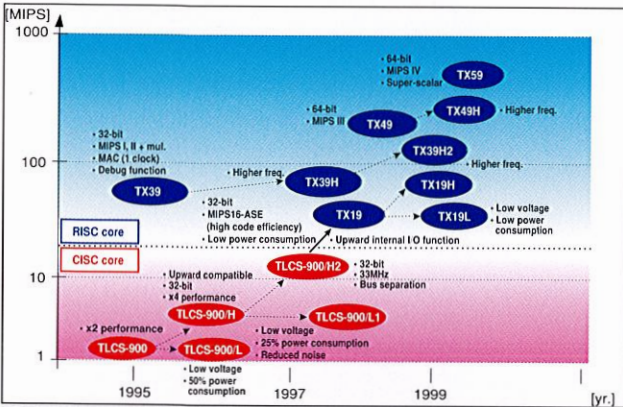


The emerging market for portable electronic devices that fuse information, telecommunications and moving picture technologies is spurring demand for increasingly sophisticated components and materials. In response, Toshiba has developed products including a low-power mini-neck display tube; a thin, lightweight TFT-LCD module with low power consumption; a high-resolution display tube that advances microfilter™ technology; a TX system RISC processor for embedded applications; a high-speed SDRAM; and a high-voltage SOI power device.

TX19 32-Bit System RISC Processor

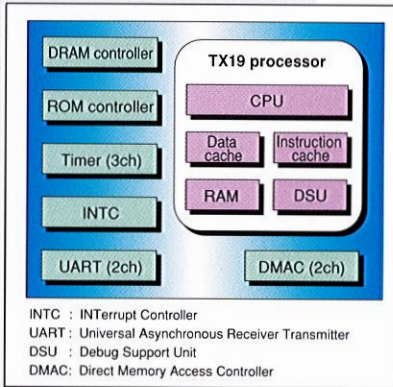


Development of Toshiba microcomputers

Part of Toshiba's TX System reduced instruction set computer (RISC) family of processors based on MIPS architecture, the new TX19 series of 32-bit system RISC processors is ideally suited for low-end embedded applications.

Adoption of the MIPS16™ Application Specific Extension (ASE) of the MIPS Group, which compresses part of the instruction set to 16-bit length, significantly raises efficiency. While the TX19 core realizes high performance of 21MIPS at 20MHz, use of an innovative, low-power consumption library and micro-architecture enables an industry-leading performance/power ratio of 1,000MIPS/W at 3V/20MHz.

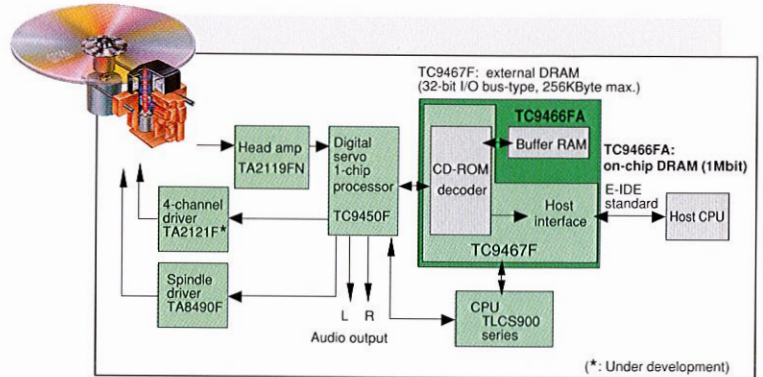
The first product in the TX19 series is the TX1904, which is built around the TX19 processor core and incorporates on a single chip peripheral circuits widely applicable for general-purpose use, such as a memory controller, DMAC, UART and a timer. The TX1904 is highly suited for applications such as portable information equipment, portable telephones and office equipment.



Block diagram of TX1904

INTC : INTERRUPT Controller
 UART : Universal Asynchronous Receiver Transmitter
 DSU : Debug Support Unit
 DMAC : Direct Memory Access Controller

LSI for 32 Times Speed CD-ROM Drive

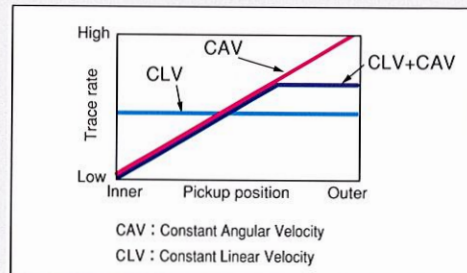


System diagram of 32x CD-ROM LSI

In response to speed-based competition in the CD-ROM market, Toshiba has developed a series of products that realize a playback speed of 32 times: the TC9450F digital servo one-chip processor; the TA2119FN head amp; the TC9466FA buffer RAM; and the TC9467F ROM decoder.

