



As information becomes increasingly digitized and portable equipment grows more widely used, new types of digital information consumer products utilizing networks are being created. For devices used in the assembly of such equipment there is a need for more compact sizes, higher density and lower electrical consumption. In response to these requirements, Toshiba has expanded its TX system RISC series of semiconductor products. Also available are highly integrated NAND flash memory, LSIs for credit-card sized radios, and IPMs. In the display and communications fields, Toshiba has developed such new products as a next-generation LCD, the p-Si TFT-LCD, as well as a super-flat CRT series, and multi-element SAW filters.

Super High Resolution 4-inch Diagonal VGA p-Si TFT-LCD

Toshiba has developed the world's first 202ppi (pixel per inch) 4-inch diagonal VGA-resolution (640 x 480 pixels) TFT-LCD module. Pixel density of 202ppi means about 4 times that of 100ppi (4-inch 320 x 240 pixels) display units, and such high resolution can make clear differences in character styles. 202ppi and 256k-colors offers excellent image quality rivaling that of printed materials, when it is taken by digital still camera, etc.

By using low temperature polycrystalline silicon thin film transistors (p-Si TFTs), the aperture ratio increases about 30% over that of conventional amorphous silicon TFTs. The number of connections between driver and electrode on the panel is cut by 95%. Increasing the aperture ratio lowered power consumption, and reduced of the number of connections for small size, low weight, and a highly durable LCD module.



Appearance of 4-inch diagonal VGA TFT-LCD



Super high resolution

(a) 202ppi



Super high resolution

(b) 100ppi

Comparison of 202ppi image and 100ppi image

Basic specifications of LTM04C380S

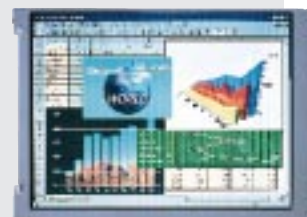
Model name	LTM04C380S
Display size	4-inch diagonal
Number of pixels	640(H) x 480(V)
Pixel pitch (mm)	0.126(H) x 0.126(V)
Number of colors	256k-colors
Contrast ratio	250 : 1
Transmission (%)	5.2
Power consumption (W)	0.35
Weight (g)	30
Dimensional outline (mm)	94(W) x 70(H) x 1.8(D)

p-Si TFT-LCD Modules for Notebook PC

Toshiba has developed 8.4-inch (21cm) diagonal SVGA-resolution (80 x 600 pixels) and 10.4-inch (26cm) diagonal XGA-resolution (1,024 x 768 pixels) p-Si TFT-LCD modules for small and lightweight mobile PCs.

Higher aperture ratio of about 110% over previous models can be obtained with low-temperature p-Si TFTs for switching devices. This technology provides high aperture ratio with high resolution, and low power consumption with high luminance. Because low-temperature p-Si TFTs can be integrated on the glass substrate as peripheral driver circuits without TAB-IC, the number of connection pins is reduced about 6% from previous models, and only 1 driver circuit PCB (Printed Circuit Board) is enough, though 2 driver circuit PCBs were used conventionally.

With other new technologies of backlight and driver circuit PCBs, Toshiba has produced the thinnest lightest weight TFT-LCD module in the world.



LTM08C343S 8.4-inch diagonal p-Si TFT-LCD module



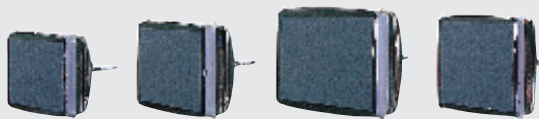
LTM10C306L 10.4-inch diagonal p-Si TFT-LCD module

Specifications of LTM08C343S / LTM10C306L TFT-LCD modules

Item	LTM08C343S	LTM10C306L
Display size (inch)	8.4 (21cm)	10.4 (26cm)
Number of pixels	800 (W) x 600 (H)	1,024 (W) x 768 (H)
Pixel pitch (mm)	0.213 (W) x 0.213 (H)	0.2055 (W) x 0.2055 (H)
Number of colors	256k	256k
Contrast ratio (CR)	250 (typ.)	250 (typ.)
Max. luminance (cd/m ²)	130 (typ.)	200 (typ.)
Power consumption (W)	2.0 (typ.) @ 70cd/m ²	2.8 (typ.) @ 70cd/m ²
Weight (g)	190 (approx.)	265 (approx.)
Dimensional outline (mm)	201.2(W) x 140.2 (H) x 5.4 (D) (typ.)	241.5(W) x 171.9 (H) x 5.1 (D) (typ.)

