ELECTRONIC MARKET DATA BOOK 1985

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FOREWORD

The important role of the electronic industries in the U.S. economy is depicted by many statistical trends. U.S. shipments of electronic equipment, systems and components totaled $172.5 billion in 1984, representing a growth rate of 17% over 1983 shipments. More than 1.8 million Americans were employed in electronics manufacturing in 1984. Employment in U.S. electronic industries grew by an estimated 10% in 1984. One of the keys to success in the electronic industries is the high degree of innovation and R&D activity that contribute to their vitality, productivity, and international competitiveness. Currently, the electronic industries spend about one-fifth of total industrial R&D funds.

The Electronics Industries Association (EIA) is the national trade organization representing all segments of electronics manufacturing, from the familiar home television set to the most sophisticated electronic systems used in national defense and space exploration.

Long recognized as a reliable source of accurate statistical information on the electronic industries, the annual *Electronic Market Data Book* contains detailed information on production, sales, foreign trade, R&D, and U.S. Government markets. Covering the many diverse products of the electronic industries, the *Electronic Market Data Book 1985* is based on data provided to EIA by several hundred companies, supplemented by selected government and private sources.

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INTRODUCTION

Electronics has been called the most influential technology of the 20th century, and much of its impact is yet to come.

Radio and television, computers, satellites, factory automation, space flight, and sophisticated defense systems are all made possible by electronics. With recent developments in microelectronics technology, allowing hundreds of thousands of electronic circuits to be imprinted on a dime-sized chip of silicon, electronics is now facilitating the everyday functions of banks, supermarkets, kitchens, mail delivery, and offices of every kind. Pick up your phone, start your car, turn on the news, or read a clock and you are in touch with the electronics revolution. During the remainder of this century, electronics will have a pervasive and long-lasting influence on international trade, employment, communications, industrial productivity, entertainment, and our entire way of living.

Electronics is defined as the branch of science and technology that deals with the study, application, and control of the conduction of electricity in a vacuum, gas, liquid, semiconductor, conductor, or superconductor. Electronic *products* contain materials, parts, components, subassemblies, and equipment which employ the principles of electronics in performing their major functions. The ability to influence the flow of electricity distinguishes electronic equipment from that which is merely electrical.

The electronic *industries* include organizations involved in the design, development, manufacture, assembly, or application of electronic equipment, systems, or components. Electronics has grown from a $200 million U.S. industry in 1927 to $172.5 billion in 1984. By the end of the 1980s, electronics is expected to rival the automobile, steel, and chemical industries in sales volume.

HISTORY

The control of electrons was first achieved in 1883 when Thomas Edison induced electrons to jump across the partial vacuum between a carbon filament and a metal plate in his light bulb. In 1897, the electron was discovered in England by Sir Joseph John Thomson. Electronic communications—the transfer of information from one place to another in the form of electronic circuits—began in 1894 when Oliver Lodge developed a system of wireless communications in England. Around the turn of the century, considerable progress in wireless telegraphy was made by Guglielmo Marconi, Ernest Rutherford, and others. The invention of the three-element vacuum tube by Lee De Forest in 1906 made possible the development of radio broadcasting and the practical application of television.

The usefulness of wireless communications in saving many lives from the *Titanic* in 1912 and during World War I demonstrated to the United States the importance of being a world leader in developing this technology. Between 1910 and 1920, rapid progress was made in the theory, application, and construction of vacuum tubes and other electronic components such as capacitors and resistors. Following the introduction of ground-to-aircraft radio communications during World War I, radio broadcasting stations began operating throughout the United States.

Radio sets were first sold to the public in 1920. The earliest industry statistics show that 100,000 radios were sold in 1922 at an average factory value of $50 each, and in the same year 1 million electron tubes were sold at an average price of $6 each. In 1924, a handful of manufacturers gathered in Chicago to form the Radio Manufacturers Association (RMA), which later became the Electronics Industries Association (EIA). By this time, annual factory sales of radios had jumped to $50 million. An estimated 750 new firms entered the industry between 1923 and 1926, taking advantage of the rapidly expanding market and the fact that relatively little capital or trained labor was needed to manufacture radios.

