Responsibilities to Customers

Research and Development of Next Generation Products

Pursuing research and development of creative technologies and products with sights set on the next generation.

Research and Development Policies

Guided by its corporate creed of "Creativity and Contribution," Casio is moving forward vigorously with its research and development efforts, aiming to contribute to society through the development of innovative products.

The electronics industry is a place of rapid technological innovation. Committed to building cutting-edge technology and the latest electronic components into its products, Casio continues to provide the world with original product concepts and designs that stimulate new demand.

Research and Development Strategies

Casio's core competence lies in high density packaging, LSI, software/IP,* communications and digital broadcast, information system, and electronic component technologies. Accordingly, the company is developing products and technologies that are focused on these proprietary technologies and are also compact, lightweight, slim, and energy efficient. Casio is creating advantage through the human interface technologies and expertise that the company has amassed by developing its diverse range of consumer products.

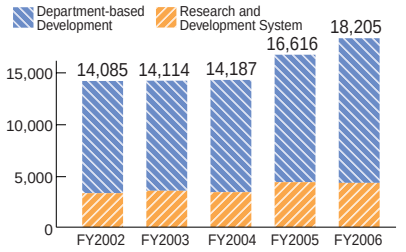
Casio is also currently concentrating its efforts on development in the field of image digitalization (digital cameras). This effort capitalizes on the company's digital technologies, which have their roots in Casio electronic calculators and have now expanded into fields like sound (electronic musical instruments) and text digitalization (electronic dictionaries).

Casio is also stepping up its efforts to construct a mechanism to consolidate the knowledge of experts within and outside the company. It is doing this through the formation of partnerships and alliances with outside organizations, such as public research centers and universities, in fields where medium to long-term growth is anticipated, and in technical fields with potential to become innovative core technologies.

* IP technology: Internet protocol (IP) technology manages communication routes and device addresses on networks.

The company spent ¥18,205 million on research and development in fiscal 2006. The expenditure was broken down by business type and by segment as shown at right.

Breakdown of research and development expenditure by business division (Unit: ¥ million)



Research and Development Organization

Casio's research and development is organized into a primary Research and Development System tasked with basic research and developing elemental technologies and next-generation products, and a Department-based Development System that handles product development that is directly linked to individual departments.

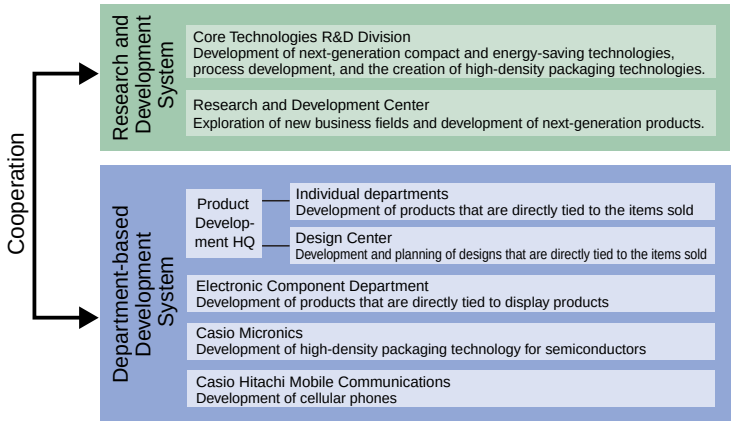
Research and Development System

The Research and Development System includes the Core Technologies R&D Division and the Research and Development Center, which are set up within Casio Computer Co., Ltd. These departments develop technologies to make inroads in new business fields, as well as fundamental technologies that are shared by all business operations. They also perform research and development, including development of next-generation products and process technologies. In order to tackle technological fields where long-term growth is projected and technology themes that have the potential of becoming next-generation core technologies, Casio is promoting joint research with outside research organizations and the formation of alliances with other corporations.

Department-based Development System

Development organizations set up within various departments and Casio group companies operate under the Department-based Development System. Here, research and development of new technologies and production technologies relating to individual products are carried out in cooperation with sales departments.

Research and development system diagram



List of research themes / joint research partners (in random order)

List of research themes

Fuel cells, WLP/EWLP®, organic EL, thin film nano-technology for next-generation information devices, basic technology for the building of a nano-medicine production base, equipment noise reduction, environmental noise measurement, etc.

