Electronic Components and Materials

Moving picture, audio and computer technologies are becoming increasingly integrated in the current multimedia era, and this integration is increasing the need for expanded functions in personal computers and peripheral equipment. Focusing on multimedia applications, Toshiba has developed a number of products including a high-resolution display tube that represents an improvement in microfilter™ technology, the Mpact™ system LSI media processor, which can handle seven functions on a single chip, and an embedded DRAM and ASIC.

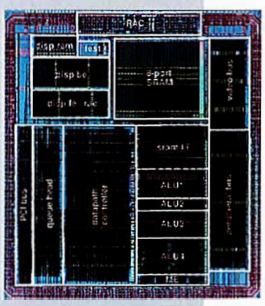
Mpact™ Media Processor

Personal computers have recently begun incorporating moving picture and high-quality sound functions to accommodate new multimedia applications such as DVD playback and video conferencing. When systems are designed so that each function is handled by a separate LSI, an increase in functions inevitably leads to a need for more LSIs. The new Mpact™ media processor handles all multimedia functions using a single LSI with high-performance digital signal processor (DSP).

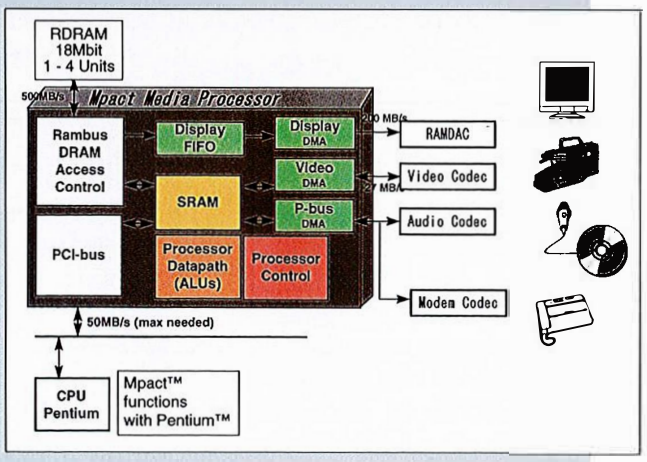
Mpact™ offers seven functions: video; 2D graphics; 3D graphics; sound; modem; telephony; and video conferencing. The features are as follows:

- The architecture uses a very long instruction word (VLIW)/single instruction multiple data (SIMD) structure;
- 600Mbyte RAMBUS™ interface;
- Peripheral component interconnect (PCI) bus-interface; and
- 3,600 million operations per second (MOPS).

Co-developed by Toshiba and Chromatic Research, Inc., Mpact™ uses a 0.35µm process rule, 3.3V voltage source and 240 pin flat package. A Pentium™ microprocessor allows Mpact™ to fully realize its functions.



Microphotograph of Mpact™ media processor



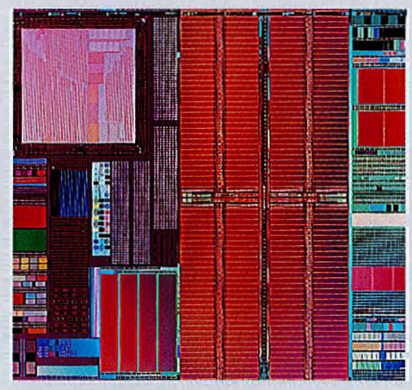
System block diagram of Mpact™ media processor

dRAMASIC™ Embedded DRAM and ASIC

The dRAMASIC™ improves on the second generation process for 64Mbit DRAMs as a design tool that embeds a 0.3µm (TC220 series) ASIC library and a high-speed synchronous DRAM to realize design capability in an ASIC/electronic design automation (EDA) environment. Its main features are as follows:

- Use of the trench process allows planization and higher performance;
- A high-speed transfer rate of 4.2Gbytes/s@133MHz is achieved using a wide bit (Max. x 256bit) interface; and
- The DRAM core is suitable for a high-flexibility ASIC library, with functions such as core expansion at the 2M unit, a control circuit with a wide range of uses, and an interleaved bank function.

The dRAMASIC™ has practical applications in a number of fields that require a high-speed transfer rate for graphic systems or small-sized, low-power-consumption portable equipment.



