

TOSHIBA REVIEW

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Special Reports

Power Electronics

*Power Electronics Supporting Energy Management

SHIMONAKA Toshiomi

*Trends in and Future Prospects for Power Electronics Technology

SAITO Suzuo EHARA Minoru

More than 30 years have passed since the appearance of power electronics, and it has now become an important technology that supports a secure and comfortable society in a wide range of fields from power, industry, and transportation to home appliances.

Toshiba began research and development of power devices, control circuits, cooling systems, mounting methods, simulation technology, and coordination with motors at an early stage, and has been supplying a large number of products offering high performance, high quality, and easy human-machine interfaces. Toshiba will continue to supply market-oriented products utilizing its information technology and analysis technology.

*Power Electronics Contributing to Green Energy Distribution and Energy Efficiency Improvement

MOSE Tadao YOSHINO Teruo KAWAGUCHI Akira

Environmental preservation is one of the most fundamental activities sustaining the social infrastructure, since a clean environment is essential to daily life. Power electronics can contribute to environmental preservation through efficient energy resource management based on its power conversion technology, which converts clean energy from wind turbines or photovoltaic cells to convenient AC electric power. Power electronics also saves energy through variable-speed drives in industrial electric motors.

*Power Electronics Pursuing System Dependability

MATSUZAKI Kaoru MANO Yasutomo KANDATSU Yukio

Networks, computer systems, and information systems process and communicate information that is not allowed to disappear even for a moment, information that changes second by second, and information that has a time function. Power electronics technology supports these information systems. Mechanical energy generating and supply systems cannot compensate for momentary interruptions. Power electronics technology represented by the uninterruptible power system (UPS) realizes dependability for such systems.

The most important points in this field are securing the reliability of insulated-gate bipolar transistors (IGBTs) as key power electronic devices; finding ways to enhance the reliability of circuit technology, control technology, cooling technology, and low-inductance mounting technology as core technologies; and ensuring high system dependability.

*Power Electronics Aiming at Environmental Harmony

HAMAGUCHI Masahiro MIYAZAKI Masanori OHTA Kinya

Power electronics equipment is widely used to increase controllability and improve efficiency of total systems. On the other hand, in some cases power electronics equipment may have a harmful effect on the environment due to electromagnetic noise induced by the switching action of power devices and to harmonics generated by rectifier circuits. With the recent strong demand for harmony with the environment, effective countermeasures are required in the design and development of power electronics equipment.

Toshiba has been introducing various technologies in response to these requirements and has achieved the suppression of harmful effects of power electronics equipment down to permitted levels. We intend to enable the wide application of power electronics equipment by continuously developing technologies for harmony with the environment.

*Power Electronics Equipment for Rolling Stock Pursuing Energy Saving and Environmental Accommodation

YASUOKA Ikuo AOYAMA Ikuya ISHIKAWA Michiaki

In rolling stock such as the Shinkansen, conventional trains, subways, electric locomotives, and so on, core technologies for miniaturization, weight reduction, and the improvement of energy efficiency, environmental accommodation, riding comfort, and reliability are essential, and form the fundamental concept for power converter equipment.

Toshiba has taken a major step forward in realizing this concept by integrating advanced power devices and application/control technologies.

*Evolution of Power Electronics by New Power Devices and Control

HOSODA Hiromi KANAI Takeo KODAMA Sumiyasu

The field of power electronics has made great progress thanks to the development of power devices. The recently developed injection enhanced gate transistor (IEGT) has been applied to large inverters and self-commutated static var compensators, and has decreased power loss to less than 50%. New control methods have also been developed that minimize harmonics and obtain maximum power from power devices.

Recent advances in information technology have improved the management and maintenance of power electronics equipment. Plant-wide central monitoring systems are now beginning to be used, and are reducing maintenance costs.

Feature Articles

*Estimation of Ultra-Shallow Implants for Semiconductor Devices

TOMITA Mitsuhiro SUZUKI Masamichi TACHIBE Tetsuya

New developments in semiconductor device processes require new estimation methods for semiconductor devices. Toshiba has developed estimation methods for ultra-shallow junction implants in next-generation devices. These methods consist of secondary ion mass spectrometry that enables accurate junction depth estimation for ultra-shallow junctions, and nuclear reaction analysis and chemical analysis that enable accurate measurement of implant doses (boron and arsenic doses). Using these three analytical methods, we are promoting the development of next-generation semiconductor devices.

