

# Environmental Protection Activities Report

## Production of Environmental Measures on Products

The FDK Group is committed to offering eco-friendly and energy-saving products free of hazardous chemical substances through the entire life cycle of them from development and design stages to disposal of them.

## Offering Super-Green Products with the Top Environmental Elements

In the Third Environmental Action Plan, the FDK Group is involved in development and provision of super-green products with top environmental elements, one step forward of the conventional green products.

### Targets of the Third Environmental Action Plan

#### Provision of Super-Green Products by the end of FY 2006

- "Super Green Products" are the advanced form of green products incorporating such properties as energy saving, 3R (Reduce, Reuse, Recycle)-based design, and elimination of hazardous chemical substances. They are forerunners having the "world's first", "world's smallest", "nation's first", "industry's first", "nation's smallest" and "industry's smallest" characteristics, which are intended to be released by the end of FY 2006.

### Super-Green Products

In FY2005, the FDK Group was committed to producing super-green products by extracting 11 themes. As a result, the first super-green product was born: ultra small multilayer power inductor, 'MIPF 2520D Series.' The inductor is the top runner product in the world with its size reduced by 40% in volume compared to the conventional eco-friendly products of similar type. The FDK Group will continue its efforts so that more super-green products can be delivered to our customers.

#### Applications:

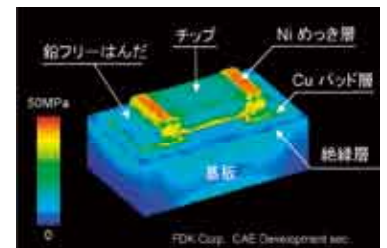
The ultra small multilayer power inductor is used as a part of a DC-DC converter used in mobile phones, digital cameras and other electronic products.



MIPF2520D Series,  
the first super-green product

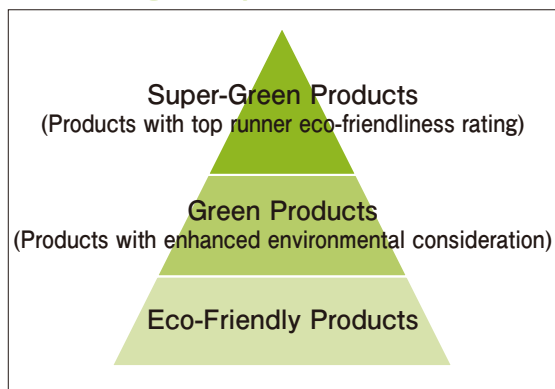
### Quality Assessment Simulation for Lead-Free Solder using CAE\*

As lead-free solder doesn't contain lead, one of the hazardous substances, its physical properties are different from conventional solders. Due to this reason, it is essential to select appropriate materials and design and manufacture parts in a way suitable for using lead-free solders. Believing that disclosure of physical properties of the lead-free solders and 'analyze' them are the best way to realize using lead-free solders, the FDK Group develops and uses a unique simulation technology. The technology incorporates the unique know-how of the FDK Group nourished through manufacturing and the latest study results.



A result of temperature cycle analysis  
of a chip using lead-free solders  
(Mises Stress Analysis)

### Positioning of Super-Green Products



### Eco-Friendly Product Assessment Category (Large Category)

#### Products

- Hazardousness (including hazardous chemical substances)
- Resource-saving and recycle-oriented design
- Reusability as resources
- Easiness for decomposition
- Energy-saving
- Easiness for disposal by disassembly

#### Packaging Materials

- Resource-saving and recycle-oriented design
- Reusability
- Using materials

#### Others

- Disclosure of information
- Eco-friendliness

\*CAE (Computer Aided Engineering): A computer system that supports design and development process of industrial products

## Major Eco-Friendly Products Developed in FY2005

### Ultra Small Multilayer Power Inductor 'MIPF2016D Series'



#### Application

Core parts for a converter circuit of small-sized electronic parts used for mobile phones, etc.

