Advanced LCD Technology

http://sharp-world.com/products/device/
In pursuit of the greater possibilities of LCD technology

In order to meet the more diversified demands for displays, Sharp is not stopping at improving visual quality, but is challenging the boundaries of integrating displays into advanced systems and giving them more advanced functions. We shall continue to pursue the possibilities of LCD technology by combining the technology that we have accumulated over the years.

Liquid Crystal Triangle — The Pride of Sharp Technology

The plants at Kameyama, Nara, Tenri, Sakai and Mie are all situated in neighboring regions, facilitating the active exchange of information among engineers.

Development of a "Manufacturing Complex for the 21st Century" in Sakai

In continuing its efforts to become an "environmentally advanced company," Sharp has been developing its business on the two pillars of energy-saving "LCDs" and energy-creating "solar cells." In order to further these efforts, Sharp is building a new factory complex in Sakai, Osaka prefecture. We hope to further propel our business forward by having companies in related fields with advanced technology join us to create a "Manufacturing Complex for the 21st Century."
Nearly LCD TV display quality – an advanced form of Super Mobile LCD

Clear, wide viewing angles from any direction
The New Mobile Advanced Super V LCD provides a wide viewing angle of 176° from all directions, making it ideally suited to the many different scenarios in which mobile equipment is used.

High contrast for brilliantly vivid color reproduction
The 2 000:1 contrast ratio provides startlingly vivid video images when compared with conventional mobile equipment.

Crystal-clear images with almost no afterimages, even with fast movement
With lightning-fast display response times of only 8 ms (black ↔ white), the New Mobile Advanced Super V LCD gives clear, sharp images with almost no afterimages, even in videos of fast-moving subjects.

Applications
Allows unprecedented freedom in the way we use mobile equipment.

Just when it becomes really feasible to watch movies on your mobile equipment, here is the New Mobile Advanced Super V LCD. Precision alignment of the liquid crystal molecules gives a wide viewing angle of 176° from all directions. This, coupled with a superb contrast ratio of 2 000:1 and super-fast responsiveness (black ↔ white in 8 ms), gives unsurpassed video display quality.
Built-in touch screen functions – LCDs evolving into input/output devices

Touch screen functionality is built into LCDs while maintaining their original high definition images. These LCDs are capable of processing complicated operations, such as simultaneous input from multiple points, and there are high expectations for these LCDs as thin input/output devices.

Evolving from display (output) devices into input/output devices

Each LCD panel pixel has an optical sensor using a photodiode. The various signals that are output according to the intensity of the input light can be read from outside the display.

Operation and simultaneous input using two or more fingers are possible. Such complicated operations allow a wider range of uses.

Simultaneous recognition of multiple points

Examples of operation using multiple fingers:
- Maps can be handled (zoom in/out, rotated) with two fingers.
- Three or more points can be pressed at the same time.

Various input devices are recognized

Any type of input device can be used for operation; e.g., fingers, fingernails, gloved fingers, pens, etc.

Applications

Highly precise touch screens that can be used for more intuitive interfaces.
A truly advanced LCD with a wide viewing angle, fast response times and excellent contrast.

**Applications**

Provides superb video quality in all screen formats, from small through to medium and large.

- Large-screen TVs
  - Delivers high-contrast pictures even in a bright living room.

- Public information displays
  - Distributes important and appealing information and images with greater visibility in open spaces.

- Electronic posters/advertisements
  - A new advertisement medium that "shows information" with greater appeal and effectiveness.

- Information walls
  - Various types of information can be displayed in real time and batch controlled.

**Wide viewing angle for bright, clear images from any direction**

The Advanced Super V LCD delivers a wide viewing angle of 176° from the top, bottom, left, and right, which makes it ideal for all sorts of applications and usage configurations. There is very little color shift with viewing angle changes and no gray scale inversion, so the picture looks bright and sharp from any direction.

