Landmark Technology

LMG216H-150X1

15" Sunlight Readable LCD Module

Introduction

The LMG216H-150X1 is a 15" Sunlight Readable LCD module. The module consists of a ChiMei G150X1-L03 TFT color LCD panel and a VHB (very high brightness) LED backlight in a side mount package of less than 14 mm maximum thickness.

At the maximum backlight power of 18.5 Watts, the LMG216H-150X1 delivers a very high screen brightness of 2,200 Cd/m^2 (nits). At this level, the display is highly readable under direct sunlight. In addition, it has an anti-reflective front polarizer that can maintain a good contrast ratio under very high ambient lighting. For applications in dark environments, the screen brightness can be adjusted down to less than 20 Cd/m^2 using a proper LED drive board with PWM dimming control.

Characteristics (Note 1, 2)

Parameters	Typical Value	Units	Conditions
LCD Screen Luminance	2,200	Cd/m^2	LCD displays the brightest white
Luminance Uniformity	20% or better		Note 3
Backlight Power Consumption	18.5	Watts	Excluding LED driving board losses
Screen Dimming Ratio	20:1		With LD200A LED driving board
Typical LCD Contrast Ratio	1,000:1		White vs. Black (measured in the dark at the normal direction)
Typical Viewing Angles			
3:00 to 9:00 direction	> ± 70	Degrees	Contrast ratio ≥ 10
6:00 to 12:00 direction	> ± 70	Degrees	Contrast ratio ≥ 10
3:00 to 9:00 direction	> ± 70	Degrees	Screen brightness ≥ 200 Cd/m^2
6:00 to 12:00 direction	> ± 70	Degrees	Screen brightness ≥ 200 Cd/m^2
LCD Screen Chromaticity (x, y)			
White	(0.310, 0.354)		Measured at the normal direction
Red	(0.594, 0.371)		Measured at the normal direction
Green	(0.320, 0.597)		Measured at the normal direction
Blue	(0.14, 0.110)		Measured at the normal direction
LCD Module Weight	1,000	Grams	
Display Resolution	1,024 x 768		
Operating Temperature Range	-30 to 80	°C	

Note 1: Please refer to the ChiMei G150X1-L03 data sheet for detailed LCD electrical specifications and general precautions.

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

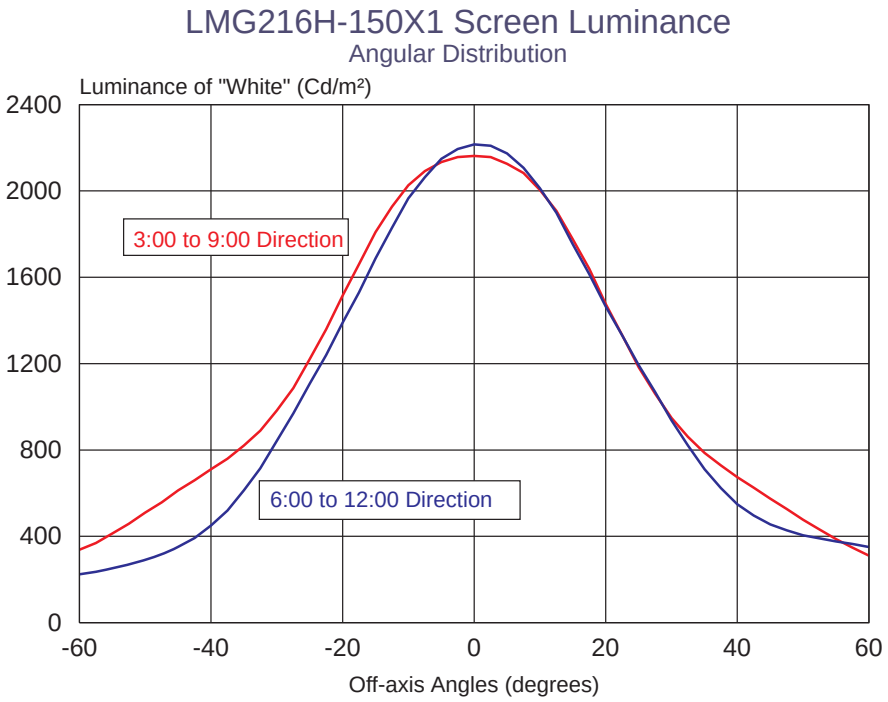
Note 3: Uniformity = (L_{max} - L_{min}) / (L_{max} + L_{min}) where L_{max} (L_{min}) is the maximum (minimum) luminance measured with a 10 mm diameter meter aperture over the LCD active area except for the last 10 mm area from the edges.

