

Semiconductor Devices



Microwave Application Products

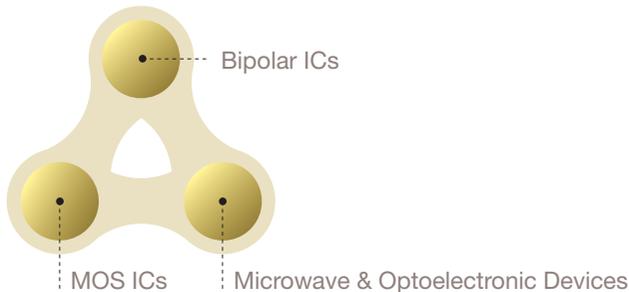


Microwave Tubes and Radar Components

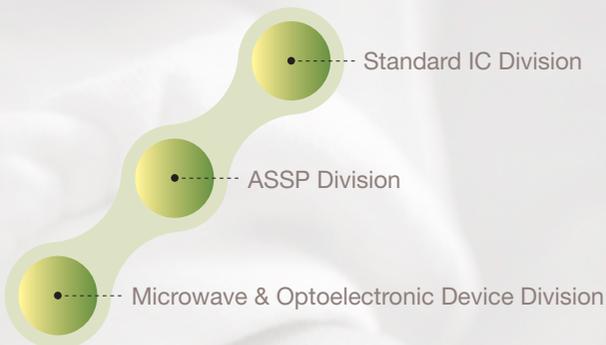


# Semiconductor Devices

Products in our semiconductor devices are mostly analog semiconductors classified broadly into three groups: Bipolar ICs, MOS ICs, and Microwave & Optoelectronic Devices.



These semiconductor products are handled by the following three divisions, covering product planning to design: Standard IC Division, ASSP Division, Microwave & Optoelectronic Device Division.



## Main Products

• **Standard IC Division: Operational amplifiers, comparators, power supply ICs, audio/video ICs, motor ICs, and communications ICs**

We are focusing on developing high value-added operational amplifiers. Demand for the power supply ICs for digital AV equipment holds steady. The audio/video ICs are in great demand, from TVs and audio equipment to cellular phones. The motor ICs are mainly used for the CPU cooler fan motors.

• **ASSP Division: Display-related ICs, audio-related ICs, and dedicated ICs**

We are focusing on developing LCD driver ICs for OA equipment and cellular phones, various audio ICs, and quartz crystal oscillator ICs. DSPs enjoying brisk sales are becoming more sophisticated.

• **Microwave & Optoelectronic Device Division: Mainly GaAs ICs, high-frequency (quasimicrowave) ICs and optoelectronic devices**

For high-frequency (quasimicrowave) ICs, ICs for cellular

phones and PHS phones are the main products. As for the optoelectronic devices, miniature photo reflectors and optical-noise-resistant remote control receivers are the main products. For high-frequency ICs, the diversification of manufacturing processes offered a wide choice of products for customers. Sales of devices using various packaging and filtering technologies are expected to increase.

## [Business Results in Fiscal 2005]

Consolidated sales in the three sections were ¥50,810 million (9.9% decrease from last year).

### • Bipolar ICs:

¥36,883 million (consolidated). The sales of the main products including operational amplifiers and comparators decreased due to the reduced number of TVs manufactured in North America. Sales of motor ICs remained unchanged from the previous year because the number of PCs manufactured was steady. 13.1% decrease from last year.

### • MOS ICs:

¥10,663 million (consolidated). Power supply ICs for digital still cameras, video ICs, and quartz crystal oscillator ICs enjoyed strong sales. On the other hand, sales of audio ICs for home audio equipment and home theater equipment, decreased due to inventory adjustment. 2.7% increase from last year.

### • Microwave & Optoelectronic Devices:

¥3,263 million (consolidated). Sales of new optoelectronic devices for data storage increased. On the other hand, sales of microwave device (GaAs) ICs for Japanese cellular phones and Chinese PHS phones decreased. 9.0% decrease from last year.



The NJM2727 is a high-speed high-voltage single operational amplifier. Slew Rate of NJM2727 is 300V/ $\mu$ s ( $\pm$ 15 V) with operating voltage.



The NJW1177 is a sound processor with SRS, BBE, and ealaBASS for TV, featuring volume, tone control, balance, mute, and AGC.

