TITLE : HM150X01-101

Product Specification

P0

BEIJING BOE OPTOELECTRONICS TECHNOLOGY

REVISION HISTORY

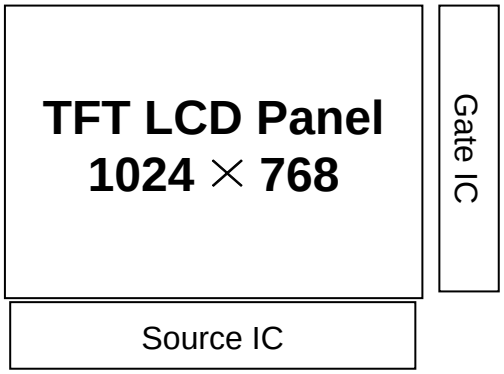
REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0	-	Initial Release	2013.12.24	Zhang Hongkun

Contents

1.0 GENERAL DESCRIPTION

1.0.1 Introduction

HM150X01-101 is a color active matrix TFT LCD module using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This module has a 15.0 inch diagonally measured active area with XGA resolutions (1024 horizontal by 768 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16,194,227 colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.0.2 Features

- LED back-light
- LED light bar replaceable
- LVDS interface
- RoHS Compliant

1.0.3 Application

- TFT-LCD Monitor
- Application

1.0.4 General Specification

< Table 1. General Specifications >

Parameter	Specification	Unit	Remarks
Active area	304.128 (H) × 228.096(V)	mm	
Number of pixels	1024(H) × 768(V)	Pixels	
Pixel pitch	0.297(H) × 0.297 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.2M	Colors	6bit+FRC
Display mode	Normally White		
Dimensional outline	326.5 (H) × 253.5(V) × 11.3(D) typ	mm	11.9max
Weight	1200	g	max
Surface treatment	Haze 25%, 3H		
Back-light	Edge side, 1-LED Lighting Bar Type		28*LED
LED life	30,000	hr	minimum

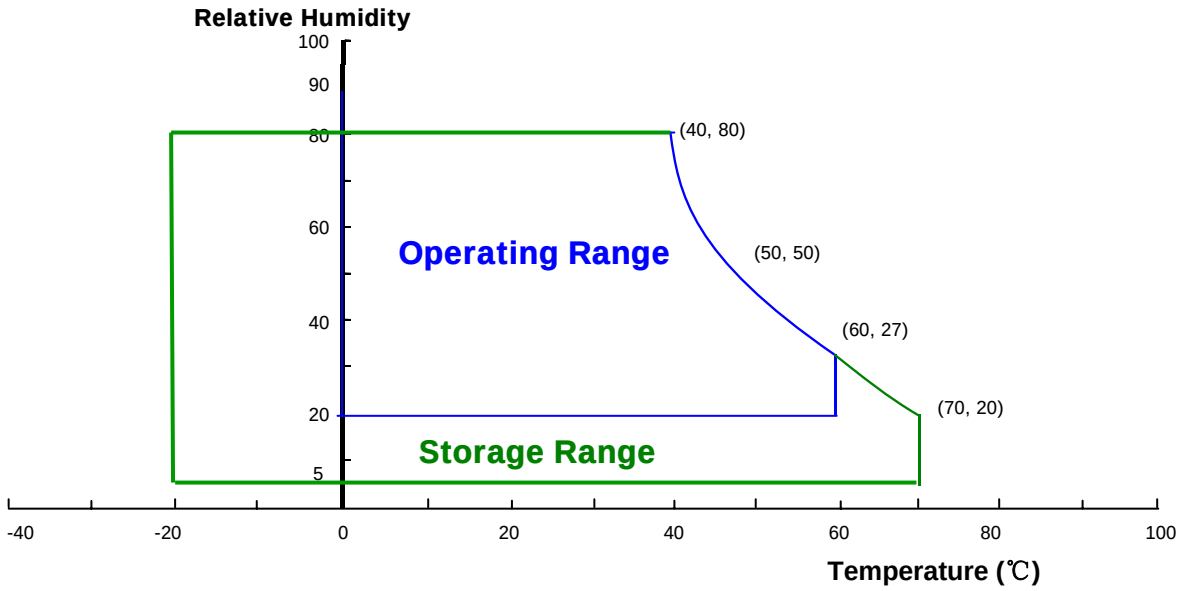
2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. LCD Module Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage (LCD Module)	V_{DD}	-0.3	3.6	V	
Back-light Power Supply Voltage	HV_{DDOUT}	-0.3	28	V	
Back-light LED Current	I_{HVDD}	60	-	mA	
Back-light LED Reverse Voltage	V_R	20.3	23.8	V	
Operating Temperature	T_{OP}	0	+60	℃	Note.1
Storage Temperature	T_{ST}	-20	+70	℃	

