

Introduction

The LMG207C-121X1-L01 is a 12.1" sunlight readable LCD module. The module consists of a ChiMei G121X1-L01 TFT color LCD panel and a VHB (very high brightness) LED backlight. At the full brightness setting, the LCD screen luminance reaches 2000 Cd/m² (nits). At this brightness, the total backlight power consumption is only 12 Watts.

With 2,000 nits screen brightness, the display is highly readable under bright ambient lighting, including direct outdoor sunlight. Also, the ChiMei G121X1-L01 is an industrial LCD with a very wide operating temperature range from -30 to +70°C, making this LCD module specifically suitable for demanding outdoor applications.

Characteristics (Note 1, 2)

Parameters	Typical Value	Units	Conditions
LCD Screen Luminance	2,000	Cd/m ²	LCD in OFF state (normally White)
Luminance Uniformity	20% or better		Note 3
Backlight Power Consumption	12	Watts	Excluding LED driver board losses
Screen Luminance Dimming Ratio	20:1		With LD200A LED driving board
Typical LCD Contrast Ratio	750:1		White vs. Black (measured in the dark along the normal direction)
Typical Viewing Angles			
3:00 direction	80	Degrees	Contrast ratio ≥ 10
9:00 direction	80	Degrees	Contrast ratio ≥ 10
6:00 direction	80	Degrees	Contrast ratio ≥ 10
12:00 direction	80	Degrees	Contrast ratio ≥ 10
LCD Screen Chromaticity (x, y)			
White	(0.325, 0.358)		Measured at the normal direction
Red	(0.570, 0.374)		Measured at the normal direction
Green	(0.349, 0.567)		Measured at the normal direction
Blue	(0.147, 0.117)		Measured at the normal direction
Response Speed			
Rise time	6	msec	White to Black, 10% - 90% transition
Fall time	17	msec	Black to White, 10% - 90% transition
LCD Module Weight	850	Grams	

Note 1: Please refer to ChiMei G121X1-L01 LCD Specification for detailed electrical specifications and general precautions.

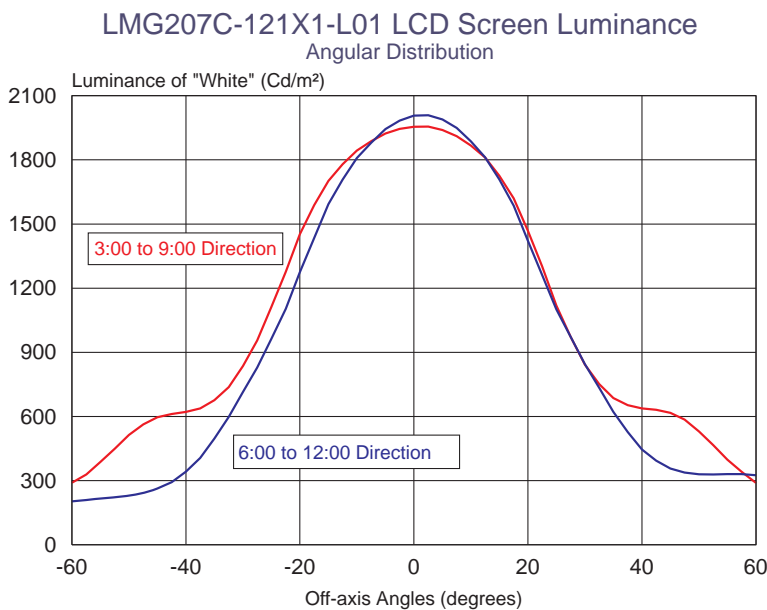
Note 2: All data is measured at 25°C ± 2°C ambient temperature.

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.

LCD Module Optical Performances

Luminance & Contrast Ratio

The typical LMG207C-121X1-L01 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 2,000 Cd/m². Since this module is a 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.



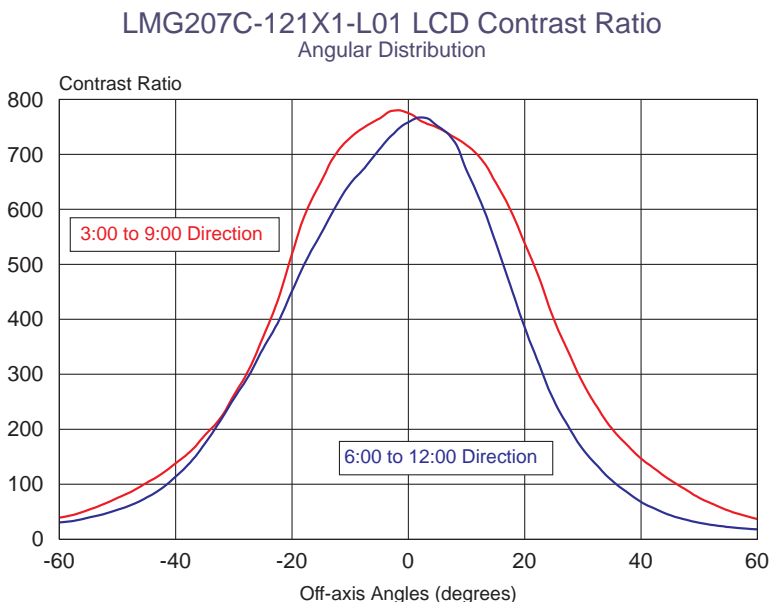
The LMG207C-121X1-L01 LCD module also has a high contrast ratio (CR) of over 700:1 measured on axis. For all the practical viewing angles, the CR value exceeds 100:1. These values are the inherent CR, which is the luminance ratio between the “White” and the “Black” states measured in a dark room. Under 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