Super Flat Color Picture Tube Series

Toshiba has developed the first super flat color picture tubes (CPT) having flat outside surfaces as shadow mask systems. The curvature design of the inner glass panel, especially in the vertical direction, has made it possible to use a press-formed shadow mask. By using a proprietary Microfilter™ and high transmission glass, uniformity of brightness across the whole screen has secured the same performance as conventional tubes. The horizontal pitch variation between center and periphery has been reduced by 10% and electron guns having an extended field type lens system has been used in these CPTs so that the resolution uniformity is improved. Furthermore, a newly developed RAC (RectAngular Cone) system that allows reduction of deflection power by 25% compared with conventional tubes has been adopted in the W86 tube. At present, Toshiba is mass-producing W86, W76, W66, A80 and A68 tubes, and will add more models to the line up of this series.



Super flat CPTs



Rectangular cone of 86 cm wide super flat color picture tube

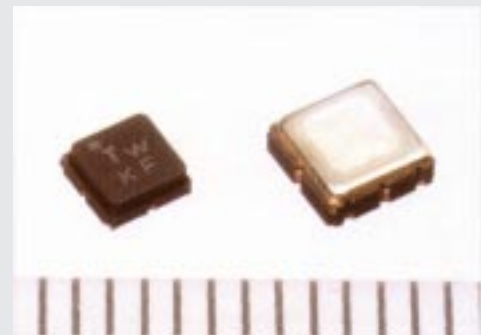
Ultra-Small SAW Dual Filter

A new ultra-small surface acoustic wave (SAW) dual filter has been developed. The filter is designed to be used in PDC (Personal Digital Cellular; one of the Japanese mobile communication systems), and has 2 filters in 1 package.

Face down bonding technology is adopted to reduce the dimension. Two SAW filters are fabricated on a 64Y-X LiNbO₃ substrate. Gold bumps are formed on the substrate, and then the substrate is bonded to a ceramic base face to face. Finally they are assembled with a ceramic cap.

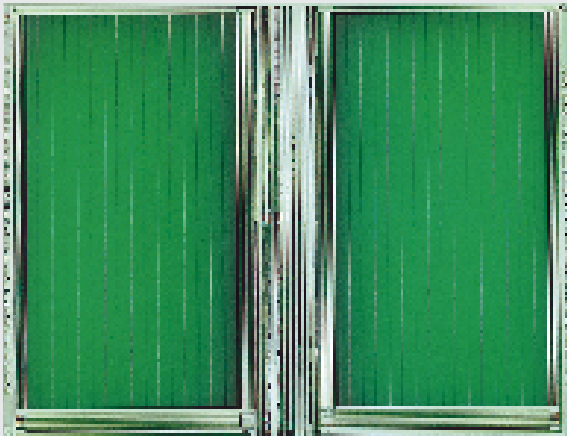
The two SAW filters have a multi-mode SAW resonator structure to achieve the steep frequency characteristics. Over 50dB of good attenuation is obtained at the image frequency band. The filters correspond to 2 up-link bands of PDC system: 893 MHz to 898 MHz and 925 MHz to 960 MHz mutually.

The filter's dimensions are 3.0 mm(W) x 3.0 mm(D) x 1.0 mm(H), and it weighs 0.03g. Compared with Toshiba's conventional SAW dual filters, it has 62 % of the surface mount area, 50% of the volume, and 45% of the weight.



Ultrasmall surface acoustic wave dual filter (left) compared with conventional type (right)

256 Mbit NAND-EEPROM



256 Mbit NAND EEPROM

Toshiba has developed an industry-leading 256 Mbit NAND type EEPROM (Electrically Erasable Programmable Read-Only Memory).

Using 0.25 μ m design rule fire process and shallow trench isolation (STI) technology, enables shrinking the EEPROM chip to an industry-leading 130 mm². NAND EEPROMs are suitable for applications in digital cameras and memory cards, and are promising for silicon audio usage in CD-quality music for 256 Mbit node and beyond.

The 256 Mbit NAND EEPROM can store as many as 200 VGA-quality images and up to 30 minutes of CD-quality music.

The 256 Mbit NAND EEPROM accepts 3.3V single power supply, meeting the low requirements of portable equipment, and faster writing performance of 2.3 Mbyte/sec and reading of 15.7 Mbyte/sec.