**Clear picture with reduced afterimages during rapid-motion video**

Responsiveness has been boosted by increasing the response rate of the liquid crystal molecules and the use of high-speed drive technology. The result is a clear picture with markedly reduced afterimages when reproducing rapid-motion image.

- Conventional LCD (LCD TV)
- Newly developed LCD (LCD TV)

**Liquid Crystal Display**

The Advanced Super V LCD is a high-end LCD panel employing advanced technology developed exclusively by Sharp. For LCD TV screens, the liquid crystal molecules in the LCD are specially aligned to give a wide viewing angle of 176° from all directions. This has been combined with low-reflectance black TFT liquid crystal and the "normally black" system to achieve deep, rich blacks and a TV screen with a superb contrast ratio of 2,000:1 or better.
Stunningly realistic 3D display without the need for special goggles.

3D graphics with no special goggles

In the past it has been necessary to wear special goggles in order to view 3D graphics. The 3D LCD, however, uses a parallax barrier system implemented using a specially developed switching liquid crystal to deliver three-dimensional images that can be viewed without special goggles.

Simple panel structure for easy control

The ease of controlling the display makes it possible to use 3D LCDs for a wide range of applications. Its simple structure helps lower costs and provides excellent reliability.

Operating principle of 3D LCDs

The distance between human eyes is about 65 mm, and the images seen by the right and left eyes are always slightly different (binocular parallax). The human brain processes the slightly different images from the two eyes to create a sense of depth.

- The directions in which light leaves the display are controlled so that the left and right eyes see different images. This makes it possible for the image on the screen to appear in three dimensions without the user having to wear special goggles.
- The basic principle of the parallax barrier system used has been understood for some time. It is achieved using a structure incorporating a conventional TFT-LCD and a specially developed “switching liquid crystal.”
- The switching liquid crystal is used to implement the parallax barrier and control the directions in which light leaves the display. This ensures that different patterns of light reach the left and right eyes of the viewer.
- The images for both the left and right eyes are displayed together on the TFT-LCD, resulting in a 3D display in which the appropriate images reach each of the viewer’s eyes.
- The parallax barrier is controlled electrically using the switching liquid crystal. When light is allowed to pass through freely, the separation between the left and right eye images disappears, allowing 3D content to be perceived identically by the left and right eyes. In this mode the display panel functions in the same manner as a conventional LCD.

Switchable between 2D and 3D display modes

The switching liquid crystal enables the parallax barrier to be controlled electrically. Switching between the flat (2D) and three-dimensional (3D) display modes can be accomplished at the touch of a button. This means the most appropriate display mode can be selected to match the application.

Applications

Realistic 3D images give content greater impact and range.

- Mobile phones
- Handheld game consoles
- Notebooks
- TVs
- Arcade games
- Museums
- Illustrated scientific or historical materials
- Public displays
- Amusement equipment

"3D LCD" technology lets you toggle between a flat (2D) image and a 3D image at the touch of a button. On a PC with this technology, you could view text documents and spreadsheets in 2D and then switch to 3D mode for incredibly realistic computer graphics and games. The 3D LCD technology opens up new horizons in equipment use and enjoyment.
Sharp Dual Directional Viewing®

Displaying two different sets of information on one screen simultaneously.

Beautiful simultaneous display allows one panel to show two different screens

The Sharp Dual Directional Viewing® LCD panel displays different information depending on whether it is viewed from the left or from the right. The panel simultaneously displays two crystal-clear, high-quality images with no intermingling. Moreover, by displaying the same image on both sides, it can also function as a normal display, allowing everyone to view the same image.

A sees only image a.
B sees only image b.
In single-screen mode

Both A and B see image a.
In dual-screen mode

How the Sharp Dual Directional Viewing® LCD works

This technology evolved from Sharp’s 3D LCD panels and is the result of advances in optical design technology and process technology (see p. 10)

A parallax barrier is used to divide light from the backlight into left and right components. Advanced optical design technology and process technology prevent intermingling of the left and right light components.

