

# Electronic Components and Materials

In the electronic components and materials field, Toshiba supplies key devices that support the trend toward digital convergence and also develops products for new businesses. We have produced a new stream processor that performs advanced image processing at high speed with low power consumption, a DNA chip that predicts risk such as side effects of rheumatoid drugs, and so on.

## SpursEngine™ (\*) High-Performance Stream Processor

Toshiba has shipped samples of the SpursEngine™ SE1000, a high-performance stream processor integrating four synergistic processing element (SPE) cores derived from the “Cell Broadband Engine™” (Cell/B.E.™), since April 2008.

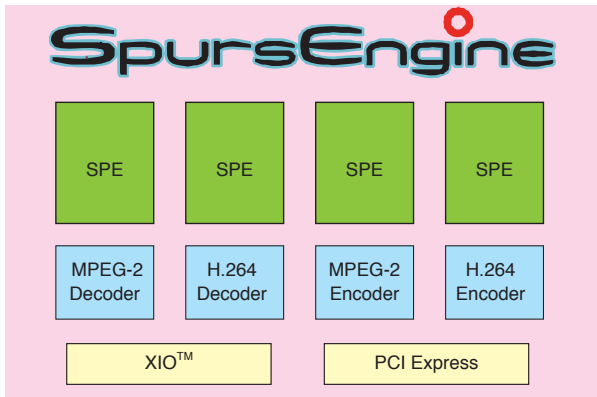


Exterior appearance of SpursEngine™

SpursEngine™ is a coprocessor that integrates a hardware codec for full high-definition (HD) encoding and decoding of MPEG-2 (Moving Picture Experts Group-phase 2) and H.264 streams with four SPEs derived from Cell/B.E.™. It operates at a clock frequency of 1.5 GHz, while consuming power of just 10 W to 20 W.

Toshiba will support developers working on SpursEngine™ applications with a reference kit that includes a reference board, middleware, development tools and documents.

Toshiba is developing cooperative relationships with many partner companies in order to develop wide-ranging video solutions that use the SpursEngine™.



XIO: XDR™ DRAM controller interface cell

Block diagram of SpursEngine™

(\*) The model name in Europe is TOSHIBA SE1000.

“Cell Broadband Engine” and “Cell/B.E.” are trademarks of Sony Computer Entertainment, Inc.

“XDR” and “XIO” are trademarks of Rambus Inc. in the United States and other countries.

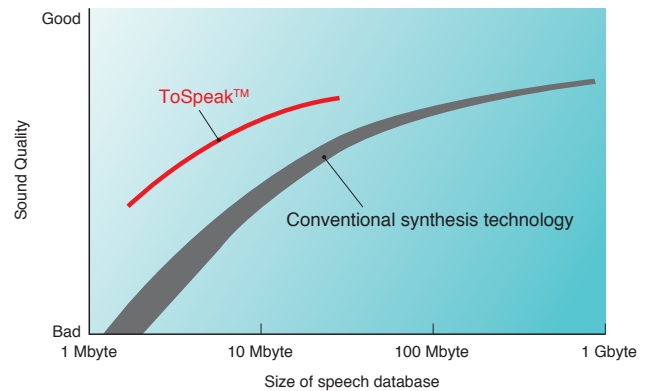
## High Sound Quality Text To Speech (TTS) Middleware ToSpeak™

Toshiba has shipped a Japanese text to speech (TTS) middleware product, ToSpeak™, to customers who use the ToSpeak™ middleware for their in-car navigation system products.

ToSpeak™ adopts the “plural unit selection and fusion method” which has been newly developed by Toshiba Research and Development Center. This technology enables natural synthetic voice generation with stable voice sound quality even from a small speech unit database of just several megabytes. The sound quality of the conventional corpus-based TTS system tends to decrease drastically when the system uses a small speech unit database. In comparison, ToSpeak™ has a great advantage especially in many embedded system applications which have only a small memory thanks to the new technology.