## [Product Development by Division and Fiscal 2006 Target]

### ■ Standard IC Division

We have developed twice as many products year by year from 2003, but sales have decreased due to sluggish sales and lower prices of set products. To overcome this situation, in overseas markets, we continue to sell products for TVs in China and small DVDs in the US two ways: one is to sell products with existing functionality at low prices, and the other is to sell sophisticated ones at high prices. In fiscal 2006, we plan to build purpose-based design centers, for example, in Japan, a new design center will be established in Osaka. The design center established at Saga Electronics Co., Ltd. (one of our subsidiaries) in January 2004 is positioned to develop and design high-performance in-car products and industrial products. Overseas, we plan to build a design center in Singapore and develop and design lower-end products.

### • Operational amplifiers and comparators

In cooperation with foreign companies, we are committed to development of high value-added products, such as high-precision and high-speed products. We still lead the world in the volume of production.

In fiscal 2006, we will sell input/output full-swing and low-power consumption products (for digital and industrial equipment), and ultra-speed and high-precision products (for industrial equipment).

In fiscal 2005, we focused on the "product manufacturing". In 2006, "product selling" is to be focused on, and to expand sales of products for industrial equipment, we established an independent sales and engineering division.

### • Power-supply ICs

Demand for the power supply ICs for digital AV equipment and PCs held steady. Our lineup of new product expanded the choices available to customers.

In fiscal 2006, we will commercialize power-supply ICs in new fields, focusing on acquiring new customers for digital applications. We will also introduce DC/DC converter ICs based on CMOS technology, which are high value-added products, to the system power-supply market. In addition, we intend to increase sales in new fields, such as charge-control ICs and battery-charger ICs for cellular phones.

### • Audio/video ICs

Sales of TV devices remained sluggish. On the other, our audio ICs have been employed by most audio manufacturers. This is due largely to our customers-tailored product development.

From fiscal 2006, we will increase sales of video amplifiers (for in-car cameras and car navigation systems), electronic volumes devices developed as successors to audio processors (for flat-screen TVs, car audios, AV amplifiers), and low-voltage video-amplifier ICs, targeting the digital camera market. We discontinue the development of TFT-LCD signal-processing ICs based on analog technology, and instead develop ICs for digital panels.

As our policy, we will integrate audio products with video products in design and development phase.



The NJW1321 is a wide band video switch with I<sup>2</sup>C Bus. It is 4-input 2-output switch with 6 dB amplifier.

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## • Motor ICs

We have positioned motor ICs for the CPU cooler fan motors as the leading products and commercialized the motor ICs for two-phase motor. In addition, we have enhanced the lineup of motor ICs for three-phase DC motor and stepper motors to improve the sales structure by applications.

Our cooling-fan motor-driver ICs (5-V fan motor driver ICs) using CMOS technology account for about 10% of the world market. The features include reduced motor noise and low power consumption, which are unique to our cooling-fan motor-driver ICs.

In fiscal 2006, we will sell high-output current and high-voltage products (for fan motors and stepping motors).

## ■ ASSP Division

### • Display-related ICs

Main products in this division are LCD driver ICs for cellular phones, cars, and OA equipment. Whereas the market of organic EL driver ICs was expected to grow, it was forced to struggle. We have promoted white LED backlight driver ICs for color LCDs. As for color LCD driver ICs for cellular phones, we have stopped to sell them.

From fiscal 2006, we will be committed to designing and selling white LED backlight driver ICs for OA equipment including facsimile, in-car equipment, and medical devices.



The NJU3427 is a 36-output VFD (Vacuum Fluorescent Display) controller/driver. The timing pins and the segment pins can be assigned flexibly. It is suited for DVD/HDD recorder, mini-component audio, and AV-Amp products.

The NJU6061 is an RGB-LED driver with PWM (Pulse Width Modulation) control. Each of the three outputs generates 16 levels PWM pattern individually, so that the RGB-LED emits various colors. It is suited for mobile phone and car audio products.



NJG1634LK5 is a GaAs SP6T antenna switch module for GSM900/GSM1800/CDMA800/CDMA1900 handsets. This switch module features low harmonics, high IIP3 and low insertion loss. The module consists of an MMIC switch die with on-chip logic circuits and an LTCC substrate with built-in LPF for suppression of transmitter harmonics on GSM 2-band. The NJG1634LK5 features small and thin in spite of the use of LTCC.

