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TITLE : HV121WX4-120

Product Specification for Customer

Rev. A

HYDIS Technologies

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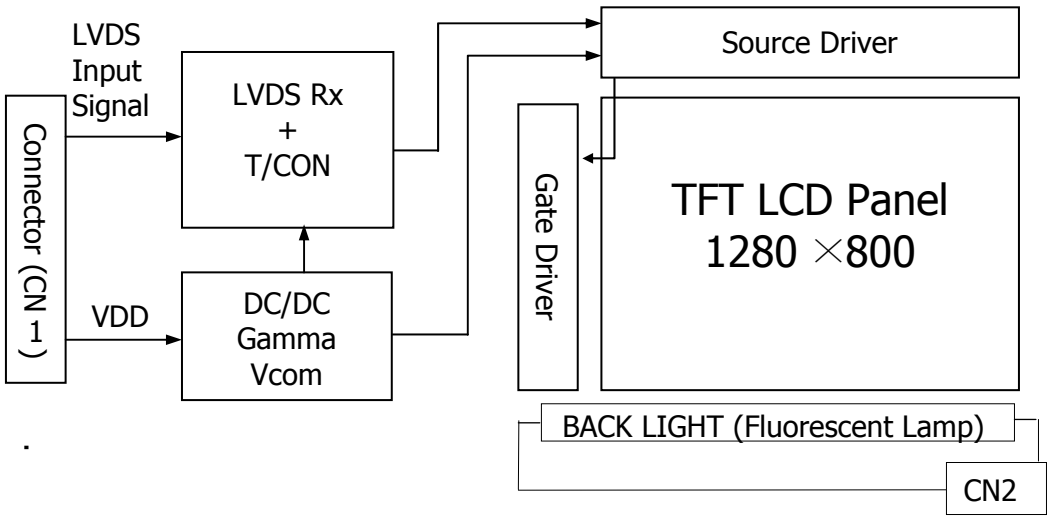
1.0 GENERAL DESCRIPTION

1.1 Introduction

HV121WX4-120 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 12.1 inch diagonally measured active area with WXGA resolutions (1280 horizontal by 800 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 262,144 colors. The TFT-LCD panel used for this module is a low reflection and higher color type.



1.2 Features

- Thin and light weight
- 3.3 V power supply
- Low driving voltage and low power consumption
- 1 Channel LVDS Interface
- Single CCFL (Bottom side/Horizontal Direction)
- 262,144 colors
- Data enable signal mode
- Side Mounting Frame
- On Board EDID chip
- RoHS Product
- VESA V2 Compatible except for thickness
- AG150T polarizer product

1.3 Application

- Tablet PC

1.4 General Specifications

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	261.12 (H) ×163.20 (V)	mm	
Number of pixels	1280 (H) ×800 (V)	pixels	
Pixel pitch	0.204 (H) ×0.204 (V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	262,144	colors	
Display mode	Normally Black		
Dimensional outline	275.8±0.5(W) ×178.0±0.5(V) × 6.4 Typ D (6.7 Max)	mm	
Luminance of White	200 (Typ.)	Cd/m²	at 5points
Weight	290 (Typ.) / 300 (Max.)	g	
EBL	3.0 (Typ.)	W	At 60nit
Back-light	CCFL, Horizontal-lamp type		Note 1

Note 1: CCFL (Cold Cathode Fluorescent Lamp)

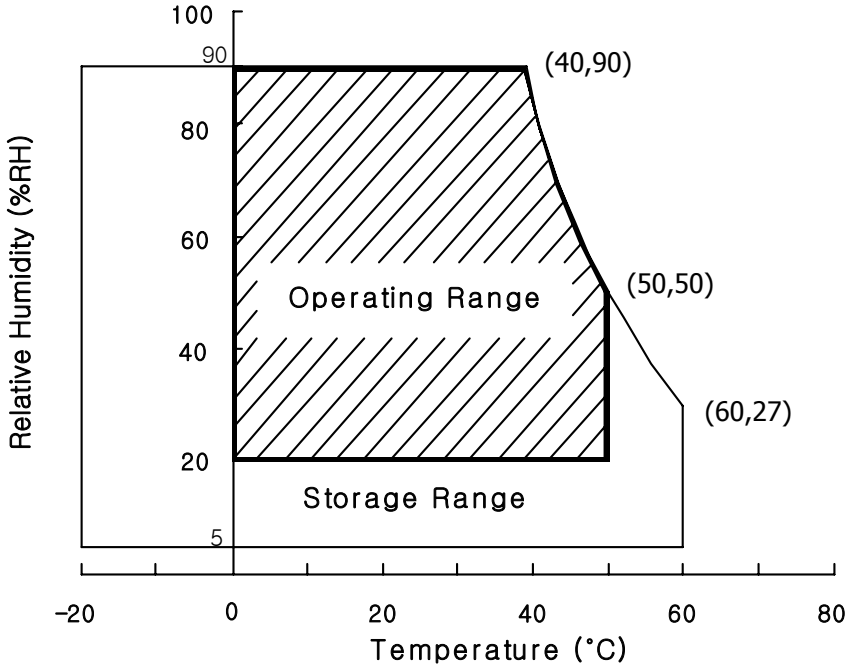
2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit.

