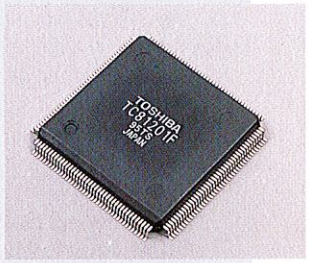
Electronic Devices and Materials

As functions improve and prices decrease, the market for home personal computers is expected to grow significantly. As a result, Toshiba is vigorously engaged in the development of new products and technologies in fields such as semiconductors and LCDs. Recent products developed from multimedia technology include an MPEG2 decoder LSI and a visible laser diode for DVD players.

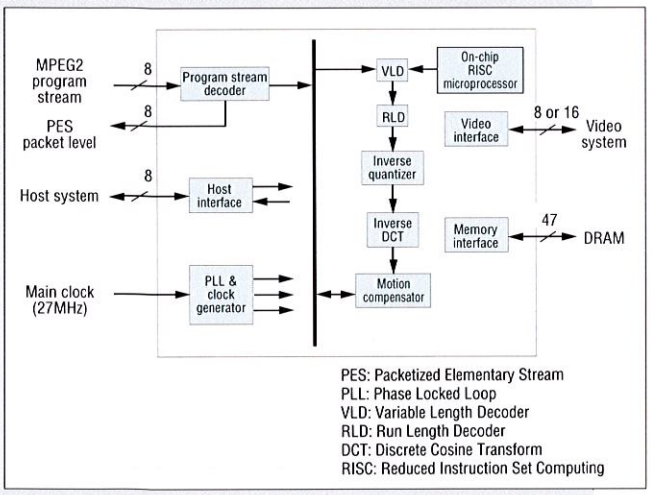
TC81201F MPEG 2 Decoder LSI

To meet a wide variety of requirements for multimedia systems, Toshiba has developed a new series of decoder LSIs that conform to Moving Picture Expert Group (MPEG) standards: the TC81200F for mass production; the TC81201F with a program stream decoder for digital disc systems; and the TC81211F with an MPEG1 audio decoder for satellite broadcasting applications.



MPEG2 decoder LSI

The TC81201F separates audio and private stream signals from a MPEG2 program stream, and decodes the video stream based on the main level main profile standard. It includes a letterbox function for displaying a wide-screen video signal on a normal-sized screen. External memory can be added by connecting 16Mb EDO DRAM or 16Mb synchronous DRAM. The target market for the TC81201F is multimedia equipment such as DVD players.

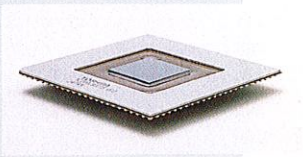


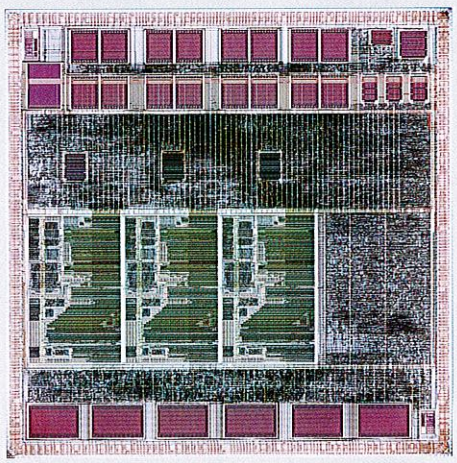
Block diagram of TC81201F

System on Silicon Cell-Base IC

The era of system-on-silicon technology, in which whole systems are integrated into one chip, is approaching. System-on-silicon technology requires not only an electronic design automation (EDA) environment, but also the implementation of various megacells.

Using 0.3μm CMOS process technology, Toshiba has developed the high-density system-on-silicon cell base IC series TC220C/E. The TC220C/E offers a maximum of 1,870,000 usable gates and a gate delay of 0.14nsec with a typical load. A number of new technologies were employed in the development of the embedded DRAM core, high-speed, high-resolution accuracy AD converter/DA converter, EEPROMs and Rambus ASIC cell (RAC) environment.


