

#### Introduction

The LMG259A-121X1 is a 12.1" sunlight readable LCD module. The module consists of a ChiMei G121X1-L03 TFT color LCD panel and a VHB (very high brightness) LED backlight. At the full brightness setting, the LCD screen luminance reaches 1,600 Cd/m<sup>2</sup> (nits). At this level, the backlight power consumption is about 9 Watts

The LMG259A has a low reflective front surface. With 1,600 nits screen brightness, the display is highly readable under bright ambient lighting, including direct outdoor sunlight. Also, the ChiMei G121X1 is an industrial LCD with a wide operating temperature range from -30 to +80°C, making this LCD module specifically suitable for demanding outdoor applications.

#### Characteristics (Note 1, 2)

Parameters	Typical Value	Units	Conditions
LCD Screen Luminance	1,600	Cd/m <sup>2</sup>	LCD in OFF state (normally White)
Luminance Uniformity	75% or better		Note 3
Backlight Power Consumption	9.1	Watts	Excluding LED driver board losses
Screen Luminance Dimming Ratio	50:1		With LD320 LED driving board
Typical LCD Contrast Ratio	800:1		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	70	Degrees	Contrast ratio ≥ 10
12:00 direction	70	Degrees	Contrast ratio ≥ 10
LCD Screen Chromaticity (x, y)			
White	(0.288, 0.329)		Measured at the normal direction
Red	(0.614, 0.371)		Measured at the normal direction
Green	(0.310, 0.632)		Measured at the normal direction
Blue	(0.139, 0.081)		Measured at the normal direction
Response Speed			
Rise time	7	msec	White to Black, 10% - 90% transition
Fall time	11	msec	Black to White, 10% - 90% transition
LCD Module Weight	550	Grams	

Note 1: Please refer to ChiMei G121X1-L03 LCD Specification for detailed electrical specifications and general precautions.

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

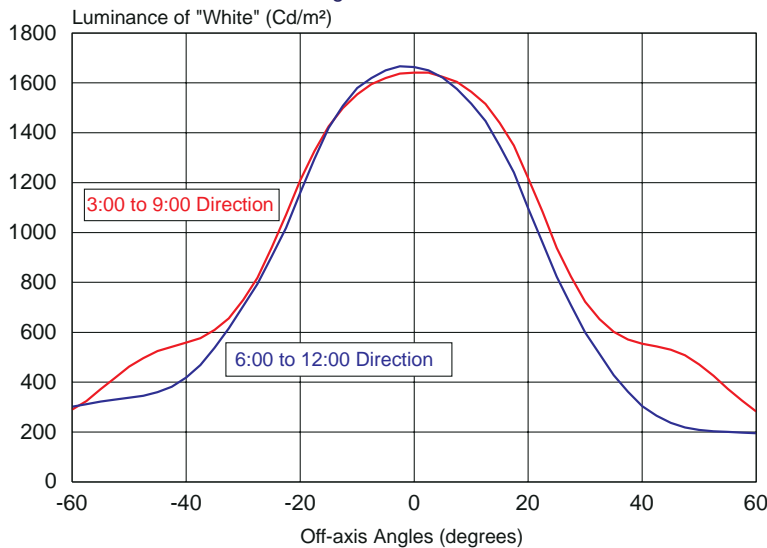
Note 3: Uniformity = (Lmin / Lmax) where Lmax (Lmin) is the maximum (minimum) luminance measured over the 5 points (the center point plus 4 points half way toward the corner) of the active area.