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.



3.0 ELECTRICAL SPECIFICATIONS

3.0.1 TFT LCD Module

< Table 3. LCD Module Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
Power Supply Input Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1
Power Supply Current	I_{DD}	-	605	730	mA	
LED Driver Power Supply Voltage	H_{VDD}	10.8	12	12.6	V	Note 2
LED Driver Power Supply Current	I_{HVDD}	-	550	657	mA	
LED Driver Efficiency	ɳ	-	81	-	%	
Positive-going Input Threshold Voltage	V_{IT+}	-		+100	mV	Vcom = 1.2V typ.
Negative-going Input Threshold Voltage	V_{IT-}	-100		-	mV	
Differential input common mode voltage	V_{com}		1.2		V	V_{IH}=100mV, V_{IL}=-100mV
Power Consumption	P_D	-	2.0	2.5	W	
	P_{BL}	-	6.4	7.5	W	
	P_{Total}	-	8.4	10.0	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.3V at 25 ℃
Max value at Black Pattern

2. Calculated value for reference (VLED X ILED)

3.2 Back-light Unit

< Table 4. LED Driving guideline specifications > Ta=25+/-2°C

Parameter			Min.	Typ.	Max.	Unit	Remarks
LED Forward Voltage		V_F	2.9	-	3.4	V	-
LED Forward Current		I_F	-	60	-	mA	-
LED Power Consumption		P_{LED}	6.01	-	7.05	W	Note 1
LED Life-Time		N/A	30,000			Hour	IF = 60mA Note 2
Power supply voltage for Back light		V_{LED}	20.3	-	23.8	V	
Power supply Current for Back light		I_{LED}	-	240	-	mA	
EN Control Level	Backlight on	V_{ENH}	1.5	-	-	V	EN logic high voltage
	Backlight off	V_{ENL}	-	-	0.8	V	EN logic low voltage
PWM Control Level	PWM High Level	V_{PML}	1.2	-	-	V	
	PWM Low Level	V_{PML}	-	-	0.4	V	
PWM Control Frequency		F_{PWM}	0.20	-	10	KHz	
Duty Ratio		-	5		100	%	

Notes : 1. Calculator Value for reference $I_{LED} \times V_{LED} \div 0.81 = P_{LED}$

2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

4.0 OPTICAL SPECIFICATION

4.0.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5A) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of Θ and Φ equal to 0°. We refer to ΘØ=0 (=Θ3) as the 3 o'clock direction (the "right"), Θ Ø=90 (= Θ12) as the 12 o'clock direction ("upward"), Θ Ø=180 (= Θ9) as the 9 o'clock direction ("left") and Θ Ø=270(= Θ6) as the 6 o'clock direction ("bottom"). While scanning Θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by BM-5A. The backlight should be operating for 10 minutes prior to measurement. VDD shall be 3.3 ± 0.3V at 25°C. Optimum viewing angle direction is 6 'clock