< Table 2. Absolute Maximum Ratings>

Parameter	Symbol	Min.	Max.	Unit	Remarks
Logic Power Supply	V_{DD}	VSS-0.3	4.0	V	Ta = 25 ±2 ℃
Logic Input Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
Back-light Lamp Current	IBL	2.0	7.0	mA	
Back-light Frequency	FBL	45	80	KHz	
Operating Temperature	T_{OP}	0	+50	℃	Note 1
Storage Temperature	T_{SP}	-20	+60	℃	

Note 1. Temperature and relative humidity range are shown in the figure below.
* 90 [%] RH Max. (40℃ ≥Ta)
* Maximum wet-bulb temperature at 39 ℃ or less. (Ta＞40℃) No condensation



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications > [Ta = 25±2℃]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	Note1
Power Supply Current	I_{DD}		330		mA	Note1
CCFL Ignition Time	t			1	sec	
High Level Differential Input Signal Voltage	V_{IH}		-	+100	mV	
Low Level Differential Input Signal Voltage	V_{IL}	-100	-		mV	
Back-light Lamp Voltage	V_{BL}	760	580	540	V_{rms}	Note2
Back-light Lamp Current	I_{BL}	2.0	6.0	7.0	mA	
Back-light Lamp operating Frequency	F_L	45		80	KHz	One Lamp, Note3
Lamp Start Voltage		1,120			V_{rms}	At Ta=25℃, Note4
		1,350			V_{rms}	At Ta=0℃, Note4
Lamp Life		10,000	15,000		Hrs	I_{BL}= 7mA, Note5
Extended Battery Life	P_D		1.0		W	At Mosaic pattern
	P_{BL}		2.0		W	At 60nit
	P_{total}		3.0		W	
Power Consumption	P_D		1.1		W	Note1
	P_{BL}		3.5	3.85	W	I_{BL}=6mA, Note6
	P_{total}		4.6		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℃.
a) Typ: Windows XP desktop Pattern b) Max: V2 Skip Pattern

2. Reference value, which is measured with Samsung Electric SIC-180 Inverter.
(VBL Min is value at IBL Min and VBL Max is value at IBL Max)

3. The lamp frequency should be selected as different as possible from the horizontal synchronous frequency and its harmonics to avoid interference which may cause line flow on the display.

4. For starting the backlight unit, the output voltage of DC/AC's transformer should be larger than the minimum lamp starting voltage.(1,120 Vrms at 25 ℃ & 1,350 Vrms at 0 ℃)
If an inverter has shutdown function it should keep its output for more than 1 second even if the lamp connector open. Otherwise the lamps may not to be turned on.

5. End of Life shall be determined by the time when any of the following is satisfied under continuous lighting at 25℃ and IBL = 7.0[mA].
• Intensity drops to 50% of the Initial Value.

6. Calculated value for reference (VBL × IBL)

4.0 OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCONE BM-5) 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 $\Theta_{Ø=0}$ (= Θ_3) as the 3 o'clock direction (the "right"), $\Theta_{Ø=90}$ (= Θ_{12}) as the 12 o'clock direction ("upward"), $\Theta_{Ø=180}$ (= Θ_9) as the 9 o'clock direction ("left") and $\Theta_{Ø=270}$(= Θ_6) 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 backlight should be operating for 30 minutes prior to measurement... VDD shall be 3.3+/- 0.3V at 25°C. Optimum viewing angle direction is 6 o'clock.