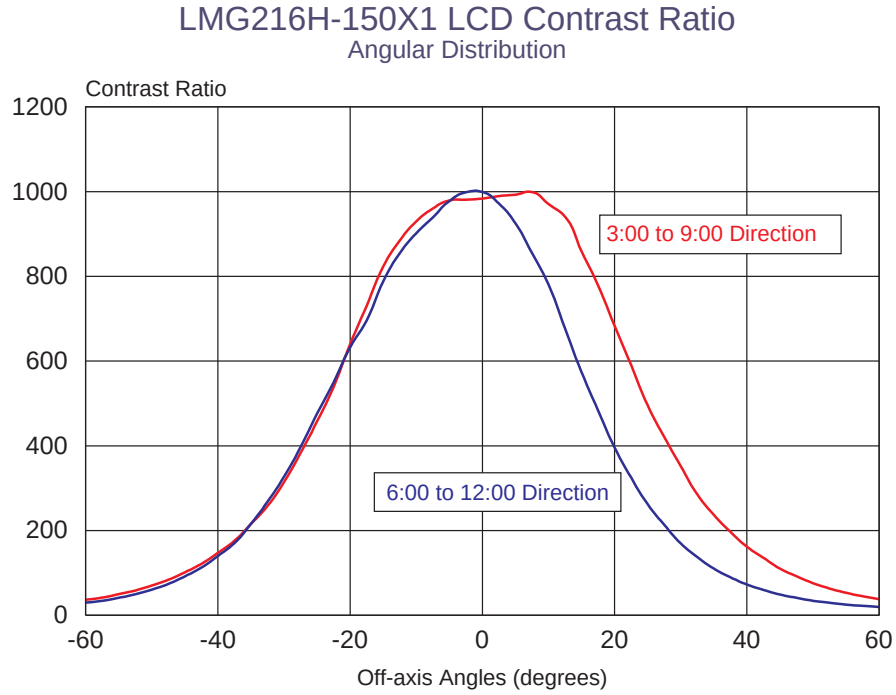
Landmark Technology 172 Component Drive San Jose, CA 95131 (408) 434-9302 Fax: (408) 434-0954 03/2012
www.landmarktek.com

LCD Module Optical Performances

Luminance & Contrast Ratio

The typical LMG216H-150X1 LCD module screen luminance and contrast ratio are shown in the figures below: Since the ChiMei G150X1-L03 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 with the maximum possible luminance.





The "white" color displayed on the screen when the video signal is applied may have a slightly lower luminance. When the LCD is properly driven, the luminance of the "white" color displayed on the screen should be within 5% of the specified value.

The LMG216H LCD module has a high contrast ratio (CR) about 1,000:1 along the normal direction. This is the inherent CR measured in a dark room. As the ambient lighting level increases, the CR value drops due to reflection and glare at the front surface of the LCD.

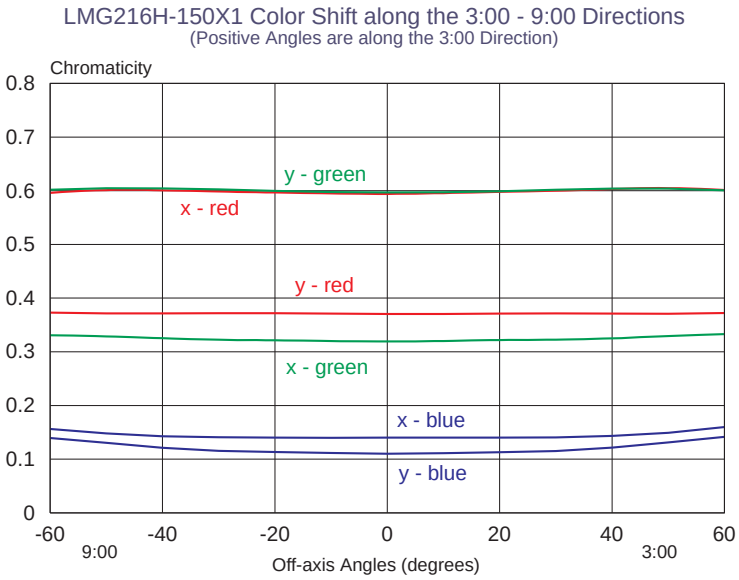
Since this LCD module has an anti-reflective front polarizer, the display can maintain a better image contrast ratio than an LCD with the standard anti-glare front coating, especially in very bright ambient lighting.