### • Audio-related ICs

We started to sell the class-D amplifier ICs. We have developed specialized ICs for portable audio products. ICs for MD are expected to hold the top market share within a few years.

From fiscal 2006, we will enhance sales of class-D amplifier ICs and will also concentrate our efforts on commercializing high-power ICs for car audio systems.

### • Quartz crystal oscillator ICs

We successfully developed further downsized quartz crystal oscillator ICs and sales have increased steadily. We have focused on developing lower-voltage, higher-frequency ICs and have offered a more competitive lineup than our competitors.

In fiscal 2006, we will sell mainly quartz-crystal oscillator ICs for optical communications and digital equipment operating at low voltage, reduced power, and high frequency.

### • Digital signal processors (DSP)

Sales grew as unit price declined. We could enter markets for plasma TVs, audio equipment, and car navigation systems. In addition to DSP core technology, we improved and strengthened the lineup of IP macros as resources, thereby enabling customization and better adaptability for customers.

With the process technology shift to 0.18  $\mu\text{m}$ , in fiscal 2006, we expect to offer high-performance DSPs with additional functions. The process technology is expected to develop into that of 0.13  $\mu\text{m}$ , and we will promote the development of highly integrated DSPs.

## ■ Microwave & Optoelectronic Device Division

### • Compound semiconductor (GaAs: gallium arsenide)

We have developed devices specialized for high-frequency (quasimicrowave) ICs for PHS phones. ICs for cellular phones remain strong. In Japanese cellular phone market, receiver front-end ICs and antenna switch ICs are the main products. We developed new ICs (multiband: W-CDMA, CDMA2000, GSM, PHS) for all carrier systems including W-CDMA, which support the sales of the GaAs ICs field. In overseas market, sales of low-noise amplifiers for GPS and for wideband are growing.

In addition to cellular phone ICs, sales of devices for increasingly widespread wireless LANs, Bluetooth and GPS are going up. On the other hand, we launched new transceiver ICs reflecting widespread PHS in China. As for optoelectronic devices, we launched optical-noise-resistant remote control receivers (for AV equipment remote control), which are resistant to inverter noise from a fluorescent lamp, and the COB (chip on board)-type microminiature photo reflectors (for lens modules for cellular phones).

In fiscal 2006, in addition to ICs with power amplifiers and single-chip switches, sales of switches with built-in logic and switches for global antennas are expected to be good. We will contribute to development of products by combining storing technologies for light sensors and Blu-ray receivers and filtering technologies. We believe these technologies can contribute to image stabilization and auto-focusing for digital still cameras. At the same time, we will also continue to pursue aggressive sales of the most popular ICs for GSM cellular phones.



The NJU26040 is a digital signal processor with built-in OTP (One Time Programmable). It can take various 3D surround sound and sound enhancement easily from our sound technical library. This DSP is suitable for TV, mini-component, speakers system and other audio/visual products.

## [General Overview]

### • Standard IC Division:

Our main products account for 57.6% of the company's total sales. We have continued to develop our core products, operational amplifiers and comparators focusing on higher precision and higher speed, but our sales have been affected by the production slowdown and lower prices of set products. In addition, we have worked energetically on developing new products to introduce products such as power supply ICs and many new products for AV systems to the market. Along with our concept, "developing profitable and high value-added products", we continue efforts to increase competitiveness and ensure profits with technical cooperation with foreign companies. In fiscal 2006, we will focus on the following issues: increase of unit prices; development of high quality/sophisticated products; development of branding strategies; operation of design center in Singapore, and enhanced sales in the Chinese market.

### • ASSP Division:

For display-related ICs, we are stimulating the monochrome LCD driver IC market. As for audio-related ICs, we intend to further expand sales of products for TVs and home audio products, including high-power class-D amplifiers. We will enhance the lineup of embedded ICs for in-car audio equipment. As for quartz crystal oscillator ICs, thanks to the continued development of technology and stable market share, we will further strengthen the lineup of products. DSPs appear to be most promising, so we plan to develop and sell improved and higher-integrated DSPs aggressively.

### • Microwave & Optoelectronic Device Division:

Sales of optoelectronic devices in fiscal 2005 were good. We have improved sensor technologies including RGB color sensors, in addition to the more sophisticated (cadmium-free) light sensors. We also have improved many filtering technologies to specialize in these sensors. The success of packaging technology using LTCC (Low Temperature Cofired Ceramic) substrate is driving us more commercialization of multiband antenna switch modules.