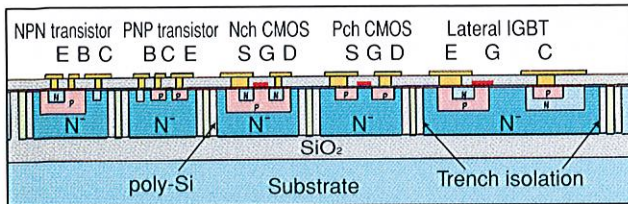
Demand is strong for CD-ROM systems that offer large data storage capacity and high-speed reading ability to meet the requirements of high-performance CPUs in personal computers. For CD-ROMs of 12 times speed or higher, there has been a shift from constant linear velocity (CLV) control systems to constant angular velocity (CAV) control systems. TC9450F and TA2119FN are designed to support both control systems.

In addition, TC9466FA and TC9467F both support PIO-mode 4 and DMA-mode 2 architecture, as well as fast audio playback. These LSIs realize high-speed, high-performance CD-ROM drives.



Trace rates for CLV, CAV and CLV+CAV

High-Voltage SOI Power IC



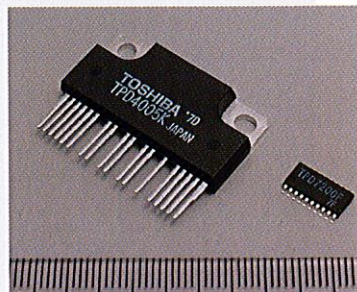
Cross section of SOI power IC

Using an inverter is a highly effective method of achieving the low power consumption required to reduce the environmental impact of electronic devices. Toshiba has developed a high-voltage dielectric isolation IC process that will become a key component of future inverters.

The new process realizes 500V blocking with a construction that uses a silicon on insulator (SOI) wafer with a 16 μ m silicon layer and 4 μ m buried oxide film, which was used for the longitudinal isolation of an element. This was accomplished using Toshiba's original silicon wafer direct bonding technology and deep trench isolation technology for buried oxide film. As a result, the manufacturing process was simplified. Moreover, compared with the conventional dielectric isolation type (using the previous Toshiba process), element isolation area is significantly reduced to 7%.

The element can be installed as an output element for IGBT (Insulated Gate Bipolar Transistor), Nch MOSFET, and FRD (Fast Recovery Diode) and as a controlling element for Bi-CMOS. This realizes a high-voltage, large-current, and high-efficiency power IC.

This process technology has been used to develop the TPD4005K high-voltage pulse width modulation (PWM) DC brushless motor driver and TDP7200F level-shift-type half-bridge MOS gate driver.



TPD4005K DC brushless motor driver (left) and TDP7200F half-bridge MOS gate driver (right)

64Mbit Synchronous DRAM for 100MHz Main Memory Bus

Toshiba has developed a 64Mbit synchronous DRAM (SDRAM) capable of data transfer of 100MHz@CL2, which is necessary for the main memory of next-generation personal computers.

High-speed circuit technology such as pipeline architecture and a burst transfer mode enables data transfer at a higher speed than conventional DRAMs.

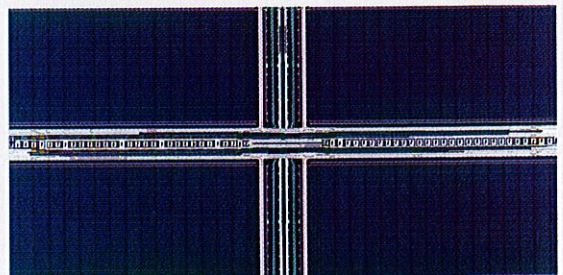
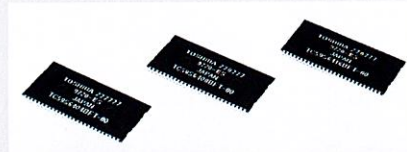
Using 0.25 μ m CMOS fine process technology and shallow trench isolation (STI) and chemical mechanical polishing (CMP) technologies enable attainment of the world's smallest chip size (79.4mm²).

In electrical performance, 2.5V internal operating voltage has been realized using chip shrink technology and optimizing memory cell array layout.