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 5	70	80	-	Deg.	Note 1
		Θ_9		70	80	-	Deg.	
	Vertical	Θ_{12}		70	80	-	Deg.	
		Θ_6		70	80	-	Deg.	
	Horizontal	Θ_3	CR > 10	70	80	-	Deg.	
		Θ_9		70	80	-	Deg.	
	Vertical	Θ_{12}		60	70	-	Deg.	
		Θ_6		50	60	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	400	700	-		Note 2
Luminance of White	9points max	Y_w	Θ = 0°	250	300	-	cd/m^2	Note 3
White Luminance uniformity	9 Points	Δ Y9		75	80	-	%	Note 4
Reproduction of color	White	Wx	Θ = 0°	Typ -0.03	0.313	Typ +0.03		Note 5
		Wy			0.329			
	Red	R_x		Typ. -0.03	0.646	Typ. +0.03		
		R_y			0.343			
	Green	G_x			0.311			
		G_y			0.577			
	Blue	B_x			0.148			
		B_y			0.120			
Response Time		T_{RT}	Ta= 25° C Θ = 0°	-	8	12	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Luminance of white is defined as luminance values of 9point max across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. The luminance is measured by BM-5A when the LED current is set at 60mA.

4. The White luminance uniformity on LCD surface is then expressed as : ΔY = Minimum Luminance of 9 points / Maximum Luminance of 9 points (see FIGURE 2).

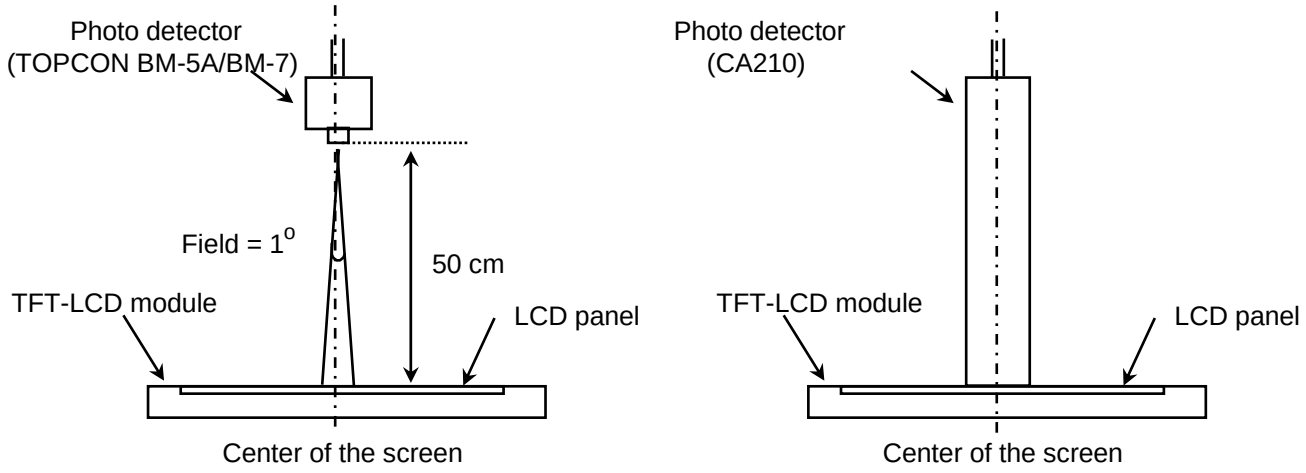
5. The color chromaticity coordinates specified in Table 5. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark. (See FIGURE 4).

