

Electronic Devices and Components

128 Gbit NAND Flash Memory Fabricated Using 15 nm Process

NAND flash memories have various applications including memory cards, smartphones, tablets, notebook PCs, and enterprise solid-state drives (SSDs) for data centers.

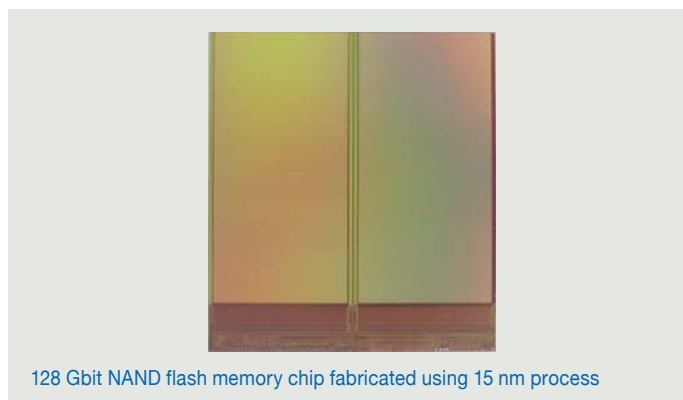
Toshiba has developed the world's smallest 128 Gbit multilevel cell (MLC) NAND flash memory^(*), fabricated using 15 nm process technology, in cooperation with SanDisk Corporation. The high-speed interface technology incorporated in this device has made it possible to increase the data transfer rate to 533 Mbit/s, which is 30% faster than the second-generation 19 nm process.

We have also developed a triple-level cell (TLC), which has higher integration than the MLC, using the 15 nm process technology. This is intended for applications in memory cards as well as the *e•MMC*^(†) and SSDs. The *e•MMC*^(†) is an embedded memory system that combines a NAND flash memory die and a controller die, which manages the NAND control functions, in a single package. Our unique controller offers high reliability by realizing optimized operation for the NAND die.

Toshiba has been gradually shifting from the manufacturing of memories using the second-generation 19 nm process and stepping up production of flash memories using the 15 nm technology at its Yokkaichi Operations in cooperation with SanDisk Corporation. This cutting-edge process is expected to increase both productivity and competitiveness.

(*) As of January 2015 (as researched by Toshiba)

e•MMC is a trademark of the MultiMediaCard Association (MMCA) and the JEDEC Solid State Technology Association (JEDEC).



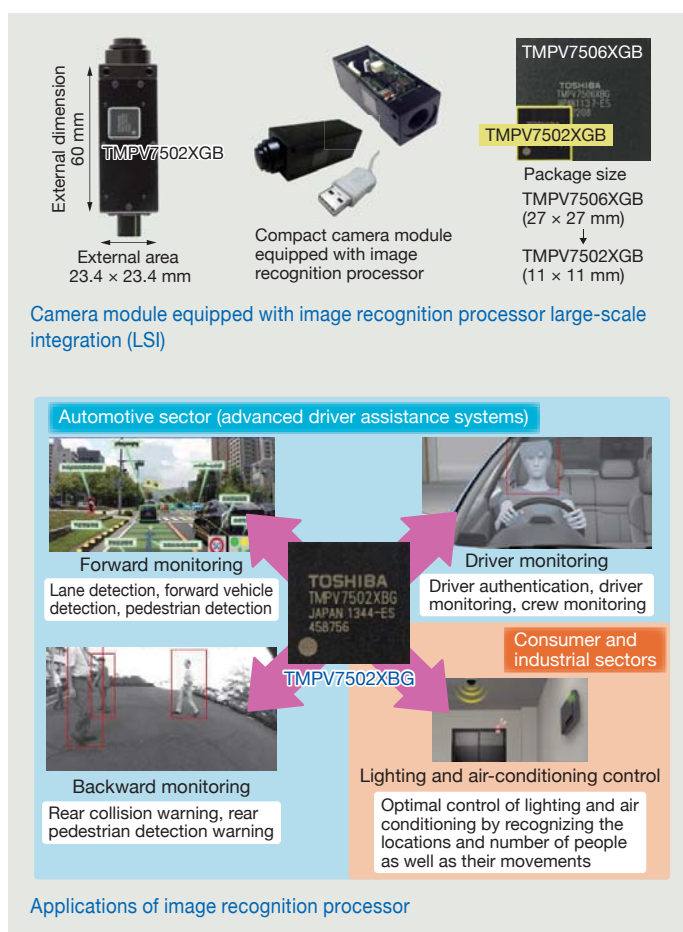
TMPV7502XGB Image Recognition Processor Embeddable in Compact Camera Modules

Image recognition technology is important in the automotive field to detect lanes and give lane departure warnings when necessary. It is also essential for advanced driver assistance systems such as automatic emergency braking (AEB) systems, to protect both vehicles and pedestrians. The range of applications of this technology has been further widening to include blind spot detection and driver monitoring, and the market for image recognition products for use in automobiles is expected to show continuing growth.