Power requirements are roughly 70% that of conventional SDRAMs.

Low-voltage transistor transistor logic (LVTTL) products are available with a clock frequency of 100MHz/125MHz and stub series terminated logic (SSTL) products are available with a clock frequency of 150MHz.

All products work at 3.3V. Three types of word organization (x4, x8 and x16) are available.



64Mbit synchronous DRAM for 100MHz main memory bus

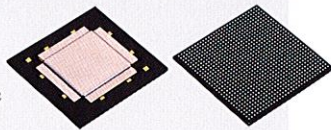
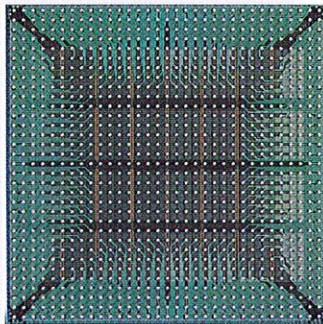
TC240 Series System ASICs

Toshiba's new TC240 series of 0.25 μ m application-specific integrated circuits (ASICs) realizes system LSIs with embedded core cells such as DRAM, TX system RISC and other functional intellectual properties (IPs).

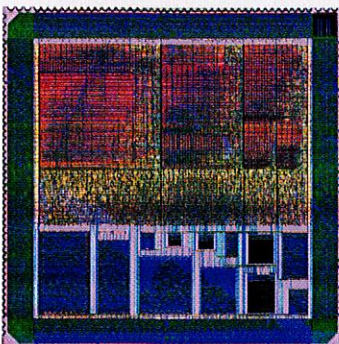
0.25 μ m CMOS fine process technology (0.18 μ m effective gate length), shallow trench gate isolation technology and 5-layer aluminum wiring technology were used to enable about 35,000 gates/mm², which is a gate density three times that of the previous series, and more than 10 million gates on a single silicon chip.

This series is the first to introduce unified cell architecture, which equalizes the basic structure of both gate array cells and cell-based IC cells. This architecture enables reduced development time for large, complex system LSIs. Selected specifications are as follows:

- Supply voltage: 2.5V internal, 2.5V/3.3V I/O
- Gate delay time: 54ps (high-speed 2-input NAND)
- Power dissipation: 0.1 μ W/MHz (low-power 2-input NAND)



Area-pad flip chip(above) and 900-pin BGA package(below)

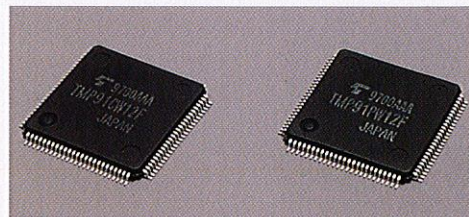


TC240 series product example

TMP91CW12F Low-Voltage/ Low-Power 16-Bit Microcontroller Unit

The TMP91CW12F 16-bit microcontroller unit (MCU) integrates low-voltage, low-power and low-noise technologies for compact portable devices such as PDAs. Power consumption has been reduced to 25mW at 3V-16MHz. As a result, it is possible to make longer-life batteries for compact portable equipment, which requires high performance at low power.

The internal memory consists of 128KByte ROM and 4KByte RAM with clock gear and dual clock circuit functions to reduce power consumption. Internal peripheral functions include timer/counters (8-bit/16-bit/clock timer), serial interface (3-channel) and 10-bit A/D converter (8-channel). The compact, 100-pin quad flat package (QFP) measures 14mmx14mmx1.4mm thick.



Low-voltage/low-power 16-bit MCUs: TMP91CW12F (left: mask ROM) and TMP91PW12F (right: one-time programmable (OTP) ROM)

12.1-Inch XGA-Resolution Poly-Si TFT-LCD Module

For the next generation of large direct-view displays, Toshiba has developed a 12.1-inch (31cm) diagonal XGA-resolution (1,024x768 pixels) polycrystalline silicon (poly-Si) TFT-LCD module.

Low-temperature poly-Si TFTs offer better electronic mobility than amorphous-silicon TFTs and enable integration on the glass substrate of peripheral drive circuits, which are applied as external LSIs on conventional TAB packages. Driver integration reduces the number of components to about 60% and connection pins to about 5% of previous models, resulting in thinner, lighter TFT-LCDs with higher reliability.

The same low-temperature process technology can be used for large substrates, expanding the selection of glasses that can be used and leading the way to larger display sizes and lower production costs.