System-on-silicon cell-base IC (above) and its chip (below)



Super-Small Flash Memory Card SSFDC

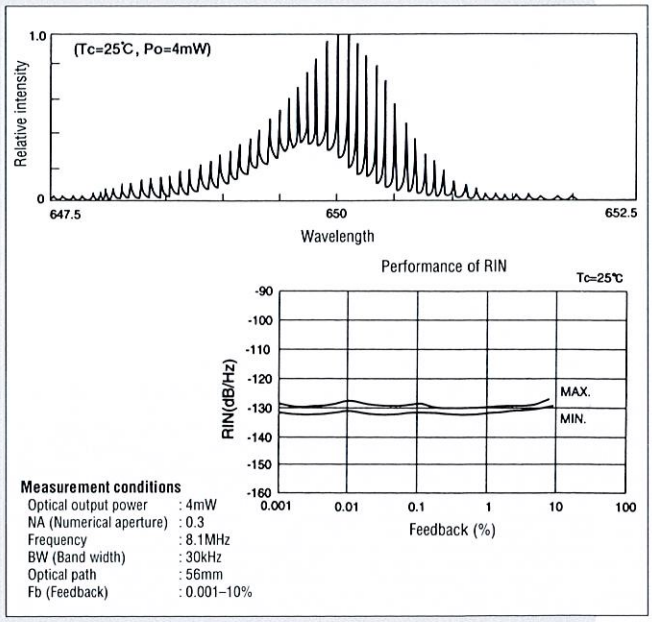
This newly developed super-small flash memory card SSFDC employs card-in-card architecture. With a thickness of about 0.8mm, the memory card TC5816ADC includes a 16Mbit flash EEPROM. The memory card is easily inserted into and detached from the credit card-sized adapter card, which is designed based on the 68pin JEIDA/PCMCIA standard. The TC5816ADC is adaptable to memory devices such as digital still camera memory and other digital handling systems. After taking photographs, the TC5816ADC can be detached from the camera and inserted into the adapter card for transfer of the stored picture data to a personal computer.

Adapter card (left) and flash memory card (right)

TOLD9450MC Visible Laser Diode for DVD Players

The visible laser diode TOLD9450MC was developed for use as a light source for DVD players. Short wavelength and low noise are important properties of a laser used as a light source for a DVD. Because TOLD9450MC is a self-pulsation laser due to its built-in saturable absorption area, it provides low noise operation without external high-frequency modulation. The wavelength of this new visible laser diode is 650nm and package diameter is only 5.6mm. Expected operation time is more than 5,000 hours at conditions of 55°C case temperature.

TOLD9450MC visible laser diode



Lasing spectrum of TOLD9450MC (above)
Relative Intensity Noise (RIN) of TOLD9450MC (below)

High DC Blocking Voltage Type GTO Thyristors

Generally, a 4.5kV rated gate turn-off (GTO) thyristor used in voltage-source type inverter equipment has less than half of its rated voltage applied to it as a DC off-state voltage. For high blocking voltage inverter equipment such as electric train motor drive units, Toshiba has developed four 4.5kV type GTO thyristors. These new GTO thyristors use high-base-resistance silicon wafers and offer improved cosmic ray protection.

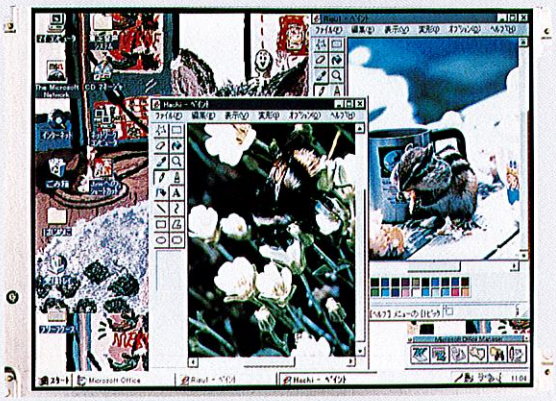
Using a flat pressed alloy-free construction, the GTO thyristors are small but powerful. The SG3000GXH29 is 75mm in diameter and its peak turn-off current is 3,000A. The respective diameters and peak turn-off currents of other thyristors are as follows: 75mm and 4,000A for the SG4000GXH29G; 85mm and 4,000A for the SG4000GXH28; and 85mm and 3,000A for the SGR3000GXH28. Using these high blocking voltage type GTO thyristors, an inverter system with characteristics of 2.6-3kV and 2-3MW can be constructed using only six units.