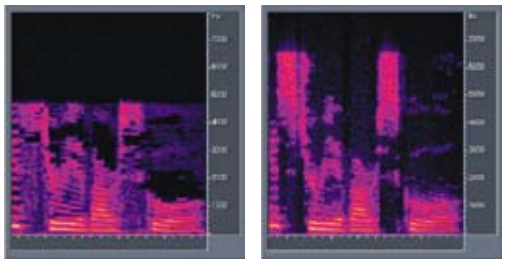
List of joint research partners

Kochi Prefecture, Kyoto City, Kochi University of Technology, Kyushu University, Kyoto University, Kogakuin University, Yokohama National University, Saitama University, University of Tokyo, Tokyo Institute of Technology, University of Electro-Communications, Tohoku University, Tokyo University of Agriculture and Technology, etc.

Development of Sound Compression Technology

Casio Computer Co., Ltd., has developed a voice function for its electronic dictionaries, far surpassing the potential of paper dictionaries. With sound quality that is close to a real voice, this technology provides more realistic sound and longer battery life, all at a reasonable price.

Since 2005, Casio electronic dictionaries have featured Casio's own True Voice sound compression format for better language learning. This technology has expanded the sound reproduction range compared to previous electronic dictionaries. By faithfully reproducing vowels and consonants it is now possible for users to more clearly hear the sound of a native speaker pronouncing the word by itself or in a dialogue. Moreover, the specialized LSI has been eliminated through technology that decodes the compressed sound at high speed, and the computing is performed by the electronic dictionary's CPU instead. This has resulted in a low-cost, energy-saving product with improved battery life. In the future, Casio will expand the number of word and dialogue pronunciations through better compression rates, and will apply the technology to products other than electronic dictionaries by adapting it for other applications.



Earlier technology　　True Voice

True Voice expands the sound reproduction range.

Digital Terrestrial Broadcasting High-sensitivity Tuner Technology

Following the start of digital terrestrial broadcasting in Japan in December 2003, One Segment broadcasting for reception by cellular phones commenced on April 1, 2006. To maintain good cellular phone reception, tuner technology that enables reception of digital broadcast signals while on the go over a wide area is indispensable. For several years, Casio worked to develop such tuner technology and has come up with orthogonal frequency-division multiplexing (OFDM) demodulation circuits, which can greatly improve sensitivity compared to conventional technology. The circuits incorporate three technologies: (1) technology that not only performs analysis and correction of digital broadcast frequency and signal strength, but also signal processing even with time fluctuations; (2) technology that controls an RF tuner so that optimal signal reception conditions are maintained even when signals are distorted by reflection off a building or for other reasons; and (3) technology that controls the directional characteristics of the primary antenna by raising the voltage of the auxiliary antenna to receive stronger signals.

W41H cellular phone with terrestrial digital broadcast receiver

Products featuring part of this technology were released in February 2006. Casio will continue to develop technology that incorporates OFDM demodulation circuits together with antenna and tuner RF circuits. Casio is constantly improving the efficiency of this tuner technology, thereby increasing the performance of One Segment receivers, most notably cellular phones.

Development of Biometric Authentication Technology

Given the popularity of online transactions and the exchange of documents over the Internet via computers and mobile devices, information security has become a pressing issue. That is why Casio Computer Co., Ltd., has been researching and developing core technologies related to information security. In particular, Casio has been developing fingerprint-scanning devices and fingerprint authentication algorithms that can serve as biometric authentication technologies that help identify the user of the device. Casio's devices have the special ability to obtain high-quality images from various types of fingerprints, and the authentication algorithms can handle a wide range of fingerprint image quality. Consequently, it is now possible to handle a variety of fingerprint images, which vary by the person's lifestyle and occupation. This technology can affect vast numbers of people, and is particularly important for applications such as online transactions and document exchange, where easy-to-use fingerprint authentication systems are required.