Toshiba has developed the TMPV7502XGB as a new product in its image recognition processor lineup. The new processor has a built-in image processing and recognition hardware accelerator that achieves fast, highly accurate detection, which was made possible by optimizing the circuit configuration in the video input interface to one channel (single camera) and reducing the package size to 11 × 11 mm.

With its smaller package size, the TMPV7502XGB can be incorporated into forward and rear view cameras and other types of cameras. The processor is easy to use and can be applied in a wide range of fields.

We plan to promote further expansion of this product in the automotive market as well as in consumer and industrial markets such as the smart community field.



TL2WK Series White LED with Industry's Smallest Chip Package

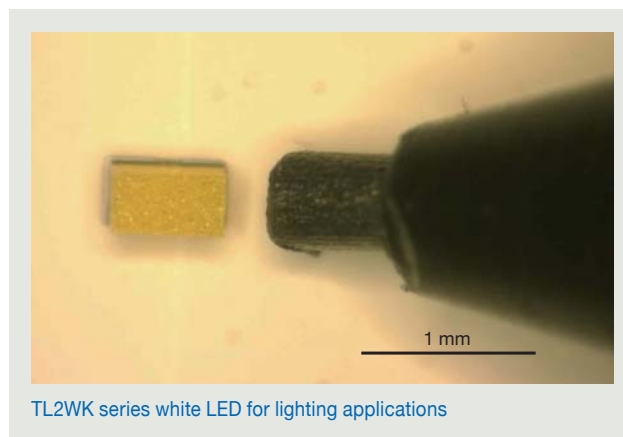
Toshiba has been developing and mass-producing blue light-emitting diode (LED) chips based on GaN-on-Si technology^(*1) for use in white LED package devices. We have now developed a 0.65×0.35 mm white LED package in order to create a small point light source LED that provides effective illumination.

This LED is intended for operation at 0.2 W, which is suitable for straight tubes that are mainly used for indoor lighting. Compared with the previous TL1WK series (0.65×0.65 mm), the top surface area is reduced by 46%, making this series the smallest 0.2 W-class LED in the industry^(*2). Generally, a smaller chip causes a decrease in the light output from the LED due to increased current density, but we have overcome this problem by improving the quantum efficiency of the chip and the package efficacy. The TL2WK series was designed with the objective of offering luminous efficacy equivalent to that of the previous series.

We are making efforts to achieve greater miniaturization of light sources so as to bring further innovation to the lighting field, including ultra-small devices such as capsule endoscopes and small lighting fixtures with narrow directivity.

(*1) A technology for the epitaxial crystal growth of gallium nitride (GaN) on silicon (Si) substrate

(*2) As of December 2014 (as researched by Toshiba)



TL2WK series white LED for lighting applications

Launching of 5 Tbyte 3.5-inch Nearline Enterprise Capacity HDDs

Toshiba has released two new series of nearline enterprise capacity hard disk drives (HDDs): the MG04SCA series, which comes with a Serial Attached SCSI (Small Computer System Interface) (SAS) interface; and the MG04ACA series, equipped with a Serial Advanced Technology Attachment (SATA) interface. These products are suitable for the high-capacity requirements of mid-tier servers, capacity-optimized data center storage systems, and cloud application workloads that benefit from high capacity per spindle. The MG04ACA500 and MG04SCA500 models have a storage capacity of 5 Tbytes^(*1), which is the largest in the industry for 3.5-inch form factor drives that require no helium gas in the HDD case^(*2).

The MG04ACA500 model also achieves an internal data transfer rate of 205 MiB/s^(*3), which is about 24% faster than our existing MG03SCA400 and MG03ACA400 models (4 TB, 165 MiB/s).

These drives offer an option allowing system designers to select the Sanitize Device Feature Set for each model, which makes it possible to rapidly invalidate important data recorded on the magnetic disks. The new drives also offer the option of incorporating our new technology to support the recording of data in the buffer memory to a hard disk medium utilizing counter-electromotive force together with media rotation inertia in the event of an unexpected power disconnection, thereby protecting data against loss.