High DC blocking voltage type GTO thyristors

12.1 Inch SVGA Color TFT-LCD Module

New notebook-sized personal computers must meet three requirements: a thinner, more lightweight body; lower power consumption; and a larger screen with higher resolution. Toshiba's new 12.1 inch (31cm) LTM12C268 color TFT-LCD module was developed to satisfy these three demands.

The module is designed to fit an A4-sized notebook PC. Thanks to a new design that arranges the cold cathode fluorescent lamp (CCFL) along the right side of the module, instead of along the top or bottom, module exterior height was reduced to 195mm and display height to 184.5mm. New technologies employed in the LTM12C268 include the highly efficient CCFL, with a diameter of 2.2mm; a new LCD panel with an improved transmission rate; and a full 3.3V digital logic circuit. As a result, power consumption at a display brightness of 70cd/m² is 2.5W, 20 percent less than the previous model. Use of a base glass of only 0.7mm thickness and a thin backlight unit contributes to an overall thinner, lighter module at 7.5mm maximum thickness and 480 grams. A fully compatible XGA, with 1,024x768 pixels, is currently under development.



LTM12C268 12.1 inch SVGA TFT-LCD module for notebook PCs

5 Inch TFT-LCD Module for Automobiles

Portable navigation devices that have recently appeared on the market require thinner and lighter LCD modules. Toshiba's TFD50W30 backlight LCD module meets these requirements.

In a single unit, the module has an edgelight-type thin backlight unit, a frame for the LCD that is thinner than previous models and TAB-IC attached to the reverse side of the backlight. As a result, the overall size is only 127.8mm (horizontal) x 90.0mm (vertical) x 13.0mm (thick) with a narrow frame construction, and is adaptable to 1DIN or 2DIN size for automobiles. Increasing the number of sub-pixels from 170 thousand to 220 thousand in a stripe arrangement and raising the transparency rate to a higher level than current models provides brighter, higher-definition images that meet all specifications for navigation.

In addition, PAL-mode scanning functions and left-right and up-down inversion capability give this LCD module a broad range of applications in overseas and consumer markets as well as for use in automobiles.

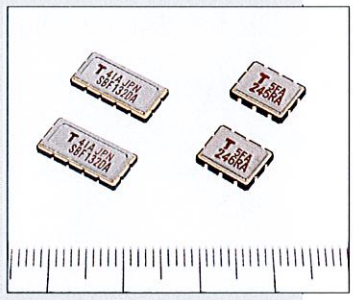
TFD50W30 full-color TFT-LCD module

SAW Filters for GSM IF Circuits

The popularity of the Global System for Mobile Communication (GSM) as a standard for mobile communications in Europe and Asia is expected to continue growing. To meet anticipated demand in these markets, Toshiba has developed two types of SAW filters for GSM intermediate frequency (IF) circuits.

The SBF132DAC2 is a transversal filter with a center frequency of 133.0MHz. Surface mount package size is 6.5x13.3mm, insertion loss is 6.8dB, and group delay ripple is 0.1μs.

The SRF246RAC3 is a resonator filter with a center frequency of 246.0MHz. Surface mount package size is 7.1x9.1mm and insertion loss is 6.0dB. Input and output interface is of a balance type, in line with current trends in the development of detective semiconductors. Toshiba plans to develop an additional product for the 100MHz to 400MHz band.



