

TOSHIBA REVIEW

2000. VOL.55 NO.1

Special Reports I

ITS (Intelligent Transport Systems)

Special Reports II

Discrete Semiconductors

Special Reports I ITS (Intelligent Transport Systems)	Special Reports II Discrete Semiconductors	Feature Articles	Techno Notes	Epoch-Making Toshiba Technologies
<ul style="list-style-type: none">*A New Era of Transportation*Trends in ITS and Key Technologies for Future Development*Traffic Management System as Starting Point of ITS*Image Surveillance/Communication System for ITS*Onboard Multimedia*ITS and Software Technologies*Network Computing Technologies for Intelligent Transport Systems	<ul style="list-style-type: none">*Discrete Semiconductors to Meet Newly Emerging Needs*Evolving Technologies for Discrete Semiconductor Devices*RF Device Support for Mobile Communications*Advanced Power Devices for Energy Saving*Compact-IPM(Intelligent Power Module) Featuring High Efficiency and Small Package*Photosensors for Widespread Use in Various Application Fields*Optical Communication Devices for Digital Audio, Video, and Computer Networks*Small-Signal Discrete Packages	<ul style="list-style-type: none">*New Automatic Gate Machine with Multi-ticket Processing Function*HoCu₂ High-Performance Magnetic Regenerator Material*Compressor Motor for Air Conditioners Realizing High Efficiency and Low Cost	<ul style="list-style-type: none">*Fuel Cell	<ul style="list-style-type: none">*1. Large-Size, Low-Temperature, p-Si TFT-LCDs

Special Reports I

ITS (Intelligent Transport Systems)

*A New Era of Transportation

OKUHARA Hiroo

*Trends in ITS and Key Technologies for Future Development

ASAHIOKA Katsuyoshi SOGABE Masami NISHIMURA Kazuo

As intelligent transport systems (ITS) provide an effective means to solve serious traffic problems, strenuous efforts to develop and deploy ITS are being made by major countries. The promotion of ITS improves the safety, efficiency, and comfort of transportation by advanced communication and information processing technologies, and the resultant smoother traffic flows significantly contribute to the reduction of air pollution. It is also anticipated that ITS will be a driving force for economic vitalization and lead to emergence of new industries.

This paper describes the efforts for realization of ITS in various countries, and discusses necessary tasks for the future development of ITS.

*Traffic Management System as Starting Point of ITS

SHIMADA Shigehito YAMAMOTO Kazumoto KAWAMI Atsushi

The Traffic Management System (TMS), which ensures safety, smooth traffic flows, and comfort for drivers on expressways, consists of a traffic control system that accurately grasps traffic congestion information and immediately provides it to information signs and other media, and a facility control system that controls and monitors lighting facilities as well as ventilation facilities in tunnels. Recently, the development of intelligent transport systems (ITS) has been attracting attention, and the Vehicle Information and Communication System (VICS), which provides traffic information for car navigation, is already in practical use. The swift realization of VICS can be attributed to the diffusion of the traffic control system mentioned above.

For new ITS services also, such as Electronic Toll Collection (ETC) and the Advanced Cruise-Assist Highway System (AHS), whose rapid development can be expected in the future, Toshiba can economically construct the optimum system with high reliability meeting the needs of society by integrating our abundant system engineering capabilities developed for TMS with advanced technologies actualized through the latest research and development.

*Image Surveillance / Communication System for ITS

TANIMOTO Itaru SHIBATA Yasuo

Intelligent transport systems (ITS) are being materialized through cooperative functioning of the road system and vehicle sensor systems. It is necessary for an infrastructure system to be developed in order to enhance the safety and smooth operation of the road system.

Toshiba is concentrating on the image processing technologies of sensing systems in this infrastructure. We have studied the functions and performance required in order to enhance the safety of the road system, and developed high-precision traffic flow measuring equipment and obstacle detection sensors.

*Onboard Multimedia

MAEDA Ken-ichi AKAMINE Masami KASE Naoki

Functions that process a variety of information in order to assist the driver are required in the next-generation vehicle. The following technologies will contribute to the production of such an advanced vehicle. Image recognition that detects obstacles in front and vehicles approaching from the rear and side will be useful in supporting safe driving. This system will use an optical flow for processing images input from onboard cameras. Noise-resistant speech recognition and the text-to-speech synthesizer will be effective in improving the human-machine interface of the onboard equipment. The InfoMirrorTM agent-based driver's information assistant will enable a driver to obtain required information easily from a huge amount of data.