4.2 Optical Specifications

<Table 4. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10		89	90	Deg.	Note 1
		Θ_9			89	90	Deg.	
	Vertical	Θ_{12}			89	90	Deg.	
		Θ_6			89	90	Deg.	
Luminance Contrast ratio		CR	Θ = 0°	400	500			Note 2
Luminance of White	5 Points	Y_w	Θ = 0° IBL = 6mA	170	200		cd/m²	
White Luminance uniformity	5 Points	ΔY5		80	85		%	Note 3
	13 Points	ΔY13		65	75			
White Chromaticity		x_w	Θ = 0°	0.273	0.303	0.333		Note 4
		y_w		0.298	0.328	0.358		
Reproduction Of color	Red	x_R	Θ = 0°	0.554	0.584	0.614		
		y_R		0.310	0.340	0.370		
	Green	x_G		0.272	0.302	0.332		
		y_G		0.523	0.553	0.583		
	Blue	x_B		0.116	0.146	0.176		
		y_B		0.111	0.141	0.171		
Response Time	Rise	T_r	Ta= 25° C Θ = 0°		28		ms	Note 5
	Decay	T_d						
Cross Talk		CT	Θ = 0°			2.0	%	Note 6

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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 shown in Appendix).

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 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. The White luminance uniformity on LCD surface is then expressed. (See FIGURE 2 shown in Appendix).

$$\text{Uniformity } \Delta Y = \frac{\text{Minimum Luminance of 5(or 13) points}}{\text{Maximum Luminance of 5(or 13) points}} \times 100\ (\%)$$

4. The color chromaticity coordinates specified in Table 4 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.

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

6. 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 shown in Appendix).

5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

<Table 5. Pin Assignments for the Interface Connector>

CN1	Interface connector	Hirose/DF19KR-20P-1H or equivalent
	User side connector	Hirose/DF19G-20S-1C or equivalent

Pin No	Symbol	Function	Remark
1	VSS	Ground	
2	VDD1	Power Supply: +3.3V	
3	VDD2	Power Supply: +3.3V	
4	Vdd_EDID	EDID +3.3V	
5	NC	Reserved	
6	Clk_EDID	EDID Clk	
7	Clk_Data	EDID Data	
8	RIN0-	LVDS Negative data signal (-)	Tx pin # 48
9	RIN0+	LVDS Positive data signal (+)	Tx pin # 47
10	VSS	Ground	
11	RIN1-	LVDS Negative data signal (-)	Tx pin # 46
12	RIN1+	LVDS Positive data signal (+)	Tx pin # 45
13	VSS	Ground	
14	RIN2-	LVDS Negative data signal (-)	Tx pin # 42
15	RIN2+	LVDS Positive data signal (+)	Tx pin # 41
16	VSS	Ground	
17	RCLKIN-	LVDS Negative clock signal (-)	Tx pin # 40
18	RCLKIN+	LVDS Positive clock signal (+)	Tx pin # 39
19	VSS	Ground	
20	VSS	Ground	

5.2. Back-light Interface

CN2	Interface Connector	•: BHSR-02VS-1 (JST) or equivalent

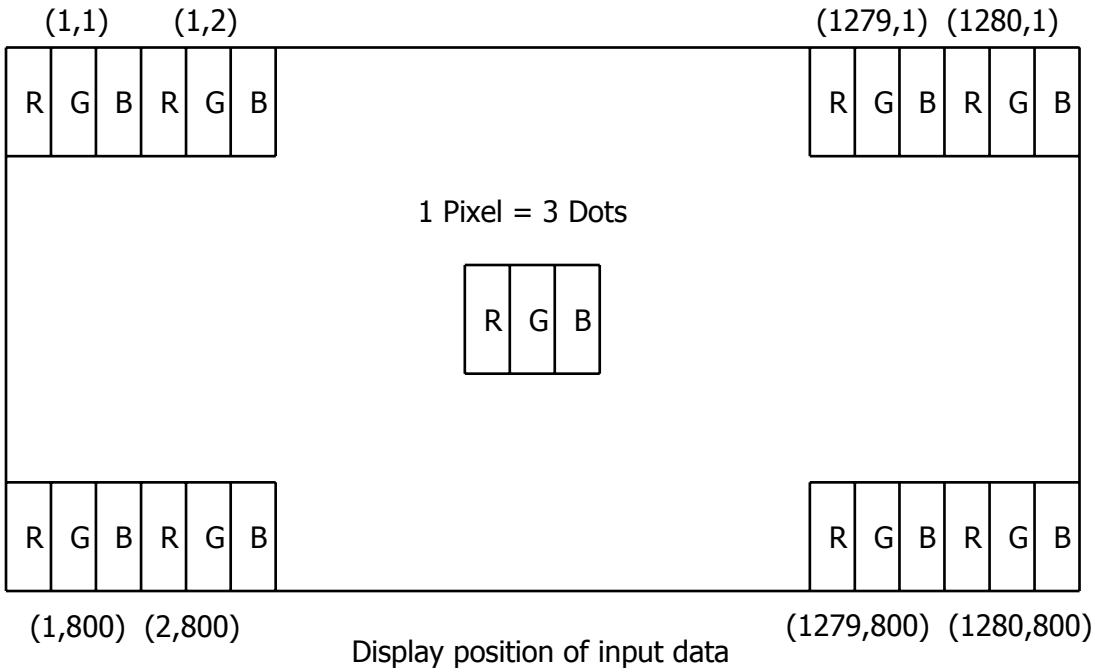
Pin No	INPUT	Function	Remarks
1	HOT	High voltage	Pink
2	COLD	Ground	Black

