Automotive

How To SELECT The RIGHT LCD For Your Automotive Application

LCD technology and its adoption in vehicular systems has happened quite quickly and smart displays have pretty much replaced mechanical dashboards in cars. In an interview with our team, Rei Tjoeng from Sharp Devices talks about automotive-grade LCDs, recent trends, and specific characteristics that make them different from the general-type LCD available in the market

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How is the modernisation of two- and four-wheelers affecting the demand for LCD displays?

Adoption of TFT in 2-wheeler cluster applications has increased in a big way. The global automotive industry is widely believed to be on the cusp of tremendous change in terms of manufacturing, sales, and the overall business model, owing to the rapid advances in new-age technologies, such as autonomous driving, augmented reality, and big data.

Visualisation technologies are the most vital components of in-vehicle interactions, with overall automotive navigation and connectivity characterising the cars of this generation.

Advanced driver-assistance systems (ADAS), such as parking assistance, forward collision, lane-departure warnings, and blind-spot monitoring, are frequently hailed as the technologies that will usher us into an age of autonomous transportation. But drivers are still either untrusting or too trusting of these features. This has led to an evolution of sorts in the in-car user experience interfaces, and more so with the way automotive display makers are developing new products.

The future for ergonomic conformal displays, display based dashboards, central consoles, in-door wing mirrors, and transparent displays that offer unobtrusive visual information during journeys is bright. Head-up displays are fast gaining popularity as an ideal interface for disseminating crucial information, such as navigation messages, vehicle speed, and warnings.

Selection Parameters For Automotive LCD Screens

Wanting to select the right LCD screen for an automotive design? Here's a list of parameters you need to consider:

Free Form display prototype (Credit: Sharp Devices)

High brightness and anti-glare. Higher brightness and contrast make the display readable even during bright sunlight conditions. Manufacturers bring down surface reflectivity with anti-reflective coatings, making the display easier to read during high-sunlight glare conditions. Progressive Super View Technology of Sharp, for example, gives an extremely crisp image under sunlight, without pumping more power from the backlight, which helps in maintaining the life and quality of the product.

Screen size and resolution. Automotive displays range from 3.8cm to over 30.5cm. There's a trend toward bigger display sizes (up to 50.8cm), with the reception of solid-state and advanced digital clusters. Thus, HD resolution is moving from wide VGA (800 × 480) to 720p and 1080p.

Form factor of display. In the automotive sector, the most commonly used aspect ratios for display sizes between 17.8cm and 31.2cm are 16:9, 5:3, 16:9, and 16:6. From Hatchback, Sedan to SUV, the height varies a lot and, therefore, aspect ratio plays a vital role for display selection. Recent innovations like Free Form help automotive designers to break free from the rectangle to any size or any form factor of the display. The device may be shaped to fulfil a large range of user needs due to the incorporation of IGZO technology and proprietary circuit design methods.

What is IGZO technology? (For followup)

Conventional displays are rectangular because they require a minimal width for the bezel to accommodate the drive circuit, called the gate driver, around the perimeter of the screen's display area. With the morpheme display, the gate driver's function is dispersed throughout the pixels on the display area. This enables the bezel to be shrunk considerably, and it gives the liberty to style the LCD to match whatever shape the display area of the screen has to be.

Interface. Low-voltage differential signalling (LVDS)

Are there any broad categories of LCD displays that are witnessing great demand?

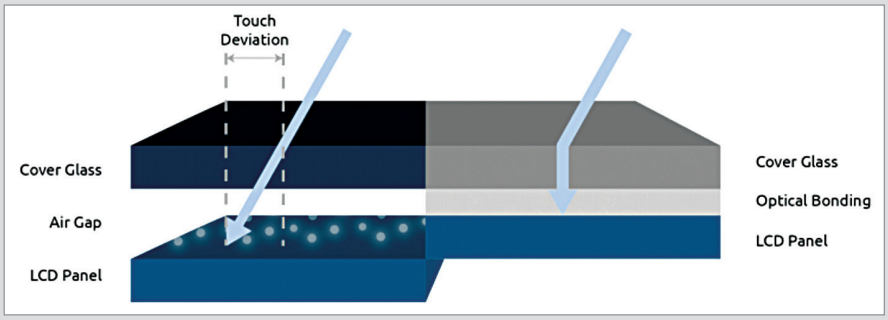
Yes, reflective LCDs, which use ambient light to reflect in order to read are one. In 2W cluster applications, where TFT is exposed to direct sunlight, readability is a major issue. Reflective LCD is a solution as visibility is crystal clear without any glare and LCD is available in colour too. Equipped with a backlight, it can be used at night also.

A normal TFT has to pump more power through the backlight, which results in more power consumption, and backlight life also gets affected to a large extent. This reflective LCD consumes very little power and could be the best fit-in product for the EV segment.

When we see a large tablet-like display in a car we fear the risk of its breaking. Is the fear true?

The market is now shifting to large-size TFT displays in the automotive segment. These displays are automotive-grade LCDs and are tested for shock, vibration, high and low temperature, etc. For more protection and safety, glass bonding is done over TFT. Glass bonding with a cover glass on the LCD protects it from shock, as the hardened adhesive behind the glass acts as a shock absorber. Shakes and shocks are less likely to damage the display and glass, making it an important

could be a popular choice for giant LCDs and peripherals in need of high bandwidth, like high-definition graphics and fast frame rates. It is most ordinarily utilised in automotive TFT applications. It is an excellent solution due to its high speed of data transmission while using low voltage.



