Landmark Technology

LMG203B-121SN01 - 12.1"

VHB LCD Module with LED Backlight

Introduction

The LMG203B-121SN01 is a 12.1" sunlight readable LCD module. The module consists of an AUO G121SN01 TFT color LCD panel and a VHB (very high brightness) LED backlight. At the full brightness setting, the LCD screen lumiannce can reach about 1,850 Cd/m^2 (nits). At this level, the total backlight power consumption is only 12 Watts, which is less than half the power required of a CCFL backlight at the same screen brightness.

With 1,850 nits screen brightness, the display is highly readable under bright ambient lighting, including direct outdoor sunlight. Also, the AUO G121SN01 is an industrial LCD with a wide operating temperature range, from -10 to +65^{o}C, making this LCD module specifically suitable for demanding outdoor applications.

Characteristics (Note 1, 2)

Parameters	Typical Value	Units	Conditions
LCD Screen Luminance	1,850	Cd/m^2	LCD in OFF state (normally White)
Luminance Uniformity	20% or better		Note 3
Backlight Power Consumption	12	Watts	Total power to the LED driver board
Screen Luminance Dimming Ratio	20:1		With LD200A ED driver board
Typical LCD Contrast Ratio	600:1		White vs. Black (measured in the dark along the normal direction)
Typical Viewing Angles			
3:00 direction	70	Degrees	Contrast ratio ≥ 10
9:00 direction	70	Degrees	Contrast ratio ≥ 10
6:00 direction	60	Degrees	Contrast ratio ≥ 10
12:00 direction	60	Degrees	Contrast ratio ≥ 10
LCD Screen Chromaticity (x, y)			
White	(0.288, 0.307)		Measured at the normal direction
Red	(0.587, 0.377)		Measured at the normal direction
Green	(0.319, 0.593)		Measured at the normal direction
Blue	(0.144, 0.093)		Measured at the normal direction
Response Speed			
Rise time	10	msec	White to Black, 10% - 90% transition
Fall time	25	msec	Black to White, 10% - 90% transition
LCD Module Weight	850	Grams	

Note 1: Please refer to AUO G0121SN01 LCD Specification for detailed electrical specifications and general precautions.

Note 2: All data is measured at 25^{o} C ± 2^{o}C ambient temperature.

Note 3: Uniformity = (L_{max} - L_{min}) / (L_{max} + L_{min}) where L_{max} (L_{min}) is the maximum (minimum) luminance measured using a 10 mm diameter meter aperture over the LCD active area, except the last 10 mm area from the edges.

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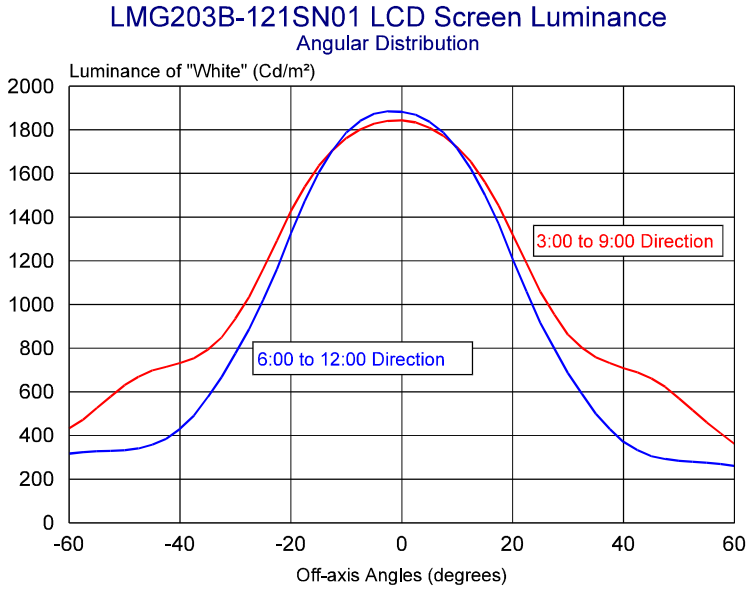
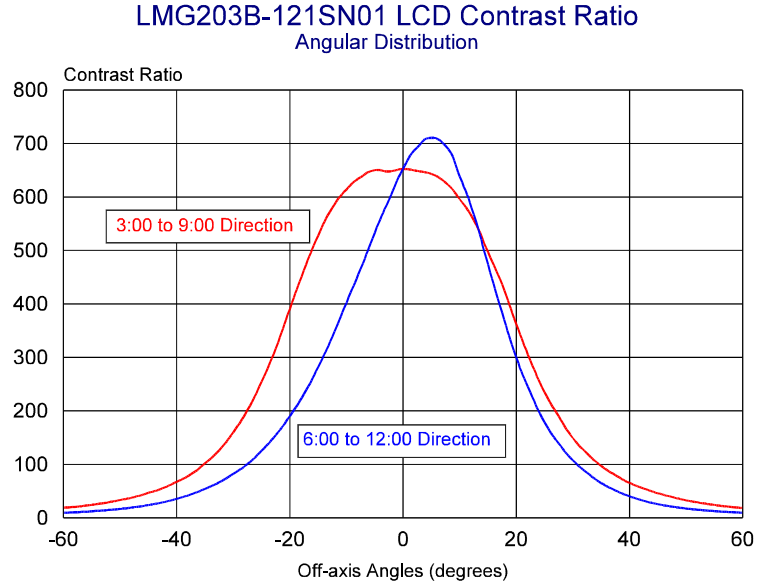
LCD Module Optical Performances

