

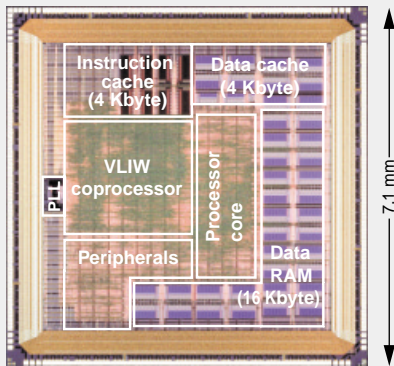
Along with the rapid proliferation of broadband networks, new digital and mobile devices are constantly appearing. Toshiba's Electronic Components Division is promoting business activity, which provides key devices for the support of this development. In the field of semiconductors, Toshiba has developed a RISC processor, which is at the core of system LSIs as well as image processing LSIs and large capacity NAND type flash memory. Toshiba has also merchandized the largest 15-inch poly-silicon TFT-LCD for a notebook PC in the field and a thin and high-capacity lithium ion battery.

Image Recognition LSI for Smart Car

Smart cars, which incorporate computer assisted safety driving are one technology being developed for ITS (Intelligent Transportation System).

Toshiba has developed an image recognition LSI, which is a key technology in smart cars. A configurable processor and the addition of a customized VLIW (Very Large Instruction Word) type coprocessor have made it possible to provide high-performance image recognition processing.

The LSI is fabricated using the 0.25 μm CMOS (Complementary Metal Oxide Semiconductor) process and achieves 4 GOPS (Giga Operations Per Second) at 125 MHz.



PLL :Phase Locked Loop
Micrograph of the image recognition LSI

Specifications of the image recognition LSI

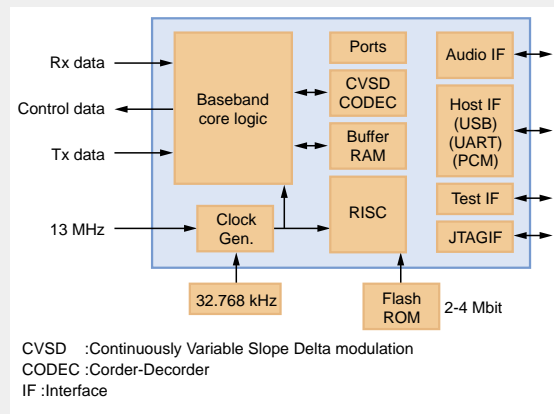
Technology	0.25 μm CMOS 4-layer metal
Operation frequency	125 MHz
On-chip memory	4 Kbyte instruction cache 4 Kbyte data cache 16 Kbyte 2-bank data RAM
Gate size	300 Kgates
Die size	50.4 mm ²
Package	TBGA 352 pins
Operation voltage	3.3V (I/O), 2.5 V (Internal)

TBGA :Tape Ball Grid Array

Bluetooth™ Baseband LSI



TC35651 Bluetooth™ baseband LSI



Configuration of TC35651

Toshiba has developed a Bluetooth™ baseband LSI, the TC35651, which conforms to Bluetooth™ Ver.1.1 specifications.

Bluetooth™ technology enables users to connect computers, cellular phones and other devices via wireless links.

The new LSI adopts Bluetooth™ core circuit technology, licensed from Nokia Corporation.

It incorporates a RISC processor, buffer RAM and several interface circuits for USB (Universal Serial Bus), UART (Universal Asynchronous Receiver and Transmitter), PCMIF (Pulse Code Modulation Interface) and JTAGIF (Joint Test Action Group Interface), and in operation the new LSI also provides low power consumption.

The chip is assembled in a small thin 113 pin fine-pitch ball grid array (FBGA) package that measures 8 mm × 8 mm × 1.2 mm, and flip chip is also available.

The Bluetooth trademarks are owned by Bluetooth SIG, Inc., U.S.A.

1 Gbit NAND Flash Memory Using Multi-Level Cell Technology

Toshiba has developed the world's first commercial 1 Gbit multi-level cell (MLC) NAND flash memory chip. The new 1 Gbit flash chip will be manufactured using the same 0.16 μm process technology that is currently used in the production of the 512 Mbit NAND. It is based on the MLC technology that allows two bits of data to be stored in one memory cell, doubling memory capacity. This commercialization of NAND MLC flash is viewed as a crucial step for improvement of margins, expansion of existing markets and opening up new markets for flash memory data storage.

Use of MLC technology, either as embedded chips or in removable cards, is expected to greatly expand the data storage capabilities of cellular phones, digital cameras, MP3 (MPEG-1 Layer 3) audio players, streaming audio and streaming video.



1 Gbit multi-level NAND flash memory

LSI for RF-ID Cards and Tags

RF-ID cards and tags that can perform non-contact read/write of data, are becoming increasingly popular in various fields, such as distribution, transportation and security.



T6N81 LSI bare chip for RF-ID cards and tags

In order to respond to this demand, Toshiba has developed a new LSI, the T6N81, which operates on a 13.56 MHz short-wave radio frequency.

The LSI is equipped with a built-in 256 byte EEPROM (Electrically Erasable and Programmable ROM).

Moreover, the capacitor for the resonance circuit is also built-in and external parts have been reduced to a minimum.

