

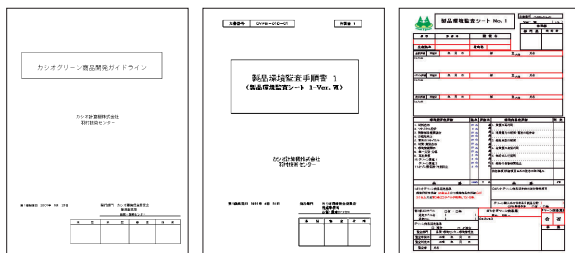
Development of Green Products

The Casio Group considers products that are light weight, compact, and energy efficient as its core competence and that developing environmentally conscious products having little environmental impact is one way to contribute to the environment.

Eco-Designs Assessment and Green Products Certification

Under its Casio Voluntary Plan for the Environment (CVPE), the Casio Group has been conducting assessments of new products since 1993. In 2001, we created the Casio Guidelines for Green Product Development to clarify the standards for developing Casio Green Products as eco-products. Based on these guidelines and documented procedures for product-related environmental audits, we prepare product environmental audit sheets,

which are used to conduct product assessment at every stage of planning, design review, and design. Based on the assessment results, we certify products that meet 90% or more of requirements in the Environmental Design Assessment and two or more items in the Environmental Compliance Assessment as Casio Green Products.



■ Casio Guidelines for Green Products Development ■ Documented procedures for product environmental audits ■ Product environmental audit sheet

Environmental Design Assessment

Degree of adoption of basic eco-designs
 • Implementation of 3R, use of Green Parts, disclosure of product environment information, etc.

Environmental Compliance Assessment

Degree of adoption of advanced eco-designs
 • As an industry leader, energy conservation, resource-saving use of lead-free solder, etc.

Product Assessment results

Product type	FY2001 results	FY2002 results	FY2003 results
Electronics Equipment Division products	121	92	73
Electronics Component Division products	45	80	84
Total	166	172	157

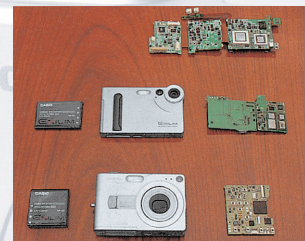
Green Product Development Technology Applied to Digital Cameras

For downsizing the internal circuit packaging area composed of the image processor and memory that are keys for realizing a thin card-size body, we have developed three-dimensional multiple-LSI packaging using an ultrahigh-density packaging technology. We have also adopted SiP (System in Package), which enables multilayer stacking of each package and forming of a single chip composed of the packages. Through these technologies, we have developed digital cameras with high performance – high-speed operation, high-resolution images, and low power consumption – and thin card-size bodies.

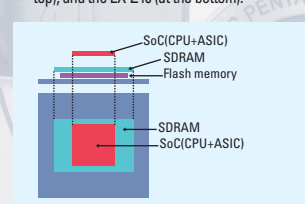
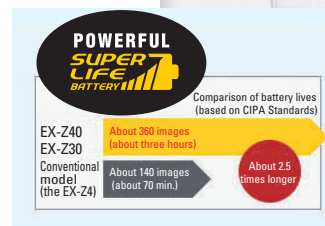
For semiconductors, low power consumption has been promoted whenever SiP has been upgraded in accordance with new product development. The power consumption of the SiP installed in the latest model is approximately one-fourth that of conventional SiP. Thanks to the high-capacity battery installed in the space created as a result of downsizing the circuit packaging area, the battery life of the EX-Z30/Z40 is about 2.5 times that of conventional models. According to CIPA Standard Procedure for Measuring Digital Still Camera Battery Consumption established in December 2003, fully charging the battery once enables continuous recording of about 360 still images (about three hours).



■ EX-Z40



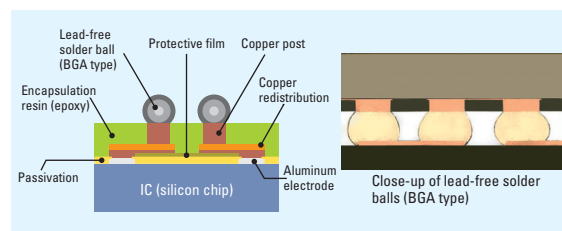
■ The photo shows changes in appearance and the batteries installed in circuit packaging areas with the EXILIM (the first model, placed at the center), the previous model (at the top), and the EX-Z40 (at the bottom).