(*1) Definition of capacity: Toshiba defines a terabyte (TB) as 10^{12} (1 000 000 000 000) bytes. A computer operating system, however, reports storage capacity using powers of 2 for the definition of $1 \text{ GB} = 2^{30} = 1\,073\,741\,824$ bytes and therefore shows a lower storage capacity. Available storage capacity (including that for various types of media files) will vary based on file size, formatting, settings, software and operating system, such as Microsoft^(TM) operating system and/or pre-installed software applications, or media content. Actual formatted capacity may vary.

(*2) As of February 2014 (as researched by Toshiba)

(*3) A mebibyte (MiB) is 2^{20} (1 048 576) bytes.

Microsoft is either a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.



3.5-inch HDD with 5 Tbyte capacity for nearline storage applications

TZ1000 Application Processors for IoT

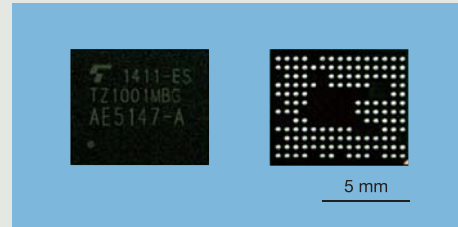
The “trillion sensor society” is emerging in which sensors will be utilized in every field including medicine, agriculture, logistics, and other infrastructures. The various types of data collected through these sensors will be stored in the cloud and analyzed to enrich people’s lives.

Toshiba has developed the TZ1000 series of application processors for sensing devices used in the Internet of Things (IoT), to contribute to the formation of the trillion sensor society. The TZ1000 series processors enable raw data to be fed to a cloud system and offer high performance and efficient signal processing. They extract only the necessary data through sensors, thereby reducing the data load. Mass production of these processors started in January 2015.

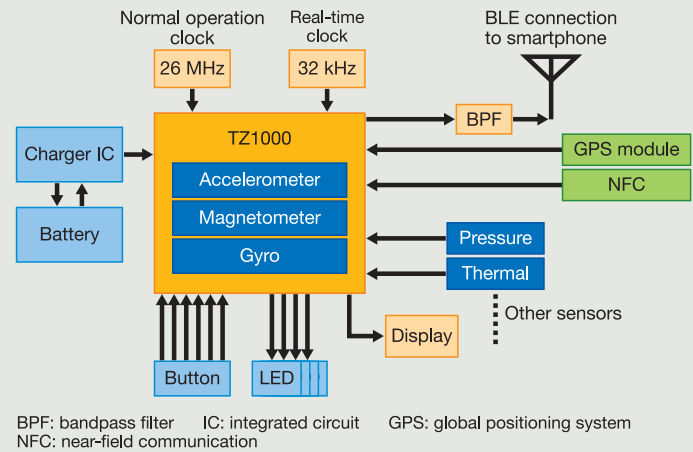
The TZ1000 series application processors support Bluetooth[®] Low Energy (BLE), a low-power wireless communication standard, as well as microelectromechanical systems (MEMS) sensors, ARM[®] Cortex[®]-M4F processors, and flash memories. These functions are incorporated into a single package so that less space is required to mount IoT devices. The TZ1000 series can also process the data acquired by an integrated high-precision analog-to-digital converter (ADC) suitable for vital sensing in wearable devices.

The Bluetooth[®] word mark and logo are registered trademarks owned by Bluetooth SIG, Inc.

ARM and Cortex are trademarks or registered trademarks of ARM Limited.



TZ1001MBG application processor integrating Cortex[®]-M4F processor, Bluetooth[®] Smart (low energy) controller, and three-axis accelerometer



Block diagram of wearable device

World's Smallest 8 Mpixel BSI CMOS Image Sensor Chip, with 1.12 μm Pixel Pitch and Low Power Consumption

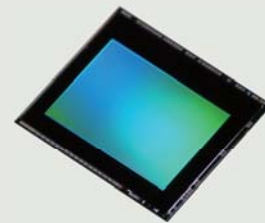
In recent years, 8 Mpixel back-side illumination (BSI) complementary metal-oxide semiconductor (CMOS) image sensors with a pixel pitch of 1.12 μm have been utilized in the main cameras of thin-profile smartphones and tablet computers. They are also used in selfie cameras, replacing 5 Mpixel CMOS image sensors.

Toshiba has developed the T4KA3 8 Mpixel BSI CMOS image sensor chip, the world's smallest chip of this type^{(*)1}. This product provides a solution for the requirements of thin and compact mobile devices. It allows the camera module to be downsized to 6.5 × 6.5 mm, and reduces power consumption by 46% compared with the previous product^{(*)2}. Moreover, the T4KA3 makes it possible to shoot high-definition video at 240 frames per second (fps), while the new “bright mode” technology produces images that are up to four times as bright as those of previous models.

