

## **Hitachi Develops AG-AND Flash Memory Cell Achieving Multi Level, High-Speed Writing as Next Generation AND-type Flash Memory For Gigabyte-Generation**

— Fast 10-Mbyte/second writing enables high-speed downloading of large-volume digital data for movies, etc. —

Tokyo, December 4, 2001 — Hitachi, Ltd. (TSE: 6501) today announced the development, in collaboration with its Central Research Laboratory and its Device Development Center, of an AG-AND (Assist Gate-AND) type flash memory cell as high speed next generation AND-type flash memory for gigabyte-generation.

Through the use of Hitachi's originally developed field isolation method employing an assist gate for preventing inter-cell interference, this cell enables high-speed writing even with a Multi Level Cell configuration, and 10-Mbyte/second writing is possible with a 0.13  $\mu\text{m}$  process.

In addition, the chip size can be further reduced, and large-volume data can be recorded at high speed in a small flash memory or flash card. This will help reduce downloading time when large-volume digital content such as movie content is distributed in the future using broadband transmission.

### **[Background]**

Flash memory for data file storage such as AND-type flash memory is already widely used as large-volume storage ROM/cards not only in digital still cameras and portable music players, but also digital video cameras, mobile phones, PDAs, and similar portable products and information devices of various kinds. In addition, demand for such memory is growing in industrial and communication fields as a replacement for small-capacity HDDs. Against this backdrop, the most important key points in flash memory development are reduction in chip size through Multi Level Cell technologies as well as continuing progress in implementing finer processes in order to achieve greater capacity, smaller size, and lower cost.

Meanwhile, there has been the problem of the programming time of a Multi Level memory cell being longer than for a conventional binary cell. In a digital camera with around two to three million pixels, the current programming time of around 1 Mbyte/second is sufficient, but the use of higher pixel counts in digital cameras and future distribution of various kinds of digital content using broadband transmission will require high-speed writing on the order of 10 Mbytes/second. To meet these demands for small size and high speed, Hitachi has developed a new AG-AND memory cell for implementing flash memory that makes possible high-speed writing in a Multi Level mode.

### **[Details of Technologies]**

#### (1) Smaller cell size

In order to achieve not only a finer process but also a smaller cell size, the cell structure has been changed from the conventional SGI (shallow groove isolation) type to Hitachi's original field isolation type. The use of an AG-AND type cell structure in which assist gates for preventing inter-cell interference and floating gates are combined alternately has made it possible to achieve a cell area of 0.052  $\mu\text{m}^2$  (on a bit basis) with a 0.13  $\mu\text{m}$  process, representing a size reduction of more than 50% compared with a conventional SGI type 0.18  $\mu\text{m}$  process product.

#### (2) High-speed writing

In order to achieve fast Multi Level Cell flash memory, in an AG-AND type cell the programming method has been changed from conventional F-N tunneling to hot electron injection. Injecting hot electrons from the source side improves the floating gate injection efficiency, making possible high-speed parallel writing. In the commercial development of 0.13  $\mu\text{m}$  process products, using a 4-bank configuration within the chip enables a high speed of 10 Mbytes/second to be achieved. A single standard music CD (around 64 Mbytes by using

compression technology ) can be downloaded to a flash card in approximately 6 seconds, and it is possible to offer the market a small card containing one or two chips capable of 10 Mbyte/second writing, the current target for small flash cards such as MultiMediaCard™\* products.

Future plans include the commercial development of gigabit-class flash memory using the present technologies and various kinds of flash cards and systems using such memory.

The above achievements will be announced at the 2001 International Electron Devices Meeting to be held in Washington D.C., U.S.A., starting December 3rd.

Notes:

\* MultiMediaCard™ is a trademark of Infineon Technologies AG of Germany, and is licensed to the MMCA (MultiMediaCard Association). Hitachi is an MMCA board member.

<http://www.mmca.org/>