#### Features

As an ultra small multilayer power inductor applying multi-layer technology and an improved version of the MIPF2520D Series, the MIPF2016D Series is smaller by 40% in volume compared to their predecessors while keeping the same performance. The small in size is applicable as electronic parts of the third generation mobile phones that incorporate advanced functions of one segment broadcasting and GPS.

#### Eco-Friendliness

Due to the small-in-size by 40% in volume compared to their predecessor inductors, the MIPF2520D Series contribute to small-in-size and light-in-weight mobile phones. No lead-containing solders are used or required in manufacturing and mounting them.

#### Voice from the Developer

A revised internal structure is embedded in the inductor using the CAE technology and know-how nourished so far. In addition, the balance of magnetic paths is optimized. Due to them, the requirements for small-in-size and maintenance of high efficiency are realized at the same time.



Daisuke Matsubayashi  
Advanced Technology Lab.  
Technology R&D Div.

### Ultra Small Multilayer Chip Low Pass Filter 'AMF1005L Series'



#### Application

Various high frequency module and other circuits of a mobile phone to eliminate high frequency noises

#### Features

In addition to optimization of multi-layer pattern using computer simulation, the products are developed using dielectric material technology, low temperature sintering technology and multi-layer printing technology. The products are the world-smallest low pass filter of 1.0mm×0.5mm×0.3mm.

#### Eco-Friendliness

Free of lead, the products are in compliance with EU's RoHS Directive. While maintaining the features, the products are smaller in volume by 80% than the conventional products. The chip size is the smallest of its kind in the world. Due to these features, volume of raw materials, power consumption and wastes are also minimized.

#### Voice from the Developer

Computer simulation is utilized in designing to minimize the environmental loads and to avoid manufacturing of mock-ups unnecessarily. The products will respond to space-saving and energy-saving requirements.



Satoshi Higuchi  
Project R Dept.  
Technology R&D Division.

### Non-Insulation Type DC-DC Converter Model 8A



#### Application

Power supply to various electronic components such as servers

#### Features

This is a DC-DC converter that can set the output voltage at any voltage from 0.75V to 5.5V. After the revision of a circuit design, higher conversion efficiency has been realized in the product. Optimization of implementation design has enabled releasing and discharging heat quite efficiently. Due to this, high output properties are realized under the operation temperature of 85°C. This product is the same size as Model 5A, one class below Model 8A, it can output the current of up to 8A, and is applicable to a large current usage without a need of changing mounting area and shape of pins at the site of customers.

#### Eco-Friendliness

Due to its high conversion efficiency, the power consumption can be reduced by approx. 3% compared to the conventional products. The size of this product is smaller by approx. 30% over the conventional products. It is also in compliance with EU's RoHS Directive enforced in July 2006.

#### Voice from the Developer

In the development of a standard DC-DC converter, there was a requirement of maintaining the same board area as other conventional converter, while achieving higher conversion efficiency. We repeated a number of trials and errors to achieve the requirements. At the same time, manufacturing easiness was one of the scopes in developing the product. We have been paying efforts to make our development as a model of developing other standard products.



Masahiro Yamabe  
MS-FIRE Project  
Module System Div.

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## Production of Environmental Measures on Products

### True Random Number (Physical Random Number) Generation IC 'RPG100B'



#### Application

Generation of random number and encryption of information for network security, e-commerce, identification, lottery, game, simulation, graphics, wireless LAN, computer and mobile devices

#### Features

With a random number generation circuit and an amplifier embedded in the main body, the product is used to generate true random number utilizing thermal noise emitted inside the semiconductor. High quality random numbers that can highly withstand external noises can be generated by differential operation of two independent circuits of thermal noise source for generating random numbers. Though the product has a serial bit random number output and parallel bit random number verification circuit, the size is very small, 5mm×5mm.

#### Eco-Friendliness

Compared to the conventional ICs of RPG100, the performance is the same, but the size is smaller by 69% in terms of actual implementation space. This can save the space of both inside and outside of the device in which the IC is mounted. Of course, the product complies with EU's RoHS Directive.