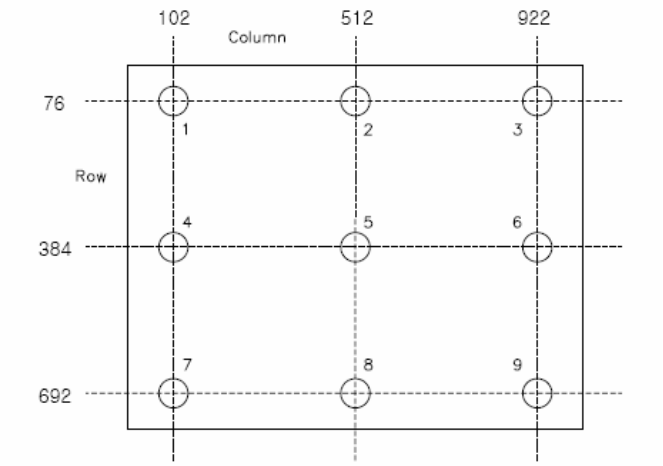
4.0.2 Optical measurements

Figure 1. Measurement Set Up



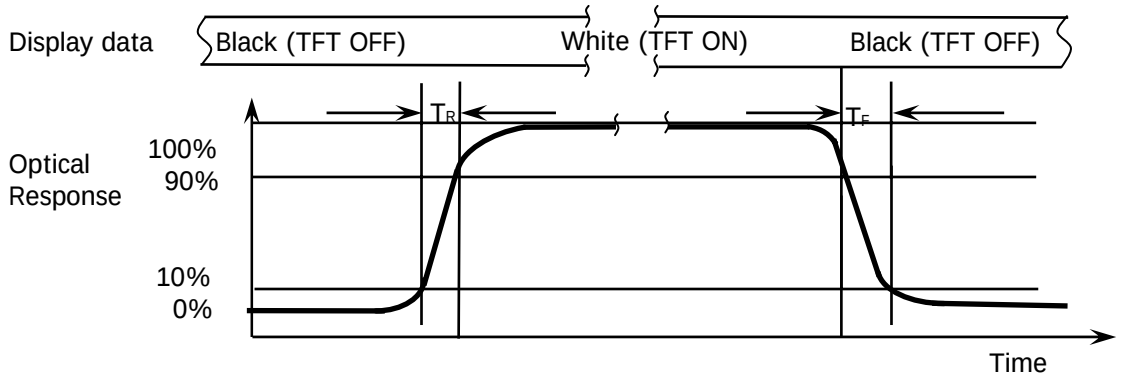
View angel range, uniformity, etc. measurement setup Flicker, measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



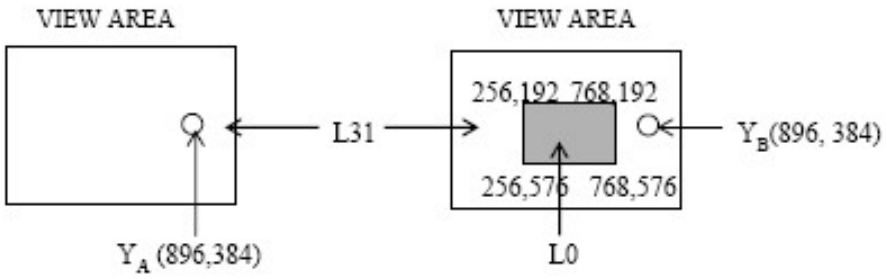
Luminance of white is defined as luminance values of max 9 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
The White luminance uniformity on LCD surface is then expressed as : ΔY9 = Minimum Luminance of 9 points / Maximum Luminance of 9points (see FIGURE 2).

Figure 3. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 3 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.

Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:

YA = Initial luminance of measured area (cd/m2)

YB = Subsequent luminance of measured area (cd/m2)

The location measured will be exactly the same in both patterns

5.0 INTERFACE CONNECTION.

5.0.1 Electrical Interface Connection

The electronics interface connector is DF14H-20P-1.25H.
The LED connector is MSB24038P5
The connector interface pin assignments are listed in Table 6 and 7.