*High-Speed Thermosonic Flip Chip Bonder for Small and Low-Pin-Count Devices

SHIBATA Motojiro IGUCHI Tomohiro AIZAWA Takahiro

Demand for mobile products such as cellular phones is dramatically increasing with the expansion of the network society. The small and low-pin-count devices, especially high-frequency devices and discrete ICs, used for these products require the miniaturization of package size, improvement of electrical characteristics, and reduction of costs.

In order to meet these requirements, Toshiba has developed a high-speed thermosonic flip chip bonder with highly precise bonding force control and high productivity (cycle time: 1.5 sec/IC). This equipment has been applied to the mass production of surface acoustic wave (SAW) devices.

*DynaBook™ SS S4/Portégé™ 2000

TAKAHASHI Toshio NANNO Nobuyuki NAKAMURA Hiroshi

Toshiba announced the launching of the DynaBook™ SS S4/Portégé™ 2000 series, which are the thinnest (14.9 mm thickness) and lightest (1.19 kg) high-performance B5-size notebook PCs on the market, in January 2002. The DynaBook™ SS 2000 series is designed for mobile PC users, who require portability, expandability, and a good user interface. It incorporates many high-technology features, such as a Pentium® III-M processor with a speed of 750 MHz, the thinnest (0.65 mm thickness) magnesium die casting, 20 Gbyte of storage on the slimmest-available 1.8-inch hard disk drive (HDD), a lithium-ion polymer battery, and the thinnest 12.1-inch low-temperature poly-silicon thin-film transistor liquid crystal display (TFT-LCD).

*Seamless Office™ Wireless Networking Strategic Product

OHTA Harunori KOBAYASHI Hironobu TABE Kenichi

The main concepts of Seamless Office™ are "Anywhere, Anytime, Always connected to the world," and "Easy to connect with security." Compared with competitor products, Toshiba Seamless Office™ is the best solution because of its excellent Mobile IP (Internet Protocol), excellent combination with IPsec and IEEE 802.1x technologies, and excellent user support. This means that mobility and security are perfectly combined.

Seamless Office™ has a major advantage in that the users keep the same IP address wherever they are (Mobile IP). Toshiba's strategic target is to sell Seamless Office™ software with the IA servers and note PCs to increase their sales volume.

*FacePass™ Face Recognition Security System

DOBASHI Hironori OKAZAKI Akio TAKAGI Kazuyoshi

Toshiba has developed the FacePass™ high-performance face recognition security system for facility access control. Although face recognition has advantages compared with other biometric techniques, it is known to have a problem in that it is affected by many types of variations such as face angle and standing position.

FacePass™ incorporates a new pattern-matching algorithm using image sequences that include variations of the facial pattern. This algorithm is robust against slightly different face angles and standing positions. The system also has a user interface with a feedback display of the face detection results. These features are useful for eliminating the above-mentioned variations. Furthermore, the system features high-speed face detection/recognition from the image sequences at the time of verification/identification, as well as easy dictionary registration and updating.

*Realization of Nonflammable Underground Substation Applying World's Largest Capacity Gas-Insulated Transformer

KOBAYASHI Tsuneo HASHIMOTO Hideo MEGURO Masanari

Even though it is difficult to build large-capacity substations in urban areas, the demand for stable and high-quality electric power continues to increase. It is therefore becoming essential to build underground substations utilizing dead space such as that under buildings or public areas.

Toshiba has proposed a gas-insulated transformer as a solution to this problem.

*Sapporo Kita Regional Control Center of Hokkaido Electric Power Co., Inc.

TAJIMA Shinichi KUDO Haruo NISHINO Masakuni

With the increasing complexity of electric power systems accompanying the rapid growth in power demand, supervisory control and data acquisition (SCADA) systems are constantly required to play a more and more significant role with more advanced technologies. The Sapporo Kita Regional Control Center of Hokkaido Electric Power Co., Inc. was put into operation in March 2002. The system was designed to provide a mutual backup capability between this center and the Sapporo Regional Control Center, which commenced operation in March 1997.

*Underwater Remotely Operated Vehicles for Nuclear Reactor Vessels

YUGUCHI Yasuhiro SHIMAMURA Mitsuaki KIMURA Motohiko

This paper describes the development and application of remotely operated vehicles (ROVs) for reactor internals. Stress corrosion cracking (SCC) on reactor internal components have become one of the most important issues in recent years, and demand for the inspection of reactor internals is increasing. Toshiba has developed and applied several types of ROVs that can inspect and maintain welds in a narrow space underwater.

Techno Notes

*Cellular Phones Realizing New Lifestyles from Your Palm

Toshiba Technologies for the New Century

16.APF System Development Technology