans-Jürgen Straub	President and Chief Financial Officer
Konrad Herre	Vice President, Production and Development

Products and Processes

Thesys' IC products include analog, digital, and mixed-signal CMOS and BiCMOS ASICs (gate arrays and standard cells) and ASSPs, high-frequency BiCMOS devices, and full-custom ICs. Its ASICs are available with up to 150,000 available gates and up to 488 pins. Thesys also provides image processing system support and design, as well as foundry services.

Thesys has design centers located in Düsseldorf, Frankfurt, Munich, and Stuttgart.

Semiconductor Fabrication Facilities

To supplement its own manufacturing capacity, Thesys has established foundry agreements with Zilog, LSI Logic, and UMC.

Thesys Microelectronics GmbH
Haarbergstrasse 61
99097 Erfurt, Germany
Cleanroom size: 10,670 square feet (Class 1)
Capacity (wafers/week): 2,100
Wafer size: 150mm
Processes: CMOS, BiCMOS
Products: Analog, digital, and mixed-signal ASICs; ASSPs; foundry services
Feature sizes: 0.6 μ m-1.5 μ m

Key Agreements

- In February 1998, Thesys renewed a multi-million-dollar contract for EDA tools and services with Cadence Design Systems, Inc.
- Thesys and Austria Mikro Systeme (AMS) have a product development agreement. The agreement covers free process, design, and product technology transfers from AMS to Thesys, while BiCMOS and CMOS expertise at both companies is shared. As part of the agreement, AMS and Thesys have developed a new mixed-signal 0.6 μ m CMOS process which was qualified for production in 1997. AMS has a 51 percent controlling interest in Thesys.
- Thesys and IMEC, Belgium's Research Institute for Microelectronics, announced a license agreement that allows Thesys to use IMEC's flash memory technology. IMEC developed the solution for 0.7 μ m technology, which provides an ideal starting point for industrial implementation with Thesys' 0.8 μ m process. Consideration has already been given for further scaling of the HIMOS technology to the 0.6 μ m platform currently under development at Thesys.
- Thesys concluded an agreement with United Microelectronics Corporation (UMC) of Taiwan in early 1994 that brought UMC's 0.8 μ m process technology to Thesys' manufacturing facility in Erfurt.
- Thesys formed a strategic partnership and technology licensing agreement with Aspec Technology, Santa Clara, California, in early 1994. The deal allows Thesys to design and manufacture 0.8 μ m ASIC gate array and embedded array products using Aspec's Portfolio family of HDA design tools.

THOMSON-CSF SEMICONDUCTEURS SPECIFIQUES (TCS)

Thomson-CSF Semiconducteurs Specifiques

Route Départementale 128, BP 46

91401 Orsay Cedex

France

Telephone: (33) (1) 69-33-00-00

Fax: (33) (1) 69-33-03-21

Web Site: www.tcs.thomson-csf.com

IC Manufacturer

Regional Offices/Representative Locations

North America: Thomson Components and Tubes Corporation, TCS Division • Totowa, New Jersey
Telephone: (201) 812-9000 • Fax: (201) 812-9050

Asia: Thomson Tubes Electroniques • New Delhi, India
Telephone: (91) (11) 644-78-83 • Fax: (91) (11) 648-26-84

Japan: DASCO • Tokyo, Japan
Telephone: (81) (3) 5351-1184 • Fax: (81) (3) 5351-1986

Company Overview and Strategy

Thomson-CSF Semiconducteurs Specifiques (TCS) is a subsidiary of Thomson-CSF, the professional electronics wing of France's Thomson SA. Thomson-CSF develops and supports advanced electronic equipment and systems for security, information, and communications applications in military, civil, and high-reliability (hi-rel) applications. As a side note, Thomson-CSF owns 20 percent of SGS-Thomson Microelectronics.