Toshiba is now developing other language versions of ToSpeak™ TTS middleware products for global markets such as the North American and Chinese markets.

Toshiba will provide high sound quality TTS middleware products for such languages in the near future because the technology is language-independent.



Comparison with conventional technology

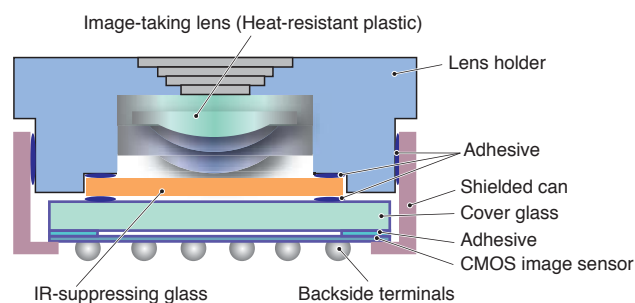
## Chip Scale Camera Module (CSCM)

The chip scale camera module (CSCM) is a new type of camera module which is as small as an image sensor chip. Miniaturization was achieved by forming terminals on the backside of the image sensor thanks to the through chip via (TCV) technology.

Moreover, a combination of the newly developed heat-resistant plastic compact-sized image-taking lens and the module enabled reflow soldering mounting. This not only reduced the mounting area to 50% compared to the conventional modules but also enabled reflow soldering mounting simultaneously with other surface-mount chip parts. This has attracted the attention of cellular phone manufacturers in particular.

CSCM is a joint product of our high-performance CMOS image sensor technology, our proprietary TCV technology based on our advanced semiconductor process technology and our conventional imaging device technology inherited from charge coupled device (CCD) imaging sensors. It offers highly functional, high-performance and highly reliable camera modules to users. The low-cost camera modules are competitive because we can manufacture them in a continuous process from mounting to soldering, which is cheaper than the conventional cooperatively integrated manufacturing by a sensor chip maker based on the chip-on-board (COB) technology and an assembly maker based on surface-mount technology (SMT). CSCM is an exceptionally competitive and promising module also in the cellular phone manufacturing market.

CSCM for VGA (640 × 480 pixels) through UXGA (1600 × 1200 pixels) will be supplied by Iwate Toshiba Electronics Co., Ltd.



IR: Infrared radiation

Cross-sectional view of CSCM

CMOS: Complementary Metal-Oxide Semiconductor

VGA : Video Graphics Array

UXGA: Ultra Extended Graphics Array

## Large-Capacity SDHC Memory Card



SD-HC016GT4 SDHC memory card



SD-HC032GT4 SDHC memory card

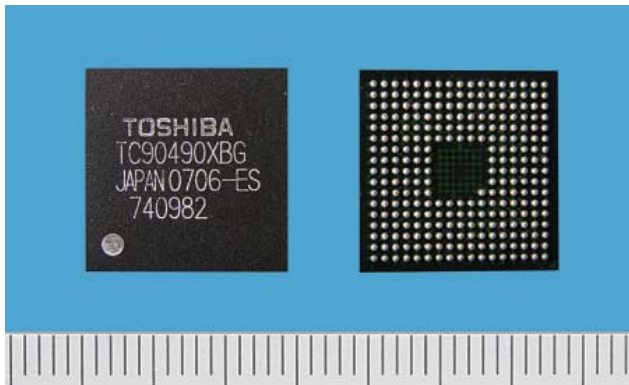
Toshiba has developed two new secure digital high-capacity (SDHC) memory cards, the SD-HC016GT4 and the SD-HC032GT4, with capacities exceeding 2 Gbytes for digital products which handle motion pictures and high resolution images.

Both cards conform to the SD memory card standard Ver. 2.00 which was established for large capacities of over 2 Gbytes. The SD-HC016GT4 can store 16 Gbytes and the SD-HC032GT4 32 Gbytes, the maximum capacity specified in this standard, making them ideal for recording large quantities of data such as full high-definition (HD) motion pictures.