In terms of electrical performance, write-time is as short as 2 ms, and the data transmission rate is 106 kbps or 212 kbps. Moreover, these units are equipped with a multi-read function that allows simultaneous reading of multiple cards.

The new LSI T6N81 conforms to the ISO 14443 type B standard.

RF-ID : Radio Frequency Identifier

Bluetooth™ SD Card

The Bluetooth™ SD card is a small size media card that can perform



Bluetooth™ SD card

Bluetooth™ specification wireless communication.

This device is an SD I/O (Input / Output) card, which can perform wireless communication simply by being inserted into the slot for an SD memory card in an SD I/O specification host equipment. The device is both small and lightweight (24 mm \times 49 mm, $t=2.1$ mm) and it delivers low power consumption.

With the appearance of these SD I/O cards, the applications for SD memory cards in PDAs, cellular phones, PCs, printers and other digital devices are broadened even further.

New SiGe (Silicon Germanium) Transistors

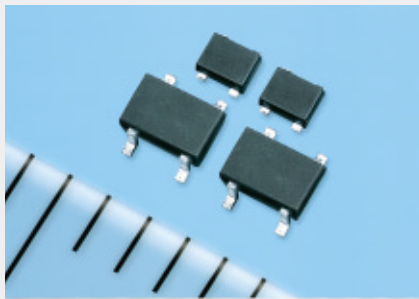
Toshiba has developed two new SiGe Transistors, the MT4S100U and the MT4S101U.

These devices are ideal for use in mobile phones where high performance, low voltage and low electric currents are required.

The MT4S100U is an ultra low noise high frequency transistor that utilizes Toshiba's proprietary SiGe Epitaxial Base Bi-polar Transistor Process (on wafer transition frequency: $f_T=60$ GHz) to maintain a V_{CEO} of 3.5 V and achieve one of the industry's lowest noise levels at NF (Noise Figure) =0.7 dB.

In addition to the MT4S100U, Toshiba also offers the MT4S101U high power gain transistor (insertion gain $|S_{21}|^2=17$ dB).

These devices are packaged in a 4-pin surface mount small package USQ (Ultra Super mini Quad), and the smaller type TESQ (Thin Extreme Super mini Quad).



SiGe transistor packages (TESQ: top, USQ: bottom)

New Aluminum Can Type Lithium-Ion Batteries

An increase in the energy density of batteries is urgently required, due to the consistent achievement of higher performance in mobile equipment.

Toshiba has developed new aluminum can type lithium-ion batteries with 10 % higher capacity (LGQ553048U: 740 mAh (min.), LGQ443048U: 620 mAh (min.)).

The new technologies employed are a combination of a new negative electrode material and thinner separator with higher reliability, and a newly introduced manufacturing process to improve the cell performance while maintaining high productivity.

These technologies enable the batteries to achieve much higher capacity without increasing the thickness when compared with previous products. These new batteries can also achieve longer working times in mobile equipment. Toshiba has developed this new lineup of batteries whose thickness varies from 3 mm to 6 mm, so as to enable customers to select the battery that best matches their equipment.

The above technologies are also now applied to Toshiba's cylindrical cells (2,200 mAh), which have recently gone into mass production. This cylindrical cell is mainly used in mobile PCs and digital still cameras.



Prismatic and cylindrical lithium-ion batteries

14.1-inch and 15-inch XGA Low-Temperature Poly-Silicon TFT-LCDs for Notebook PCs



14.1-inch low-temperature p-Si TFT-LCD

Toshiba has developed a series of new 14.1-inch and 15-inch XGA (Extended Graphics Array) displays, the largest low-temperature poly-silicon (LTPS) TFT-LCDs (Liquid Crystal Displays) available commercially for portable PCs.

The crystallized silicon of LTPS TFT-LCDs supports much faster electron flow in transistors than the non crystallized silicon in amorphous silicon TFT-LCDs, a performance enhancement, which supports higher resolution and richer colors. LTPS TFT-LCDs also enjoy greater design flexibility and higher reliability than other LCD technologies, as most LCD drivers can be integrated directly on the display panel itself. This minimizes the space required at the periphery of the panel, cuts the number of components in the LCD module by 40 %, and reduces the number of connections between driver IC's and electrodes on the panel by 95 %.

The design philosophy behind Toshiba's new 14.1-inch and 15-inch XGA LTPS TFT-LCDs maintains compatibility with amorphous TFT-LCDs in terms of both the electrical interface and mechanical dimensions, which will enable portable PC manufacturers to switch to the new display easily.

90 cm Super Large Pure Flat Color Picture Tube

Toshiba has developed a new shadow mask type flat color picture tube with a maximum screen size of 90 cm. Toshiba has achieved a better design balance of bulb strength, brightness and contrast with the following special approach:

- New shadow mask with super grade aperture system
- Optimum panel internal curvature/formed mask curvature

Especially in terms of shadow mask strength, which shows a reverse correlation to visual flatness characteristics, improvements have been made through a structural analysis simulation of not only shadow mask curvature, but also the mask frame supporting the shadow mask.

By installing the above unique technologies, better cost-performance is achieved and Toshiba's USA factory began mass production of this type in May 2001.



90 cm super large pure flat color picture tube (left) and 51 cm pure flat color picture tube (right)