Luminance & Contrast Ratio

The typical LMG203B-121SN01 LCD module screen luminance and contrast ratio are shown in the figures below:

At the best viewing direction, this module delivers a very high screen luminance of about 1,850 Cd/m^2. For this normally white LCD, the screen luminance is measured with the LCD in the "Off" state (i.e. the pixels are not energized). This is the "white" state that provides the maximum possible luminance. The "white" color displayed on the screen when the video signal is applied may have a lower luminance which can be caused by the improper settings of the graphics card and/or the LCD controller. When the LCD is properly driven, the measured luminance of the "white" color displayed on the screen should be within 10% of the specified value.





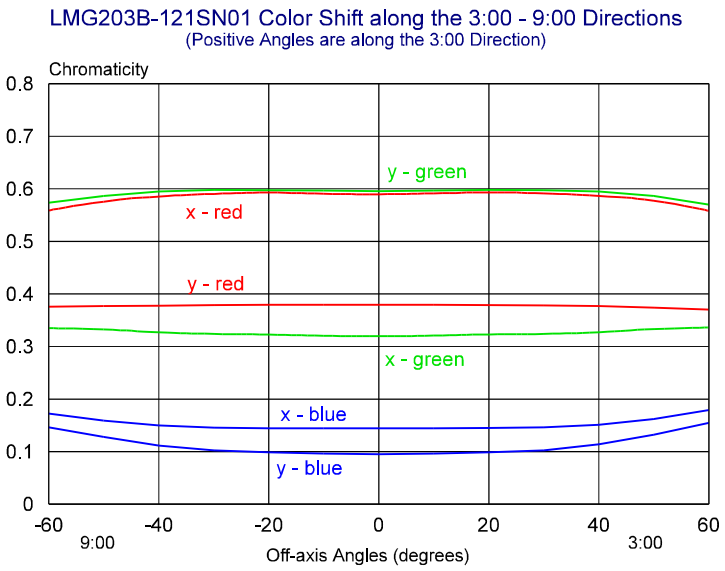
The LMG203B-121SN01 LCD module also has a high contrast ratio (CR) of about 600:1 measured on axis. At the best viewing angle, the CR value exceeds 700:1. These values are the inherent CR, which is the luminance ratio between the "White" and the "Black" states measured in a dark room. Under ambient lighting, particularly in bright outdoor environments, the CR value of the display drops significantly due to the reflection and glare caused by the strong ambient illumination.

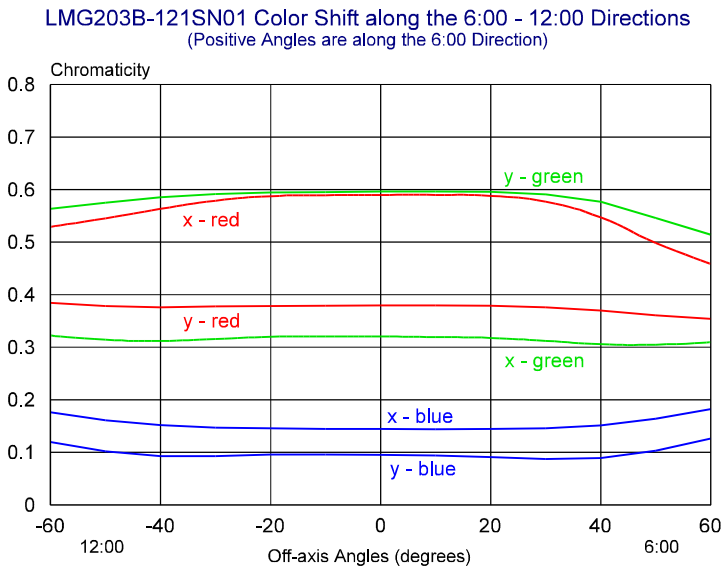
Chromaticity

The figures on the next page present the chromaticity (x, y) data of the R, G, B primary colors displayed on the screen.