12.1-inch diagonal XGA-resolution poly-Si TFT-LCD module

Specifications of 12.1-inch XGA-resolution TFT-LCD module

	LTM12C300	Unit
Number of pixels	1,024 (W) x 768 (H)	
Pixel pitch	0.24 (W) x 0.24 (H)	mm
Display size	12.1-inch (31cm) diagonal	
Number of colors	256k	
Backlight	CCFL side light (single light)	
Luminance	140 max. (FL=6mA)	cd/m ²
Power consumption	3.5 (70cd/m ²)	W
Response time	t _{on} + t _{off} : 40	ms
Contrast ratio	1 : 250	
Dimensions	275 (W) x 199 (H) x 6.1 (D)	mm
Weight	455	g

5.8-Inch and 7.0-Inch Wide Display TFT-LCD Monitors for Car Navigation

The market for car navigation devices in Japan reached sales of 1 million units in 1997, and Europe and North America are expected to become major markets in the near future. Currently, 5.0-inch monitors (4:3 aspect ratio) are preferred in Europe and North America. However, in anticipation of future trends in market demand toward diversification and multiple display, Toshiba has developed the TFD58W03-MM 5.8-inch and TFD70W10-MM1 7.0-inch diagonal TFT-LCD monitors, both of which have a 16:9 aspect ratio.

The two monitors can handle both composite video (NTSC) and analog RGB video (NTSC/PAL) signal inputs. Both offer various display modes (16:9, 4:3, widescreen, zoom, etc.) in a compact design (thin package and narrow frame). Toshiba expects the 5.8-inch monitor to be installed in compact to mid-class cars, and the 7.0-inch model in mid-class to luxury cars.



7.0-inch diagonal wide display TFT-LCD monitor

X-Ray Image Intensifier with CCD Camera

Toshiba has developed an X-ray image intensifier (XRII) system with a visual field of 23cm in diameter that incorporates a charge coupled device (CCD) camera for X-ray fluoroscopy and radiography diagnostic use. Integrating the image processing unit, XRII and CCD camera shortened the overall length by 77mm to 471mm for a compact product with low power consumption. A J-type advanced image intensifier was adopted to obtain high contrast ratio, high detective quantum efficiency (DQE) and superior image quality for diagnostic applications.

A new X-ray quantum noise reduction (NR) processing unit uses an improved NR filter to produce high-quality fluoroscopy images. The novel photo detection unit determines X-ray exposure time by directly measuring the brightness of the XRII output image. These new technologies enable a significant reduction in size.

The compact, lightweight system contributes to the patient's feeling of security when getting on and off the examination table, and reduces the oppressive feelings that may be caused by large diagnostic equipment.



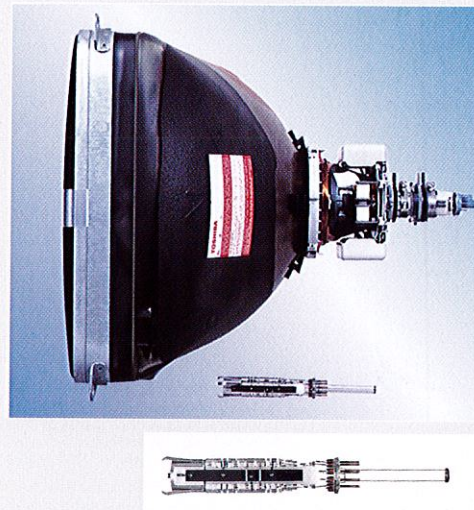
23cm X-ray image intensifier with CCD camera

41cm Mini-Neck High-Resolution Color Display Tube

In response to market demand for low-power color display tubes, Toshiba has developed a 41cm mini-neck color display tube, the latest in its series of mini-neck high-resolution display tubes for PC monitors.

The enlarged display area and reduced neck diameter of this tube caused problems with focus deterioration. Toshiba's solution was to optimize the design of the main lens and triode in the electron gun. In particular, a newly developed resistor with high electrical resistance was introduced between the quadrupole focus electrodes to expand their dynamically activated quadrupole (DAQ) lens action for vertical as well as horizontal directional control of the dynamic astigmatism.

Furthermore, by optimizing the relative position of the core and the coil, a smaller deflection yoke maintains the convergence performance of previous models without correcting devices. As a result, the 41cm mini-neck tube achieves a reduction in deflection power of 30% over Toshiba's previous models.



41cm mini-neck color display tube