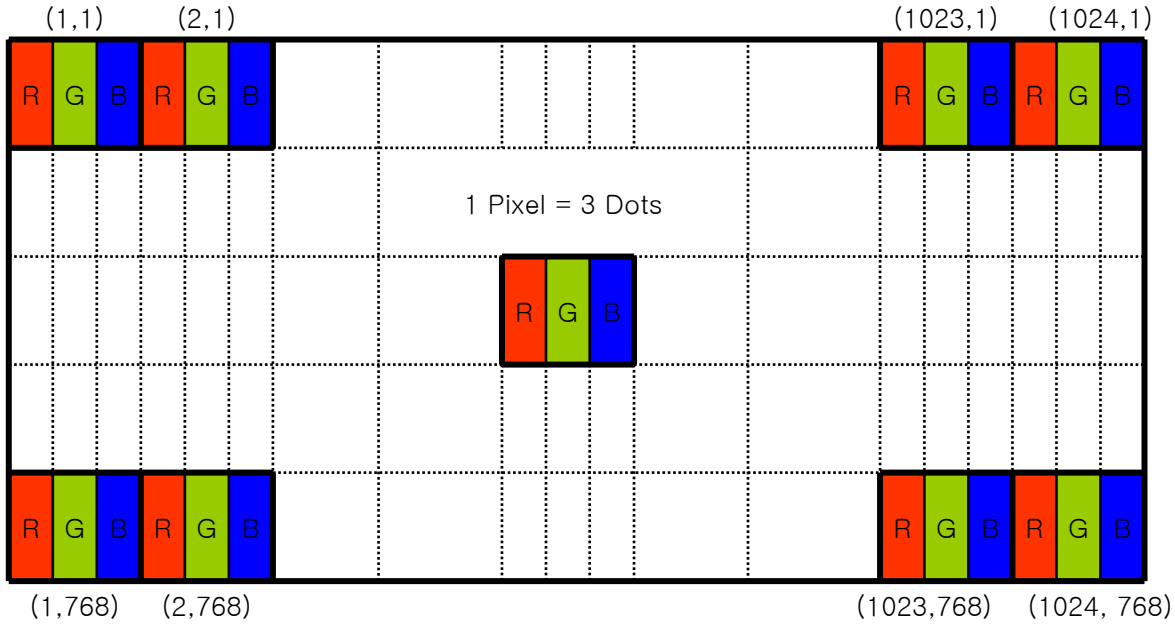
<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	VDD	Power Supply,3.3V(typical)
2	VDD	Power Supply,3.3V(typical)
3	VSS	Ground
4	VSS	Ground
5	RIN0-	-LVDS differential data input(R0-R5,G0)
6	RIN0+	+LVDS differential data input(R0-R5,G0)
7	VSS	Ground
8	RIN1-	-LVDS differential data input(G1-G5,B0-B1)
9	RIN1+	+LVDS differential data input(G1-G5,B0-B1)
10	VSS	Ground
11	RIN2-	-LVDS differential data input(B2-B5,HS,VS,DE)
12	RIN2+	+LVDS differential data input(B2-B5,HS,VS,DE)
13	VSS	Ground
14	CLKIN-	-LVDS differential clock input
15	CLKIN+	+LVDS differential clock input
16	VSS	Ground
17	RIN3-	-LVDS differential data input(R6-R7,G6-G7,B6-B7)
18	RIN3+	+LVDS differential data input(R6-R7,G6-G7,B6-B7)
19	VSS	Ground
20	VSS	Ground

<Table 7. Pin Assignments for the LED Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	VCC	12V
2	GND	GND
3	Enable	5V-On / 0V-Off
4	Dimming	PWM Dimming
5	NC	No Connection

5.2 Data Input Format



Display Position of Input Data (V-H)

6.0 SIGNAL TIMING SPECIFICATION

6.0.1 The HM150X01-101 is operated by the DE only.

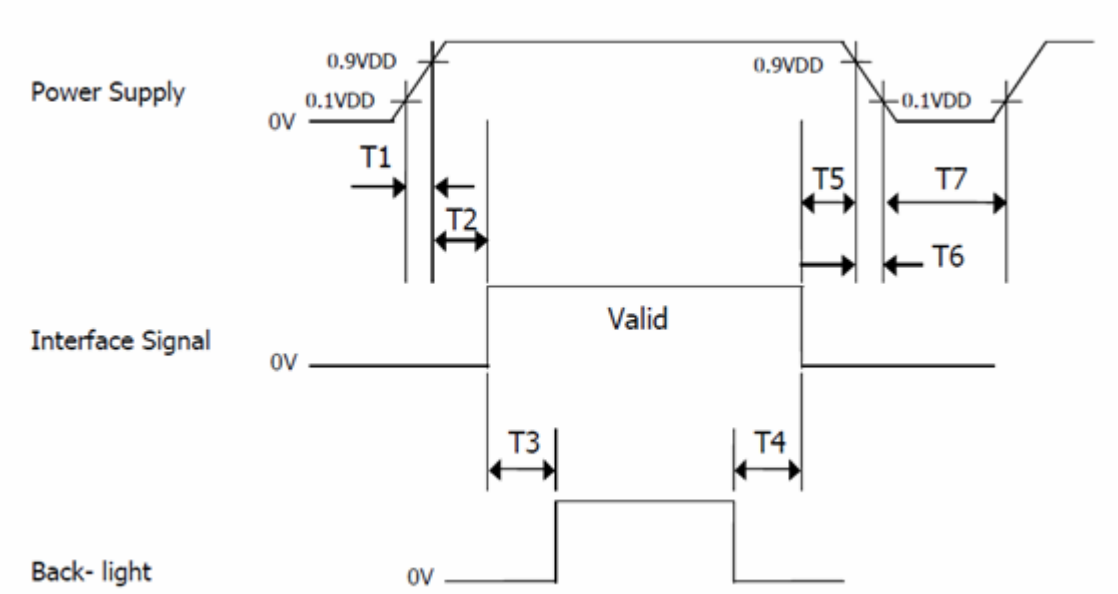
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Horizontal display area	thd		1024		pixel
HSYNC period time	th	1102	1344	2046	pixel
HSYNC blanking	thb+ thfp	78	320	1022	pixel
Vertical display area	Tvd		768		H
VSYNC period time	Tv	772	806	1022	H
VSYNC blanking	Tvb+ Tvfp	4	38	254	H