5.3. LVDS Interface

LVDS Transmitter: THC63LVDM83A or equivalent.

Input signal	Transmitter		Interface		DF19KR-20P-1H	Remark
	Pin No	Pin No	System (Tx)	TFT-LCD (Rx)	Pin No.	
R0	51	48 47	OUT0- OUT0+	IN0- IN0+	5 6	
R1	52					
R2	54					
R3	55					
R4	56					
R5	3					
G0	4					
G1	6	46 45	OUT1- OUT1+	IN1- IN1+	8 9	
G2	7					
G3	11					
G4	12					
G5	14					
B0	15					
B1	19					
B2	20	42 41	OUT2- OUT2+	IN2- IN2+	11 12	
B3	22					
B4	23					
B5	24					
HSYNC	27					
VSYNC	28					
DE	30					
MCLK	31	40	CLKOUT-	CLKIN-	14	
		39	CLKOUT+	CLKIN+	15	

5.4. Data Input Format



Display position of input data

6.0. SIGNAL TIMING SPECIFICATIONS

6.1 HV121WX4-100 is operated by the only DE (Data enable) mode (LVDS Transmitter Input)

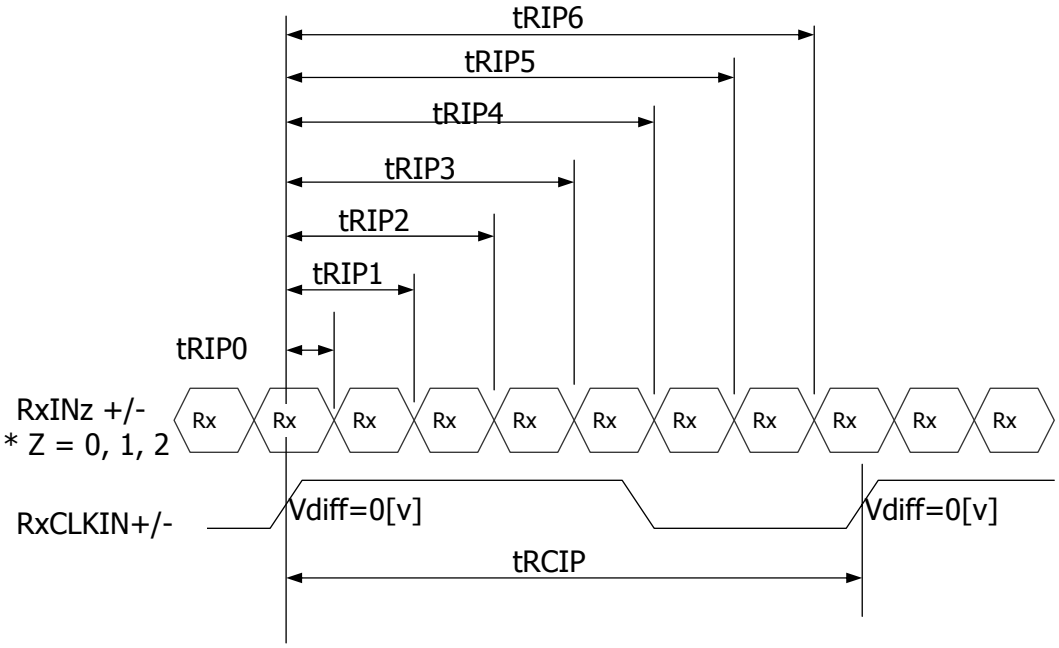
Item	Symbols	Min	Typ	Max	Unit
Frame Period	T1	804	823	-	lines
Vertical Display Period	T2	-	800	-	lines
One Line Scanning Period	T3	1350	1440	-	clocks
Horizontal Display Period	T4	-	1280	-	clocks
Clock Frequency	1/T5	-	71.11	-	MHz