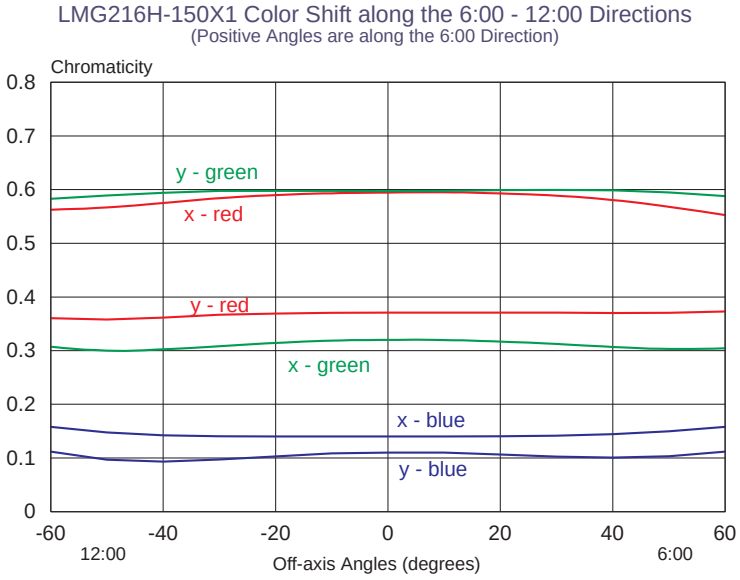
Chromaticity

The 1931 CIE chromaticity coordinates of the R, G, B primary colors are presented in the table on page 1. These numbers are measured from a viewing direction normal to the LCD screen.

The ChiMei G150X1-L03 is a normally white TN LCD, yet it has wide viewing angles with very small color shifts. The figures on the next page present the chromaticity (x, y) data of the R, G, B primary colors as a function of the viewing angles.

Along the 3:00 to 9:00 (horizontal) directions, only the blue primary has minor chromaticity changes at large off-axis angles. Along the 6:00 to 12:00 (vertical) directions, the blue and the red primary colors have minor changes at large off-axis angles. Therefore, the image on the screen has virtually no color shifts over ± 45^{o} viewing angles. Beyond that, some minor color shifts toward the "White" is observed.





LED Backlight Driving Specifications

The LCD module has a VHB backlight with two LED lamp strips. Each LED strip has 48 white LEDs that are electrically connected into 6 strings in parallel. Each string has 8 LEDs connected in series.

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

At the maximum screen brightness setting of 2,200 nits, the driving conditions of each LED strip (with 6 strings) are,

LED strip driving voltage	25	Vdc (typ)
LED strip driving current	360	mA

Thus, the 2 LED strips in the backlight consume about 18.5 Watts. With Landmark's LD200A LED driving board (tuned for the LMG216H), the total power drain from the 12V supply is 21.5 Watts.

Thermal Management

The backlight power consumption of the LMG216H-150X1 LCD module is approximately 18.5 Watts at full screen brightness. This is only 10 Watts higher than the backlight power consumption of the original ChiMei LCD at 450 nits. So the LCD temperature increase due to this additonal backlight power is quite small.

For outdoor display applications where the LCD may be subject to direct sunlight exposure, the LCD screen can absorb a large amount of solar heat. In the worst conditions, the heating power generated from sunlight exposure can reach 70 Watts, which is close to 4 times the LED backlight power. As a result, the LCD temperature can rise more than 40 ^{o}C, particularly if there is a cover plate in front of the LCD.

Thermal Management (continued)

Since the ChiMei G150X1-L03 has a wide operating temperature of -30 to 80^{o}C, in conditions with no direct sunlight exposure, thermal management is not an issue or can be accomplished with simple cooling fans and/or heat sinks.

For outdoor applications with direct sunlight exposure, the combined heating power from the sunlight and the VHB backlight can raise the LCD temperature possibly beyond 80^{o}C. 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 80 ºC to ensure good display performances and long LED backlight life span.

For outdoor applications in cold winter weather, the ambient temperature may drop to below -30^{o}C. Therefore, the thermal management (cooling and heating) system should be designed according to the worst case conditions anticipated for the LCD to ensure sure that the LMG216H LCD with its LED backlight will operate properly.

Backlight Life

The half brightness life of the VHB backlight in the LMG216H-150X1 sunlight readable module is rated at 50,000 hours. The half brightness life is the number of operating hours before the backlight luminance (seen as the LCD screen brightness) drops down to 50% of its initial value.