A sees only image a.
B sees only image b.
C sees only image c.
In triple-screen mode

Everyone sees image a.
In single-screen mode

The Sharp Triple Directional Viewing LCD (under development)

The Sharp Triple Directional Viewing LCD takes this controlled viewing-angle technology a step further. Using a proprietary parallax barrier on a standard TFT LCD, the screen splits light in three directions—left, right, and center—and displays three separate images on the same screen at the same time.

Sharp is meeting consumer needs by expanding its lineup and developing new and convenient uses for controlled viewing-angle LCDs.

Displaying two different sets of information on one screen simultaneously.

A parallax barrier is used to divide light from the backlight into left and right components.

Applications

Concurrent display of information tailored to viewers on each side, in the same place, at the same time.

- Business presentations: Check out the sales manual while you show customers the product specifications.
- Vehicles: Creates the perfect driving environment by displaying car navigation screens to the driver and a DVD movie to the passenger.
- Stores: Display information on new arrivals or sales campaigns that target different parts of the store.
- Shopping malls: Display advertisements, store information, area maps or other content that is tailored to where viewers are heading.

- Mobile phones
- Games
- In-Vehicle equipment
- Public displays

*Dual Directional Viewing® is a registered trademark of Sharp Corporation.

The Sharp Dual Directional Viewing® LCD splits light left and right, enabling it to show two different sets of content on the same screen. This ability to display content such as TV broadcasts and Internet sites concurrently opens the way to myriad new uses, making Dual Directional Viewing® LCDs the ideal technology to cope with today’s rapidly growing demand for greater access to information and other content.

Liquid Crystal Display

Mobile phones

Games

In-Vehicle equipment

Public displays
Increasingly these days, people are using mobile equipment such as mobile phones, notebook PCs and PDAs to handle confidential information. Sharp’s "switchable viewing-angle® LCD" technology lets you switch your screen’s display mode from the normal wide viewing angle to a narrow angle, guarding against unwanted peeking by people nearby and helping prevent the leakage of confidential information.

**A "peek-proof" narrow-angle display to keep your information safe and secure.**

A peek-proof LCD screen displaying images that are virtually unviewable from the side

Normally, the switchable viewing-angle® LCD screen has the same wide viewing angle as ordinary LCD panels. But a flick of a switch converts it to a narrow viewing angle that prevents unwanted viewing from either side.

**How the switchable viewing-angle® LCD works**

Sharp’s switching liquid crystal is used to control light from the backlight.

Voltage applied to the switching liquid crystal changes its directional characteristics, greatly reducing the passage of light to left and right. The result is an image on the screen that is no longer readily visible from either side.

**Applications**

Enhances privacy protection, providing peace of mind as you use the device.

- **Mobile phones**
- **PDAs**
- **ATMs**
- **Notebook PCs**

Increasingly these days, people are using mobile equipment such as mobile phones, notebook PCs and PDAs to handle confidential information. Sharp’s "switchable viewing-angle® LCD" technology lets you switch your screen’s display mode from the normal wide viewing angle to a narrow angle, guarding against unwanted peeking by people nearby and helping prevent the leakage of confidential information.

*Switchable viewing-angle® is a registered trademark of Sharp Corporation.*
This LCD utilizes memory display elements that require no power except when changing the display content. It is ideal for price tags in supermarkets, where the information displayed does not change for a period of time. Linking the memory LCDs to a POS system through a wireless connection then makes it possible to quickly and easily update displayed prices. As well as reducing labor, time and costs, this system significantly reduces paper waste. Because the LCD panels store the displayed information internally, they use no power until the information is changed.

No power required, except when changing the display content, for low power consumption

The use of memory display elements eliminates the need for power except when changing the display content, thus achieving an environmentally friendly liquid crystal display.

Area colors

Color tones can be changed by using different colors for sections of the color film on the back of the LCD. This technique enables the creation of “area colors” in the LCD panel.

Clear display with no secondary images (shadows)

This LCD requires no reflective plate and therefore characters and other images do not cast a shadow, resulting in a clearer display.