Since the mid-1970's TCS has been designing, manufacturing, and marketing hi-rel semiconductors for military, aerospace, and professional electronics applications. Its semiconductor products include ASICs, microprocessors and controllers, non-volatile memories, linear devices, and image sensors. Through its long-term cooperation and license partnerships with major semiconductor suppliers such as Motorola and SGS-Thomson Microelectronics, TCS is able to offer hi-rel versions of leading edge commercial technologies and products. In addition, to meet the long lifecycle requirements of hi-rel systems, the company has implemented a specific strategy to insure that its devices are available for periods in excess of 25 years.

Management

Corporate

Denis Ranque	Chairman and Chief Executive Officer
Daniel Rapenne	Senior Executive Vice President
Benart Retat	Senior Executive Vice President
Alain Hagelauer	Senior Vice President, Finance

Group

Jean-Robert Martin	Sextant Avionique
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Products and Processes

TCS has three hi-rel semiconductor product lines: standard products, including microcomponents, non-volatile memories, and linear ICs; ASIC products from linear to digital and mixed-signal; and image sensors, including CCDs and infrared sensors.

Standard Products

TCS produces hi-rel versions of Motorola microcomponents, everything from 68000, and PowerPC microprocessor families and microcontrollers like the 68302, the 68332, and the 68en360 to peripheral chips such as PCI bus bridges, memory controllers, and clock drivers.

Through its partnership with SGS-Thomson, TCS offers hi-rel versions of non-volatile memories — 16K to 1M, Flash EPROMs, and single-voltage flash memories starting at 4M.

TCS' standard products also include monolithic fast A/D converters (6-bit to 12-bit) for military and aerospace systems, as well as for scientific, industrial, and medical instruments.

A device called the FingerChip is being developed. The FingerChip device combines both fingerprint sensor and conventional microelectronic technologies to form a monolithic device that will scan a fingerprint directly from the chip surface. No optical parts will be needed.

ASIC Products

TCS' ASIC design and production capabilities range from high-complexity CMOS digital products to high-performance analog arrays and mixed-signal products. Applications for its ASICs include radio communications, video, data processing, and sensor data acquisition.

Semiconductor Fabrication Facilities

Thomson-CSF Semiconducteurs Specifiques

Avenue de Rocheplaine, BP 123

38521 Saint-Egrève Cedex, France

Telephone: (33) (4) 76-58-30-00

Cleanroom size: 28,000 square feet (Class 10-1)

Wafer size: 100mm

Processes: CMOS, NMOS, BiCMOS, bipolar

Products: MPUs, MCUs, MPRs, EPROMs, flash memories,
ASICs, linear ICs, CCDs, and IR sensors

Feature sizes: $\geq 0.5\mu\text{m}$

UNITED MONOLITHIC SEMICONDUCTORS (UMS)

United Monolithic Semiconductors
Route Departementale 128
B.P. 46
91401 Orsay, Cedex-France
Telephone: (33) (0) 1-69-33-03-08
Fax: (33) (0) 1-69-33-03-09
Web Site: <http://ums-gaas.com>
IC Manufacturer
Founded: 1996

Regional Offices/Representative Locations

Europe: United Monolithic Semiconductors Alberta • Ulm, Germany
 Telephone: (49) (0) 731-5-05-30-02 • Fax: (49) (0) 731-5-05-30-02

Financial History (\$M)

	<u>1997</u>
Sales	\$23
Employees	150

Ownership: Privately held - 50 percent Thomson-CSF; 30 percent Daimler-Benz Aerospace; 20 percent TEMIC.

Company Overview and Strategy

United Monolithic Semiconductors designs, produces and sells devices and monolithic integrated circuits based on GaAs technologies. With ASIC development and production, the company also provides foundry services. Besides supplying components for other companies, UMS provides standard components for the open communication market, available for distributors and representatives worldwide. UMS provides key components for mobile communications, radiolinks, automotive radars, traffic control, space, defense, and ISM.

Products and Processes

Following are the three major product lines of UMS.

Traffic, Automotive, and ISM

- Focuses on road pricing and identification systems at 5.8GHz. UMS is the first in the world to provide complete MMIC solutions compatible to CMOS ASICs or processors
- Automotive radar MMIC sets (77GHz).

