

Oki Electric Industry Co., Ltd.

1. The Challenge of Micromachine Technology

Oki Electric first became involved in micromachine/MEMS-related technology in the 70s by developing an anisotropic etching technique for silicon that was applied to the production of high-voltage thyristor switches used in electronic exchanges. First, KOH is used to etch about 50 microns from the surface of a silicon wafer, forming a V-shaped channel. After oxidizing the surface of the wafer, the channel is implanted with polysilicon. The silicon substrate on the bottom of the wafer is polished, ultimately forming a high-voltage device on a silicon island surrounded by an oxide layer. The technology was developed by Nippon Telegraph and Telephone Public Corporation (present-day NTT). Oki Electric also participated as a member of a fact-finding committee (chairman: Prof. Kyoichi Ikeda, Department of Mechanical Systems Engineering, Faculty of Technology, Tokyo University of Agriculture and Technology) concerned with the concept of a foundry network system for micro and nano production technologies and has actively worked toward achieving practical MEMS devices.

2. Development of Micromachine Technology

(1) Accelerometer

Oki Electric is developing small, high-performance 3-axis accelerometers for use in portable devices, in-vehicle units, games, industrial equipment, security equipment, and the like.

(2) RF-MEMS/W-CSP

Using a photolithography rerouting technique, we are developing and mass-producing wafer level CSP (W-CSP), which are extremely thin, light-weight, and compact packages ideal for mobile devices and have



Three-axis accelerometer



RF-MEMS/W-CSP



Fumio Ichikawa

General Manager of the VLSI Research Center

outer dimensions equivalent to the size of the semiconductor chip. Oki Electric is developing a next-generation rerouting technology for forming Hi-Q passive devices (e.g. inductors and capacitors) on the surface of semiconductor chips by decreasing the size and increasing the layers. In this way, passive devices that to date have been provided externally can be built into high value-added semiconductor packages (next-generation W-CSP).

(3) Optical Interconnections

Electric wiring on printed circuit boards cannot keep pace with the decrease in size of LSI wiring and the improvements in clock speed, resulting in a problem known as an I/O bottleneck that limits the performance of the overall system. Optical interconnections are attracting attention as a technology for solving this problem. At Oki Electric, we are studying optical chip interconnections using free space based on the understanding that the ability to increase channel density, enabling light to cross without interference, can be used to achieve multichannel interconnections over short distances.

3. Future Challenges

In addition to our silicon processing technologies fostered through many years of LSI production, Oki Electric works closely with its customers to provide a micromachine/MEMS foundry service based on process control and quality control technologies that have been shaped by strict market quality requirements. Oki Electric is flexible in supporting various types of services, from undertaking part of the client's processes to undertaking the entire process and design, including joint projects with alliance partners.