## LCD Module Optical Performances

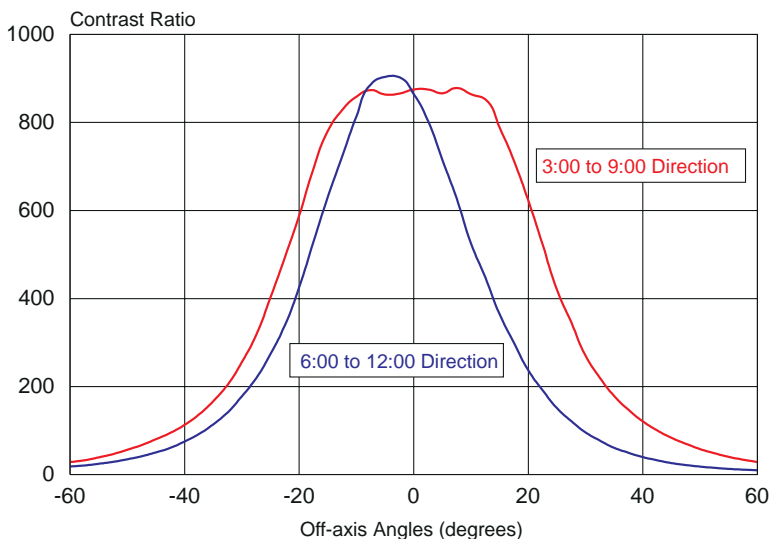
### Luminance & Contrast Ratio

The typical LMG259A-121X1 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 over 1,600 Cd/m<sup>2</sup>. 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 LCD controller and/or the graphics card. 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.

**LM259A-121X1 Screen Luminance**  
Angular Distribution



**LM259A-121X1 LCD Contrast Ratio**  
Angular Distribution



The LMG259A-121X1 LCD module also has a high contrast ratio (CR) of over 800:1 measured on axis. For all the practical viewing angles, the CR value exceeds 50:1. These CR values are measured in a dark room. Under ambient lighting, particularly in bright outdoor environments, the CR value of the display drops significantly. Basically the front surface of the LCD reflects the ambient illumination. Thus, the luminance of the black color increases significantly which reduces the CR value. For details, please refer to Landmark Tecknote TK0101.

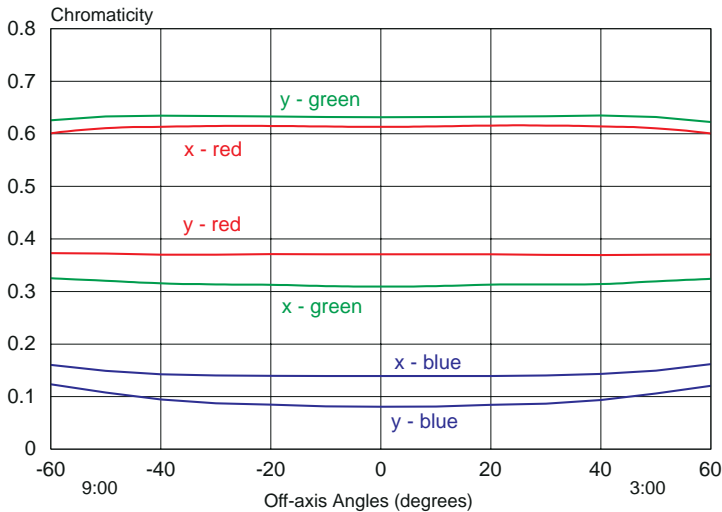
### Chromaticity

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

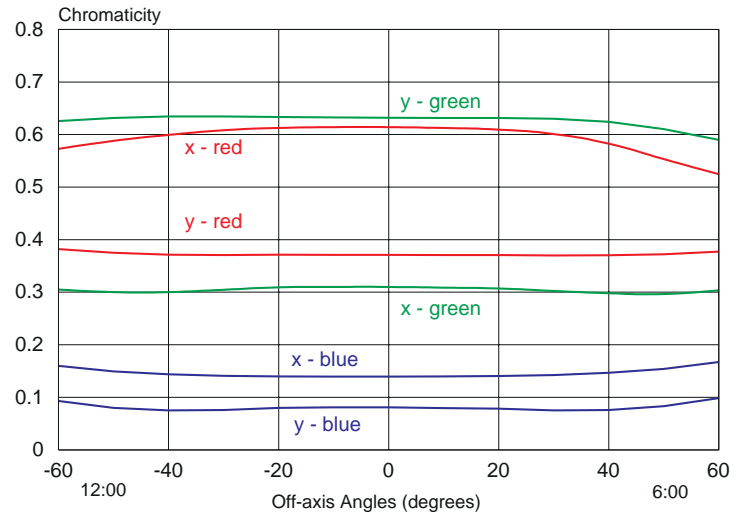
Along the 3:00 to 9:00 (horizontal) directions, the chromaticity values of the Red and Green primary colors virtually have no change. Only the Blue primary color shows a very slight color shift at large off-axis angles.

Along the 6:00 to 12:00 (vertical) directions, the chromaticity value changes are small. At very large off-axis viewing angles, the Red and Blue primary colors have minor 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.

