

TOSHIBA REVIEW

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Special Reports

Evolution of Mobile Communications

*Pursuing the Realization of a Ubiquitous Society

SUGIYAMA Fumio

*Multimedia Services and Technologies on Mobile Cellular Phones

HAYASHI Katsuhiko WATANABE Eiichi

The dissemination of mobile cellular phones has grown dramatically due to their ability to provide Internet access and Web browsing functions in the mobile environment, with the number of subscribers in Japan having reached almost saturation level at around 60% of the population. It is therefore necessary to create attractive new services to further enlarge the mobile cellular phone market.

One of the promising new services is multimedia services such as visual telephony and video distribution, which commenced with the introduction of third-generation mobile communication services in 2001. These multimedia services are realized by MPEG-4 video compression technology and the latest LSI technology, which enable complicated video processing with low power dissipation under the restricted conditions of mobile cellular phones. The performance of these multimedia services will further improve with the progress of LSI and device technologies, and with the advent of new infrastructure services such as wireless LAN and digital terrestrial broadcasting systems, the introduction of new migrating services can be expected.

*Multimedia Wideband CDMA Cellular Phone

YAMAGUCHI Kentoku SATO Yuichi HONDA Makoto

Third-generation services of the mobile communication system (IMT-2000) commenced in Japan in October 2001. These mobile services have a radio interface that has been standardized according to the international standards, and offer various services with a quality comparable to that of fixed communication systems. Specifically, mobile multimedia services have been realized that enable data communication with a maximum transmission speed of 2 Mbps (indoor office)/384 kbps (mobile) as well as visual communication. This system also reportedly provides double the bandwidth of the present Personal Digital Cellular (PDC) system.

Toshiba has developed a small and lightweight (111 cm³, 110g) wideband CDMA (W-CDMA) cellular phone that supports multimedia services and has double the standby time (125 h) of existing W-CDMA cellular phones.

*Development of Chip Set for Third-Generation Cellular Phones

KOBAYASHI Takahiro IIDA Shinichi MITSUGI Jun

This paper describes the development of a base-band LSI chip set for W-CDMA Cellular phone. W-CDMA is one of the third-generation cellular phone technologies. This chip set consists of three LSIs employing 0.18 μ m CMOS technology: a modem LSI, control LSI, and mixed signal LSI. The modem LSI has W-CDMA modulation/demodulation, channel codec, and vocoder functions. The control LSI is used for the processing of protocols and applications, and has the human-machine interface (HMI) and several data interfaces. The mixed signal LSI performs analog/digital conversion of base-band signals.

A Cellular phone with the chip set for W-CDMA has attractive features such as small size, a long talking time, and a long standby time.

*Transmitter/Receiver IF IC Chip Set for W-CDMA Mobile Cellular Phones

KAWAGUCHI Shunji OONISHI Yasuo

The Wideband Code Division Multiple Access (W-CDMA) system, one of the IMT-2000 standards, uses the 2 GHz frequency range for wireless communication and has a wide bandwidth (5 MHz/channel).

Toshiba has developed a chip set for this system consisting of a transmitter intermediate frequency/radio frequency (IF/RF) IC, receiver IF IC, and fractional-N phase locked loop (PLL) frequency synthesizer IC. The new circuits used in these ICs and Toshiba's proprietary plastic package called the thin quad outline non-leaded package (TQON), the smallest package in the industry, are expected to become the core elements for present and future mobile communication systems.

*Power Amplifier Module for W-CDMA Mobile Cellular Phones

YAMAGUCHI Keiichi UENO Yutaka NAGASAWA Hironori

Toshiba has successfully developed a miniaturized, high-efficiency, two-stage power amplifier module employing an InGaP/GaAs heterojunction bipolar transistor (HBT) for 1.95 GHz-band W-CDMA mobile cellular phones. This power amplifier module with a small volume of 0.047 cm³ (7.0 x 7.0 x 0.95 mm) exhibited high power added efficiency (PAE) of 47% with an adjacent channel leakage power ratio (ACLR) of -38 dBc at an output power level of 27.5 dBm under a supply voltage of 3.6 V

*Advanced Portable Multimedia and Multifunctional Cellular Phones

IGARASHI Junichi YAHAGI Mitsuru HYODO Masakuni KOBAYASHI Shigeyuki

Most cellular phone users today, especially younger generation users, have a strong requirement for data services such as e-mail and Web browsing rather than voice service. Communication styles surrounding cellular phone users are also rapidly changing according to user needs. Under these circumstances, cellular phone companies are endeavoring to enhance phone performance to support more data service contents and to take advantage of currently fashionable communication styles. Cellular phones are now said to be evolving into pocket multimedia terminals.