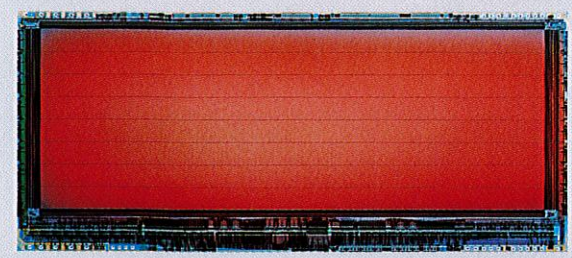
64Mbit DRAM and ASIC test chip

64Mbit NAND EEPROM

Toshiba and Samsung Electronic Corporation have jointly developed a 3.3V-only 64Mbit NAND flash memory based on the NAND-structured technique, which is suitable for high integration. The device is fabricated using 0.4μm double-poly, single-metal CMOS technology. A single NAND string is composed of 16 cells. The effective cell size is 1.1μm² and the die is 122.9μm². The cells are organized in 1,024 blocks and each block consists of 16 pages. Page and block sizes are 528bytes and (8k+256) bytes, respectively.

A staggered row decoder scheme reduces the word line charging and discharging time by 30 percent compared to the previous design, resulting in a random access time of 3μs. A data output throughput of 29Mbytes/s and an effective program throughput of 3.5Mbytes/s are achieved by using a gapless sequential read mode and an incremental step pulse programming (ISPP) technique, respectively.

This memory is installed in the SmartMedia™ memory card (SSFDC specification), which is widely used as a storage medium for digital cameras. The card is based on JEIDA/PCMCIA specifications.

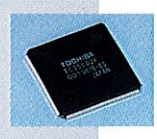


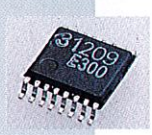
64Mbit NAND EEPROM

IC/LSI Chipset for PHS

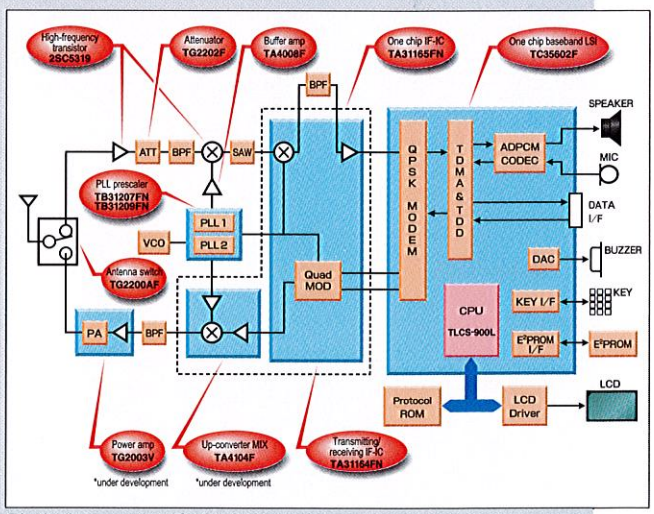
Toshiba has developed the following IC/LSIs for the third generation of personal handy phone systems (PHS):

- The TC35602F baseband LSI integrates all required functions, such as protocol, sound and man-machine interface processes, onto one small-sized chip with low current consumption.
- The TA31165FN one-chip intermediate frequency (IF)-IC employs an IF receiver amp and quadrature modulator, as well as an up-converter, to realize a small-sized radio frequency (RF) section with low current consumption.
- The TB31209FN phase locked loop (PLL) synthesizer is fixed at the setting for the second local frequency for PHS to further decrease power consumption.
- The TG2003V power amplifier has a high-gain 40dB (typ) GaAs-MMIC built in for transmission power control functions.





All of the chipsets were designed to achieve reduced size and low power consumption, and offer a wide range of practical applications in mobile communications terminals such as ultra-small PHS terminals and handheld PCs that use PHS high-speed wireless data communication.



Block diagram of PHS IC/LSI chipset

2.5kV-1kA Press Pack IGBT

Toshiba has developed the world's first high-voltage, high-current (2.5kV-1kA) press pack IGBT. The IGBT is assembled without wire-bonding and soldering, thus supporting high reliability of a level equivalent to that of a press pack gate turn-off (GTO) thyristor and high-frequency operation.

An inverter that uses the press pack IGBTs can operate at three to four times the frequency of a GTO inverter and can greatly reduce operating noise. This inverter is suitable for use in a power range of up to 100MVA on high-speed trains, electric locomotives and high-voltage power converters. The main features of the press pack IGBT are as follows:

- The structure has a high level of reliability in withstanding thermal fatigue because all of the electrical connections are carried out without wire-bonding and soldering.
- Even in the event of an electrical breakdown of a product part, the short-mode construction maintains electrical safety in the series connections.

2.5kV press pack IGBT

LTM15C151A 15 Inch TFT-LCD for Monitors

The LTM15C151A is Toshiba's new 15 inch (38cm) diagonal XGA (1,024 x 768 pixels) format thin-film transistor (TFT) color LCD module. The module has a display area equivalent to that of a 17 inch diagonal color display tube (CDT) and is suitable for LCD monitor use for personal computers as well as engineering workstations.