LM259A-150X1 Color Shift along the 3:00 - 9:00 Directions  
(Positive Angles are along the 3:00 Direction)



LM259A-1121X1 Color Shift along the 6:00 - 12:00 Directions  
(Positive Angles are along the 6:00 Direction)



### LED Backlight Driving Specifications

The LMG259A LCD module has a VHB backlight with one LED strip. The LED strip is terminated with a JST 2-pin connector, BHRS-02VS-1. The JST mating connector part number is SM02-BHSS-1-TB.

The driving voltage and current for the LED strip is listed below:

LED strip driving voltage	33.3	V (typ)
LED strip driving current	270	mA

At this driving condition, the backlight delivers 1,600 Cd/m<sup>2</sup> of LCD screen luminance. The total power from the 12V supply is about 10.5 Watts.

Currently, The Landmark LD320 LED driver board can drive the LED strip at the rated 270 mA current. The LD320 can adjust the screen brightness down to about 30 nits.

### Thermal Management

The backlight power consumption of the LMG259A LCD module is about 9 Watts at full screen brightness of 1600 nits. With this power, the LCD temperature increase is small and thus do not requires any thermal management.

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 LMG259A LCD module can absorb up to 50 Watts of solar power. This is five times of the power consumption of the LED backlight. As a result, the LCD temperature can rise significantly.

Since the LMG259A-121X1 has a wide operating temperature range from -30 to 80°C, the thermal management issue is relatively simple. Some cooling fans can be used to maintain the LCD temperature in the operating temperature range. However, both the LED efficiency (in Lumens per Watt) and the LED life span decrease when the ambient temperature rises beyond a certain level. Thus, please implement cooling measures to maintain the LCD temperature below 60° C to ensure good display performances and long backlight life.

## Thermal Management (continued)

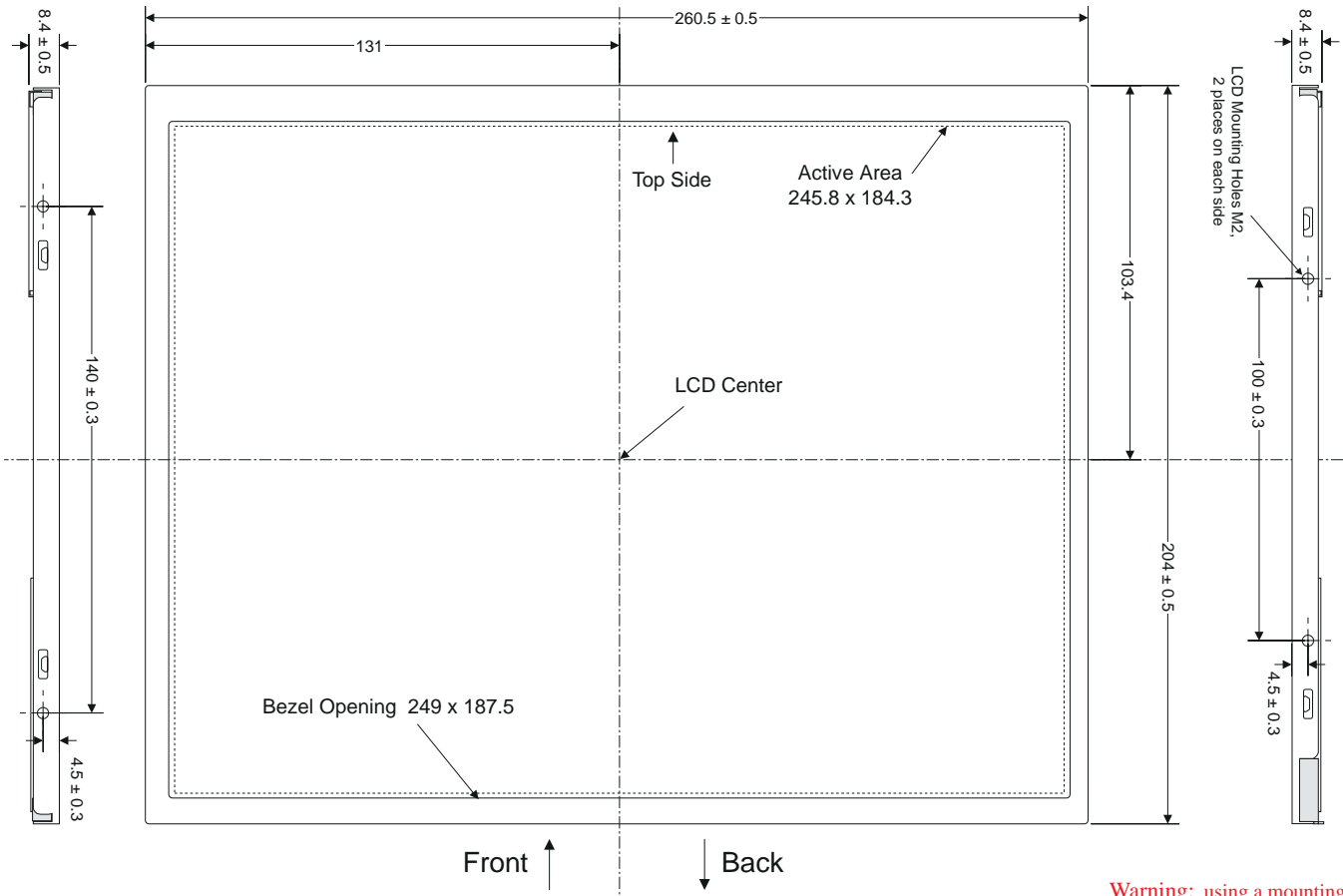
For outdoor applications in very cold weather, the ambient temperature may drop below -30° C. Therefore, the thermal management (cooling and heating) system should be designed according to the worse case conditions anticipated for the LCD to ensure that the LMG259A LCD with its LED backlight will operate properly.