In 1926 President Coolidge referred to the invention of radio as "one of the most wonderful incidents in the advance of civilization," and told RMA that the Government "stands ready to do what may be done to encourage the development of radio."

In the years to follow, the industry was plagued by such problems as overproduction and patent infringement suits. Consumer preference for well-known brands began to develop, and by 1934, only about 40 U.S. firms remained in the industry. The absence of technical standards presented what was perhaps the industry's greatest problem, and the creation of standardization procedures by RMA was considered its most significant contribution to the rapid development of radio broadcasting and the eventual introduction of television, FM radio, and other broadcast services.

Although radio manufacturers were hit by the financial failures and low profits of the Depression era, the need for entertainment amidst widespread unemployment made the 1930s the golden years of radio. The years prior to World War II also saw technical progress in many areas, including the development of television, radar, oscilloscopes, voltmeters, and electromechanical analog calculators and computers.

Although television and FM radio were first authorized in 1941, civilian production of electronic products was suspended within a few months after Pearl Harbor, and the radio industry converted its plants and manpower to production of military equipment for communications, detection, surveillance, and guidance. The War Production Board reported that in 1941, factory sales of radios totaled $240 million, and by 1944, the ra-

dio and radar industry, including parts manufacturing, reached a peak production rate of $4.5 billion per year—a gain of 1,775%! With the stimulus of multi-million dollar R&D funding, electronics entered a period of extraordinary growth and innovation, leading to the production of sophisticated radar, sonar, testing, measuring, and flight control equipment. Giant calculators, the first form of digital computers, were perfected for use in high-speed data processing, automatic fire, navigation, and flight control.

The cessation of hostilities caused a sharp decline in electronics manufacturing from its wartime peak of 560,000 workers, but the post-war advent of large-scale television production resulted in another upward trend in employment. Also contributing to the post-war growth of consumer electronics was the development of high fidelity sound, FM radio, and the first tape recorders. Sales of radio equipment were superseded by the advent of television, the increasing application of electronics to industrial uses, and expanding military markets.

Wartime research also contributed to a technological breakthrough that transformed the electronic industries: the invention of the transistor, announced by Bell Laboratories in 1947. A transistor consists of semiconducting material—usually silicon—to which minute quantities of impurities have been added, causing it to conduct electricity and perform switching operations. Initially developed for telephone switching and first used in hearing aids and military products, this tiny, ultra-reliable substitute for the electron tube proved ideal for computers and consumer products. Electronics was soon to become dominated by semiconductor technology.

The laborious, time-consuming process of assembling components into electronic equipment, the growing number of transistors used as switching devices in computer and other digital equipment, and the increasing complexity of circuits eventually led to the next, inevitable breakthrough in electronics: fabricating transistors and other components such as capacitors and resistors from a quarter-inch-square piece of silicon. The integrated circuit (IC) was born in 1959, and produced in mass quantities by 1962.

The growth of the semiconductor industry was made possible by large orders from the U.S. Department of Defense for integrated circuits used in military equipment in the late 1960s. This led to huge increases in production, resulting in rapid price decreases which made semiconductors cost-effective for many consumer, industrial, and commercial applications. This also helped to stimulate growth of digital computer technology and markets.

It soon became feasible to combine thousands of circuits into a single silicon chip, in a technique known as large-scale integration (LSI). During the past two decades, phenomenal increases in the number of circuits that can be imprinted on a chip have been accompanied by huge reductions in cost and energy consumption. By the end of the 1970s, the United States was selling over $6 billion worth of semiconductors annually to worldwide markets, and the advanced industrial nations were racing to develop "very large-scale integration" (VLSI), in which hundreds of thousands of circuits are etched onto a chip using lithography of micrometer line widths.

Since most of the time and expense needed to produce ICs comes at the design stage, the use of special chips for particular applications has often been discouraged by the complexity of the design required. This has fostered the development of the microprocessor, in which the entire central processing unit of a computer—the complex circuitry that processes information and carries out computations—is contained on a silicon chip. Because its software can be altered to fit a variety of applications, the microprocessor can be incorporated relatively cheaply into a wide range of products and systems, from cruise missile to children's toys.

The growth of electronics has thus been built on the development of circuits, from the vacuum tube to the transistor to the integrated circuit. While the phenomenal potential of semiconductor technology has only begun to be realized, ongoing research in VLSI, optical circuitry, superconduction, and other technologies may soon lead to yet another era in electronics technology.