Biometric authentication device

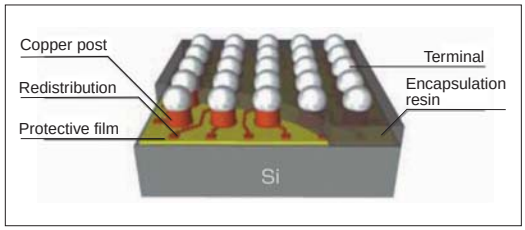
Development of High-density Packaging Technology (WLP Technology*1)

With the advancement of digital products, semiconductors need to be ever more compact and feature ever greater performance. Casio is researching high-density packaging technology to contribute to the realization of better semiconductors.

Casio has been developing Wafer Level Package (WLP) technology since 1997, and in 2001 Casio Micronics started WLP mass production. In 2002, WLP was widely adopted in the image signal processing devices for GPS cellular phones with built-in cameras. Since 2003, WLP has spread to other areas such as flash memory for digital cameras and sound generator LSIs for cellular phones.

In fiscal 2006, the Casio Micronics No. 2 Factory set up 300-mm wafer-size processing for WLP technology, and started mass production of the industry's most advanced semiconductors in 2006. Casio is also promoting the development of Embedded Wafer Level Package (EWLP) technology*2, which is gaining attention as next-generation systems-in-a-package (SiP), making mass production possible at Casio's partner manufacturers of printed circuit boards. The company has also established the EWLP Consortium in order to promote greater use of EWLP technology in the industry.

Cross-sectional view of a WLP

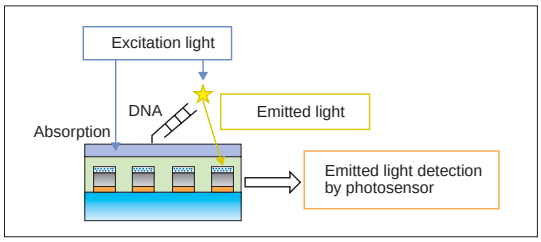


*1. Wafer Level Package (WLP): This is a new semiconductor-packaging technology that enables copper redistribution, electrode terminal formation and resin encapsulation to be done in the wafer stage.
*2. Embedded Wafer Level Package (EWLP): This technology embeds WLPs in a printed circuit board.

R&D for Biosensor Technology

There is a growing need today for new technologies that can help reduce medical costs. Casio Computer is carrying out joint R&D with Tokyo University of Agriculture and Technology in order to realize DNA diagnosis utilizing TFT photosensors which form the core of biometric authentication devices, which Casio is also developing. Presently, basic research is being carried out in the following technological areas: (1) immobilization of DNA on a sensor; (2) chemical reaction processing on a sensor; and (3) single nucleotide polymorphism (SNP)* determination based on fluorescent labeling, in diagnosis models that perform SNP determination, which has a strong relation to human alcohol sensitivity. By directly immobilizing DNA on a sensor, it is possible to make the entire system more compact. In the future, Casio will continue research and development of biosensor technology. The aim is to realize compact, easy-to-use biosensor systems that can enable genetic diagnosis in hospitals, and eventually at home.

Genetic diagnosis using biosensors



* Single Nucleotide Polymorphism (SNP): A DNA sequence variation occurring in a single nucleotide (A, T, C, or G) of the genome that enables the determination of susceptibility to a disease. It is estimated that there are three million SNPs for human beings.

Research and Development of OLED Display*

Casio Computer Co., Ltd., is pursuing the development of organic light emitting diode displays (OLEDs) that employ an amorphous silicon TFT drive and a printing OLED. This effort is guided by the company's commitment to developing energy-saving, space-saving and environmentally friendly technologies that are based on a simple design and manufacturing process.

In fiscal 2006, Casio began developing small flat panel displays (FPDs) for portable information devices, adding this to its existing development program for large FPDs. As a result of this effort, Casio has realized improved peak brightness, aperture ratio, writing ratio, and image characteristics. This was achieved through the adoption of custom driver LSI and a new drive method, as well as high aperture ratio and high definition technologies. These technologies utilize Casio's own distinct printing OLED process and amorphous silicon TFT device design.

OLED display

* OLED display: A device that displays text and images by using organic light emitting diodes that produce light when an electric current is passed through them. Because they are self illuminating, OLED displays require no backlighting. They thus consume less electricity and are thinner than liquid crystal displays. OLEDs provide a wide viewing angle and a fast response speed for smooth picture movement. For these reasons, they are expected to become the next-generation display.