Demand is high in the LCD monitor market for large screens with a wide viewing angle and a high-luminance, long-life backlight system that requires low maintenance. Using a newly developed reflective polarizing sheet and optical compensation polarizer film, the LTM15C151A offers improved viewing angle characteristics. The vertical and horizontal angle ranges are 35° at display luminances of higher than 50cd/m², and the vertical and horizontal angle ranges are 25° and 20°, respectively, at contrast ratios higher than 10:1.

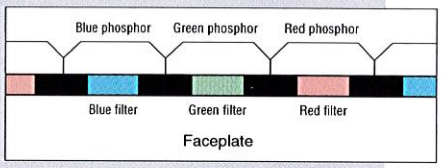
Backlighting is provided by two cold cathode fluorescent lamps (CCFLs) at the top and bottom, with an initial luminance of 200cd/m² and long-life operation at an average of 25,000 hours. The new developments in the LTM15C151A not only enable the display of pictures with both high luminance and a wide viewing angle, but also approximately double the time between CCFL replacement.

LTM15C151A with sample display

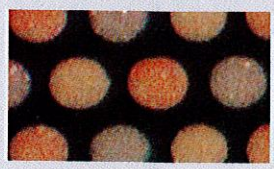
M41 Microfilter™ High-Resolution Display Tube

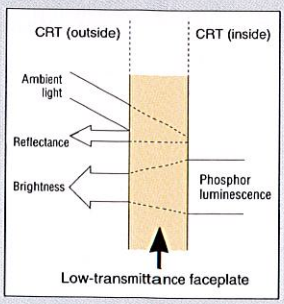
The M41 microfilter™ is the latest model in the microfilter™ series of high-resolution display tubes for use in monitors. Microfilter™ tubes feature red, green and blue primary color filters made of superfine pigments inserted between the corresponding color-emitting phosphor pattern and the high-transmittance faceplate of the CRT display. The color filters and high transmittance provide improved brightness, contrast and color purity for greatly enhanced picture quality.

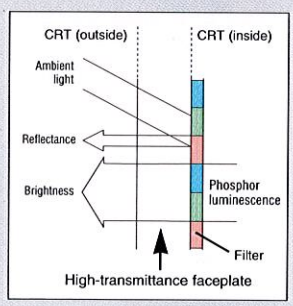
The high-resolution M41 microfilter™ employs an improved version of the color filter patterning technology of the microfilter™ for televisions. As a result, the M41 microfilter™ offers remarkably enhanced picture quality, with a 36 percent improvement in both brightness and contrast and 7 percent increase in color gamut compared to conventional high-resolution display tubes.



Screen structure of microfilter™







Luminance and diffuse reflectance of microfilter™ (right) and conventional CRT (left)

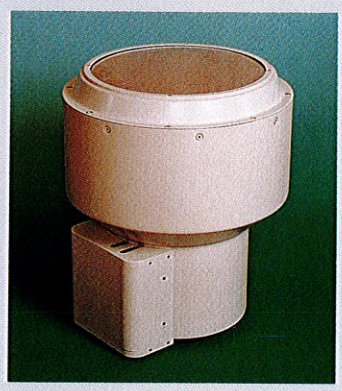
36cm X-Ray Image Intensifier with High Modulation Transfer Function

To meet the multipurpose digital X-ray requirements of recent diagnostic systems, Toshiba has developed an X-ray image intensifier (I.I.) with a 36cm input size and a high modulation transfer function (MTF).

Improvements to the MTF of the image intensifier include the adoption of a new type of electron lens with a high electric field near the input screen and a significant increase in the output screen diameter to 70mm, compared with 30mm for previous models. These features allow an MTF spatial frequency value of 20 line pairs (Lp)/cm to be achieved over 40 percent, compared with 20 percent for a conventional 36cm I.I. The I.I. has three mode sizes: 36cm, 25cm, and 18cm, with resolutions of 65Lp/cm, 71Lp/cm and 84Lp/cm, respectively. The resolution level of 65Lp/cm is about 1.5 times that of a conventional I.I. The contrast ratio at 10mm diameter (the small area contrast ratio) is 20, and the contrast ratio for 10 percent of the area is 35, compared with ratios of 15 and 25, respectively, for previous models.

As a result of these specifications, the I.I. can achieve an MTF value of over 40 percent at a resolution of 20 Lp/cm, compared with 20 percent for the conventional 36cm I.I.

This new I.I. provides a sharper image for any diagnostic application. It is particularly suited to interventional radiology (IVR) applications.


High MTF 36cm X-ray image intensifier