Rugged 10.4” LED Backlight high efficiency Sunlight Readable LCD (Model: MCH1040-IP)

Introduction

MCH1040-IP is a latest developed 10.4” LED backlight high efficiency sunlight readable LCD module. The module consists of a BOE-Hydis HV104X01-100 Amorphous silicon thin film transistor (AM TFT) addressed color LCD and a i-Tech high brightness LED edge type backlight for high screen luminance and also capable of operating under extreme temperature condition.

At the maximum backlight power of 12 Watts, the MCH1040-IP module delivers a LCD screen brightness of 1000 cd/m^2 (nits). At this brightness level, the display is highly readable under sunlight. With a wide dimming range LED drive power such as i-Tech MB-CVE2-V6, the screen brightness can be adjusted down to about 10 cd/m^2.

The MCH1040-IP module displays an excellent color image at 1024x768 resolution with 6 bits color depth for up to 262,144 colors. Coupled with its high screen luminance, the display is highly suitable for outdoor applications under rugged working condition.

Characteristics (Note 1 & 2)

Parameters	Typical Value	Units	Conditions
LCD Screen Luminance:	1000	cd/m^2	White (LCD in On state)
Luminance Uniformity	20% or better		Note 3
Backlight Power Consumption	12	Watts	Excluding power PCB losses
Screen Dimming Ratio	100:1		With BI040A inverter
Typical LCD Contrast Ratio	500		White vs. Black (measured in total dark at the normal direction)
Typical Viewing Angles			
3:00 to 9:00 direction	± 89	Degrees	Contrast ratio > 10
6:00 to 12:00 direction	± 89	Degrees	Contrast ratio > 10
3:00 to 9:00 direction	± 89	Degrees	Screen luminance >250 Cd/m2
6:00 to 12:00 direction	± 89	Degrees	Screen luminance >250 Cd/m2
LCD Screen Chromaticity			
White	x = 0.313, y = 0.329		Note 4
Red	x = 0.557, y = 0.359		Note 4
Green	x = 0.314, y = 0.556		Note 4
Blue	x = 0.155, y = 0.155		Note 4
LCD Module Weight	1260	Grams	
Operating Temp.	–10° C to 55° C or –40° C to 60° C with ITO heater glass		
Storage Temp.	–30° C to 70° C		

Note 1: Please refer to the BOE-Hydis HV104X01-100 data sheets for detail.
Note 2: All data is measured at 25°C ± 2°C ambient temperature.
Note 3: Uniformity = (Lmax - Lmin) / (Lmax + Lmin) where Lmax (Lmin) is the maximum (minimum) luminance measured with a 10 mm diameter meter aperture over the LCD active area except the last 10 mm area from the edges.
Note 4: Measured at the direction normal (perpendicular) to the LCD.

Backlight Lamp Driving Specifications

It is recommended that a constant voltage sourcing with a 9.2VDC to be used to drive the high brightness LED backlight on the MCH1040-IP module. At the maximum LCD screen luminance, the LEDs voltage and current are listed below:

Operating Voltage cross each LED 2.95 Vrms
LEDs Current (each branch) 30 mArms

At this driving condition, the backlight delivers a LCD Screen brightness of 1000 cd/m^{2}with a power consumption about 12 Watts. The constant voltage power sourcing has an efficiency between 80 - 85%, higher than CCFLs inverter, the total DC power input to it is about 14.5 to 15.5 Watts. When the LED backlight is dimmed down, the power consumption decreases.

It is quite easy to measure the LED current accurately. If you intend to run the MCH1040-IP high brightness LED backlight with your own drive power sourcing, please measure the total input current and voltage applied to LED backlight. It should not be over 1 Amp and 9.35 Volt. You also can measure the screen brightness instead, to use the brightness data to determine the correct driving condition. To do so, turn on the power sourcing to operate the backlight but do not turn on the LCD. Make sure that the room temperature is about 25 °C and run the backlight for at lease 20 minutes before measuring the screen brightness. If the measured screen brightness exceeds the specified value by a significant margin, for example, more than 10%, the LEDs are over-driven. Over-driving the LEDs can cause a significant reduction in backlight life.

Thermal Management

This high brightness edge type LED backlight consumes a significant amount of power and as a result, the temp of the LED housing will be higher, but the LCD temperature of this sunlight readable module will **NOT** be higher than normal, only the top and/or bottom parts of the LCD bezel temperature will be higher. In addition, the front surface of an LCD is a good sunlight absorber. Placing an LCD under strong direct sunlight can cause a significant temperature rise even without the extra heating from the LED backlight power.