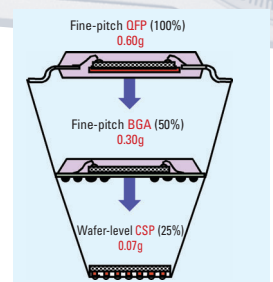
■ High-density circuit packaging area of the EX-Z40

WAFER-LEVEL CSP Technology Supporting High-performance Image Processing

By adopting WAFER-LEVEL CSP (Chip Size Package), a high-density packaging technology developed by Casio Micronics Co., Ltd. that leads to downsized, light weight, and low-cost products, we have drastically reduced the number of parts and downsized the circuit packaging area so that the circuit can be packaged on conventional boards. In addition, lead-free solder is used for circuit packaging area joints.



■ Structure of WAFER-LEVEL CSP



■ Size comparison

Green Product Development Technology Applied to Watches

Maintenance-free radio-controlled solar-powered watches, which keep accurate time and do not need battery replacements, are rapidly expanding in the market. The WVH-500DJ and the WVH-100DJ, both of which are thin radio-controlled solar-powered watches, have thicknesses of 6 mm and 7 mm respectively.

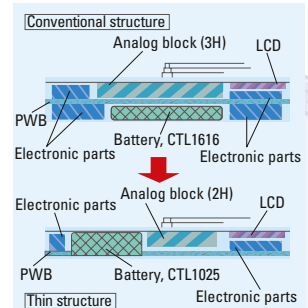
To make them thin, all parts are newly designed; especially the antennas and the batteries are custom-made (Casio original). Accordingly, compared with conventional watches in terms of size, the two thin watches are downsized as follows: 36% in antenna, 61% in battery, and 73% in IC together with peripheral parts.



■ WVH-500DJ



■ WVH-100DJ



■ Comparison between the conventional combined module structure and the thin structure

To Reduce Resources, Casio Actively Promotes Paperless Lifestyles through the Electronization of Paper

Green Product Development Technology Applied to Electronic Dictionaries

Our electronic dictionaries employ a new Casio-original structure, TAF-COT^{*1}, which emphasizes portability and is designed for realizing robustness, and with which a long life is achieved. With this structure, the electronic dictionaries are resistant against drops, bangs, and shakes that they are subject to during carrying or commuting.

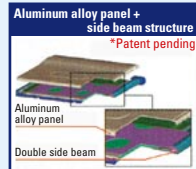
Especially, the EX-word H series features excellent portability that comes from a stylish body whose thickness is 9.8mm^{*2} – the thinnest electronic dictionary in the industry.

^{*1} Totally Advanced Force Control Technology

^{*2} The thinnest part of the main body (when the dictionary is closed and not covered by the My Panel cover) among full-fledged electronic dictionaries as of February 2004

Original reinforced structure reduces shocks

Reinforcing the body

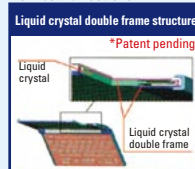


Side beams made of a high-tension special material and an aluminum alloy panel are packaged together. The panel thus made protects the liquid crystal and the electronic circuit parts from external pressure such as bending and pressing.

Note: Although the EX-word XD-W series featuring an LCD with a backlight has a different structure, its robustness is the same.

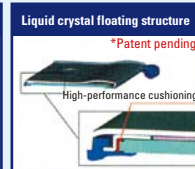
Note: The above contents are derived from data on tests carried out according to our standards; they do not guarantee that the actual product is free from cosmetic flaws, damage, or failures.

Protecting the liquid crystal from both directions



Liquid crystal double frames made of a high-tension special material are inserted in spaces derived from the downsized circuit packaging area created by high-density circuit packaging technology. The double frames protect the liquid crystal.

Absorbing shocks



High-performance cushioning is adopted to reduce stress caused by a sudden impact on the liquid crystal.