### Disclaimer

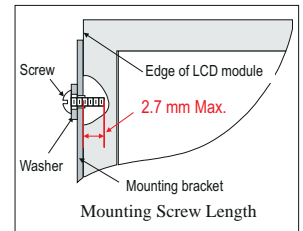
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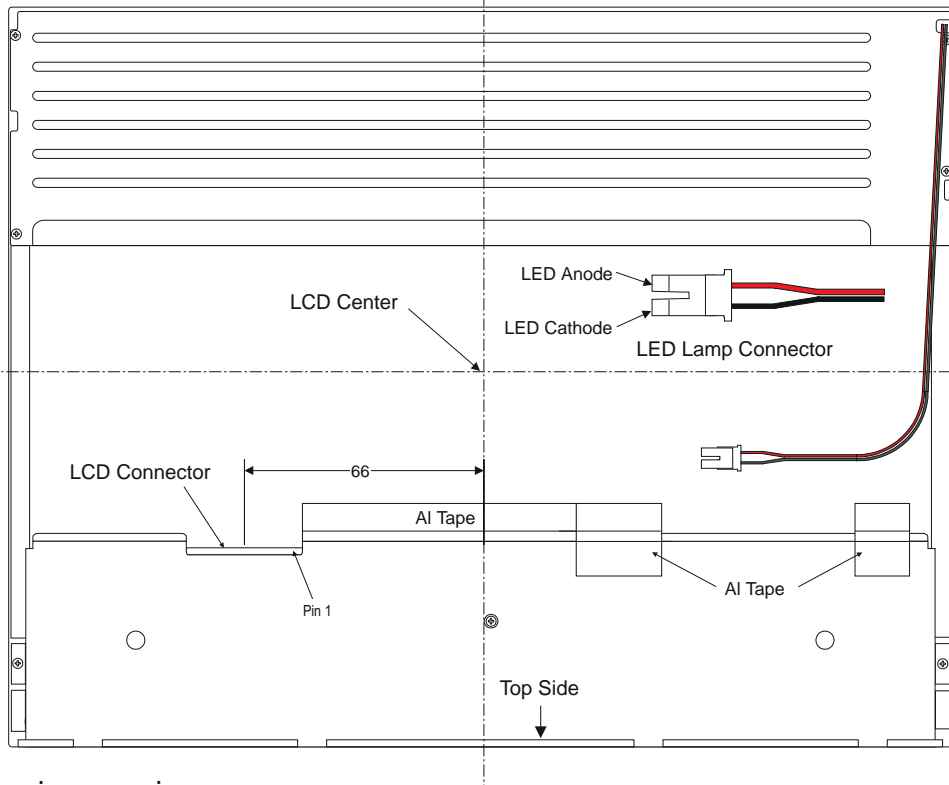
LMG259A-121X1 Mechanical Dimensions



**Warning:** using a mounting screw longer than 2.7 mm or tighten it with a torque exceeding 2.0 Kg-cm will damage the LCD module.



Max. torque - 2.0 Kg-cm



All dimensions are in mm