Along the 3:00 to 9:00 (horizontal) directions, the chromaticity values of the Red and Green primary colors do not change significantly. Only the Blue primary color shows some color shift at very large off-axis angles. Therefore, the color shift along the horizontal direction is small.

Along the 6:00 to 12:00 (vertical) directions, the chromaticity value changes are mostly small except at large off-axis angles along the 6:00 direction. Therefore, the image displayed on the screen shows color shift toward the white at large off-axis viewing angles along the 6:00 direction.





LED Backlight Driving Specifications

The LMG203B LCD module has a VHB backlight with two LED lamp strips. Each LED strip has 32 white LEDs that are electrically connected into 4 strings in parallel. Each string has 8 LEDs connected in series.

Each LED lamp strip is terminated with a JST 2-pin connector, BHRS-02VS-1. The JST mating connector part number is SM02-BHSS-1-TB.

Please refer to the dimensional drawing on page 5 for the pin connections.

At the maximum screen brightness, the driving current for each LED strip is 240 mA.

At this drving current level, the norminal LED strip voltage is about 25V and the backlight delivers 1,850 Cd/m^2 of LCD screen luminance. With LD200A LED drive board, the total power drain from the 12V power supply is baout 13.7 Watts

Thermal Management

The backlight power consumption of the LMG203B LCD module is 12 Watts at 1,850 nits screen brightness. This is about 4 - 5 Watts higher than the backlight power of LCDs with a regular brightness of 300 - 500 nits. Thus, the LCD temperature increase due to this extra backlight power is negligible.

For outdoor display applications where the LCD may be subject to direct sunlight exposure, the major source of heat usually comes from sunlight. LCDs are suitable for outdoor applications because they have low reflective, black front surfaces. However, a black surface is a good solar absorber. For example, if strong sunlight shines on the display at a perpendicular direction, the LMG203B LCD module can absorb up to 50 Watts of solar power. This is about four times the power consumption of the LED backlight including the driver board losses. As a result, the LCD temperature can rise very quickly.

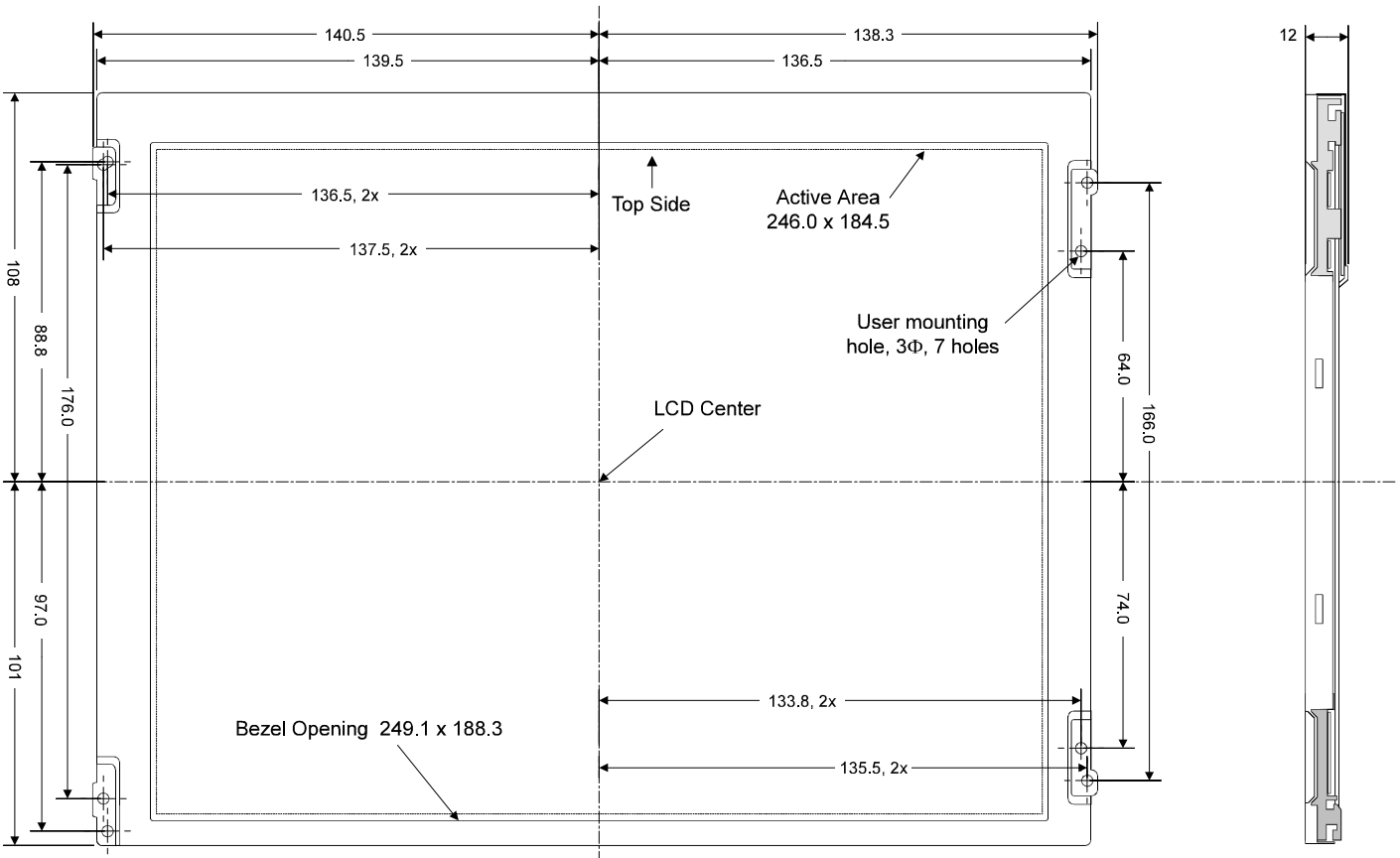
Since the LMG203B-121SN01 LCD has a wide operating temperature range from -10 to 65^oC, the thermal management issue can be resolved with air cooling even with strong, direct sunlight exposure. On the other hand, both LED efficiency in Lumens per Watt and LED life span decrease when the ambient temperature rieses beyond a certain leve. Thus, it is necessary to cool the LED strips well below 60ºC temperature to ensure good performances