Optical bonding with cover glass (Credit: Newline Interactive)

Two wires carry the signal, with one wire carrying the precise inverse of its companion. The electrical field generated by one wire is neatly concealed by the opposite, creating much less interference to nearby wireless systems. At the receiver end, a circuit reads the difference (hence named 'differential') in voltage between the wires. Therefore, this does not generate any noise or gets its signals scrambled by external noise. The interface consists of four, six, or eight pairs of wires, plus a pair carrying the clock and a few ground wires.

Wide viewing angles. Centre stack displays should be visible to both drivers and passengers, including those within the rear seat(s). LCD display modules are designed to provide the best contrast and readability in one of the four directions, known as the viewing angle or optimal viewing direction. These four directions are laid out in the shape of a clock. The top view is at 12:00pm and the bottom view is at 6:00pm.

Touch and glass bonding. Optical bonding involves overlaying touchscreens, glass or plastic cover lenses, adding EMI filters, and other display upgrades to an LCD. A layer of glue is incorporated between the cover layer and display to fill the air gap left in a regular edge or gasket bonding. Optical bonding helps in enhancing clarity, viewability, reducing reflections, and making the TFT more rugged, and these are critical factors in automotive applications.

Wide temperature range. Temperature range can typically span from -40°C to +85°C. Such a wide temperature range is required because in summer ambient temperature adds up with the operational temperature of TFT; in desert areas ambient temperature rises to 55°C in summers. And the display also has to work in icy cold conditions.

Colour depth. Higher-resolution displays might have to upgrade from 18-bit RGB (red, green, and blue) to 24-bit RGB for a wider colour gamut.

Refresh rate and response time. Keeping away from slacks is basic for warning indicators and navigation functions like maps and traffic updates.

Power consumption. Low power consumption enables better fuel consumption and allows components to be placed in hot spots.

Lifetime and production support. Displays must support design and production cycles of a minimum of five years, extendable up to ten years, because of vehicle warranties.

feature for transportation applications. In the unlikely event that the glass is damaged, shards of broken glass will remain stuck to the optical adhesive.

Reflection or glaring sunlight in the wrong direction sometimes makes it difficult to read these displays. Any innovation introduced recently, or underway, that may solve this issue?

Reflective LCD and Progressive Super View are the two technologies (by leaders like Sharp) that are effective under high ambient light. In the progressive super view technology, internal and external reflection is cut down, which results in a clear view without glare. And the beauty of this technology is that it happens without pumping more power from the backlight. This helps in more lifetime of the backlight and less power consumption.

Reflective LCD is another technology that uses ambient light to reflect in order to read, hence there is more clarity under sunlight and very less power is needed. It is more beneficial for EV applications.

How do your LCDs combat the continuous temperature changes throughout the day, especially in automobiles?

Automotive-grade LCDs have strict requirements. The LCD must remain working during the extreme

A head-up display (HUD) is usually a transparent display (Credit: GoMechanic)

environment, for example, Indian summertime. Our LCDs are tested for storage temperature of -40 to +95°C and operating temperature of -30 to +85°C.

From a design engineer's perspective, what are the top three or five factors (besides the obvious ones like price, the size, the brand, after-support, etc) that one must bear in mind while selecting the right LCD panel?

There are a few LCD specs the design engineer needs to consider at high priority while selecting the LCD. The first is the screen size and aspect ratio. The aspect ratio is the ratio between the length and width of the LCD. Some common ratios are 4:3, 5:4, 16:9, and so on. Of course, sometimes marketing people also point out these specs as they affect the whole outlook and design of the product.

Then the engineer may need to consider the LCD's resolution and interface, whether they are matching with the motherboard. If the product is for semi-outdoor or outdoor use, the engineer needs to also check the LCD's brightness and operating temperature range, because these are very important specs if the product is located in the sunshine.

Design engineers can also refer to the box item titled 'Selection Parameters for LCD Screens for Automotive Applications' (covered later).

What are the common myths or little known facts related to designing of LCD screens for automotive solutions?

The smartphone has become very popular in recent years, and it is influencing the engineers' design. We saw some EV companies use the smartphone LCD as the cluster or GPS display for their first-generation products. The smartphone LCD is nice but, unfortunately, it is not designed for automotive applications, especially not for two-wheeler outdoor usage. When a two-wheeler is under sunshine, the driver can barely see anything on the smartphone screen. Also, the smartphone LCD's lifetime becomes much shorter under the automotive application scenario.

How do you support customers, design engineers, and R&D teams during their initial stages of identifying the right LCD for their design?

Sharp Singapore has been in this region for many years. We understand our customers. First, our team gets the customer's requirements from both the marketing and engineering sides. We check the customer's motherboard's graphics capability, display interface, and other necessary technical details. We then propose the best suitable LCDs to the customer and explain the reason. We also explain what we observe from the market trend and advise the best options to the customer.

LCD samples and demo kits are available for the engineers to see the actual performance. There is also technical support available to help the design engineers to evaluate the LCD and design in the LCD.

Do you provide samples during prototyping stage? Or do you have development or evaluation kits for your LCD displays?

Sharp Singapore understands that samples and evaluation kits are important in the project's early stage. Evaluation kits are available for the engineers to evaluate the LCD performance during the proof of concept stage. Then we will provide sample LCDs for the customer's prototype builds.

What is your support structure for design engineers in India?

We have salespersons stationed in New Delhi and Bangalore. They work closely with the customers' design engineers. There are technical support persons in Singapore and Japan. Our Indian team can support the customer onsite and bridge the technical person effectively between India and Singapore.

Do you supply the displays through distributors or through your India office?

We have many distributors in India who can support the customers' needs. Major OEMs are supported directly through our headquarter in Singapore. EFY