

Semiconductor Devices



Microwave Application Products

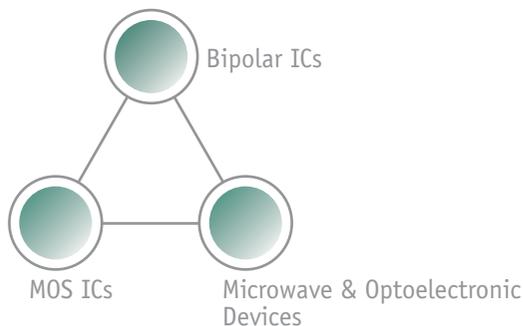


Microwave Tubes and Radar Components

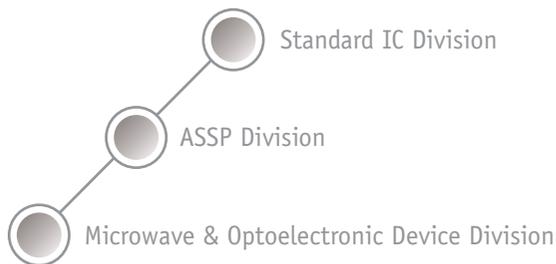


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Our semiconductor products are mostly analog semiconductors classified broadly into three groups: Bipolar ICs, MOS ICs, and Microwave & Optoelectronic Devices



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, power supply ICs, audio/video ICs, motor ICs and communications ICs

We are committed to development of high value-added (high precision) operational amplifiers. Demands for the power supply ICs for digital AV equipment hold steady. The audio/video ICs are in great demand, from TV and audio equipment to cellular phones. The motor ICs are mainly used for the CPU cooler fan motors.

- **ASSP Division:** DSPs, audio-related ICs, quartz crystal oscillator ICs and display-related ICs

We are committed to development of LCD driver ICs for OA equipment and cellular phones, and various audio ICs and quartz crystal oscillator ICs. Sales of DSPs grew well.

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

were the main products. As for the optoelectronic devices, we focused on the light sensor reflector. We also enhanced development of high-frequency ICs for cellular phones and various wireless communications.

[Business Results in fiscal 2004]

Consolidated sales in three sections were ¥56,397 million (5.1% down year-on-year).

- **Bipolar ICs:**

¥42,428 million (consolidated). AV-related ICs were favorable with especially good sales of video amplifiers, switches and signal processing ICs. Sales of power supply ICs also grew steadily centered on LDOs. Sales of operational amplifiers slowed down. 2.3% drop year-on-year.

- **MOS ICs:**

¥10,382 million (consolidated). Due to the success of digital AV equipment, sales of analog audio processors and digital signal processors (DSPs) increased. LCD-driver ICs for cellular phones did not sell well. 4.2% drop year-on-year.

- **Microwave & Optoelectronic Devices:**

¥3,587 million (consolidated). Microwave device (GaAs) ICs, which should be leading products, did not enter the markets for domestic cellular phones and Chinese PHS phones, and sales were down. 30.7% drop year-on-year.



The NJM411D is a single, precision JFET input operational amplifier. It is suitable for a high speed integrator, sample & hold circuits and high speed buffer.



The NJM2386A is a low dropout voltage regulator with ON/OFF control. It is suitable for power module, TV, Display, Car stereo and other power applications.
The NJM2550 is an FM IF demodulator IC with 10.7MHz (standard) IF input.

[Product Development by division and fiscal 2005 target]

■ Standard IC Division

• Operational amplifiers

Demands for price reductions make it difficult to secure profits. To overcome this situation, we are committed to developing high value-added products to increase price. The volume of production is still ranked number one in Japan.

In fiscal 2005, our efforts are focused on selling high value-added operational amplifiers (ultra-high-speed products) using the dielectric isolation process, and in-car products.

Furthermore, we are pursuing commercialization of input/output full swing, low-power consumption, and ultra-speed and high-accuracy products for both digital and industrial equipment.

• Power supply ICs

Demands for the power supply ICs for digital AV equipment held steady. We had developed many new products with high sophisticated features, which widened the range of choices available to customers, resulting in appreciation from the market. In fiscal 2005, we are actively developing switching regulators in addition to the existing LDOs and voltage detectors. In addition, development of battery charger ICs, low-voltage/high-current ICs, and combined power supply ICs using these ICs is expected. In particular, development of combined power supply ICs for each application is being pursued as high value-added products.