SUMMARY

U.S. factory sales of electronic equipment, systems, and components totaled $172.5 billion in 1984, an increase of 17% over the 1983 total of $147.3 billion.

Sales of industrial electronic products, including computers and related products sold to commercial markets, accounted for almost 39% of the industry total. In 1984, sales in the industrial category came to $67.6 billion, marking a 15.8% increase over 1983 sales of $58.4 billion.

Communications equipment and systems accounted for another 26.7% of total electronics shipments. Sales in this category came to an estimated $46.1 billion in 1984, an increase of 11.2% over the 1983 total of $41.4 billion.

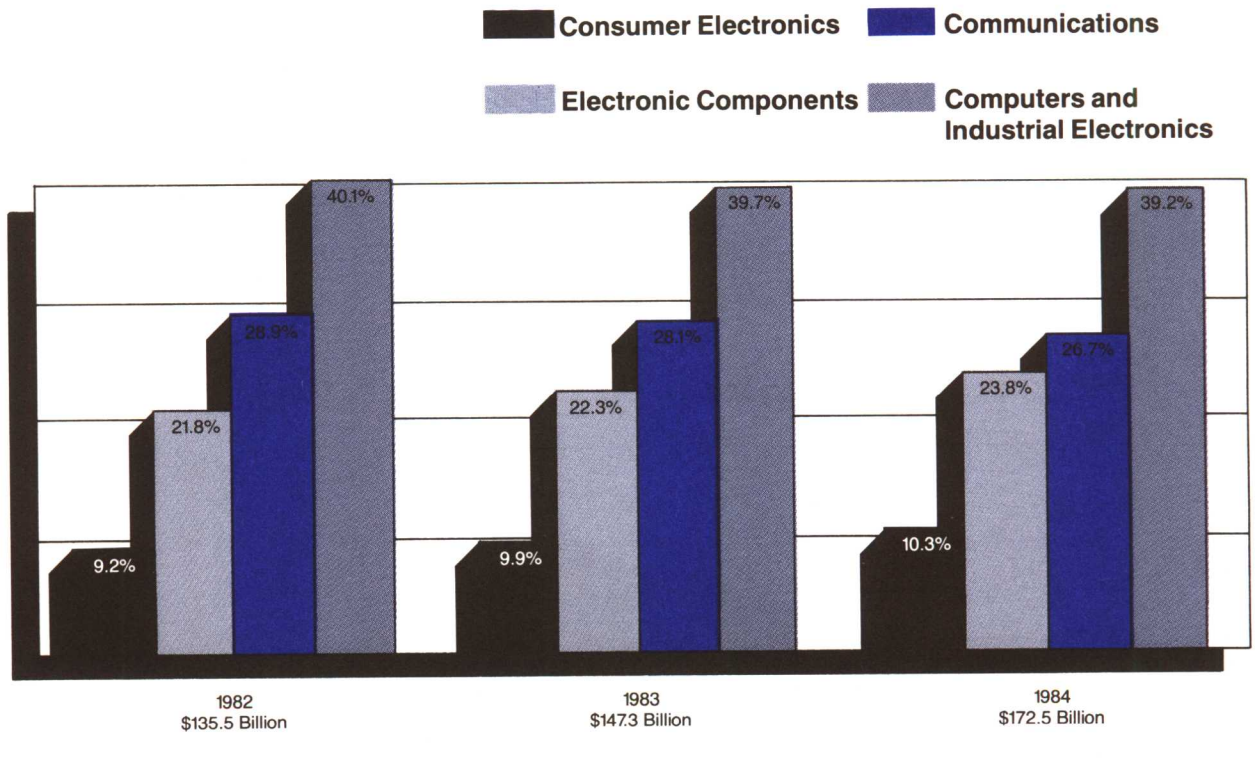
Factory sales of electronic components totaled $41 billion in 1984, an increase of 24.8% over 1983 sales of $32.9 billion.

The consumer category saw a 21.8% increase in factory-level sales, with the 1984 total reaching $17.8 billion, compared to 1983 sales of $14.6 billion. Consumer electronics accounted for over 10% of the electronic industries' total sales volume in 1984.