Both cards offer a class-4 data transfer rate which is equal to or faster than 4 Mbytes/s<sup>(\*)</sup> and a maximum writing speed of approximately 6 Mbytes/s<sup>(\*)</sup> which is sufficient for the action mode of digital still cameras, motion pictures taken by digital video cameras etc.

(\*) As measured under conditions specified by the SD Association.

## TC90490XBG H.264/VC-1 Video Decoder for HD Digital TV



TC90490XBG H.264/VC-1 video decoder

Toshiba has developed the TC90490XBG, an H.264/VC-1 video decoder SoC (System on Chip) for full-HD video content delivered through the coming digital broadcasting network.

This product can be attached easily to an existing digital TV set, and makes it possible to conform to full-HD (1980 × 1080 pixels) H.264/VC-1 video coding standards.

The newly developed SoC integrates the following functions into one chip:

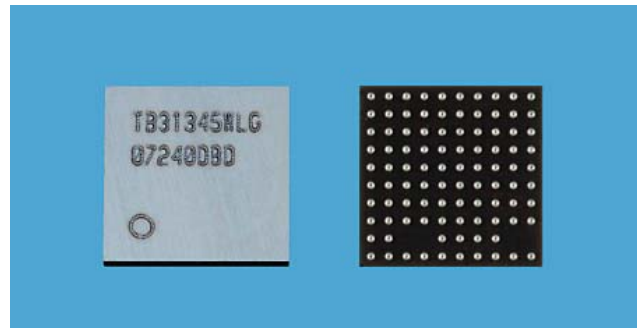
- H.264/VC-1 video decoder
- Digital video output interface unit
- MPEG-2 (Moving Picture Experts Group-phase 2) transport stream input unit
- Peripheral component interconnect (PCI) bus interface unit
- DRAM controller
- Phase locked loop (PLL) unit for video clock and system clock generation

We expect this H.264/VC-1 video decoder SoC will be widely used in the markets for IPTV (Internet Protocol TV) and digital TV sets, especially in Brazil, France and other European countries where the digital broadcasting system follows the H.264 standard.

H.264: A standard for video compression, approved by the ITU-T (International Telecommunication Union – Telecommunication Standardization Sector) in May 2003

VC-1: A standard for video compression, initially developed by Microsoft and published by SMPTE (Society of Motion Picture and Television Engineers) as SMPTE 421M

## TB31345WLG Single-Chip Transceiver RF-IC for W-CDMA Cellular Phones



TB31345WLG single-chip transceiver RF-IC for W-CDMA cellular phones

Toshiba has developed the TB31345WLG, a single-chip tri-band transceiver radio frequency (RF)-IC for wideband code division multiple access (W-CDMA) cellular phones.

The market for W-CDMA cellular phones, which is one of the rapidly-developing types of 3rd-generation (3G) cellular phones, requires RF-ICs that are more integrated, smaller, and lower profile.

The developed RF-IC has the following features:

- Smallest in the industry (4.13 mm × 4.16 mm × 0.6 mm, 96 pins) thanks to wafer-level chip size package (WCSP)
- Compatible with band I (2 GHz), band V/VI (800 MHz) and band IX (1.7 GHz)
- Receiving low-pass filter (LPF) that copes with disturbing or interference waves sent by the Global System for Mobile Communications (GSM)/ CDMA 2000
- Low power consumption and low error vector magnitude (EVM)

We are also planning to develop a next-generation RF-IC with the following specifications:

- Compatible with W-CDMA (HSDPA / HSUPA)
- Compatible with GSM (GPRS / EDGE)
- Extension of multiband
- Incorporation of high-speed digital interface unit with built-in AD/DA converter
- Elimination of external band-pass filter (BPF)