#### Voice from the Developer

The RPG100 can output unforeseeable uniform random numbers at a high speed and withstand fluctuation of power supply and temperature, external noise and other environmental factors. I believe the product will be one of the key parts for security systems that will respond to a higher security requirements expected in the future, and amusement devices. An encryption module using the RPG 100 is under development in cooperation with other universities such as Tsukuba University.



Hiroyasu Yamamoto  
Technology Development Dept.  
Module System Div.

### GPS Antenna 'DA-1S22N Series'



#### Application

Antenna for a GPS receiver of small-size electronic devices such as mobile phones and PDAs

#### Features

Though its small-in-size and use of highly dielectric materials, the product realizes very high accuracy utilizing an adjustment technology using laser trimming.

#### Eco-Friendliness

Compared to a GPS antenna for ordinary automobile navigation system, the product is smaller in volume by 40%. No lead is used.

#### Voice from the Developer

Generally speaking, in order to make a smaller antenna, some functions should be sacrificed. In order to keep the functional loss at a minimum, an adjustment technology was developed using laser trimming to realize various functions of an antenna kept at high speed highly accurate. Our efforts have resulted in development of a highly functional antenna at an affordable price.



Mitsuru Sato  
Technology Development Dept. 2  
Ceramic Component Div.

### Alkaline Batteries 'G, D and R. Series'



#### Application

Devices requiring high output power such as digital cameras and PDAs, electric lights and clocks and other wider applications. Three types of batteries are available for optimized applications.

#### Features

The G series are for wide range of applications that requires high performance, while the D series are the best for digital equipment requiring large volume of current. The R series are regular type alkaline batteries for remote controllers and electric lights.

#### Eco-Friendliness

All of the three types are the modified version of the previous types in terms of the shape of anode zinc particles and chemical composition of battery electrolyte to enhance the efficiency. Our internal test revealed that the life of the batteries are extended by approx. 30% for G series, approx. 40% for D series and approx. 10% for R series compared to their conventional batteries. Hence, the resources can be effectively utilized.

#### Voice from the Developer

The digital alkaline battery 'D series' is a high rate dry battery which performance is greater by approx. 40% over the conventional batteries when it is used to a device requiring a large current such as digital cameras. Its discharging performance is among the highest in the world. Besides the improved shape of anode zinc particles and cathode materials, optimized chemical composition of battery electrolyte is achieved. As a result, a large current pulse discharging performance has been raised and hence, it is best suit for use in digital equipment.



Hidenori Tsuzuki  
Technical Dept.  
FDK Energy Co., Ltd.



# Approaches to Totally Eliminate Hazardous Substances in Products

In order to strengthen its efforts in totally eliminating use of hazardous substances in manufacturing products, the FDK Group set up 'Committee for Products Containing Hazardous Chemical Substances' in October 2004, and continue its activities toward realizing it. The activity includes compliance to EU's RoHS Directives, requiring submission of a hazardous chemical substances non-use certificate from our suppliers, and establishment of supplier control system.

## Targets of the Third Environmental Action Plan

To eliminate use of hazardous substances designated by Fujitsu Group in manufacturing products by the end of FY 2005, except for those designated by RoHS whose elimination target is the end of December 2004

- Use of hazardous substances listed in 31 categories of Fujitsu Group's list will be totally eliminated by the end of FY 2005.
- For products shipped to Europe and covered under the RoHS Directive, use of mercury, hexavalent chromium compounds, PBB and PBDE will be totally eliminated by the end of December 2004.

## Hazardous Substances Elimination Activity and Result

In conducting our research on chemical substances contained in procured items, the scope of hazardous substances was reduced from 1403 to 518 in line with the industrial trend. The reason for the reduction is to accelerate the speed and increasing the accuracy of the research activities to reduce workloads relating to them. The activities were accompanied by collection of documents including a declaration of non-use of hazardous substances to understand which substances are included in each procured item. Items found as containing hazardous substances as a result of our research were shifted to those don't contain them. For the items that the business partner didn't reply to our survey sheet or others which inclusion of hazardous chemical substances were highly likely, we inspected them by ourselves using an 'X-ray fluorescent spectrometer.'