Through the release of products such as the T4KA3, our aim is to contribute to the further advancement of high-frame-rate videos and high-quality images with low power consumption.

(*)1 As of August 2014 (as researched by Toshiba)

(*)2 Compared with the T4K35 model



World's smallest 8 Mpixel BSI CMOS image sensor chip, with 1.12 μm pixel pitch and low power consumption

Electrolyzed Functional Water Generating System

Toshiba has developed an electrolyzed functional water generating system using a three-chamber type electrolyzer with two separators that produces electrolytic water from water and salt. Electrolytic water has excellent antibacterial characteristics and is harmless to the human body.

Although there are several types of electrolytic generators, an advantage of the three-chamber type is its ability to generate high-quality salt-free hypochlorous acid water from salt and water. However, the main drawback of the three-chamber type is its limited water-producing capability because of its lower electrolytic efficiency in comparison with other systems.

To overcome this problem, our system uses a newly developed three-chamber type electrolyzer with two separators. As a result, the new system provides significantly improved electrolytic efficiency, achieving a water-producing capability equivalent to that of other systems.

The highly functional, high-quality, and safe electrolytic water produced by this system is expected to have a wide range of applications for food processing and other hygiene-conscious industries, including the medical and healthcare industries and the agriculture and livestock industries. In the household sector, the new system will help to improve the safety of food since electrolytic water reduces the risk of bacterial diseases and infections due to its antibacterial characteristics.



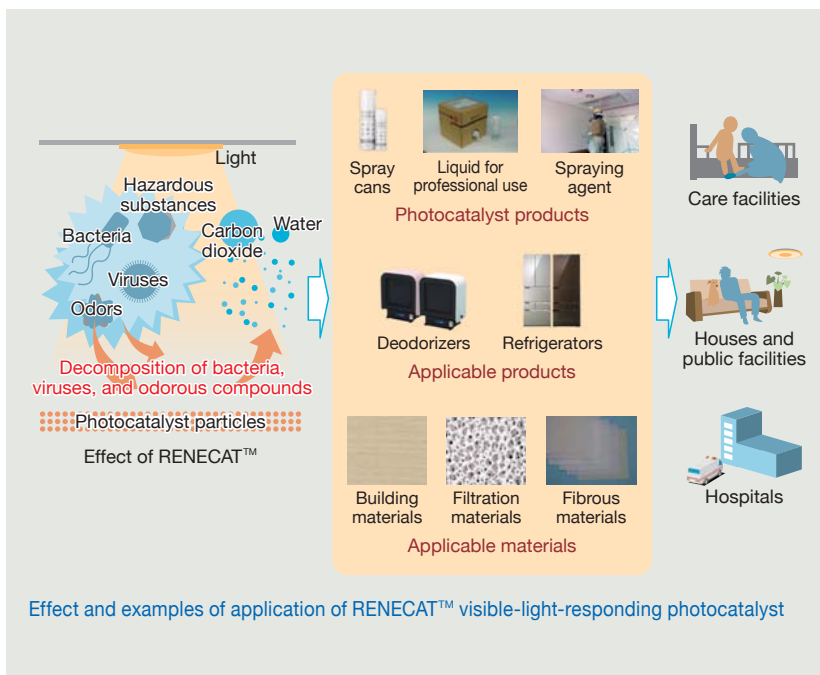
Electrolyzed functional water generating system using three-chamber type electrolyzer with two separators

RENECAT™ Visible-Light-Responding Photocatalyst to Improve Indoor Environments

Accompanying the increasing focus on health and safety in recent years including with respect to the atmospheric environment, household odors and airborne bacteria, viruses, and allergens have been attracting attention in addition to emissions of volatile organic compounds (VOCs) and air pollution due to particulate matter of 2.5 μm or less in diameter (PM 2.5).

Against this background, Toshiba Materials Co., Ltd. has developed the RENECAT™ visible-light-responding photocatalyst. Activated by exposure to room light, RENECAT™ decomposes and removes indoor odors, bacteria, and viruses. The application of RENECAT™ to various household articles helps to provide a safe, secure, and comfortable indoor environment.

Air pollution due to VOCs and PM 2.5 is becoming a social issue in developing countries as well as in Japan. In response to this issue, we will launch RENECAT™ in overseas markets.



Effect and examples of application of RENECAT™ visible-light-responding photocatalyst