Communications

- HPAs for MOBICOM (35dBm at 3.3V, 45 percent PAE, DC/DC on chip).
- RF frontends for cordless systems.
- mm-wave and microwave radio: these transmit and receive components for point-to-point and point-to-multi-point systems. This includes very low noise amplifiers, mixers, drivers, variable gain, and medium power amplifiers up to 27dBm. A family of high power amplifiers up to 30dBm at 28GHz and 28dBm is presently under development.

Defense and Space

- UMS is supplying nearly all GaAs components required for defense systems, ranging for 1GHz to 94GHz, covering low noise (<1dB at 6GHz, <1.3dB at 12GHz, <2.5dB at 60GHz) and high power up to 9W at 10GHz. In addition, UMS provides gain and phase control circuits and multifunctional MMICs. For space, UMS supplies LNAs and discrete devices for power applications. Two technologies (low noise and high power) are presently under space qualification.

Semiconductor Fabrication Facilities

United Monolithic Semiconductors

Wilhelm Runge Strasse 11

D-89081 Ulm, Germany

Telephone: (49) (0) 731/5-05-30-02

Fax: (49) (0) 731/5-05-30-05

Capacity (wafers/year): 5,000 for 3 inch
10,000 for 4 inch

Processes: MESFET, PHET, GaAs, HBT

Products: MMIC, ASIC

VTT ELECTRONICS

VTT Electronics
Tekniikantie 17
FIN-02150 Espoo, Finland
Telephone: (358) (9) 456-1
Fax: (358) (9) 456-7012
Web Site: www.ele.vtt.fi

IC Manufacturer

Company Overview and Strategy

VTT (Valtion Teknillinen Tutkimuskeskus) is a contract research and development laboratory for applied technical research. Two thirds of its research is contract-based and one third is self-initiated. Total staff is 2,700. VTT Electronics is one of the nine VTT research institutes, with a staff of 250. Research and development covers IC materials, processing and design, electronics hardware, measurement systems, and embedded software. VTT's budget for microelectronics research in 1996 was approximately \$10 million.

VTT's integrated circuit activities include process integration, process module development, circuit design, modeling, and test. The main emphasis is on mixed analog/digital technology for telecom, instrumentation and interface circuits, such as RFICs, sensor interfaces, and power circuits.

Other activities in silicon include crystal growth and epitaxy, silicon room-temperature radiation detectors, and silicon micro-mechanical and micro-optical sensors.

Management

Tapio Wiik, Ph.D.	Manager, Process Technology
Markku Aberg, Ph.D.	Manager, Design and Modeling

Products and Processes

VTT Electronics uses various process technologies including mixed-signal 0.8 μ m analog/digital CMOS (custom processes available), 0.8 μ m RF BiCMOS (24GHz, capacitors, resistors), and 0.6 μ m RF BiCMOS (30GHz, under development, includes inductors). Its products include RFICs, power ICs, silicon radiation detectors (3.0 μ m MOS), and silicon microsensors (bulk and surface).

Semiconductor Fabrication Facilities

VTT Electronics moved into a new Microelectronics Center in early 1997.

VTT Electronics

Tekniikantie 17

FIN-02150 Espoo, Finland

Cleanroom size: 11,000 square-feet (Class 10)

Wafer size: 100mm

Processes: CMOS, BiCMOS

Feature size: 0.8 μ m

WOLFSON MICROELECTRONICS

Wolfson Microelectronics
Lutton Court,
Bernard Terrace,
Edinburgh, Scotland, UK EH8 9NX
Telephone: 44 0 131 667 9386
Fax: 44 0 131 667 5176
Web Site: www.wolfson.co.uk

Fabless IC Supplier
Founded: 1984

Financial History (\$M)

	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales	5.31	5.67	7.01
Employees	—	—	55

Company Overview and Strategy

Wolfson Microelectronics is a leading developer of mixed-signal products and also has a strong intellectual property base in signal processing and design software. Wolfson has also introduced new interface products for digital imaging and audio processing applications.

Wolfson Microelectronics markets its products globally with over half of its revenues in 1997 from Asia Pacific. Wolfson is a supplier to a number of major electronic corporations and several high growth small to medium size enterprises on a worldwide basis.