As to our in-process control, with a view of any products as defective in terms of the quality assurance system (ISO9001), if they contain hazardous chemical substances, a product quality control system was established and has been in operation.

At the same time, 'FDK Product RoHS Directive Compliance Information' is uploaded on our webpage so that both our customers and employees can understand the conditions by making an access to it.



An X-ray fluorescent spectrometer introduced in Kosai Plant



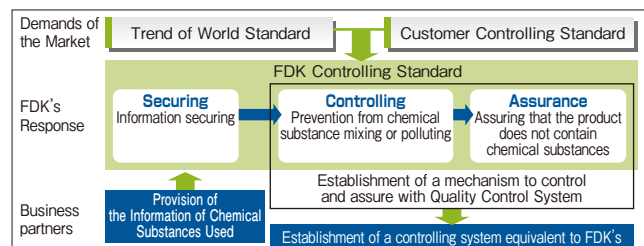
'FDK Product RoHS Directive Compliance Information' webpage

## How to Control Hazardous Chemical Substances

As a result of our activities, all chemical substances prohibited among the designated hazardous chemical substances by Fujitsu were successfully eliminated from our products. As to the chemical substances required to be totally eliminated under the RoHS Directives, they were totally eliminated from all products shipped to Europe including those that substitutions were requested by the customers, except for some, for which substitutions were not available due to the reasons of reliability assurance.

For the items which substitutions were not available, we will further examine how to do so and take necessary measures for it. As to the materials such as plating materials, which inclusion of chemical substances prohibited by the RoHS Directive is suspected, we will measure them in-house to confirm no such substances are included in any of them.

### Control Process for Banned Substances



### Hazardous Substances Designated by Fujitsu Group

Banned Substances: Substances prohibited for use in products (27)	
<ul style="list-style-type: none"> <li>• Polychlorinated biphenyls (PCBs)</li> <li>• Polychlorinated naphthalenes (with 3 or more chlorine atoms)</li> <li>• Asbestoses</li> <li>• CFCs</li> <li>• Specified halons</li> <li>• Carbon tetrachloride</li> <li>• 1,1,1-Trichloroethane</li> <li>• Bromochloromethane</li> <li>• Methyl bromide</li> <li>• HBFCS</li> <li>• Polybrominated biphenyls (PBBs)</li> <li>• Polybrominated diphenyl ethers (PBDEs)</li> <li>• Short-chained chlorinated paraffins (carbon chain length 10-13)</li> <li>• Bis (tri-n-butyltin) oxide (TBTO)</li> <li>• Tributyl tins (TBTs), Triphenyl tins (TPTs)</li> </ul>	<ul style="list-style-type: none"> <li>• Specified amines (Those which contact to skin directly and for a long time only)</li> <li>• Azo dyes and azo pigments that generate specified amines (Those which contact to skin directly and for a long time only)</li> <li>• Chlorodanes</li> <li>• DDT</li> <li>• Aldrin</li> <li>• Dieldrin</li> <li>• Dieldrin</li> <li>• Hexachlorobenzene</li> <li>• NN'-ditolyl-p-phenylenediamine, N-tolyl-N'-xylyl-p-phenylenediamine and NN'-dixylyl-p-phenylenediamine</li> <li>• 2,4,6-tri-tert-butylphenol</li> <li>• Toxaphene</li> <li>• Mirex</li> </ul>
Substances to be totally abolished: Substances banned for use in products (4)	
<ul style="list-style-type: none"> <li>• Cadmium and its compounds</li> <li>• Hexavalent chromium compounds</li> </ul>	<ul style="list-style-type: none"> <li>• Lead and its compounds</li> <li>• Mercury and its compounds</li> </ul>