7.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

8.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



Parameter	Values			Units
	Min	Typ	Max	
T1	0	-	10	ms
T2	0	-	50	ms
T3	200	-	-	ms
T4	500	-	-	ms
T5	0	-	50	ms
T6	0	-	10	ms
T7	500	-	-	ms

Notes:

1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

9.0 MECHANICAL CHARACTERISTICS

9.0.1 Dimensional Requirements

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	304.128 (H) × 228.096(V)	mm
Number of pixels	1024(H) X768 (V) (1 pixel = R + G + B dots)	
Pixel pitch	0.297(H) × 0.297 (V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	16.2M (6bit+FRC)	colors
Display mode	Normally White	
Dimensional outline	326.5 (H) × 253.5(V) × 11.3(D) (typ)	mm
Weight	1200 (max)	gram
Back-light	Edge side, 1-LED Lighting Bar Type	
LED life	30,000 (minimum)	hr

9.0.2 Mounting

See FIGURE 5&6.

9.0.3 Glare and Polarizer Hardness.

The surface of the LCD has a hard coating to reduce scratching.

9.0.4 Light Leakage

There shall not be obvious light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 150lux.

10.0 RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

<Table 9. Reliability test>

Item		Test condition
High temperature storage		70 ℃, 240 hrs
Low temperature storage		-20 ℃, 240 hrs
High temperature & high humidity operation		50 ℃, 80%RH, 240hrs
High temperature operation		60 ℃, 240hrs
Low temperature operation		0℃, 240hrs
Thermal shock		0 ℃ ↔ 50 ℃ (0.5 hr), 100 cycle
Vibration test	Frequency	10/ 500/10 Hz,Sine X/Y/Z Direction
	Gravity / AMP	1.5 G
	Period	±X, ±Y, ±Z 30 min
Shock test	Gravity	50G
	Pulse width	11msec, sine wave
	Direction	±X, ±Y, ±Z
On/Off test		On/10 sec, Off/10 sec, 30,000 cycles
ESD	Air	± 15KV, 150pF(330) 1sec, 8 points, 25 times/ point
	Contact	± 8KV, 150pF(330) 1sec, 8 points, 25 times/ point

11.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module
- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.

12.0 LABEL

(1) Product label

1	2	3	4	5	6	7
X X	X	X	X X	1	0 0 X X	X X X X X X

Type designation

No 1. Control Number

No 2. Rank / Grade

No 3. Line classification (BOE OT:A/BC)

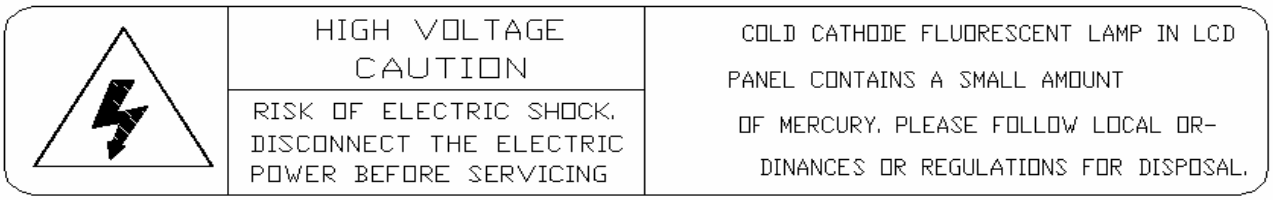
No 4. Year (10 : 2010, 11: 2011, ...)