An estimated 1,810,000 persons were employed in electronics manufacturing and related activities in 1984. This represents a 10.4% increase over the 1983 total of 1,639,400.

U.S. exports of electronic products came to $31.8 billion in 1984, and imports totaled $40.3 billion, resulting in a balance of trade deficit of $8.5 billion.

Factory Sales of Electronics by Industry Group (%); United States, 1982-1984



Factory Sales of Electronics by Industry Group ($ Million); United States, 1975-1984

Year	Consumer Electronic Products[1]	Communications Equipment and Systems[2]	Computers and Industrial Electronics[3]	Electronic Components[r]	Grand Total[r]
1975	5,224	14,302	13,457	9,708	42,691
1976	6,739	15,695	16,865	11,762	51,061
1977	8,145	19,041	20,164	13,538	60,888
1978	9,107	21,737	25,697	17,101	73,642
1979	9,359	25,734	32,412	21,366	88,871
1980	10,891	30,772	38,996	25,605	106,264
1981	12,453[r]	35,659	47,225	28,839	124,176
1982	12,516[r]	39,130[r]	54,302[r]	29,577	135,525
1983	14,575[r]	41,404[r]	58,432[r]	32,886	147,297
1984	17,758	46,060[e]	67,645[e]	41,055[e]	172,518

[1]Does not include sales of home telephones and answering devices, home computers and software, programmable video game and video game cartridges. Data prior to 1981 exclude video disc players and blank audio cassettes. Data prior to 1982 exclude blank video cassettes.

[2]Includes sales of home telephones and answering devices estimated at $1.115 million in 1983 and $1,480 million in 1984.

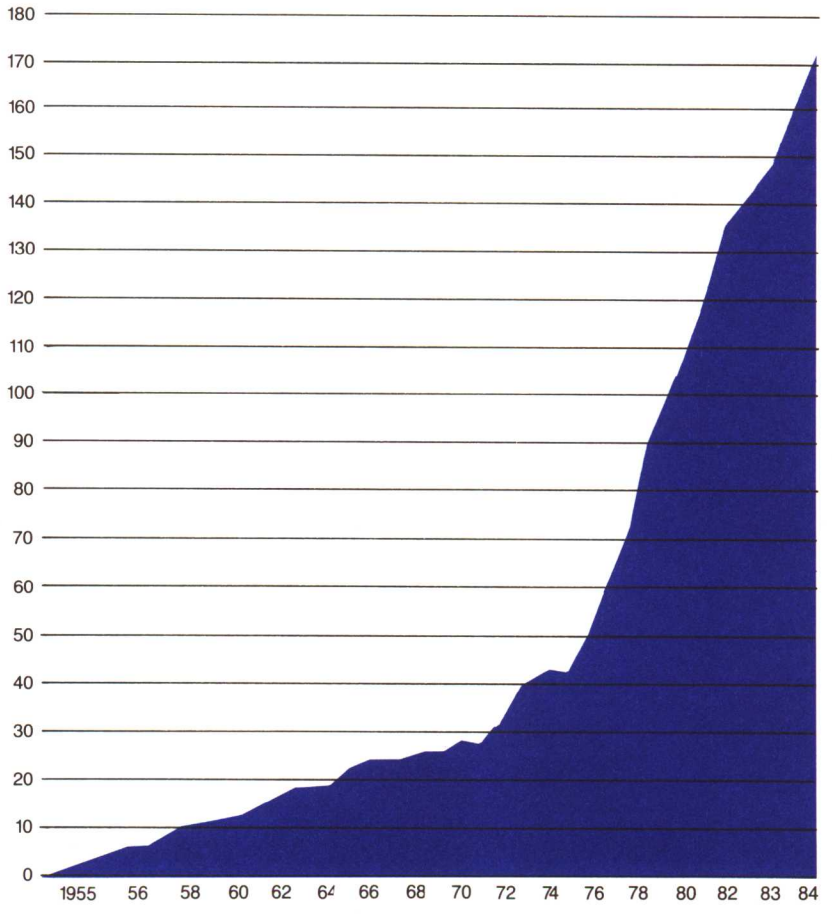
[3]Includes sales of home computers and programmable video games estimated at $2,710 million in 1983 and $2,415 million in 1984.

r-Revised.

e-Estimated.