Based in Edinburgh, United Kingdom, the company started as a Design House and then in 1993, it started marketing its own range of semiconductor products.

Management

David Milne, OBE, Ph.D.	Managing Director
James R.C. Reid	Technical Director
John McPate	Sales and Marketing Director
Neil Hattersley, Ph.D.	Finance Director and Company Secretary
John Urwin	Product Director

Products and Processes

Imaging

Wolfson provides high performance, system level, integrated A/D conversion solutions for document scanner, linear and area CCD interface systems.

Audio

Wolfson has recently introduced leading edge products into PC audio and consumer audio markets. The WM9701 is a fully compliant AC '97 analogue codec. Another product is a stereo audio DAC, WM8725. The technology leveraged to develop these and future members of the audio roadmap comes from Wolfson's strong history of custom IC development in wireless communications and audio band processing.

Converters

Wolfson Microelectronics' expertise in the design and production of data converters has been applied to a range of low power, high performance, standard products. A series of multiple channel 5/3V D to A and A to D converters are now being supplied.

Communications

Wolfson supplies a series of highly integrated system chips for international analogue cellular telephone standards (AMPS, TACS, NMT). In addition, a number of innovative communications chips for telephone and main modems, subscriber line interfaces, paging, radio control and radio detection to meet specific customer requirements have been developed. These products are complemented by specialist power management chips for mobile communications currently under development.

Key Agreements

- In December 1997, Wolfson Microelectronics and Texas Instruments collaborated on a joint development program for data converter products. Both Wolfson and TI will contribute marketing and engineering resources to the program with TI providing manufacturing facilities. Additionally, Texas Instruments has taken a five percent equity position in Wolfson Electronics. The joint program accelerates the expansion of Wolfson's product catalog of leading-edge data converters.

XEMICS SA

XEMICS SA
Maladière 71, P.O. Box
CH-2007 Neuchâtel, Switzerland
Telephone: (41) (32) 720-5511
Fax: (41) (32) 720-5770
E-mail: info@xemics.ch
Web Site: www.xemics.ch

Fabless IC Supplier

Company Overview and Strategy

XEMICS S.A. was created from the IC Design Business Unit of CSEM employing designers and engineers with a solid project design and management track record. XEMICS is a fabless semiconductor company, delivering advanced solutions to OEM customers. XEMICS is active in two areas.

- The ultra low-power, low-voltage, mixed-signal (analog, digital, RF), full custom ASIC solution: XEMICS helps customers identify the best approach for the realization of their ASICs and systems. Services available include: specification definition, design, testing, production management, and assembly.
- The Application Specific Standard Product (ASSP) solution: For key market segments, XEMICS develops a strategy for the commercialization of ASSPs. Three product lines are available: Ultra low-power 4- and 8-bit microcontrollers (CoolRISC), sensor interfaces, and short-range data radio-transceivers.

XEMICS is solution oriented and focuses on those markets for which low power, high performance and product miniaturization are key priorities.

Portable Instruments: hearing aids, medical assistance systems, portable audio systems, drug delivery systems, implanted devices.

Wireless Communications: short-range communications, body monitoring, pagers, personal communications.

Industrial Sensing and Control: energy metering systems, remote monitoring systems, vision and position systems, security.

Identification: access control systems, tags.

Management

Roland Heer	Chief Executive Officer
Remy Pache	Executive Vice President, Strategic Marketing and Business Development
Jean Martin	Executive Vice President, Production
Jean-Paul Bardyn	Executive Vice President, Operations and Quality

Products and Processes

As a fabless semiconductor company, XEMICS delivers solutions at the appropriate level of integration.

- Ultra low-power Custom Specific Mixed-Signal Integrated Circuits (ASIC)
- Ultra low-power Application Specific Standard Products (ASSP)
- Ultra low-power CoolRISC Microcontroller-based Products
- Ultra low-power digital cell libraries

From the initial concept through development to the production management of the finished system, either on-chip or in module form, XEMICS creates high integration innovative solutions for portable, wireless and battery-powered applications. Design expertise includes low-power, low-voltage (+0.9V), RF (to 900MHz), analog/digital, non-volatile memory and sensor elements on chip.