HSDPA: High Speed Downlink Packet Access

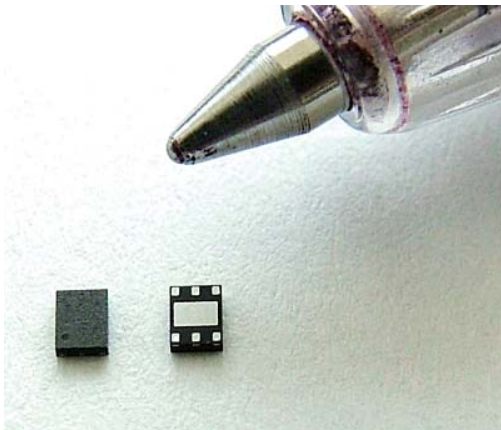
HSUPA: High Speed Uplink Packet Access

GPRS: General Packet Radio Service

EDGE: Enhanced Data rates for GSM Evolution

AD/DA: Analog to Digital/Digital to Analog

## TA4029CTC Low-Noise Amplifier for 1SEG Tuners Using Latest and Fastest BiCMOS Process



TA4029CTC low-noise amplifier

Digital broadcasting for mobile communication terminals or one-segment broadcasting (1SEG) is required to display stable images for incoming waves under any circumstances. Toshiba has developed a low-noise amplifier (LNA) for 1SEG tuners, the TA4029CTC, with a control terminal which selects the optimal operating mode according to the strength of the receiving signal.

The newly developed amplifier features a function in which when the receiving signal is strong near the broadcasting station, the mode that does not use the LNA is selected and conversely, when the receiving signal is weak, the mode that uses the LNA is selected. Low noise characteristics of the LNA were attained by our advanced IC manufacturing process which optimizes the concentration distribution of silicon germanium (SiGe) in the SiGe-bipolar complementary metal-oxide semiconductor (BiCMOS) which is excellent in high-frequency characteristics and integration. Moreover, the mounting surface of the amplifier was made flat with no leads so that the tuner module can be made low-profile and smaller, with body dimensions of 1.5 mm × 1.15 mm × 0.38 mm.

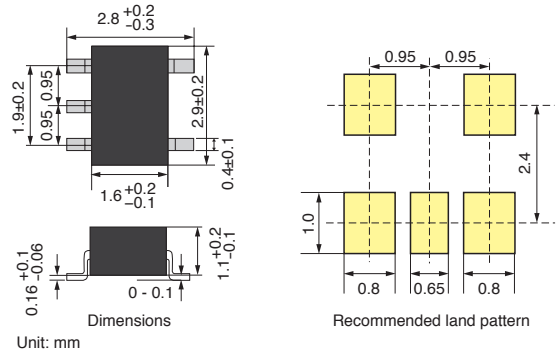
## Low-Noise CMOS Regulator

In recent years, multi-function mobile devices with camera and audio capabilities, incorporating analog-digital hybrid circuits, have become commonplace. To support these capabilities, high-quality power sources are required. Toshiba has developed a new type of low-noise CMOS regulator for high-quality power sources.

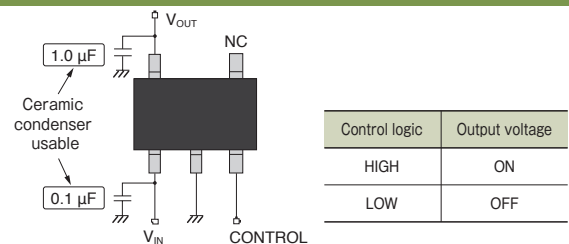
The newly developed regulator has the following features:

- Low dropout voltage:  
 $V_{IN} - V_{OUT} = 85 \text{ mV (typ.) at } I_{OUT} = 50 \text{ mA}$
- High ripple rejection ratio:  
 $R.R = 80 \text{ dB (typ.) at } I_{OUT} = 10 \text{ mA, } f = 1 \text{ kHz}$
- Low output noise voltage:  
 $V_{NO} = 30 \text{ } \mu\text{Vrms (typ.) at } I_{OUT} = 10 \text{ mA, } f = 10 \text{ Hz to } 100 \text{ kHz}$
- Low bias current:  
 $I_B = 40 \text{ } \mu\text{A (typ.)}$
- Output voltage range:  
 $1.5 \text{ V to } 5.0 \text{ V (} 0.1 \text{ V/step)}$

### Dimensions



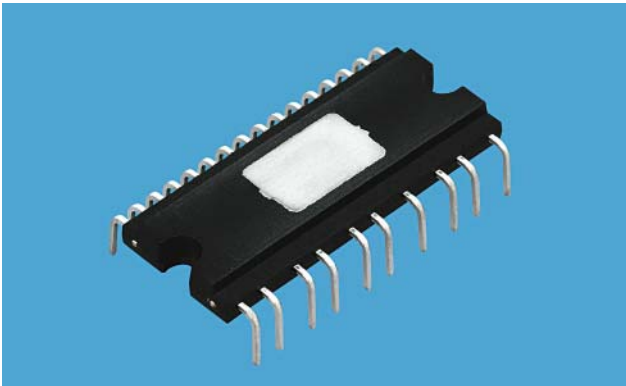
### Recommended circuit



For control terminals, voltages of -0.3 V to 6 V are allowed, not limited to the input voltage.

Dimensions and recommended circuit of SMV package

## DIP26 Series Single-Chip Inverter IC



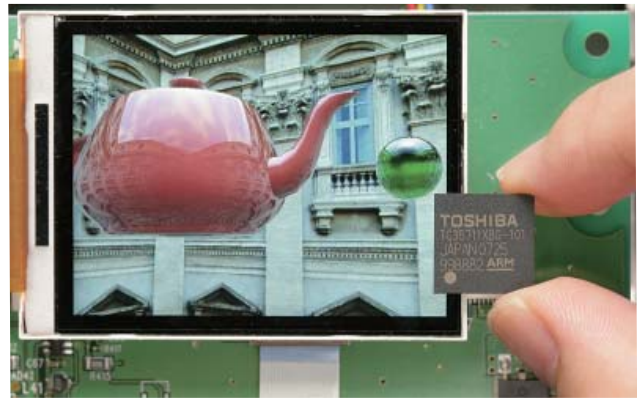
DIP26 series single-chip inverter IC

As the demand for energy-saving increases year by year, substitution of DC motors and improvements in their efficiency are advancing. At the same time, semiconductor products must be made low-profile and smaller so that components and devices can be miniaturized. To meet these market demands, Toshiba has developed a new type of Dual Inline Package 26 (DIP26) series which is low-profile and has improved distance between pins.

The newly developed DIP26 series facilitates substrate wiring by separately aligning the high-voltage high-current pins and control pins along both sides of the dual inline package. Moreover, the DIP26 series uses our proprietary trench isolation type high-voltage withstanding silicon-on-insulator (SOI) process to ensure high performance.

Toshiba has started mass production of DIP26 series in eight variations from 250 V/1 A to 500 V/1-3 A for white goods and home appliances and DC brushless motor drivers.

## 3D Graphics LSI for Mobile Phones



3D graphics demonstration image with TC35711XBG 3D graphics LSI

Toshiba has developed a new three-dimensional (3D) Graphics LSI, the TC35711XBG, for mobile phones. It is compatible with the latest 3D programming technology “Programmable Shader” that creates realistic 3D images such as reflection images on a glossy surface or sun glare.

The new LSI integrates a 3D graphics processor that has approximately 38 times higher polygonal drawing capacity<sup>(\*)</sup>, namely 100 mega polygons/s, compared with the conventional TC35296XBG, high-performance ARM processor ARM1176JZF-S, Toshiba’s “Media Embedded Processor (MeP)”, and a WVGA (864× 480 pixels) LCD controller. It provides quality 3D drawing performance comparable to a desktop game machine.