Toshiba is developing multimedia and multifunctional cellular phones in a timely manner, especially for the Personal Digital Cellular (PDC) and Code Division Multiple Access (CDMA) systems, and is making efforts to offer the latest features to customers around the world such as large and high-resolution LCDs, high-resolution cameras, and MPEG movie recording. As one of the leading developers of cellular phones in Japan and North America, we are introducing the most advanced models into the wireless market.

Feature Articles

*Realization of Highly Reliable Ultrathin Gate Oxide by Deuterium Incorporation

MITANI Yuichiro SATAKE Hideki

We investigated the effect of deuterium incorporation on the reliability of ultrathin gate oxide films. Deuterium pyrogenic oxidation and deuterated poly-Si deposition were utilized for deuterium incorporation into gate oxide films. As a result, interface-state generation and stress-induced leakage current (SILC) were significantly suppressed. From a physical analysis, it was found that deuterium atoms were introduced throughout the entire SiO₂ film and more stable deuterium bonds were realized by deuterium pyrogenic oxidation.

*Ultrafast Optical Switching Devices Utilizing Intersubband Transition in GaN Quantum Wells

IIZUKA Norio KANEKO Kei SUZUKI Nobuo

Optical switches are being developed utilizing the intersubband transition (ISBT) in nitride semiconductor quantum wells, for application to future ultrafast network systems. So far, the ISBT has been achieved at optical communication wavelengths and optical responses within a picosecond have been demonstrated. Moreover, the ISBT has been observed for a waveguide structure.

Simulations were carried out utilizing the parameters obtained from the experiments. The results suggest that operation at 1 Tb/s could be achieved with a power consumption of less than 1 W. These results confirm the possibility of realizing optical switching devices.

*Design and Product Identity Development for Flat Screen Color Television

IZU Yuichi

Although design has significant weight together with picture quality and price in sales of color television sets as well as other consumer electric appliances, differentiation of these purchase determination factors is difficult and it is not easy for the user to select from among similar products. In response to these circumstances, Toshiba developed and introduced a flat screen television with a new design concept in 2000 and has continued development of the same design concept up to the present time. This design development combines quantitative design evaluation using a statistical technique with idea development based on the designer's sensitivity, in order to maintain differentiation in the market and strengthen the product identity.

*Activities and Solution Service for IPv6 Network Construction

OKA Mitsuaki SAKAE Mitsuhiro HASHIMOTO Kosuke

Internet Protocol version 6 (IPv6), the next-generation network technology, is moving into the dissemination phase due to various factors including the growth of the Internet, the introduction of dedicated-line and broadband services by Internet service providers, and promotion of the e-Japan strategy by the Japanese government.

As activities related to IPv6, Toshiba has carried out the development and evaluation of a mobile micro server and conducted mixed IPv6/IPv4 experiments. Based on the know-how acquired through these activities, we have started providing an IPv6 solution service from fiscal year 2002.

*Atmospheric Environmental Diagnosis for Electrical Equipment Using the Internet

SAWADA Akira SASAKI Keiichi ITO Makoto

Superannuated electrical equipment has been increasing at industrial plants in recent years. Under these circumstances, it is necessary to quantitatively evaluate degradation in order to perform proper maintenance or renewal of such equipment.

Toshiba has developed key technologies to analyze mechanical stress, electrical stress, and environmental stress, which are the major causes of degradation, in order to evaluate the life of electrical equipment. In particular, we have obtained many successful results in the evaluation of environmental stress, which has a strong effect on degradation. This experience and the database we have accumulated have made it possible to develop a methodology for diagnosing the effect of the atmospheric environment on equipment life.

This paper presents a simple method of diagnosing the atmospheric environment by consultation using the Internet.

*Toshiba's Efforts for Standardization of Analytical Methods and Preparation of Reference Materials

KOZUKA Shoji ONUMA Masayuki HAYASHI Masaru

Many analytical methods are used to establish suitable materials, processes, and quality control procedures in various industrial fields. However, few reference materials are available for confirming the reliability of new analytical methods, and there is also the possibility of original methods being used that have not been adopted by the respective analysis-related organizations. Standardization work and the preparation of reference materials are therefore necessary to ensure the reliability of analytical values and the validity of analytical methods.

Toshiba is a member of several committees and participates in joint analysis projects to support the standardization of analytical methods and the preparation of reference materials.

*Structure Optimization Design for Large-Scale Welded Structures

TANAKA Akira SAITO Kazuhiro TAKAKI Keisuke

Particularly in recent years, shorter delivery times, lower prices, and higher quality products have been increasingly demanded by manufacturing industries. The conventional reliance on experience and intuition is insufficient for prompt responses to these severe customer requirements. Rather, simulation models have become necessary. The basis of this new design simulation is the structure optimization technique.

Toshiba is making advances in structure optimization design using simulation, centering around energy equipment. Significant results have been achieved in reducing structural weight, as well as shortening design time and realizing greater compactness.

Techno Notes

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