FOR IMMEDIATE RELEASE

Development of world's first RFID sensor chip for DNA analysis

-- SNPs in DNA detected using chip and reader only --

Tokyo, 10th February 2005 --- Hitachi, Ltd. (NYSE:HIT / TSE: 6501) announced today that it has developed a 2.5×2.5mm^2 RFID(*1) sensor chip capable of detecting and transmitting the data collected on single nucleotide polymorphisms(*2) (SNPs) in DNA. As the chip can operate in solution, it can be used to detect and transmit SNP data from within a sealed container holding a DNA sample solution, using passive RF communication, to an external reader/writer (R/W) unit located outside the solution. Further, anticollision control(*3) was developed to enable data collection from multiple chips in the same solution at the same time. This technology is expected to provide a simple and convenient SNP typing method for healthcare tailored to individual genetic predispositions (tailor-made medicine) in local clinics and hospitals. This work was performed as a part of a research and development project of the Industrial Science and Technology Program supported by New Energy and Industrial Technology Development Organization in Japan (NEDO).

The Human Genome Project to read the whole human DNA is complete, and currently the compilation of a SNP database is underway in the effort to achieve tailor-made medicine. Using this database, it is hoped that more effective, safe and cheaper medical treatment will become available by being able to provide healthcare, prescriptions and treatment tailored individual constitutions. Conventional analysis techniques using DNA sequencers and DNA chips(*4) were developed for research centers and clinical testing facilities to efficiently process a large number of samples at one time, but are not suited to tailor-made medicine as the equipment and process involved is complex and expensive. To promote SNP detection in clinics and small hospitals, a compact, inexpensive, and simple technique, suited for the use in clinics and small hospitals, is necessary.
In response to this need, Hitachi developed a compact and inexpensive RFID sensor chip which monolithically integrates an optical sensor, signal processing and RF communication circuit on a silicon chip. Costs were minimized by using conventional semiconductor manufacturing technology (0.35 μm CMOS process), and a standard off-the-shelf R/W unit. Features of RFID sensor chip developed are as below:

(1) **RFID sensor chip for detecting SNPs:**
An RFID sensor chip with an optical sensor for detecting bioluminescence,(*5) high-resolution signal processing and transmission control circuits for a communication

distance of 1.5mm, and an antenna coil, was fabricated on a single 2.5×2.5 mm^2 silicon chip. To detect SNPs, the sensor chip, which is activated by RF transmitted from an R/W unit, is placed in a DNA sample solution. A bioluminescent reaction(*5) which differs for mutant and wild-type genetic sequences is used to produce bioluminescence in the solution, which is then detected by the sensor, and transmitted to an R/W located outside the sample container.

(2) **Anticollision control for multi-chip reading from a solution:**
To enable stable operation in a liquid solution, an electrically insulated structure was employed. Further, anticollision control was embedded to enable data collection from multiple chips in the one solution, to one R/W, by discriminating the ID number of each chip. As this procedure can be conducted from a sealed container, possible contamination of the DNA sample solution is through mishandling is also minimized.

Using the RFID sensor chip developed, SNPs were successfully detected by measuring bioluminescence in DNA sample solutions, and sensed data is transmitted by RF to the R/W located outside a container. Sensor chips capable of detecting temperature and pH were also developed, and can be used in conjunction to monitor measurement conditions, allowing sophisticated testing. Using this system, various experiments on SNPs data will be conducted in order develop new applications to establish an RFID sensing platform in DNA analysis.

These results were presented at the IEEE International Solid-State Circuits Conference (ISSCC 2005), held in San Francisco, California, U.S.A., from 6th - 10th February 2005.

Technical Terms:

(*1) **Radio Frequency Identification (RFID)**: An identification tag composed of an IC chip and an antenna for data transmission. The IC chip can store information for identification, and uses RF to transmit data. In this case, passive RF communication, suited to close distance communication, was used. Power for the communication terminal (in this case, the RFID sensor chip) as well as the data, is generated by RF from a RW unit, and thus the chip size can be kept small as a battery is not required. In active RF communication, the system is powered by a battery contained in the terminal.

(*2) **Single Nucleotide Polymorphisms (SNPs):** single nucleotide variations (A, T, C, or G) in a genome sequence which occur in at least 1% of the population. SNP are believed to affect an individual's predisposition to diseases and drugs.

(*3) **Anticollision procedure:** An architecture to control the communication between multiple RFID chips and one R/W. A number of methods to avoid data collisions between multiple chips are known. In the RFID sensor chip developed, a time-slot method combined with a random number generator, was adapted.

(*4) **DNA chip:** DNA micro-array is commonly used for gene analysis To detect a target DNA labeled with fluorescent dye, a detection apparatus called a scanner is used. The scanner consists of a light source, detecting optics, and an X-Y stage, so it is large and expensive, and thus not well suited for personalized medicine.

(*5) **Bioluminescent reaction:** Light emission originated from biological reaction. A well-known form of bioluminescence is that emitted from a firefly. For this reaction, photons are emitted when luciferin is oxidized in the presence of luciferase.

About Hitachi, Ltd.

Hitachi, Ltd. (TSE: 6501 / NYSE:HIT), headquartered in Tokyo, Japan, is a leading global electronics company, with approximately 326,000 employees worldwide. Fiscal 2003 (ended March 31, 2004) consolidated sales totaled 8,632.4 billion yen ($81.4 billion). The company offers a wide range of systems, products and services in market sectors, including information systems, electronic devices, power and industrial systems, consumer products, materials and financial services. For more information on Hitachi, please visit the company's Web site at http://www.hitachi.com.

###

Information contained in this news release is current as of the date of the press announcement, but may be subject to change without prior notice.