In the future Casio will focus on the printing OLED process and hyper amorphous silicon TFT (HAST) technology application for small displays. In addition to developing high-resolution, high-productivity technology, the company aims to reduce flame area (outside of the view area) to increase added value in small size displays.

Participation in Collaboration of Regional Entities for the Advancement of Technological Excellence*

Kochi Prefecture
Development of Thin Film Nano Technology for Next-Generation Information Devices

Casio has been participating in the above-named project since January 2003. At a results briefing exactly halfway through the project period, it was announced that a working prototype of a 60,000-pixel zinc-oxide TFT display had been created, and that the theory behind this technology had been proven. The project has already shown that low-resistance zinc oxide offers the same properties as indium tin oxide (ITO) at 180$\mu\Omega$-cm, and the aim is now to improve upon this performance to less than 100$\mu\Omega$-cm. Based on these results, it is expected that a high aperture-ratio, power-saving display with a low-temperature, energy-saving manufacturing process will be realized.

Field emission lamp (FEL) technology uses thin nano-diamond film as an electron source, and was originally developed for display backlighting. The project has created a sample of FEL for use in vehicle taillights, in a joint research project with an automobile manufacturer. Subsequently, this technology has gained a lot of attention at various exhibitions, as well as through the official results announcements. FEL has become a reality for a wide range of uses as a power-saving, mercury-free lighting technology.

World's first zinc-oxide TFT display


Second research results presentation
October 14, 2005
Panel Discussion: Creating New Industries in Kochi Prefecture


Prototype of a Four-Color Field Emission Lamp Using Thin Nano-diamond Film

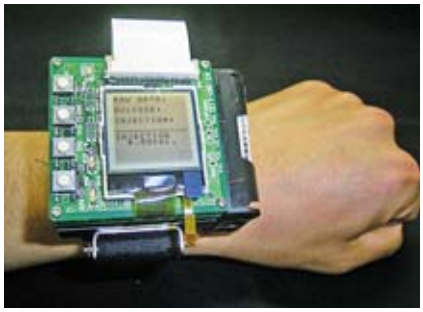
Japanese-language Website of Kochi Prefecture's Collaboration of Regional Entities for the Advancement of Technological Excellence
http://www.kochi-create.com

Kyoto City
Development of Fundamental Technology to Create a Key Location for Nano Medicine

Kyoto City's Collaboration of Regional Entities for the Advancement of Technological Excellence project began in January 2005 and is led by Kyoto University. It aims to develop fundamental technology to create a major site for nano medicine. This five-year project will operate until December 2009.

There are four groups in this project working closely together and sharing results. These groups are involved in development of: (1) portable devices for blood analysis focusing on several markers for tumors; (2) wristwatch-type devices that perform painless blood collection and analysis using a micro-needle; (3) nano materials that enable imaging and targeting of tumor markers that are unique to cancer; and (4) imaging and targeting materials based on magnetic resonance imaging (MRI) technology that uses nano particles.

The goal of this research is to create new technology that will help build a future society where people can feel secure by knowing the current status of their health. Casio Computer is participating in the group for development of wristwatch-type devices, and is promoting the development of systems devices for medical testing.


Prototype of a second-generation wristwatch-type device


Kickoff meeting
March 23, 2006

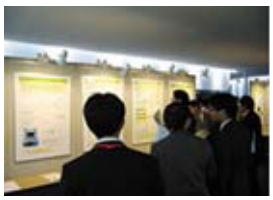


Exhibit at the joint symposium
May 29, 2006

Japanese-language Website of Kyoto City's Collaboration of Regional Entities for the Advancement of Technological Excellence
http://www.astem.or.jp/kyotokesshu/index.html

*** Collaboration of Regional Entities for the Advancement of Technological Excellence (CREATE):**
Projects conducted by various communities (prefectures or government-designated cities) in one of the eight priority research fields specified by the Japanese government—life sciences, information and telecommunications, environment, nano technology, materials, energy, manufacturing technology, and social foundation/frontiers. The projects draw upon the collective efforts of community research potential (R&D-oriented corporations, universities, public testing and research organizations) to advance research and development in the community's chosen field. The goal is to contribute toward the creation of new technology and new industries throughout Japan.