• Audio/video ICs

Audio/video ICs enjoyed favorable sales because some of the major TV manufacturers employed our ICs. In particular, most audio manufacturers have employed our audio ICs. This is due

largely to our customers-tailored product development.

From fiscal 2005, we enhance the selling of high-performance electronic volume device as the leading products, in the audio equipment field. Furthermore, we expand the line of products including digital still cameras, video amplifiers for DVD recorders, TFT signal processing ICs for car navigation systems and portable DVDs, audio processors for flat-screen TVs and car audios, and DSPs for flat-screen TVs and portable equipment.

In addition, although still in the development phase, commercialization of digital microphones is being pursued.

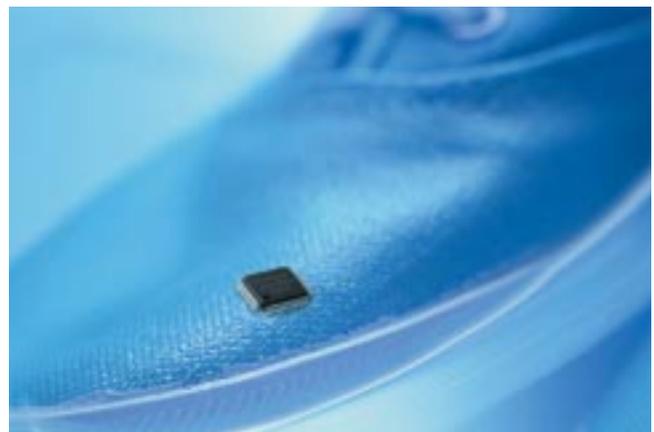
• Motors ICs

Previously, we positioned motor ICs for the CPU cooler fan motors as the leading products and commercialized motor ICs for two-phase motors. In addition, we have strengthened the line-ups of motor ICs for three-phase DC motors and stepper motors to enhance the selling system by applications. We will develop high-output current and voltage ICs for fan motors and stepper motors in the future.

■ ASSP Division

• DSPs (Digital Signal Processors)

Our DSPs have been eagerly anticipated for the last few years and sales grew very well (about 200% up year-on-year). We could enter the market mainly of LCD TVs, plasma TVs, audio equipment, and car navigation systems. In addition to DSP core technology, we are also improving and strengthening the line-ups of macro IPs as resources.



The NJU26220 is a digital signal processor providing Dolby Virtual Speaker and Dolby Headphone decoder functions. It is suited for digital TVs, stereo mini-components, PCs, and any audio / visual products.

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The NJU8774 is a stereo class-D power amplifier with analog signal input. The output power is 10W/ch without a heat sink. It is suited for PDP-TV, LCD-TV and etc.

Sales are expected to grow further in fiscal 2005. We position DSPs as higher-value added products because of a shift to 0.18 μm process technology and new features added to the products. From fiscal 2005, we target overseas markets.

• Audio-related ICs

We started to introduce the class-D amplifier ICs to the market. We have developed headphone amplifiers specialized for portable audio products including MDs and CDs.

Starting in fiscal 2005, in addition to the existing low-power products for headphones, we speed up strengthening of development and line-up of high-power products (over 10 W), and will target the flat-screen TVs and car audio systems markets.

• Quartz crystal oscillator ICs

Along with the popularization of downsized quartz crystal oscillator ICs, we offered product line-ups of the quartz crystal oscillator ICs quickly.

We are committed to the development of lower voltage, low power consumption, and higher-frequency ICs to offer competitive ICs.

From fiscal 2005, we develop and sell quartz crystal oscillator ICs for optical communications and digital equipment.

• Display-related ICs

Main products in this division are B&W LCDs driver ICs for audio equipment, OA equipment, car information panels, etc. We have developed 65,000-color STNs. However, prices are falling rapidly,

which compels us to continue to sell them in the non-cellular phone markets, avoiding the cellular phone market with short product life-cycle. We also strengthen marketing of the RGB LED drivers and white LED backlight driver ICs for color LCDs. Development of organic EL drivers was also launched in fiscal 2005. In addition to LCD drivers, we enhance the product lineup of promising self-luminous organic EL drivers.