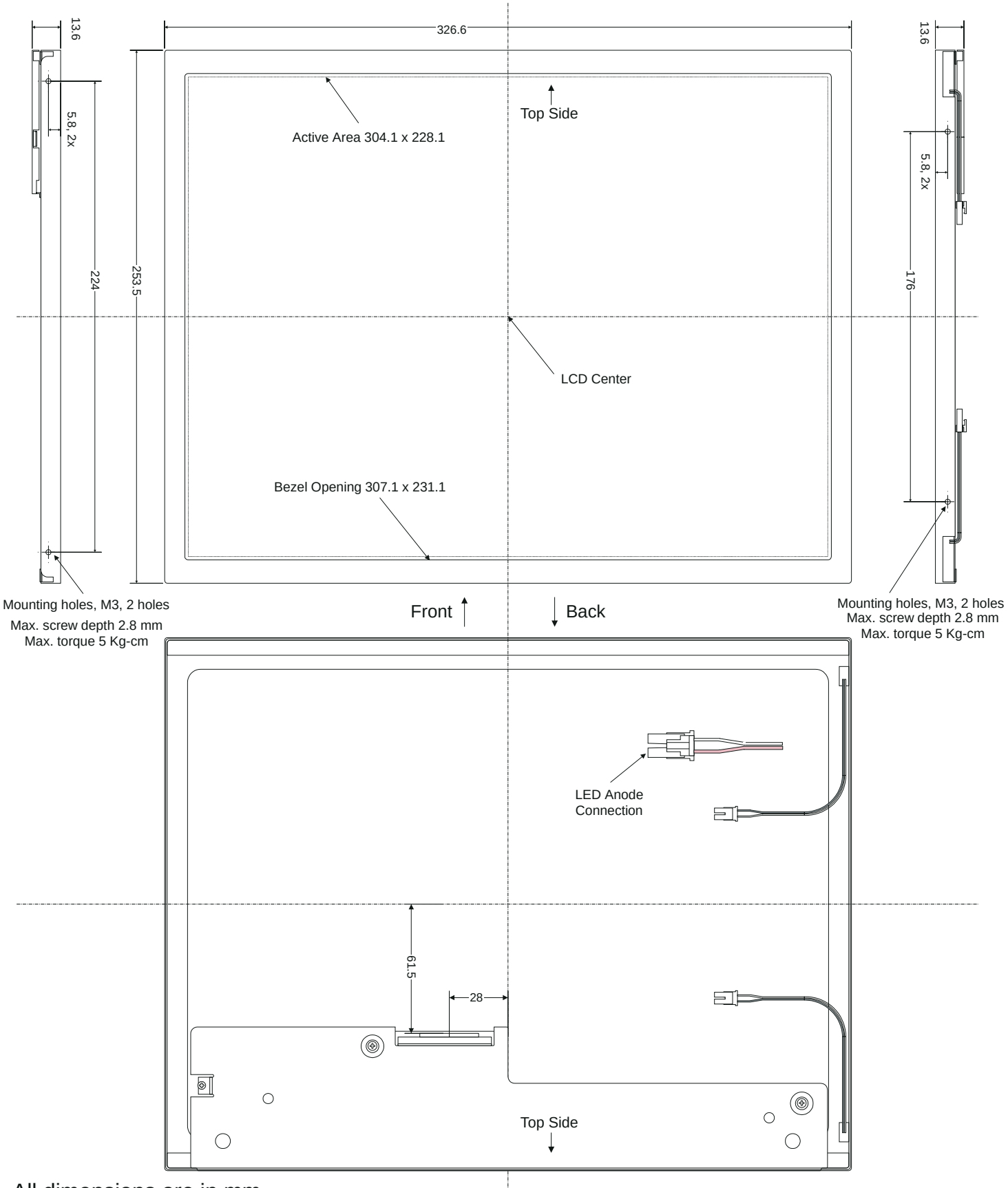
The lifetime of an LED backlight is mainly determined by the luminous decay of the LEDs. As the temperature of the LED chip rises, the LED luminance decay accelerates. This temperature effect on the LED life is relatively small if the LCD case temperature is maintained below 50 ºC.

Caution:

The LMG216H-150X1 is a side mount LCD module. The locations of the mounting holes and the screw size are specified in the Mechanical Dimensions Drawing on the next page. Please use four M3 screws to mount the LMG216H LCD onto the display case.

The maximun depth of the screws penetrating inside the LCD module is 2.8 mm. The maximun torque used to tighten the screws is 5 Kg-cm (4.3 lb-in). Excessive torgue and longer screws can cause severe damage to the LCD module.

LMG216H-150X1 Mechanical Dimensions



All dimensions are in mm