6.2. LVDS Rx interface timing parameter

The specification of the LVDS Rx interface timing parameter

<LVDS Rx Interface Timing Specification>

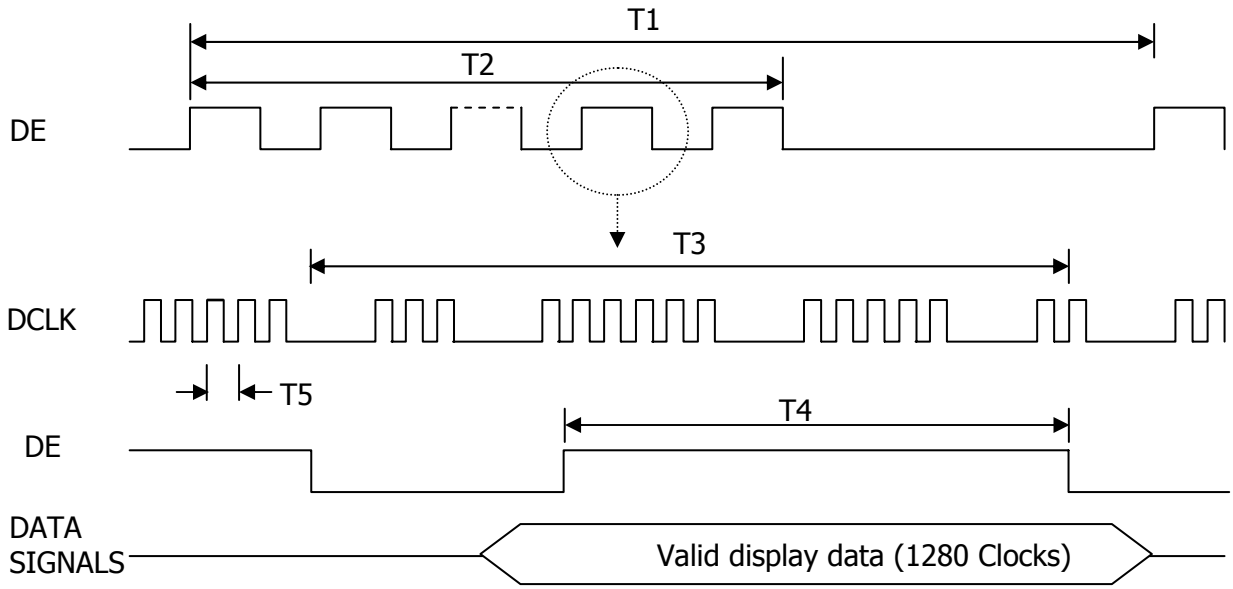
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	12.5	14.06	25.00	nsec	
Input Data 0	tRIP0	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP1	tRICP/7-0.4	tRICP/7	tRICP/7+0.4	nsec	
Input Data 2	tRIP2	2 ×tRICP/7-0.4	2 ×tRICP/7	2 ×tRICP/7+0.4	nsec	
Input Data 3	tRIP3	3 ×tRICP/7-0.4	3 ×tRICP/7	3 ×tRICP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRICP/7-0.4	4 ×tRICP/7	4 ×tRICP/7+0.4	nsec	
Input Data 5	tRIP5	5 ×tRICP/7-0.4	5 ×tRICP/7	5 ×tRICP/7+0.4	nsec	
Input Data 6	tRIP6	6 ×tRICP/7-0.4	6 ×tRICP/7	6 ×tRICP/7+0.4	nsec	



* Vdiff = (RINz+)-(RINz-), (RCLKIN+)-(RCLKIN-)

7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL (DE MODE)

