Landmark Technology

LMG223B-170EG01 - 17"

Sunlight Readable LCD Module

Introduction

LMG223B-170EG01 is a 17" sunlight readable LCD module. The module consists of an AUO G170EG01 TFT color LCD panel and a Landmark VHB (very high brightness) LED backlight to achieve a maximun screen brightness of 1,200 Cd/m^2 (nits). At this brightness, the power consumption of the LED backlight is only 29 Watts.

The LMG223B-170EG01 LCD has 1,280 x 1024 resolution with a wide viewing angle around ±80º in both horizontal and vertical directions. For applications in low lighting environments, the screen brightness can be adjusted down to less than 5 Cd/m^2 using a proper LED drive board with PWM (Pulse Width Modulation) dimming control.

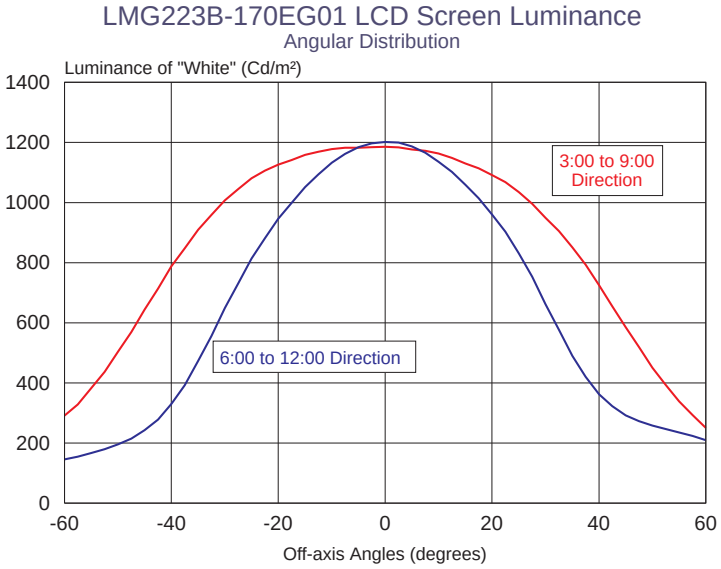
Characteristics (Note 1, 2)

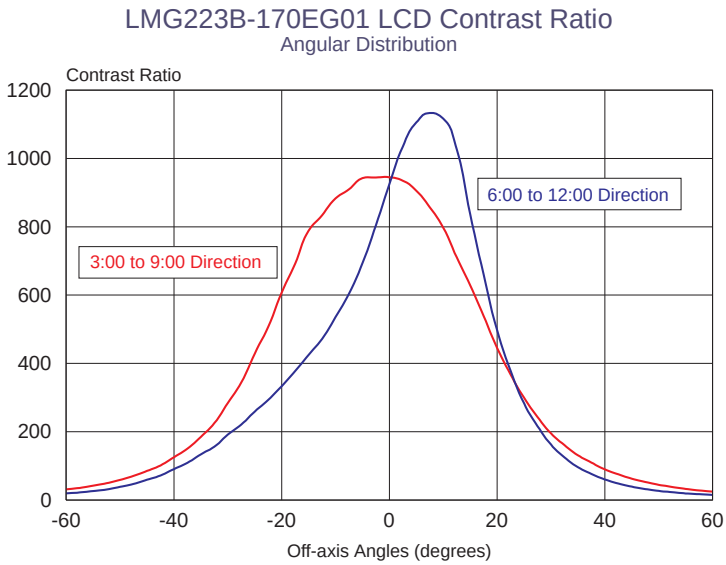
Parameters	Typical Value	Units	Conditions
LCD Screen Luminance	1,200	Cd/m^2	LCD in OFF state (normally White)
Backlight Power Consumption	29	Watts	
Typical LCD Contrast Ratio	1,000:1		White vs. Black (measured in the dark at the normal direction)
Typical Viewing Angles			
3:00 direction	~ 85	Degrees	Contrast ratio ≥ 10
9:00 direction	~ 85	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	(0.261, 0.296)		Measured at the normal direction
Red	(0.602, 0.349)		Measured at the normal direction
Green	(0.291, 0.632)		Measured at the normal direction
Blue	(0.141, 0.045)		Measured at the normal direction
Response Speed			
Rise time	3.5	msec	White to Black, 10% - 90% transition
Fall time	1.5	msec	Black to White, 10% - 90% transition
LCD Module Weight	1,700	Grams	

Note 1: Please refer to AUO G170EG01 LCD data sheet for detailed electrical specifications and the precautions of LCD handling..
Note 2: All data is measured at 25^o C ± 2^{o}C ambient temperature.

LCD Module Optical Performances

The typical LMG223B-170EG01 LCD module screen luminance and contrast ratio are shown in the figures on the next page.





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 slightly lower luminance which can be caused by 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.

At the optimal viewing directions, the LMG223B-170EG01 LCD module has a very high contrast ratio (CR) of about 1,000:1. This is 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.