Many color variations

Various colors can be achieved through combination with a background color. You can also switch the display color of characters and images, as well as the background color.

Easy-to-read wide viewing angle

The wide 135° viewing angle expands the range of possible applications.

Color variations (background)

- Red/yellow
- Black/green
- Blue/white

Applications

New possibilities for LCDs: Replacing paper

Electronic shelf price tags

In addition to eliminating the need for replacing price tags, the volume of paper trash can be greatly reduced.

Floor directories

Greater visibility. An energy-saving design that only consumes power when the display is being rewritten.
Resistant to shocks, vibrations and high temperatures. Ideal for on-site applications in the manufacturing and distribution industries.

**Resistance to vibration**

**Resistance to pressure**

Extreme **temperature ranges**

**Resistance to impact**

Sharp’s Strong LCDs were developed around a range of new technologies, including innovative mounting and drive technologies, liquid crystals capable of withstanding a wide range of temperatures, and backlights with an extended service life. Strong LCDs have excellent resistance to physical impacts, vibrations and variations in temperature, making them tough and highly reliable tools in the punishing environments routinely found in the manufacturing and distribution industries.

### Simplified design for better reliability

The total number of component parts has been reduced considerably through consolidation and integration, allowing for the use of smaller circuit boards. This provides excellent performance, together with improved reliability.

### Innovations in liquid crystal for better resistance to temperature extremes

The use of a specially developed new liquid crystal and optimization of the drive voltage results in the capability to function at a wide range of temperatures. This means that the Strong LCD can stand up even to punishing outdoor use.

### Excellent reliability in spite of shocks and vibrations

Sharp has developed a module offering substantially better resistance to shocks and vibrations than conventional LCDs by reconfiguring the mechanical design and the usage of component parts. The ability to withstand surface pressure has also been improved, in order to allow the displays to be used as touch panels.

### Module designed for stable results over long-term operation

The module provides stable brightness over a long period of time, thanks to the development of new technology for the backlight system. This enables it to operate satisfactorily for many years.

### Key technology used in Strong LCDs

- **High-reliability device mounting technology**
  - The module was developed with high reliability in mind and the number of component parts has been kept to a minimum.
- **Temperature-resistant liquid crystal**
  - Response is superior to conventional LCDs over a wide range of temperatures, allowing for outdoor use under punishing conditions.
- **Temperature-resistant liquid crystal**
  - Response is superior to conventional LCDs over a wide range of temperatures, allowing for outdoor use under punishing conditions.
- **Backlight designed for long life and high reliability**
  - The backlight was specially developed to provide stable illumination over the long term.

### Applications

- **Designed to be tough for stable operation even in harsh environments.**
  - **Industrial machines**
  - **Monitors and control systems**
  - **Outdoor electronic displays**
  - **Panel computers**
  - **Pressure testing equipment**
  - **ATM**
  - **Gas station POS terminals**

<table>
<thead>
<tr>
<th>Strong LCD1</th>
<th>Strong LCD2</th>
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<tbody>
<tr>
<td>Vibration resistance</td>
<td>57 to 500 Hz Acceleration 1 G</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>50 G, 11 ms</td>
</tr>
<tr>
<td>Vibration resistance</td>
<td>57 to 500 Hz Acceleration 1.5 to 2 G</td>
</tr>
<tr>
<td>Shock resistance</td>
<td>60 to 70 G, 11 ms</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Conventional LCD</th>
<th>Strong LCD1</th>
<th>Strong LCD2</th>
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</thead>
<tbody>
<tr>
<td>Operating temperature range</td>
<td>0 to +50 °C</td>
<td>-10 to +45 °C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>-25 to +60 °C</td>
<td>-30 to +70 °C</td>
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Certifying organization: Japan Quality Assurance Organization (JQA) [JAB certified]

The following division of Sharp Corporation has been certified under the ISO 9001:2000 international standard for quality management systems.

Certifying organization: Japan Quality Assurance Organization (JQA) [JAB certified]

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Specifications are subject to change without notice.

All screen images are simulated.