SOURCE: Tables 1-1, 2-1, 3-1, and 5-1 in this edition of the Electronic Market Data Book.

Total Sales of Electronics ($ Billion); United States, 1955-1984



CONSUMER ELECTRONICS

The consumer electronics industry swept into the decade of the '80s on a technological tidal wave that brought with it a new generation of entertainment, educational and commercial products and systems that have already had a profound impact on the lifestyles of America. Its impressive array of products: **Video**—Television, Tape and Disc Systems and Software, Satellite Earth Stations and Videotex; **Audio**—Components, Compacts and Personal Units, Tape Equipment, Radios and Car Audio; **Computers and Video Games**—Home Computers, Game Consoles, Accessories and Software; **Telecommunications**—Telephones, Telecommunications and Communications Equipment; and **Personal Electronics**—Watches, Calculators, Electronic Games and Toys, Security Systems, Health Care Products—adds up to total industry retail sales of nearly $34 billion annually.

This is an industry that offers consumers a steady diet of innovative products at prices that are remarkable values when measured against other items listed in the Consumer Price Index.

As the decade of the '80s continues, excitement is being generated across the entire spectrum of industry products. In video it centers on the emergence of component TV systems, an expansion of program sources and new uses for the TV screen. Digital hi-fi products and the advent of multi-channel sound for video are sparking a renewed surge of interest in audio. Personal computers and video games have drastically altered the way millions of Americans spend their working and leisure hours. In personal products, the revolution in how America communicates, educates, does its business and cares for itself—all with the aid of electronics—has only just begun.

Unit sales to retailers of such items as color televisions, videocassette recorders and cameras set all-time records in 1984, resulting in an overall value of factory sales of $23.4 billion, a value of nearly $34 billion at retail.

Color television receivers continued as the industry's largest dollar value product, with factory sales of just over $5.5 billion in 1984. Monochrome television receiver factory sales decreased to $419 million. Videocassette recorder factory sales rose to $3.6 billion from $2.2 billion in the preceding year (Table 1-1).

Factory sales of audio equipment, including complete home systems, separate components, portable tape

TABLE 1-1

Factory Sales of Consumer Electronic Products ($ Million); United States, 1975-1984

Category	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Monochrome TV Receivers	416	495	530	549	561	588	505	507	465	419
Color TV Receivers	2,268	2,755	3,289	3,674	3,685	4,210	4,349	4,253	5,002	5,538
Projection TV	–	–	–	–	–	–	287	236	268	385
Video Cassette Recorders	34	65	180	326	389	621	1,127	1,303	2,162	3,585
Color Cameras	–	–	–	–	–	–	147	232	303	355
Video Disc Players	–	–	–	–	–	–	55	54	81	45[e]
Audio Systems[1]	474	489	606	748	748	809	720	573	630	976
Separate Audio Components	652	1,027	1,275	1,143	1,178	1,424	1,363	1,181	1,268	913
Home Radio	372	356	523	436	436	468	501	530	565	661
Portable Audio Tape Equipment[2]	653	1,055	1,208	1,649	1,739	1,403	1,157	971	1,102	1,191
Car Audio[3]	355	497	534	582	623	1,368	2,000[r]	2,100[r]	1,900[r]	2,484
Blank Audio Cassettes	–	–	–	–	–	–	242	219	249	275
Blank Video Cassettes	–	–	–	–	–	–	–	357	580	931
Total	5,224	6,739[r]	8,145	9,107	9,359	10,891	12,453[r]	12,516[r]	14,575[r]	17,758
Estimates by Consensus[4]	–	–	–	–	–	7[e]	44[e]	4,310[e]	5,975[r]	5,680[e]
GRAND TOTAL	5,224	6,739	8,145	9,107	9,359	10,898	12,497[r]	16,826[r]	20,550[r]	23.438

[1]Prior to 1981, data includes console phono.
[2]Prior to 1980, data includes some tape equipment other than portable.
[3]Prior to 1980, data reflects factory installed car audio products only.
[4]Includes home computers, software, programmable video games, video game cartridges, telephones, telephone answering devices, and video discs.
r-Revised.
e-Estimated.
SOURCE: EIA marketing Services Department.

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