The LMG223B-170EG01 is a normally white TN LCD, yet it has a very wide viewing angle with very little color shifts at the large off-axis viewing angles. Out of the R, G, B primary colors, only the Blue primary color shows some chromaticity shifts at the large off axis angles of 50 degrees and beyond.

LED Backlight Driving Specifications

The LCD module has a VHB backlight with two LED lamp strips. Each LED strip has 44 white LEDs that are electrically connected into 4 strings in parallel. Each string has 11 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.

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

At the maximum screen brightness setting of 1,200 nits the driving current of each LED strip is 420 mA.

At this current level, the typical driving voltage is about 34.5V, and the power consumption of the 2 LED strips is about 29 Watts.

With ERG SFDZDA4210F LED drive board (tuned for the LMG223B), the total power drain from the 12V supply is about 33.5 Watts.

Thermal Management

At 1,200 nits screen brightness, the 29 Watts backlight power consumption of the LMG223B-170EG01 LCD module is about 10 Watts more than the backlight power consumption of the original AUO LCD at 350 nits brightness. So the LCD temperature increase due to this VHB LED backlight is not very significant.

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 90 Watts, which is more than 3 times the LED backlight power. As a result, the LCD temperature can rise well beyond the maximun operating temperature of the LCD, in particular, if there is a cover plate in front of the LCD.

As the LCD temperature rises beyond certain level, both the LED efficiency in Lumens per Watt and the LED life span decrease. Also, if the LCD temperature exceeds the N - I (nematic to isotropic) transition point of the liquid crystal material, the LCD loses its display function. Thus, it is important to implement cooling measures to maintain an LCD temperature below 50 ºC to ensure good display performance and long backlight life span.

For outdoor applications in cold winter weather, the ambient temperature may drop well below 0^{o}C. The thermal management (cooling and heating) system should be designed according to the worst case conditions anticipated to ensure the proper operation of the LMG223B-170EG01 LCD and its LED backlight.

Backlight Life

The half brightness life of the VHB backlight in the LMG223B-170EG01 LCD 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.

LCD Mounting

The LMG223B-170EG01 is a side mount LCD module. The locations of the mounting holes and the screw size are shown on the mechanical dimension drawing on the next page. Please use four M3 screws to mount the LMG223B-170EG01 LCD module to the display case.

The maximum screw penetration depth inside the LCD module is 4.2 mm. The maximun torque used to tighten the screws is 5 kg-cm (4.3 lb-in). Excessive depth of penetration and amount of tightening torque can potentially cause unrecoverable demage to the LCD module