The exact amount of temperature rise due to these two factors depends on how the LCD module is mounted and also depends on the heat dissipation design. For example, if the LCD is mounted vertically, a significant portion of the high brightness backlight heat will be dissipated into the air without heating up the LCD panel, and as a result, the LCD temperature rising will be low. On the other hand, if the LCD module is mounted horizontally, then almost all of the backlight heat rises to warm the LCD panel. However, if a small fan or a heat sink is mounted onto the high brightness backlight, the temperature rise of the LCD panel can be reduced significantly.

With the MCH1040-IP module operating at its maximum brightness, the LCD temperature rise due to the high brightness LED backlight is about 3 to 6 $^{\circ}$C only. So it would be quite easy to design a heat sink, such as connected with metal enclosure closely to dissipate the heat. But the absorption of direct sunlight, in the extreme cases, can heat up the LCD by more than 30° C! Therefore, it is recommended that the LCD temperature be measured at full display brightness in the installed equipment under actual operating environments (for example, on a summer day with full sunshine). The cooling solution should then be designed accordingly. Please make sure that the specified maximum LCD temperature is not exceeded.

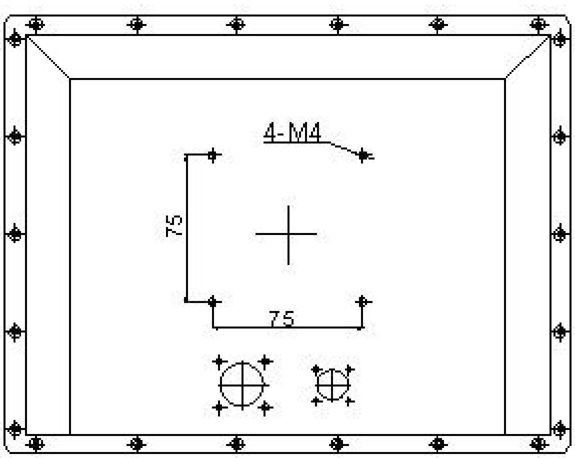
If the thermal issue becomes difficult to resolve, i-Tech recommends an “S-mode” operation. By limiting the LEDs current to 2/3 of its full level, or lower, the power consumption of the backlight is proportionally reduced and, consequently, the thermal issue may be relaxed. In the meantime, the LCD screen luminance reduced but may still be adequate for your applications. Please refer to Technical Note for further details.

Backlight Life

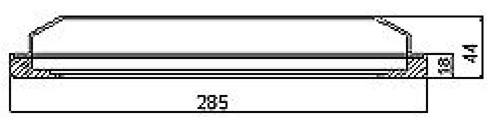
The backlight life is usually specified in half brightness life, which is the cumulative number of operating hours before the backlight luminance drops down to 50% of its initial value. The very high brightness LED backlight in the MCH1040-IP sunlight readable LCD module is rated at 50,000 hours when it is operated at the maximum brightness. The backlight life is mainly determined by the LEDs life. LED life depends strongly on the LED current. If the LEDs are operated at a reduced current, then the half brightness life of the very high brightness backlight can be extended far beyond the specified 50,000 hours.

In actual applications, a very high bright sunlight readable display will most likely be dimmed down during dusk and at night. For example, if the screen brightness of the LCD module is dimmed down to half of its full level, the LED current decreases to 25 mA (each branch) and the LED life increases to about 60,000 hours. Therefore, the actual operating lifetime of the high brightness LED backlight in an MCH1040-IP LCD module is expected to exceed 50,000 hours under most practical situations. For more detailed information on backlight life issues and actual test data on i-Tech backlights, please refer to Technical Note MBT0801.

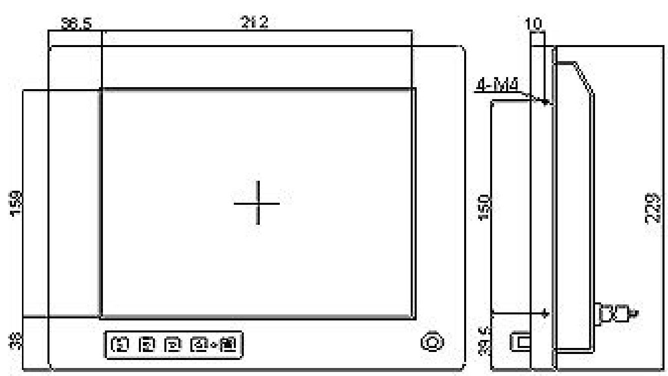
Mechanical Specifications



REAR VIEW



TOP VIEW



FRONT VIEW