*ITS and Software Technologies

YAMASHIRO Akihiro HORIKAWA Kiyoshi CHIKAHISA Iwao

Intelligent transport systems (ITS) have now reached the practical stage. The Japanese domestic market for ITS has been estimated at almost 60 trillion yen in total. A large amount of software will be necessary for these systems. An architecture-centric software development method and the combination of framework, components, and platforms make it possible to develop ITS application software that can endure long-term deployment and offer flexible modification.

*Network Computing Technologies for Intelligent Transport Systems

OHSUGA Akihiko KASE Naoki IKETANI Naoki

As the market for intelligent transport systems (ITS) becomes more widely recognized, research and development is becoming more active in this field. However, problems remain concerning the development of user interfaces that permit easy operation of the systems in restricted environments such as when driving or walking. Software agent technology is one solution. The use of agents allows flexible information retrieval for users, and the extraction of information that satisfies user requests.

We have developed two ITS application systems: InfoMirrorTM, which provides agent-based information assistance to drivers through car navigation or onboard computer; and Yugashiman, an agent-based human navigation system which provides information tailored to individual users.

Special Reports II

Discrete Semiconductors

*Discrete Semiconductors to Meet Newly Emerging Needs

KURAMOTO Tsuyoshi

*Evolving Technologies for Discrete Semiconductor Devices

NAKAGAWA Akio SHINOHE Takashi

In the 21st century, the progress of information systems and mobile equipment will further accelerate despite the limits of silicon technology. Discrete devices supplementing silicon LSI performance, high-density assembly, circuit technologies, and system architectures will be important. Environmental preservation, including energy-saving legislation, will influence the standards for device selection. Discrete devices will continue to evolve under the principle of optimizing circuit blocks or overall system performance.

*RF Device Support for Mobile Communications

TADA Noboru SAITO Masahisa YAMAMOTO Tomohiko

The cellular phone system is changing from an 800 MHz AMPS/TACS (advanced mobile phone service/total access communication system) analog system to an 800-900 MHz TDMA/GSM (time division multiple access/global system for mobile communications) digital system. Recently, the number of subscribers to the CDMA (code division multiple access) system, which was launched in the United States and Korea ahead of other countries, has been increasing. In addition, the cellular system is shifting to a high frequency for DCS/PCS (digital cellular system/personal communication system) systems using 1,800 MHz.

We are developing an RF power amplifier for CDMA use in the PCS band (for the Tx port) ; a wideband amplifier called Cell-Pack using the SMART-2 (silicon monolithic architecture for RF technology2) process (for the Rx port) ; and the MT series microwave transistors for voltage control oscillator (VCO) use (also for the Rx port).

*Advanced Power Devices for Energy Saving

KAWANO Tomohiro MARUOKA Masayuki YAMAKAWA Yuji

The key word in the world nowadays is ecological consideration to preserve the global environment. In response to this need, the underlying concepts of electronic equipment must change from greater comfort and safety to high efficiency and energy saving.

Toshiba is developing new power device technologies and products that enable electronic equipment to be efficient and consume less energy. This paper introduces several advanced power devices for energy saving that we have developed and commercialized : super-high-speed power MOSFETs utilizing super-fine pattern trench technology, high-performance IGBTs utilizing high-blocking-voltage trench technology, and one-chip inverter ICs containing a power output section and a control IC utilizing high-blocking- voltage SOI technology.

*Compact-IPM (Intelligent Power Module) Featuring High Efficiency and Small Package

MIYAZAKI Yuuji

The fields of application of high-power electronics have expanded in recent years, to include not only industrial use but also a variety of other fields such as consumer products, transportation, and information. With this situation as a background, there is demand for low loss and high-level functions in power devices. Moreover, it is clear that the expansion of applications will further accelerate in the future with the continuing progress of technology.