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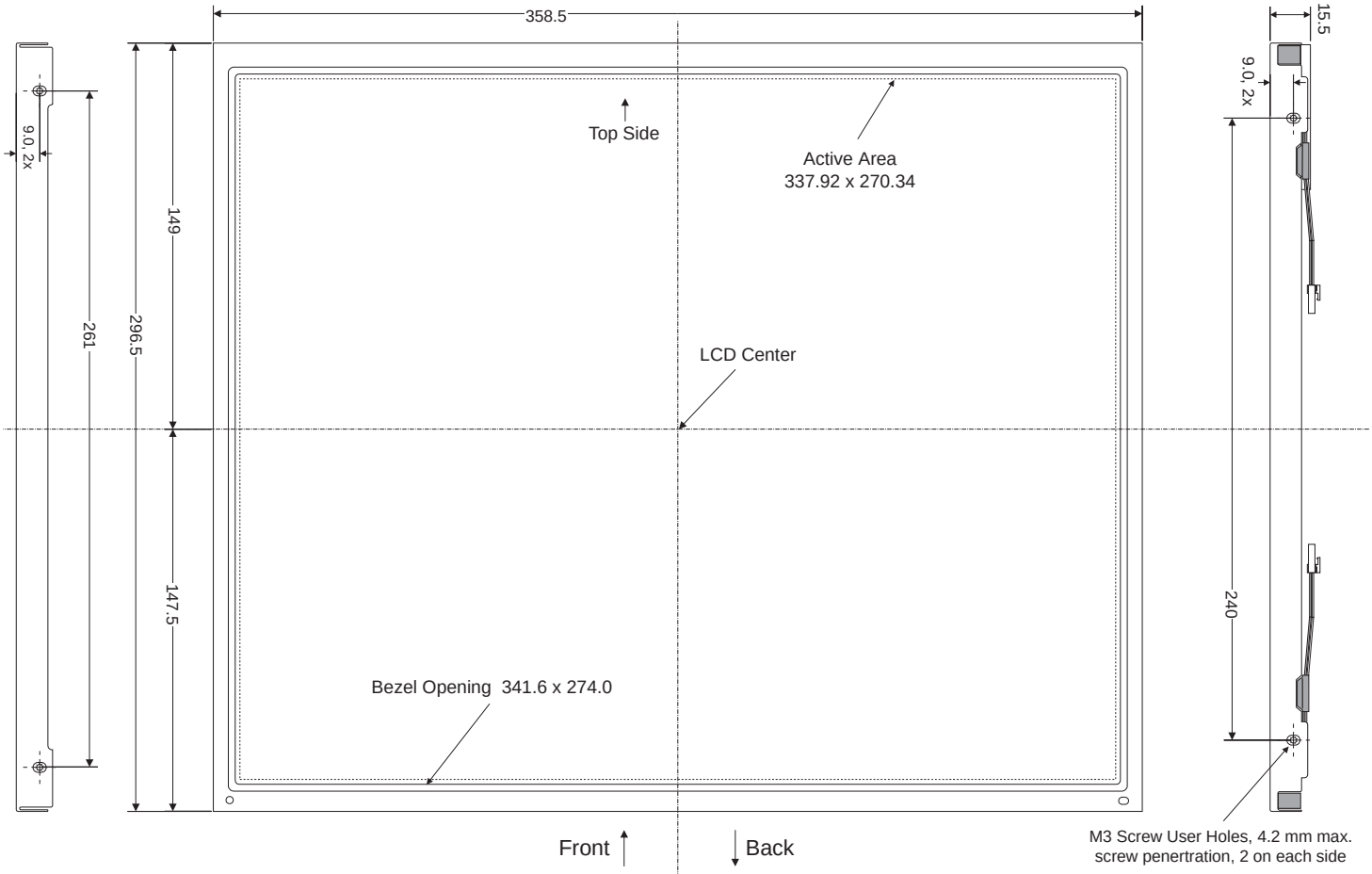
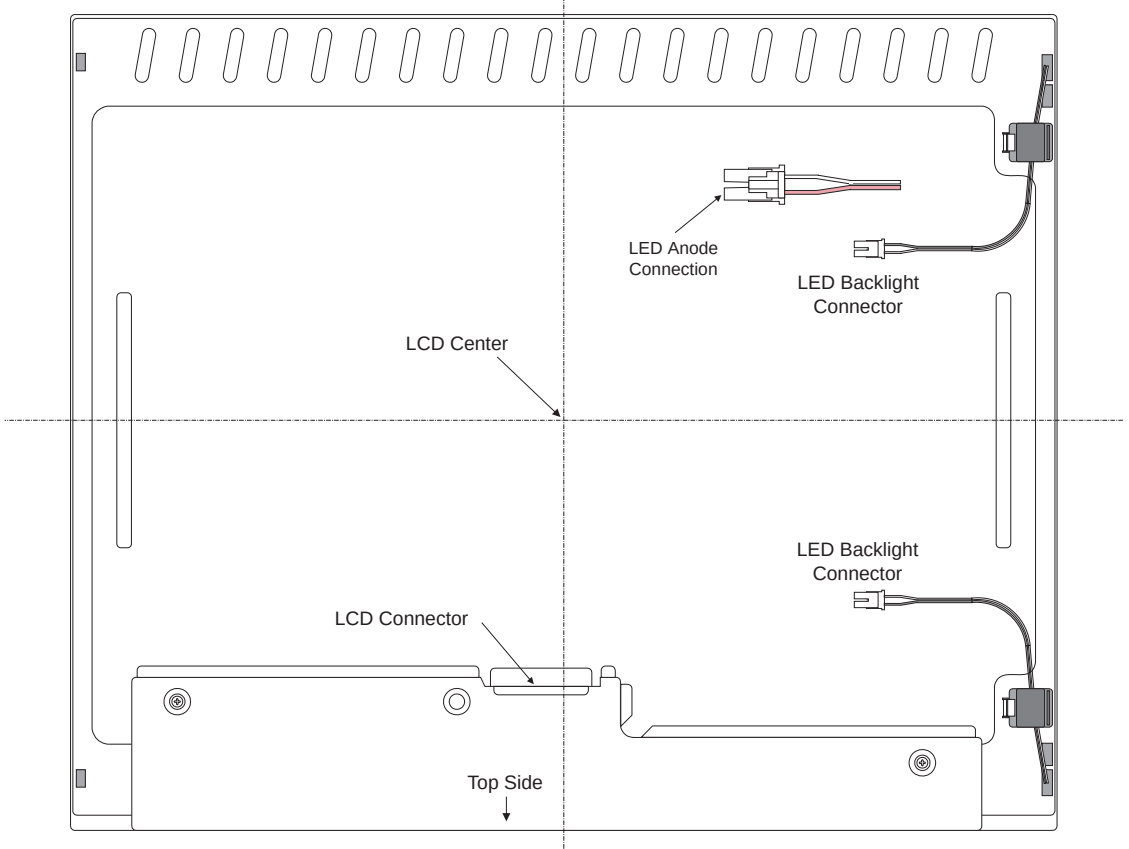
LCD Module Mechanical Dimensions





All dimensions are in mm