■ XD-H9100

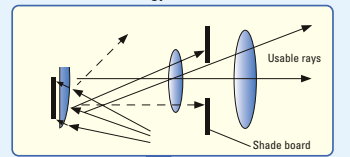
Paper reduction achieved by the spread of electronic dictionaries
..... Equals the preservation of about 300,000 trees

We estimated the effect of using electronic dictionaries by assuming that how many paper dictionaries are needed to cover the content of the electronic dictionaries that Casio sold in fiscal 2003. The total weight of the paper dictionaries (14,895 tons) required to cover the content + 50 kg (on the assumption that 50 kg of paper equals one tree) = the preservation of about 300,000 trees

Green Product Development Technology Applied to Data Projectors

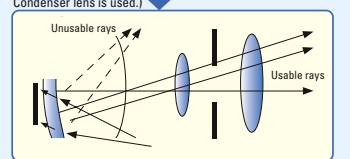
Data projectors project images by adjusting the light projected onto a screen. Casio adopts the Digital Light Processing (DLP) technology (in which mirror reflection is used) as the projection method so Casio data projectors will take up less volume. We also adopt the Inverse Meniscus Condenser (IMC) lens technology which, with the help of a special lens placed in front of the reflector, increases light-gathering ability. A reflector is provided around the light source to project the light onto the screen more efficiently. We adopt the Acornic Reflector (ACR) technology, which uses a reflector with an original shape to increase the brightness by 30%.

Conventional technology



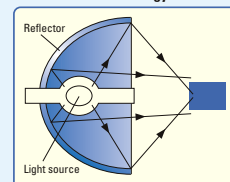
IMC technology

(An Inverse Meniscus Condenser lens is used.)

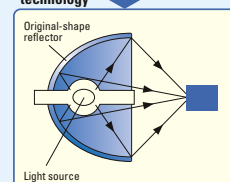


■ Projection method

Conventional technology



ACR technology



■ Light-gathering method



■ XJ-350



■ XJ-450

The XJ-350 (ultra-compact package, 230 x 55 x 171mm, 1.8kg) delivers 2200 ANSI lumens. The XJ-450 (compact package, 278 x 64 x 197mm, 2.4kg) delivers 2800 ANSI lumens. They are the smallest and the lightest among projectors with equivalent brightness in the world. (As of November 2003)

Note: The value is derived from a comparison between the expected brightness obtained by conventional technology and that by the ACR technology.

LCA Evaluation



We conducted LCA (Life Cycle Assessments) of 1.6-inch TFT LCD modules and virtual digital cameras.

Evaluated objects

TFT LCD modules

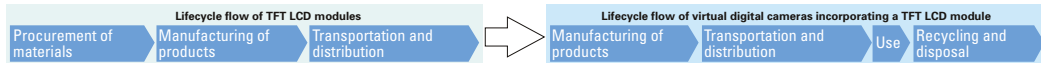
Model	2002 model	2000 model
Name	1.6-inch digital interface TFT color LCD monitor (80,000 pixels)	1.6-inch analog interface TFT color LCD monitor (60,000 pixels)
Main specifications	Power consumption: 0.16 W, Weight: 9 g, Dimensions (mm): 40.1 (W) x 32.5 (H) x 3.3 (D), LED backlight	Power consumption: 0.53 W, Weight: 12 g, Dimensions (mm): 42.6 (W) x 36.4 (H) x 5.9 (D), Cathode ray tubes backlight

Virtual digital cameras*

Virtual digital camera incorporating the 2002 model	Virtual digital camera incorporating the 2000 model
	

*A virtual digital camera is a non-existent camera that incorporates one of the TFT-LCD modules on the left.

Lifecycle flow



Conducting an LCA (per module/model)

TFT LCD modules: We calculated the environmental impact generated in the lifecycle stage of each model.

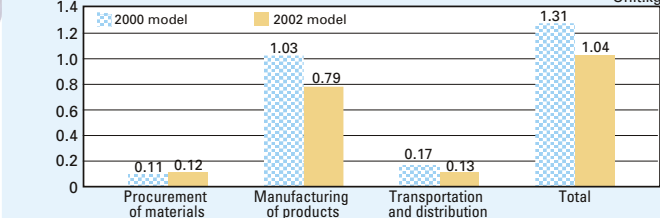
Virtual digital cameras: We estimated the difference** between the environmental impacts generated by the lifecycle stages of each of the two cameras.

** Difference between the environmental impacts = Environmental impact generated by the use of the virtual digital camera incorporating the 2000 model - Environmental impact generated by the use of the virtual digital camera incorporating the 2002 model; the difference shows how well eco-designs have contributed to the improvement in environmental impacts.