No 5. Month (1, 2, 3, ..., 9, X, Y, Z)

No 6. Product Identification (FG)

No 7. Serial Number

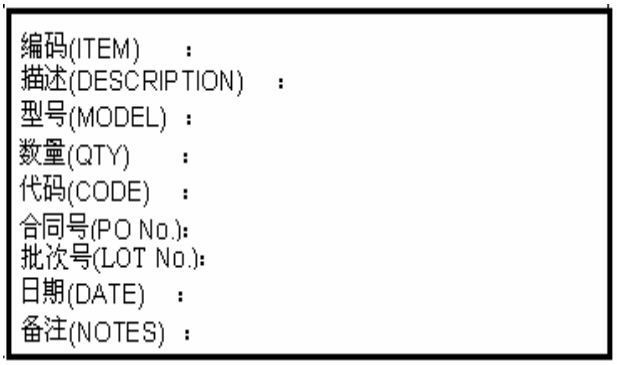
(2) High voltage caution label



(3) Box label

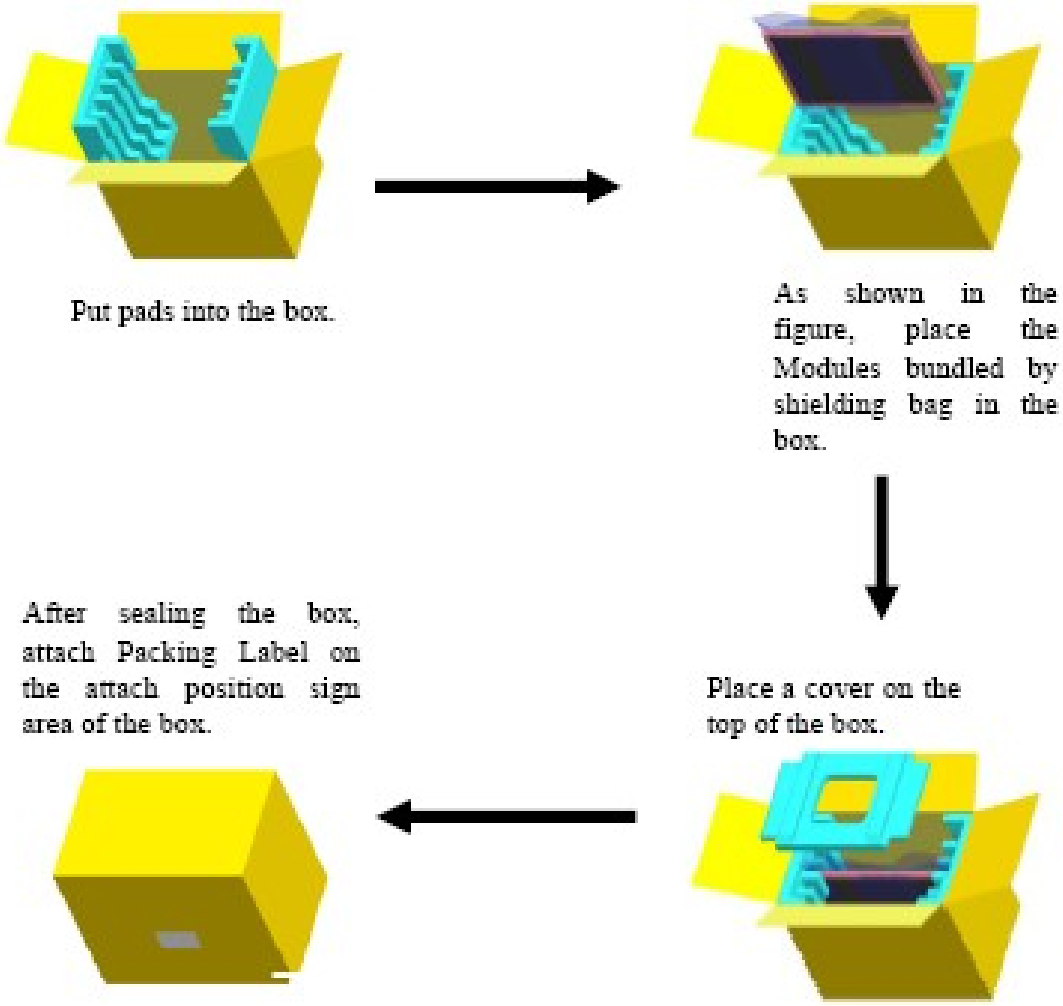
Label Size: Label 1：165 mm (L) × 102 mm (W)
Label 2： 100 mm (L) × 70 mm (W)
Contents
Model: HM150X01-101
Q`ty: Module Q`ty in one box
Date: Packing Date
Internal use of Product