Management of Intellectual Property

Policies and goals

Casio is promoting a unified business strategy while linking research and development with its management of intellectual property. The company aims to increase profitability and protect its business through proper management of intellectual property. Casio views intellectual property as an important indicator of corporate value. The company has set out the following four points as its policies and goals for effectively promoting intellectual property management and properly administering its results.

Intellectual Property Management Policies

1. Making Casio a company with strong technologies and intellectual property rights
   - Establishment and promotion of intellectual property strategy based on business, technology, and product strategies
   - Global acquisition of strong intellectual property rights based on competitive technologies
   - Creation of better awareness in order to strengthen intellectual property
2. Utilizing intellectual property rights
   - Making the most of intellectual property using the overall activities of the entire company
   - Promotion of licensing (cross licensing)
   - Elimination of Casio product imitations
3. Avoiding the risk of intellectual property infringement
   - Prevention of use of third-party intellectual property rights by always placing importance on technological advancement
   - Thorough investigation of third-party intellectual property rights
4. Developing human resources for intellectual property
   - Intellectual property education for employees of the company at all levels
   - Training of intellectual property specialists

Role of the Intellectual Property Center

Creation of innovative new technologies and products has been Casio's approach to development since the beginning. The competitiveness of a corporation is heavily influenced by its ability to protect its innovations through patents. At the same time, companies must patent their brands and designs, in order to protect themselves from fakes and imitation products.

The Intellectual Property Center is tasked with managing Casio's intellectual property worldwide. Its role is to ensure the competitiveness of Casio's business by making use of secured patent rights, design rights, trademarks and other rights. The center is also responsible for resolving disputes and signing agreements with third parties, while broadly managing all intangible assets and intellectual property rights such as copyrights and trade secrets.

Intellectual Property Activities

Casio has various systems in place to properly manage the intellectual properties that it has amassed over the years. They also ensure that research and development results will continue to be produced, resulting in new intellectual properties.

(1) Patent application and acquisition activities

The aim of these activities is to establish basic and de facto patents based on the improvement of quality, while building a patent network through patent application and acquisition in important fields (selection and concentration).

(2) Utilizing intellectual property rights

Using intellectual property rights already obtained, Casio provides licensing to other companies (including cross licensing). At the same time, the company rigorously pursues and eliminates imitations of Casio products.

(3) Patent Advisory Engineer System

This system was initiated in 1994 for the ongoing creation of outstanding intellectual properties. Highly qualified engineers with good technical knowledge and strong leadership qualities are appointed as patent advisory engineers and assigned to divisions. Their responsibility is to strengthen the intellectual properties within their individual divisions by helping to create core inventions, explore opportunities for new inventions, evaluate inventions, and avoid infringement of other companies' patents.

(4) Techno Power

The Techno Power awards were launched in 1992 to provide incentive to technology developers while encouraging the sharing and accumulation of technology. They provide engineers and designers with an opportunity to present their work to top management, and awards are given for outstanding achievements. By properly evaluating and rewarding intellectual property accomplishments, the Techno Power awards encourage engineers to take on new technological challenges with pride and motivation.

(5) Invention Prize System

In 1968, Casio created an Award Program to recognize employees' contribution through inventions and creative work. By providing incentives to inventors and creators, the program serves to motivate the company's engineers to tackle new technology. In addition, Casio recently revised its intellectual property regulations in compliance with Article 35 of the new Patent Law (Employee Inventions), which came into effect in April 2005. In the new regulations, the company added a discussion process to allow inventors to express their opinions, along with a mechanism for inventors to dispute the amount of a monetary award. The regulations were again revised in April 2006, to better meet the needs of inventors.

(6) Intellectual Property Education System

Casio conducts various educational activities in order to raise the employee awareness of the importance of competitive intellectual property acquisition. The company holds internal seminars to increase interest and understanding of intellectual property, discloses information on the utilization of the Website (the contents of the intellectual property homepage), and utilizes outside educational organizations, such as the Japan Intellectual Property Association and the Japan Institute of Invention and Innovation.