2Mbyte SmartMedia™ (left) and TSOP (right)

64bit RISC Microprocessor TMPR4951F



TMPR4951F 64bit RISC microprocessor

Toshiba's semiconductor division has released a new 64 bit RISC (Reduced Instruction Set Computer) microprocessor called TMPR4951F.

This RISC microprocessor belongs to the TX System RISC Series and is based on MIPS architecture.

TMPR4951F is a high-end microprocessor in the TX System RISC series.

Key features :

- Operating frequency: 133 MHz
- Instruction cache: 16kbyte, Data cache: 16kbyte
- Power consumption: 1.2W (at 133 MHz)
- 32 bit SysAD Bus
- 48 double entry TLB (Translation Lookaside Buffer)
- Pre fetch instruction and debug support instruction is added into MIPS-III ISA (Instruction Set Architecture)
- Operating voltage: 3.3V, Package: 120pin QFP (Quad Flat Package)

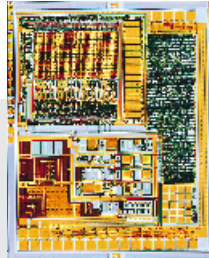
Main applications are Laser Beam Printers, Set Top Boxes, Networking and embedded systems requiring high performance.

LSI for Contactless Cards and Tags

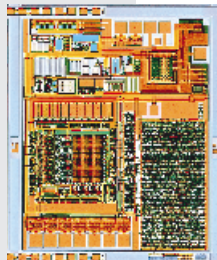
Toshiba has developed its JT6N46S and JT6N38S LSIs for contactless cards and tags that enable non-contact writing and reading of information to be used for person and object identification systems that are becoming increasingly popular in the distribution, transportation and security fields.

Contactless card and tag systems are characterized by reduced maintenance and increased durability in external environments by comparison with contact types of storage media. Systems have recently come to be required that offer more efficient identification due to the increased number of applications and the growing diversity of information.

It is easy to make contactless cards and tags using only these LSIs and resonance circuits that are composed of an antenna and capacitor. Since the operating power is generated from radio waves transmitted from the reader/writer, a power supply is not required on the card or tag. In addition, the new products are equipped with a built-in security function that judges whether or not to write or read data by comparing keys stored in its memory. Moreover, they are also equipped with a high-speed multi-lead function that allows simultaneous reading of multiple cards or tags, enabling enhanced identification efficiency.



JT6N38S LSI chip



JT6N46S LSI chip

Specifications of RF-ID LSI

Item	JT6N38S	JT6N46S
Reception frequency (Hz)	100k-500k	100k-200k
Return frequency	1/2 of reception frequency	
Modulation method	180° PSK	
Data transmission rate	1/16 of reception frequency	
Rectification method	Full-wave rectification	
Transmission method	Direct transmission	Load modulation
EEPROM capacity	4 kbit	1 kbit
Write unit	16 byte	8 byte
Write time	Max.6 ms	
Read time	16 byte	
Security key	6	2
Multi-read	10 cards or tags/s@125kHz	
Supply form	Chip, Wafer	
Chip size (mm x mm)	3.09 x 2.57	2.35 x 1.92

Compact IPM

Toshiba has developed a compact intelligent power module (IPM) which realizes lower power dissipation (30% reduction in on-state voltage of our conventional IPM) and also much smaller package (one-half the size of Toshiba's conventional type).

Compact IPM is ideal for energy saving as well as the compact size required in various applications such as general purpose inverters, motor control for machine tools, un-interruptible power supplies and so on.

A trench gate structure is used in the 600V type. Toshiba has utilized the most advanced fine patterning technology to realize sub-micron trench width.

As for the 1,200V type, a thin Non-Punch-Through structure with low injection emitter is adopted. By optimizing cell design of insulated gate bipolar transistor (IGBT), a good trade-off between switching performance and ruggedness such as high latch-up current capability is realized.



Top view of trench gate IGBT chip

In order to achieve the small package size, the layout of internal terminal connections is optimized and the size of the insulation ceramic substrate is minimized. In addition to the improvement in IGBT mentioned above, a soft reverse recovery diode in anti-paralleled free-wheeling-diode is installed, which greatly improves the important electro-magnetic interference (EMI) noise level.

This new compact IPM is expected to contribute to progress in the equipment market.



Example of compact IPM