LCD: Liquid Crystal Display

WVGA: Wide VGA

(\*) Polygonal drawing capacity is the peak performance of the 3D graphics processor.

## DNA Chip for Personalized Medicine of Rheumatoid Arthritis



Electrochemical DNA chip

Genelyzer™ automated DNA detection system

Toshiba has established the DNA (Deoxyribonucleic Acid) chip which predicts the efficacy and side effects of rheumatoid drugs and the risk of serious complications of rheumatism. This is the second version following a DNA chip for HPV geno-typing aiming at practical use in the field of medical diagnostics.

Rheumatoid arthritis is a severe disease with about 700 000 patients in Japan. Effective drugs have been developed, but the efficacy and side effects depend on individual patients and there may be serious complications. Since early treatment is crucial to slow the progression of the disease, patients' expectations for genetic diagnostics for each patient and medical treatment based on those diagnostics are high. Tokyo Women's Medical University has found SNPs related to the efficacy and side effects for the major rheumatoid drugs methotrexate and sulphasalazine, and to the risk of amyloidosis, which is a serious complication.

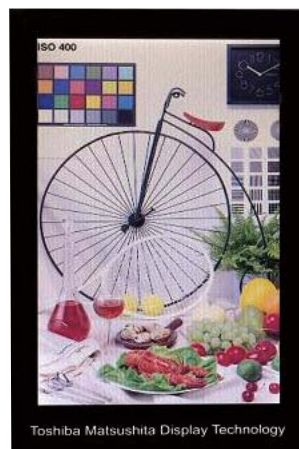
Based on these findings on genetic information, we have developed a DNA chip which can identify these SNPs for predicting the efficacy and effect of these drugs and predicting the risk of complications. Through the feasibility test using samples from around 300 patients performed at Tokyo Women's Medical University, we proved the ability of our DNA chip to detect SNPs with high precision.

We have also established a compact automated DNA chip detection system, the Genelyzer™, which offers improved usability and reliability. By injecting amplified DNA into the chip and placing it in the equipment, the Genelyzer™ automatically and quickly identifies SNPs.

HPV: Human Papillomavirus

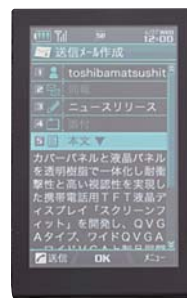
SNP: Single Nucleotide Polymorphism

## Lens Lamination LTPS TFT-LCD "Screen Fit" for Mobile Phone Applications

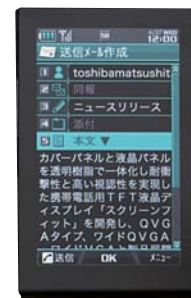


Toshiba Matsushita Display Technology

"Screen Fit" lens lamination TFT-LCD



7.1-cm (2.8 type) wide QVGA  
Conventional



7.1-cm (2.8 type) wide QVGA  
"Screen Fit"

Increased contrast of "Screen Fit" under bright light

Toshiba Matsushita Display Technology Co., Ltd. has developed a lens lamination LTPS TFT-LCD "Screen Fit" for mobile phone applications. The new technique, in which a transparent cover panel and an LCD are laminated, delivers high mechanical durability and high optical performance. Mass production started in April 2007, and the product lineup has expanded to 7 models.

Since "Screen Fit" has no air gap between the LCD and the cover panel, the transmissivity is improved by nearly 7%, thus greatly improving readability. Accordingly, power consumption is improved by saving backlight power. This structure also provides high mechanical durability and high reliability suitable for thinner mobile phone applications.

This technology is already used for Toshiba's mobile phones, marketed as "Clear Screen", which has been well received by the market.

LTPS: Low-Temperature Polycrystalline Silicon

TFT: Thin Film Transistor