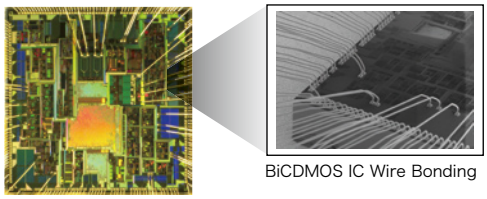
MORE MOORE and MORE THAN MOORE: Opening the door to the future through innovation

Electronics technology, amid growing awareness of global environmental problems, is increasingly providing solutions that will allow us to not only peacefully coexist with the environment but go beyond energy conservation to address concerns over safety and comfort. Digital broadcasting of high definition digital video has driven widespread acceptance of flat-screen TVs, leading to advancements in performance and energy savings. Technological evolutions in portable audio players paved the way for the growth of the internet and the personalization of images. Concerns about environmental health spawned interest in health care, home automation and home security products, further extending to energy conservation, safety and comfort. Electronics technology now permeates every aspect of our lives and addresses a variety of consumer needs, providing unparalleled functionality while breaking down physical barriers and minimizing the impact on the environment. At ROHM we continue to build on our strong foundation of reliable, high-quality semiconductor technology, developing new products and technologies that benefit society at an ever increasing pace and to an unprecedented degree.

Technological developments in semiconductors are driven by research in micromachining aimed at increasing miniaturization and performance. The development of truly novel products requires advanced expertise in a variety of areas, such as new materials, new circuitry, new compounds, new applications, and software. Only by combining these disparate areas is it possible to develop high value-added products.



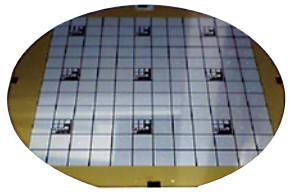
BiCDMOS IC Wire Bonding

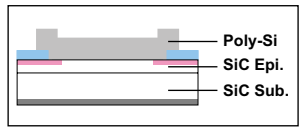
BiCDMOS IC chip

Advancements in system IC technology have allowed ROHM to produce system ICs utilizing 90nm processes. ROHM is also developing BiCMOS and BiCDMOS devices from 300mm wafers using a unique 350nm mixed signal power process and continues to make rapid strides in the mass production of power-related system ICs.

In the field of high-speed communication, where circuit design and device quality are of critical importance, high definition TVs are growing at a rapid pace, along with Blu-Ray disc recorders and full HD*1 movie cameras. ROHM has developed an HDMI*2 transmission IC that provides high-quality waveform transmission at speeds up to 2.25Gbps (HDMI ver.1.3a) and stable digital audio/video operation over 20m cables – far longer than the conventional 10m length. This was achieved using proprietary RF circuit technology and optimized pattern layout that corrects for signal attenuation/deterioration due to cables and connectors and ensures high-precision impedance matching*3.

Regarding new materials, ROHM has focused on the R&D of SiC (Silicon Carbide) elements for inverters in electric cars (HEV, FCV, EV). A new SiC diode has been developed in collaboration with Nissan that incorporates a newly structured





Heterojunction SiC diode
◀Wafer ▲Diagram

HJD (Hetero Junction*4 Diode). This new SiC diode is a revolutionary device that can be used at temperatures up to 200°C under currents approaching 300A with low loss and low ON-resistance, typically 1mΩ/cm² or less – one-fifth to one-tenth that of silicon, whose 5mΩ/cm² to 10mΩ/cm² generates relatively high power loss, necessitating heat dissipation countermeasures. Silicon devices also feature low temperature resistance, making them more damage-prone under harsh conditions. ROHM's new SiC Schottky barrier diode, first introduced in October 2007 at CEATEC Japan, proved its stability under high temperatures by running in a prototype inverter module at 200°C. ROHM is continuing to research applications for this new technology in large appliances, industrial machinery, and electric vehicles.

In the IC application technology sector ROHM offers a wireless LAN system module that integrates all required parts, including power circuitry, EEPROMs, and software utilizing advanced IC, module, and system technologies.

ROHM is also currently researching a number of next-generation technologies that apply the principle of MORE THAN MOORE*5, including organic EL microdisplays and ultrasensitive infrared image sensors constructed of thin laminate image sensors on an IC chip. In addition, a new CIGS ($CuInGaSe_2$) image sensor, developed jointly with the National Institute of Advanced Industrial Science and Technology (AIST), is capable of successfully recognizing images in light conditions as low as 0.001 lux (the brightness of starlight) – 100 times the sensitivity of silicon-based CCD and CMOS sensors currently used in vehicle mounted and security (night-vision) cameras.

In the realm of environmental technology ROHM is developing narrow-pitch taping to improve efficiency and is initiating full-scale manufacturing of halogen-free packages for bulk cases to lessen environmental impact.

ROHM will continue to develop new technologies that benefit society under its guiding principle: "Contributing to Society through Electronics,"

(*1) Full HD
A high definition digital TV broadcasting (HDTV) format specifying a resolution of 1080 scan lines or more. Most full HD TVs have a resolution of 1920×1080 pixels.

(*2) HDMI (High Definition Multimedia Interface)
A digital audio/video interface standard for TVs capable of transmitting uncompressed video, audio and control signals through a single cable. HDMI expands the color depth from 8 bits to 10 bits for a much wider color range and supports the latest multi-channel audio formats, including Dolby True HD and DTS-HD. HDMI is also compatible with the Lip Sync function for synchronizing video and audio.

(*3) Impedance matching
The practice of making the output impedance of a source the same as the input impedance of a load. Without impedance matching high-speed waveforms cannot be reproduced correctly.

(*4) Heterojunction
A junction that occurs between two different solid state structures. In this case polysilicon and SiC.

(*5) MORE THAN MOORE
Refers to technology developed to integrate heterogeneous elements onto a single semiconductor device (e.g. MEMS, organic components). Innovations merging different fields will be required in the near future, since CMOS transistors are quickly approaching their physical limits.