■ Microwave & Optoelectronic Device Division

• Compound semiconductor (GaAs: Gallium arsenide)

We have developed devices specialized for high-frequency (quasimicrowave) ICs. In Japanese cellular phones market, receiver front-end ICs and antenna switch ICs are the main products. We developed new ICs for all carrier systems including W-CDMA, which have enjoyed expectations. Our efforts have been focused on marketing low-noise amplifiers for GPS and for wideband in overseas market. In addition to cellular phones ICs, the devices for wireless LAN are also widely prevalent and we further expand the line of LAN-capable products. On the other hand, we advanced the development of new devices including transceiver ICs in accordance with the increase of PHS phones in China.



NJG1612HA8 is an SPDT switch IC featured extremely high speed switching. This device is suitable for high speed switching of Tx/Rx signals at sub-microwave applications. This switch exhibits wide frequency range from 100MHz to 5.0GHz. An ultra small and ultra thin package of USB6-A8 is adopted. This product is RoHS directive compliant.

As for the optical semiconductor devices, we further improved and realized minitization of optical-noise-resistant remote control receivers, which are resistant to inverter noise generated by fluorescent lamps, etc. In addition, the COB (chip on board)-type microminiature photo reflectors that incorporate new packages have been improved and expected to be used in the camera module of cellular phones.

In fiscal 2004, it is particularly worth noting that we developed a "process recipe" to increase alternatives for customers (see below). We also established technology embedding a logic circuit in the HEMT chip to obtain the both of RF and digital function.

- HBT (Hetero-junction Bipolar Transistor) process ((1) Power amplifiers for PHS phone transceiver, (2) Power amplifiers for wireless LAN, (3) Power amplifiers for W-CDMA)

- Development of a high-noise-resistant light sensor departed from the traditional manufacturing systems of competitors. Active development of various filtering.

- HEMT process (Development of various switches compatible with triple-band and dual-band cellular phones)

In 2005, we start overseas selling of LNAs and switches in the W-CDMA field and will complete development of triple-band module for CDMA2000. In the field of GSM, we advance to development of high-reliability devices start to sell them at home and abroad.

As for PHS phones, entry into the China market is a most important matter. As for wireless LAN, we will complete development of 2.4-GHz power amplifiers. In addition, we have commercialized various switches. In GPS, products with standby function are under development. In addition, we are focusing on developing and marketing Bluetooth ICs and microwave diodes.

[General Overview]

- Standard IC Division:

Our main products. We have emphasized human resources, and increased the number of employees including new graduates hired, to try to ensure future profits. We continued the development of our core products, operational amplifiers, emphasizing high precision and high speed. In addition, we are also working on development of new products energetically to get to market with power supply ICs and new products for audio and video equipment based on our concept for new products, "developing profitable products". We are making efforts to ensure profits by developing high-value-added products with technical collaboration with foreign companies.

The NJR FUKUOKA CO., LTD., which started operations in April 2003, enjoyed favorable sales. Also, the Design Center at Saga Electronics Co., Ltd. set up in January 2004 will be used effectively to develop and design new products.

- ASSP Division:

Our DSPs, including products for flat-screen TVs and car entertainment systems, its achievements are expected to increase dramatically and we plan to sell them actively enhancing their functions. As for the class-D amplifiers in the audio-related ICs, we plan to further development of high-power products to be applied in flat-screen TVs and home audio equipment.

Furthermore, we are preparing to expand sales to the car mounted audio market. We will further strengthen the line-up of quartz crystal oscillator ICs and build up a customer-oriented system. As for display ICs, we will market unique ICs using our own technology. In this field, we will reinforce to introduce LCD driver ICs, LED drivers, and organic EL drivers actively.

- Microwave & Optoelectronic Device Division:

Sales were particularly sluggish in 2004. This is largely because sales of PHS phones in the Chinese market grew less than expected. In the future, we will actively market products for GSM, W-CDMA, and CDMA2000. In addition, hopes are pinned on the improved COB (chip on board)-type microminiature photo reflectors and optical-noise-resistant remote control receivers, which are miniaturized and minimized. We expect sales of GPS low-noise amplifiers and wideband low-noise amplifiers to increase steadily. In the high-speed wireless LAN market, we have made products for this market (2.4 GHz and 5 GHz), and now plan to enter the market actively.



NJW1157 is an eight channel electric volume IC. It is suitable for multi-channel audio equipment such as AV receivers and DVD receivers.

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