Label 1



Label 2

13.0 PACKING INFORMATION



14.0 MECHANICAL OUTLINE DIMENSION

Figure 5. TFT-LCD Module Outline Dimension (Front View)

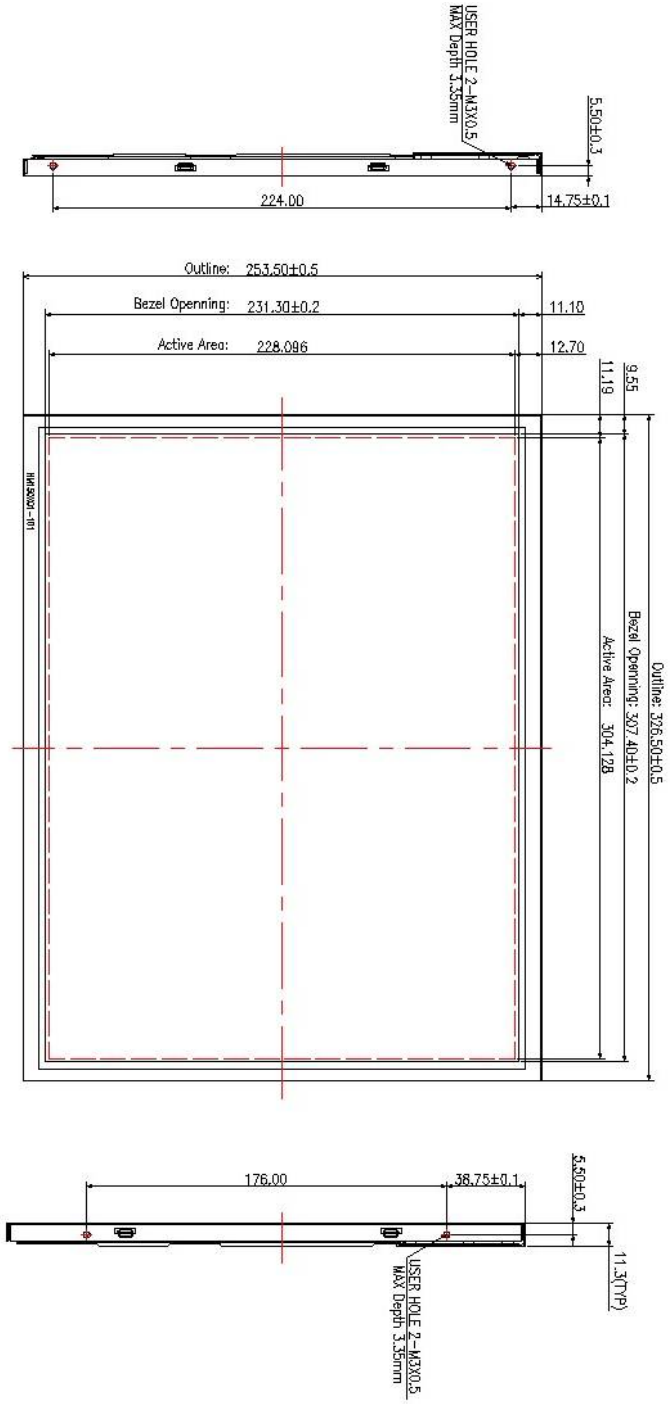


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)