Based on these trends, we have targeted our efforts at inverters from the several to several hundred kW class, as well as servo amplifiers. As a result, we have developed the Compact-IPM intelligent power module, which offers lower loss, a smaller package, and lower noise. This new-concept IPM will significantly contribute to the realization of compact application equipment as well as high performance for application systems.

*Photosensors for Widespread Use in Various Application Fields

MORI Hideyuki KOBAYASHI Mitsuhiro SOGABE Hisashi

Photosensors are used as key components for remote control systems, wireless communication systems, and object sensing systems in many fields. In order to meet the recent needs of the market, we have been developing new products aiming at smaller packages, lower power consumption, higher speed, and higher light emission power.

This paper describes some of these products.

*Optical Communication Devices for Digital Audio, Video, and Computer Networks

IWAKAMI Tetsuya

IEEE1394 is expected to be the new interface for digital audio, video, and computer networks. Toshiba is planning to release two new optical devices: an optical transceiver for plastic optical fiber (POF), and a high-speed fiberless optical transmission device. These devices enable the transmission of IEEE1394 signals.

*Small-Signal Discrete Packages

KAKISHIMA Yutaka KAWANO Akihiro

In addition to improvement of their electrical characteristics, discrete semiconductors have been developed targeted at designing shapes and sizes suitable for various applications. In particular, with the introduction of flatter and more compact equipment, small-signal transistors and diodes have been developed aiming at smaller size. In recent years, as well as greater compactness, easy handling in mounting has also been added as a feature. Various types of packages have therefore been commercialized, contributing to the compactness of equipment for various uses.

Feature Articles

*New Automatic Gate Machine with Multi-ticket Processing Function

MIYASHITA Takehiko IMAZUKA Katsuo TAKAHASHI Makoto

Automatic gate machines were first introduced in Japan about 30 years ago. Although they spread mainly in the Kansai region in the early stage, they have rapidly become common facilities in the Kanto region as well since the development of the third-generation machines 10 years ago. Nowadays, main Japan Railway (JR) stations across the nation are equipped with these gate machines, as are other public and private railway stations around metropolitan areas. JR recently introduced special automatic gate machines even for the Shinkansen (" Bullet Train ").

These developments indicate that railway companies' initial plans for the deployment of gate machines have almost been achieved. Now, their next goals are to realize significantly enhanced customer satisfaction through the use of stored fare cards, and to eliminate fraudulent avoidance of fare payment.

We have therefore developed the fourth-generation automatic gate machine to meet the various needs of railway companies and to respond to the trend toward smart cards with advanced performance.

*HoCu₂ High-Performance Magnetic Regenerator Material

OKAMURA Masami OOTANI Yasumi SAITO Akiko

We have developed a new antiferromagnetic regenerator material, holmium copper 2 (HoCu₂). HoCu₂ has a larger specific heat than erbium 3 nickel (Er₃Ni) below 10K. This specific heat features two large peaks owing to two magnetic transitions. Antiferromagnetic material is suitable for use in a superconducting magnet system because the force affecting the material in a magnetic field is weak.

A layered structural regenerator of HoCu₂ and Er₃Ni having a larger specific heat than HoCu₂ between 10 and 15K having the refrigeration capacity of a two-stage Gifford-McMahon (GM) refrigerator by 30% at 4.2K. It is anticipated that these magnetic regenerator materials will improve the performance of superconducting magnet systems as well as being used in expanded fields of application.

*Compressor Motor for Air Conditioners Realizing High Efficiency and Low Cost

INABA Yoshiaki KAWAMURA Kiyotaka IMAZAWA Kazumoto

The compressor motor accounts for most of the consumption of electric power in an air conditioner. To promote energy-saving, Toshiba has been progressively changing the compressor motors in its air conditioners to high-efficiency brushless DC motors.

We have now developed a new compressor motor in order to achieve even greater energy-saving. A concentrated winding system was adopted featuring direct winding on the teeth of the stator core, for the first time in the industry. As a result, it was possible to realize a high-efficiency, compact, lightweight, and low-cost motor. Moreover, by constructing a new system for production, we were able to improve productivity and quality.

The newly developed motor is expected to contribute to the further diffusion of energy-saving air conditioners.

Techno Notes

*Fuel Cell

Epoch-Making Toshiba Technologies

*1. Large-Size, Low-Temperature, p-Si TFT-LCDs