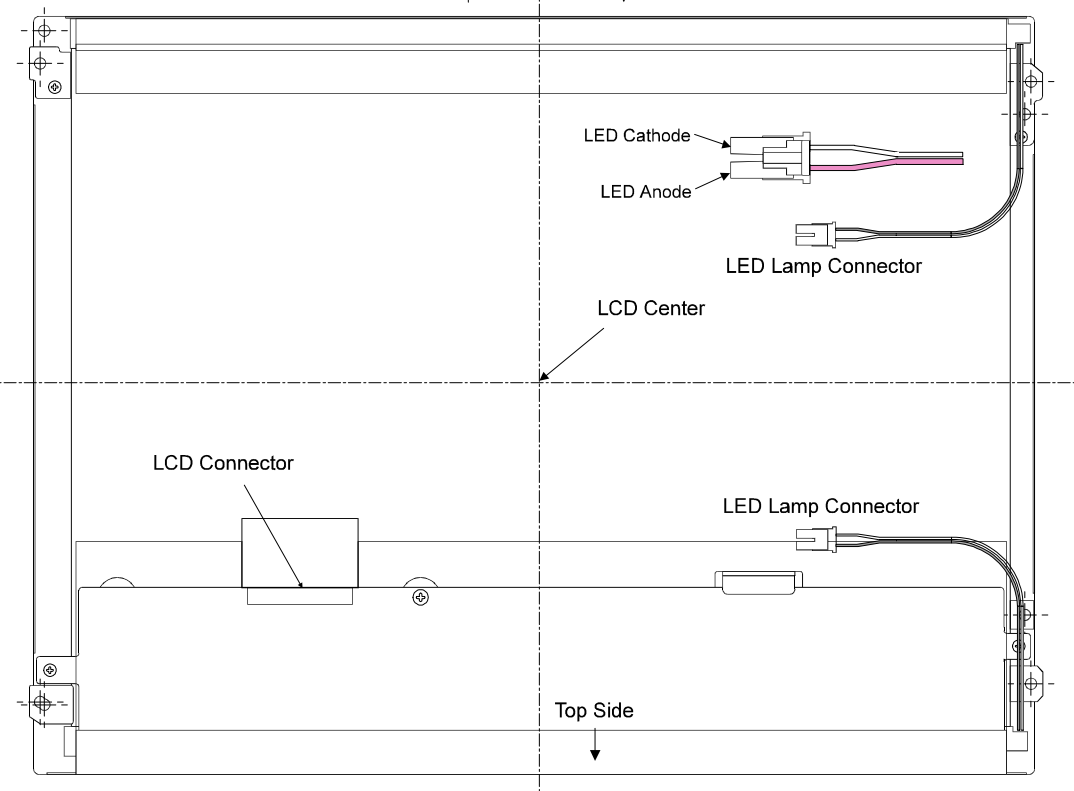
Thermal Management (continue)

and long LED backlight life.

For outdoor applications in very cold weather, the ambient temperature may drop below -30^{o}C. Therefore, the thermal management (cooling and heating) system should be designed according to the worst case conditions anitcipated for the LCD to ensure that the LMG203B LCD with its LED backlight will operate properly.

LMG203B-121SN01 Mechanical Dimensions





All dimensions are in mm