SAW filters for GSM mobile phone IF circuits

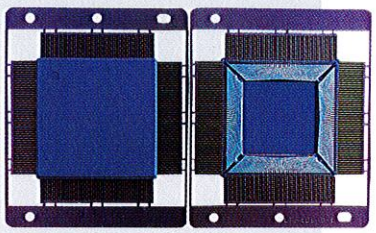
		SBF132DAC2	SRF246RAC3
Center frequency fo (MHz)		133.0	246.0
Insertion loss (dB)		6.8	6.0
Amplitude ripple (dB)		0.5	0.9
Group delay ripple (μs)		0.1	0.9
Relative rejection level (dB)	fo-0.8MHz	25	33
	fo-0.4MHz	6	30
	fo+0.4MHz	5	30
	fo+0.8MHz	27	33
Package (mm)		6.5x13.3x1.6	7.1x9.1x2.0

Specifications of SAW filters for GSM mobile phone IF circuits

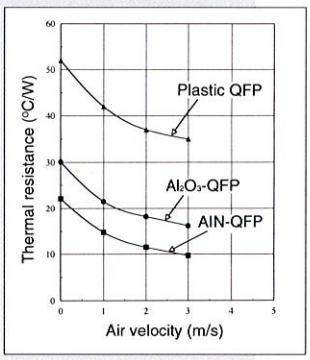
Aluminum Nitride Quad Flat Package

Toshiba has developed a quad flat package (QFP) consisting of an aluminum nitride (AlN) substrate on which a semiconductor element is mounted. The high thermal conductivity (170W/m·K) of the AlN provides low thermal resistance. Consequently, its thermal expansion matches that of the silicon semiconductor element, making it a highly reliable package. The package is suitable for 2W chips without a heat sink.

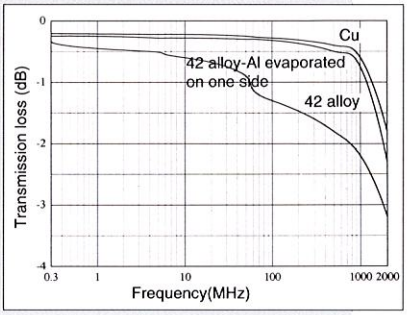
Processes for mass production of the AlN substrate include sintering aids composition, press-molding, sintering, and surface treatment. Dimensional accuracy and airtight sealing reliability of the AlN-QFP is equal to that of a conventional alumina QFP. The lead frame has a coating of aluminum on only one of the opposite surfaces of a lead frame matrix made of 42wt%Ni-Fe. The coating is sufficient to curb the resistance and the dependency of inductance on clock frequency.



208-lead AlN quad flat package



Thermal resistance of 208-lead AlN-QFP

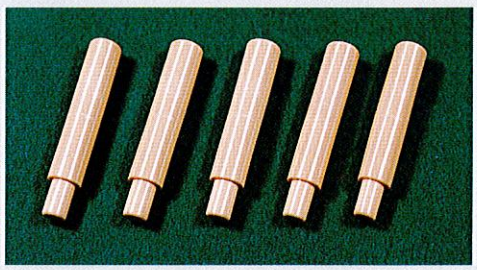


Transmission properties of 208-lead AlN-QFP

Fine Ceramic Parts for Fuel Injector of Heavy-Duty Diesel Engine

Toshiba has begun production of a ceramic plunger for heavy-duty diesel engine fuel injectors for Cummins Engine Company, Inc. of the United States. Cummins, headquartered in Columbus, Indiana, is a worldwide leader in the design and manufacture of diesel and natural gas engines.

Zirconia (ZrO_2) ceramic is being used for the parts because the material has a high level of hardness and comparatively high thermal expansion, a necessary property to prevent excessive leakage of fuel oil. The ceramic plunger exhibits superior scuffing resistance compared with the previous steel plunger and has significantly improved the reliability and durability of the injector. The ceramic plunger has been in production since April 1995.



Zirconia engine parts