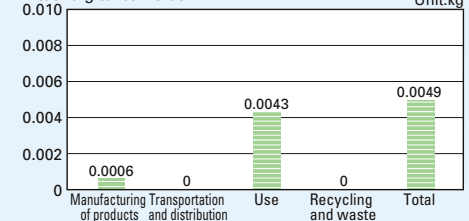
Inventory analysis (per module/camera)

CO₂ emissions

TFT LCD modules



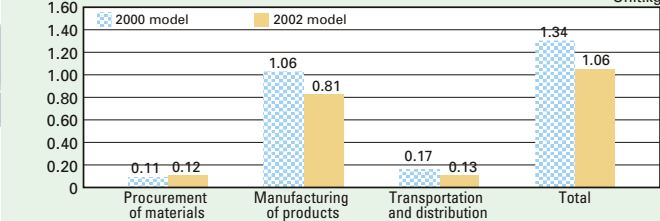
Virtual digital cameras



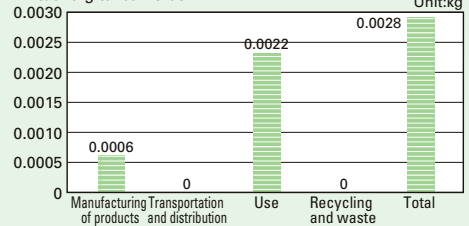
Impact assessment (per module/camera)

Global warming (in terms of CO₂)

TFT LCD modules



Virtual digital cameras



Conclusions

[TFT LCD modules] The inventory analyses and the impact assessments show that the 2002 model is superior to the 2000 model in terms of LCA. Especially, the value difference in the manufacturing stage was brought about by the great reduction of environmental impacts (electric power, water, etc.) achieved by manufacturing plants.

[Virtual digital cameras] The reason why the value difference in the use stage is large is that the 2000 model consumes more electric power than the 2002 model. The LCA result shows that the reduction of electric power consumption achieved by the 2002 model, which is due to design improvement, greatly contributes to the reduction of whole environmental impacts.

Utilizing the data in Casio

We are going to utilize the assessment data on the TFT LCD modules as in-house data.

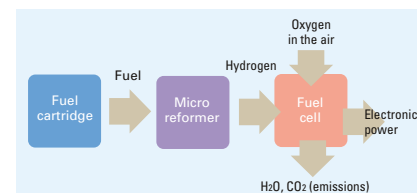
Note: The recycling and waste stage of virtual digital cameras does not contain a process in which mercury used for cathode ray tubes is made harmless.

Measures to Develop Micro Fuel Cells

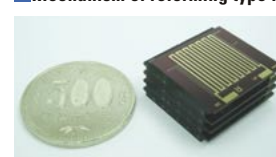
Micro fuel cells attract attention as a new technology that realizes the environmental consciousness and high energy characteristics which are required for future portable devices. By using technologies for processing electronic components, Casio has drastically downsized a hydrogen generator (reformer) which is said to be a lifeline to fuel cells.

The size of the reformer is only about 2 (W) x 2 (H) x 1 (D) cm. A fuel cell with the reformer on it can drive a common notebook PC for 8 to 16 hours.

The micro reformer shown on the right incorporates five types of reactors (a catalytic combustor, two types of evaporators, a steam reformer, and a CO selective oxidizer) and two types of control sensor (a temperature sensor and a thin film heater), all of which are necessary for generating hydrogen. Since the micro reformer is made up of an inexpensive glass material, it can be produced at a low cost. We will continue research and development in finding practical uses for micro fuel cells, which will lead to the development of environmentally conscious portable devices.



Mechanism of reforming type fuel cells system



Size comparison between a 500-yen coin and an all-glass integrated micro reformer

Progress on the Use of Lead-Free Solder

In fiscal 1999, Casio started using lead-free solder for environmentally conscious calculators. In fiscal 2003, all divisions completed establishing technologies for lead-free solder packaging, and the percentage of our products made with lead-free solder increased to 15%. We will actively promote the use of lead-free solder, and try to phase out leaded solder by the end of fiscal 2004.

Glossary

Inventory analysis: Environmental impacts are quantified for each stage, regarding inputs (energy, materials, parts, etc.) and outputs (CO₂, waste, etc.), and are listed in a table. Inventory analysis thus enables the quantification of input- and output-related environmental impacts.

Impact assessment: Based on the inventory analysis results, environmental impacts are assessed for each category item (energy resource, global warming, acidification, etc.). Specific impacts caused on the global environment are identified through such impact assessment.