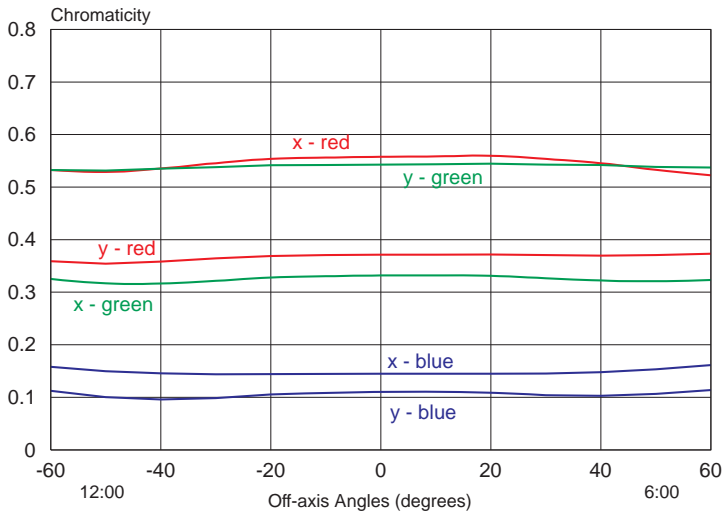
The figures on the next page present the chromaticity (x, y) data of the R, G, B primary colors displayed on the screen.

Along the 3:00 to 9:00 (horizontal) directions, the chromaticity values of the Red and Green primary colors virtually have no change. Only the Blue primary color shows a very slight color shift at very large off-axis angles.

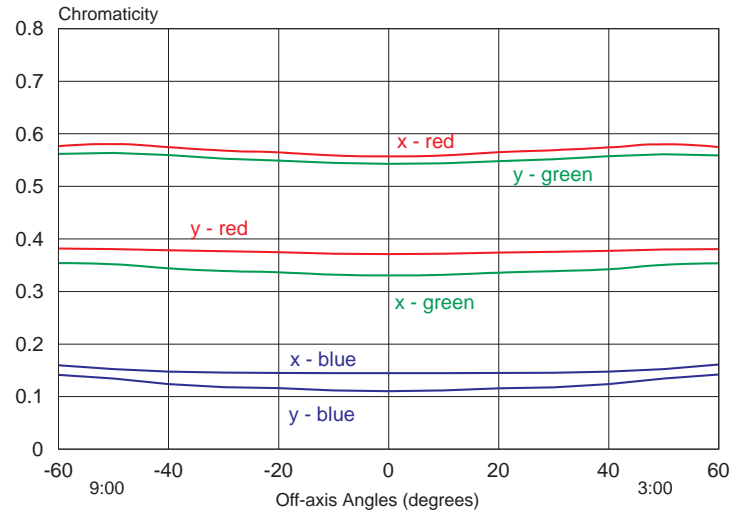
Along the 6:00 to 12:00 (vertical) directions, the chromaticity value changes are also very small. At very large off-axis viewing angles, the Red and Blue primary colors show slight color shifts toward the white. Therefore, the image displayed on the screen has only very small color shifts for all the practical off-axis viewing angles along all the directions.



LMG207C-121X01-L01 Color Shift along the 6:00 - 12:00 Directions
(Positive Angles are along the 6:00 Direction)



LMG207C-121X01-L01 Color Shift along the 3:00 - 9:00 Directions
(Positive Angles are along the 3:00 Direction)



LED Backlight Driving Specifications

The LMG207C LCD module has a VHB backlight with two LED lamp strips. Each LED lamp 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 driving current level, the nominal LED strip voltage is about 25V and the backlight delivers 2,000 Cd/m² of LCD screen luminance. With LD200A LED driver board, the total power drain from the 12V supply is about 13.7 Watts.

Thermal Management

The backlight power consumption of the LMG207C LCD module is about 12 Watts at 2,000 nits screen brightness. This is only 4 watts higher than the backlight power consumption of the original ChiMei LCD at 450 nits. Thus, the LCD temperature increase due to this additional 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 energy absorber. For example, if strong sunlight shines on the display at a perpendicular direction, the LMG207C LCD module can absorb up to 50 Watts of solar power. This is more than four times the power consumption of the LED backlight including the driver board losses. As a result, the LCD temperature can rise quickly.

Since the ChiMei G121X1-L01 has a wide operating temperature range from -30 to 70°C, the thermal management issue is not difficult to resolve. Also, both LED efficiency in Lumens per Watt and LED life span decrease when the ambient temperature rises beyond a certain level. Thus, please remember to implement cooling measures to maintain the LCD temperature well below 70° C to ensure good display performances and long backlight life.

Thermal Management (continued)

For outdoor applications in very cold weather, the ambient temperature may drop below -30° C. Therefore, the thermal management (cooling and heating) system should be designed according to the worse case conditions anticipated for the LCD to ensure that the LMG207C LCD with its LED backlight will operate properly.

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