The custom- and application-specific ICs XEMICS develops cover the following segments.

- Portable Instruments
- Sensing Applications
- Short Distance Wireless Communication
- Low-Power Microcontroller and DSP
- Low-Power cell based ICs

Semiconductor Fabrication Facilities

XEMICS is a fabless semiconductor company that has business relationships and alliances with state-of-the-art fabs for its wafer supply and with assembly houses for chip packaging and system solutions.

- TSMC for down to 0.35 μ m mixed-signal, and 0.25 μ m digital CMOS process technologies.
- SGS-Thomson Microelectronics for down to 0.35 μ m BiCMOS mixed-signal/RF and CMOS process technologies.
- Alcatel Mietec for down to 0.35 μ m, mixed-signal CMOS process technologies.
- MHS/TEMIC for down to 0.5 μ m mixed-signal, non-volatile memory CMOS process technologies.
- EM Microelectronic-Marin for down to 1.0 μ m, mixed-signal and EEPROM CMOS process technologies.

Key Agreements

- Exclusive distribution agreement between Mentor Graphics Corporation Inventra Intellectual Property Division (Wilsonville, OR) and XEMICS SA of Neuchâtel, Switzerland, for XEMICS's ultra low-power digital cell libraries worldwide.
- Agreement with Sulzer Microelectronics USA (SME) to represent them in Fremont, California and with RTR Technologies Inc. to represent them in East Coast of United States and Canada.

ZENTRUM MIKROELEKTRONIK DRESDEN (ZMD)

Zentrum Mikroelektronik Dresden GmbH (ZMD)
 Grenzstrasse 28, Postfach 34
 01109 Dresden, Germany
 Telephone: (49) (351) 8822-0
 Fax: (49) (351) 8822-600
 Web Site: www.zmd-gmbh.de

IC Manufacturer
Founded: 1961

Regional Offices/Representative Locations

North America: ZMD America Inc. • Santa Clara, California
 Telephone: (408) 562-9310 • Fax: (408) 562-9311

Financial History (\$M)

	<u>1994</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>
Sales*	8	24	41	44
Capital Expenditures	27	23	15	16
Employees	560	550	490	526

*IC Sales only. SIMM-business separated from ZMD in 1996.

Ownership: 50 percent Dresdner Bank AG, 50 percent Commerzbank AG

Company Overview and Strategy

Zentrum Mikroelektronik Dresden (ZMD) develops, manufactures, and supplies integrated circuits and multichip modules, focusing mainly on application-specific integrated circuits (ASICs) and application-specific memory products.

The company's core business is silicon manufacturing. ZMD's four business units are: Foundry, Memory ICs, Mixed-signal ICs and Digital ASICs. The Foundry business designs, manufactures, tests, and packages digital and mixed-signal ICs for semiconductor manufacturers, fabless IC suppliers, and systems and hardware manufacturers. Silicon foundry customers include Siemens, Philips, and TEMIC. Memory products from ZMD comprise three sectors: standard SRAM, application-specific SRAM, non-volatile memories (nvSRAMs), and specialized DRAMs. The mixed-signal IC business specializes in identification systems particularly for automotive and communications applications. The Digital ASIC business area produces gate array and cell based ASICs and DSPs. ZMD also provides its FPGA Fast Prototyping Service and its FPGA-to-Gate Array Conversion Service to complete its semiconductor offerings.

ZMD was founded in 1961, as a leading research and development center in Eastern Europe. ZMD was the first East European company to build a 1M DRAM and to introduce ASIC technology. With more than 30 years of experience in the field of microelectronics, ZMD was re-founded as a private company in 1993, as a result of the reunification of Germany.

