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LCD Monitor Technology

1. What is the important factors to consider when evaluating an LCD monitor?

- Resolution: The horizontal and vertical size expressed in pixels (e.g. 1024x768). Unlike CRT monitors, LCD monitors have a native-supported resolution for best display effect.
- Dot pitch: The distance between the centers of two adjacent pixels. The smaller the dot pitch size, the less granularity is present, resulting a sharper image. Dot pitch may be the same both vertically and horizontally, or different (less common).
- Viewable size: The size of an LCD panel measured on the diagonal (more specifically known as active display area).
- Response Time: The minimum time necessary to change a pixel's color or brightness.
- Matrix type: Active or Passive.
- Viewing angle: (coll., more specifically known as viewing direction).
- Color support: How many types of colors are supported (coll., more specifically known as color gamut).
- Brightness: The amount of light emitted from the display (coll., more specifically known as luminance).
- Contrast ratio: The ratio of the intensity of the brightest bright to the darkest dark.
- Aspect ratio: The ratio of the width to the height (e.g. 4 by 3, 16 by 9, 16 by 10, etc.).
- Input ports (e.g. DVI, VGA, LVDS, or even S-Video & HDMI).

2. How do I know what type of LCD to use for our product?

That will really depends on a number of factors including multiplex driving scheme, temperature, voltage/power, artwork design, contrast requirements and cost budget.
The main categories which we may supply by our own facility are: TN, HTN, STN, and also special product such as cholesteric bi-stable displays and single polarizer high contrast reflective TN/HTN display.

3. What is life time of LCD and backlight?

Very long, in most cases, providing the operating condition is stable, the LCD may operate for years. Just for reference, below is typical life time for displays:

	LCD	LED	EL	CCFL
Current consumptions	N/A	High (7.5mA per die)	Low (0.12 mA/cm2)	Low
Service Life	>80,000 hrs	Long >30,000 hrs	Short (typical 5,000 hrs)	Long (typical 30,000 hrs)
Driving Characteristics	AC	DC	AC	AC
Brightness	N/A	Low to medium	Low to Medium	High

4. What is thickness of LCD and glasses?

Thickness of LCD depends on stacking height. Typical standard structure of LCD consists of:

Layer	Description
1	Top Polarizer with thickness of approximately 0.08mm~0.15mm
2	Top Glass with thickness between 0.5mm and 1.1mm typical
3	Liquid crystal cell with thickness negligible (4 to 9 micron)
4	Bottom Glass with thickness between 0.5mm and 1.1 mm typical
5	Bottom polarizer with or without reflector

5. What is a TFT-LCD?

TFT-LCD (thin film transistor liquid crystal display) is a variant of liquid crystal display (LCD) which uses thin film transistor (TFT) technology to improve image quality. TFT LCD is one type of active matrix LCD, though it is usually synonymous with LCD. It is used in televisions, flat panel displays and projectors.6.What are the common types of LCDs used in the market?

6. What types of connectors are used in LCDs?

The connectors used for LCDs are elastomeric (rubber connector), pin and flexible cable.

7. How many types of viewing modes are used in LCD glass?

There are three types of basic modes:
"Reflective", "Trans-missive", and "Trans-flective". " Tran-missive" and "Trans-flective" are used with an LED, EL, or CCFL backlight.

8. Is temperature a matter of concern in LCDs?

Yes, since the LCDs are widely used, some of the applications will be in extreme weather conditions where a wide temperature range is required. Normally the wide temperature range for a TN type LCD is -30 ~ 75C (operation Temp.) and -30 ~ 70C (storage temp.)

9. Why does my LCD turns dark when left under the sun and is there any problems with the display?

For most cases, both TN, HTN and STN utilize the phase known as nematic for display purpose. Within this phase, the liquid crystal has a "rod shape" exists within the solution which has fast response and has excellent electro-optic properties. This phase, however, only exists within a limited temperature range. The higher end of this temperature range is known as clearing point, above which, the liquid crystal lost its birefrigerance properties and cannot bend the light path anymore. Thus the polarizer will then be the only factor which affect incoming and out coming light. When the LCD is cooled down to below its clearing point, the display

should be working again. The temperature for the clearing point varies greatly from material to material and you should contact our engineers regarding what you have. Normally a safe margin should be used to avoid clearing point when designing the display.

10. How does LCD gets driven?

LCD is driven by AC (alternating current), it is best to use standard LCD driver IC to generate as this will simplified your development time. Alternatively, for simple TN segment drive, most MCU may emulate the AC current but would need a lot of background know how. For example, simple TN segment drive would require as low as 40Hz to as high as 120 Hz. Depending on the operating environment such as temperature and would affect the contrast of the display. Some experiment may be need to find the optimum operating condition.

11. What test is done to LCD?

Standard tests and control includes

1. 100% Electrical test (that test for operating voltage, logic of display)
2. Dimensional and cosmetic inspection including viewing angle
3. Sample inspection using thermal, thermal cycle, and humidity

12. Does UV light affect LCDs?

The answer really depends on material selection and configuration. Because liquid crystal is primarily organic compounds, most liquid crystal material are susceptible to UV disintegration. There are some liquid crystal which are specially design for outdoor application that is more UV resistance. When use with UV blocking polarizer, the LCD can be resistance to ultra violet damage.

13. What other factors may affect life of LCD?

Two factors:

1. Moisture - extreme moisture exposure will cause sodium migration in the glass which will contaminate the liquid crystal, often result in increase of current and effect extrusion of ITO patterns.
2. Heat - as the polarizer is made of plastic (often Mylar based material), heat will de-stress the polarizer which will eliminate the polarizing effect. Special iodine type polarizer may be necessary to use at cost of lower polarizing efficiency (thus darker and diminishing contrast). This is trade off one must take when specify the product. The cut off is normally at around +85 degree centigrade.

14. What is Luminance?

Luminance is a photometric measure of the density of luminous intensity in a given direction. It describes the amount of light that passes through or is emitted from a particular area, and falls within a given solid angle. The SI unit for luminance is candela per square metre (cd/m^2). The CGS unit of luminance is the stilb, which is equal to one candela per square centimetre or 10 kcd/m^2.

15. What is Contrast Ratio (CR)?

The contrast ratio is a measure of a display system, defined as the ratio of the luminosity of the brightest color to the luminosity of the darkest color that the system is capable of producing. High contrast ratio is a desired aspect of any display, but with the various methods of measurement for a system or its part, remarkably different measured values can sometimes produce similar results.