Management

Heinz W. Hagmeister	Chairman
Dr. Wolfgang Nolde	Chief Executive Officer
Rulf Petzoldt	Production and Technology
Klaus Kapitz	Sales
Frank Lorenz	Quality Assurance

Products and Processes

ZMD's product offerings include:

- ASICs
 - Digital cell-based ICs (up to 500,000 transistors)
 - Gate arrays (up to 100,000 transistors)
- ASSPs
 - Telecommunication ICs
 - Industrial communication ICs
 - Automotive electronics ICs
 - MCUs
- Memory
 - Standard SRAMs
 - Application-specific SRAMs
 - Non-volatile SRAMs
- PCMCIA Cards

ZMD develops and manufactures digital and mixed-signal ASIC products for customers in many sectors of the electronics industry. The mainstream ASIC families, based on 0.8 μ m SPDM CMOS technology, are the U2400 Cell Array Series and the U5600 Gate Array Series. In 1997, an EEPROM option, a second polysilicon layer option for resistors and capacitors, a fuse option, and a high voltage transistor option (up to 40V) were made available. Also in 1997, a low voltage 0.8 μ m CMOS process operating on supply voltages down to 1.2V with options for EEPROM and analog features for single-battery applications were made available.

In addition, ZMD offers 2.0 μ m and 1.2 μ m BiCMOS processes with high voltage transistors (up to 40V). Additional analog options make the BiCMOS processes also suitable for analog and mixed-signal design.

All ZMD technologies used for ASIC products are also offered for silicon foundry services. Additional services are provided for special customers like Siemens, Philips, or TEMIC, where their own technology is provided.

Standard SRAMs up to 256K and application-specific SRAMs (specializing in fast automotive types up to 256K) are the basis of ZMD's memory business. DRAMs are manufactured for special foundry customers only.

The current strategy of ZMD's memory products business is focused on nvSRAM technology. The nvSRAM not only provides the advantages of fast SRAMs but also those of EPROMs. Development of nvSRAM occurs jointly with Colorado Springs, Colorado-based Simtek. ZMD's new 64K and 256K nvSRAM product families are available with access times of 25ns, 35ns, and 45ns.

Semiconductor Fabrication Facilities

Zentrum Mikroelektronik Dresden GmbH

Grenzstrasse 28

Postfach 34

01109 Dresden, Germany

Cleanroom size: 16,000 square feet, Class 10 (locally Class 1)

Capacity (wafers/week): 2,000

Wafer size: 125mm

Processes: CMOS, BiCMOS

Products: ASICs; memory, microcomponent, and telecom ICs; DSPs; foundry services.

Feature sizes:	0.8 μ m-2.0 μ m	CMOS
	0.8 μ m	SNOS-CMOS
	0.8 μ m-1.2 μ m	Analog CMOS
	1.2 μ m, 2.0 μ m	BiCMOS

ZETEX SEMICONDUCTORS

Zetex Semiconductors
Fields New Road
Chadderton
Oldham OL9 8NP, United Kingdom
Telephone: (44) (161) 622-4422
Fax: (44) (161) 622-4446
Web Site: www.zetex.com
Email: uk.sales@zetex.com

Discrete/IC Manufacturer

Financial History (\$M)

	<u>1997</u>
Sales	62
Employees	500

Company Overview and Strategy

Zetex is one of Europe's leading suppliers of discrete and linear integrated circuits. The company was formed as the result of a management buyout from Plessey Semiconductors in 1989, its parent company is Telemetrix plc.

Applications areas are: automotive; computing; industrial electronics; and telecommunications.

Management

Bob Conway Chief Executive Officer

Products and Processes

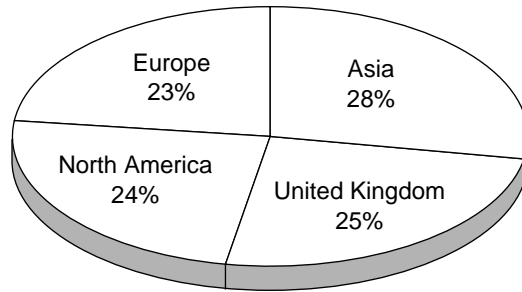
The wafer fab area utilizes silicon planar technologies including:

- Bipolar
- Vertical DMOS

Assembly is also performed including surface mount packages.

Zetex is QS-9000 certified.

Products include the 555 timer IC and various NPN and PNP bipolar transistor configurations.



1997 Sales by Geographic Region