7.1 Timing Waveforms of Interface Signal



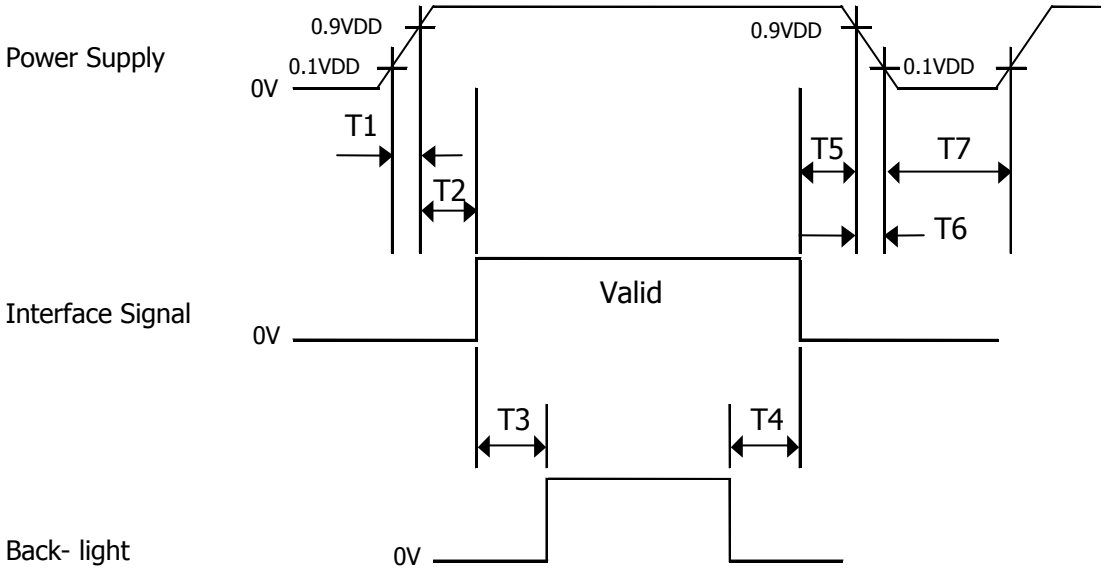
8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Each color is displayed in sixty-four gray scales from a 6 bit data signal input. A total of 262,144 colors are derived from the resultant 18 bit data.

Colors & Gray Scale		Red Data						Green Data						Blue Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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	1	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	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	1	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	▽	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	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	1
	Darker	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	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Gray Scale Of White & Black	Black	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	1	0	0	0	0	0	1
	Darker	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
	△	↓						↓						↓					
	▽	↓						↓						↓					
	Brighter	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1
	▽	1	1	1	1	1	0	1	1	1	1	1	0	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

9.0 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



- 0 < T1 ≤ 10 ms
- 0 < T2 ≤ 50 ms
- 200 ms ≤ T3
- 200 ms ≤ T4
- 0 ≤ T5 ≤ 50ms
- 0 ≤ T6 ≤ 10ms
- 500ms ≤ T7

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.
3. Back Light must be turn on after power for logic and interface signal are valid.

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 5, 6 shown in appendix shows mechanical outlines for the model.

Parameter	Specification	Unit
Active area	261.12 (H) ×163.20 (V)	mm
Number of pixels	1280(H) ×800(V)	pixels
	(1 pixel = R + G + B dots)	
Pixel pitch	0.204(H) ×0.204(V)	mm
Pixel arrangement	RGB Vertical stripe	
Display colors	262,144	colors
Display mode	Normally Black	
Dimensional outline	275.8±0.5(W) ×178.0±0.5(V) × 6.4 Typ D (6.7 Max)	mm
Weight	290 (Typ.) / 300 (Max.)	g
Back-light	CCFL, Horizontal-lamp type	

10.2 Mounting

See FIGURE 5. (shown in Appendix)

10.3 AG150T Polarizer.

The surface of the LCD has an anti-glare coating to minimize reflection

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50 cm from the screen with an overhead light level of 150lux. The manufacture shall furnish limit samples of the panel showing the light leakage acceptable.

11.0 RELIABLITY TEST

No	Test Items	Conditions
1	High temperature storage test	Ta = 60 °C, 240 hrs
2	Low temperature storage test	Ta = -20 °C, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 240hrs
4	High temperature operation test	Ta = 50 °C, 240 hrs
5	Low temperature operation test	Ta = 0 °C, 240 hrs
6	Thermal shock	Ta = -20 °C ↔ 60 °C (30 min), 100 cycle
7	Vibration test (non-operating)	Frequency : 10~500Hz Gravity/AMP : 1.5G Period : X,Y,Z 30min
8	Shock test (non-operating)	Gravity : 220G Pulse width : 2ms, half sine wave ±X, ±Y, ±Z Once for each direction
9	Electro-Static Discharge Test (non-operating)	Air : 150pF, 330ohm, 15KV Contact : 150pF, 330ohm, 8KV

12.0 HANDLING & CAUTIONS

12.1 Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

12.2 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 backlight 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.

12.3 Cautions for the operation

- When the module is operating, do not lose MCLK, DE signals. If any one of these signals were lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence were applied, the module would be damaged.

12.4 Cautions for the atmosphere

- Dewdrop 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.

12.5 Cautions for the module characteristics

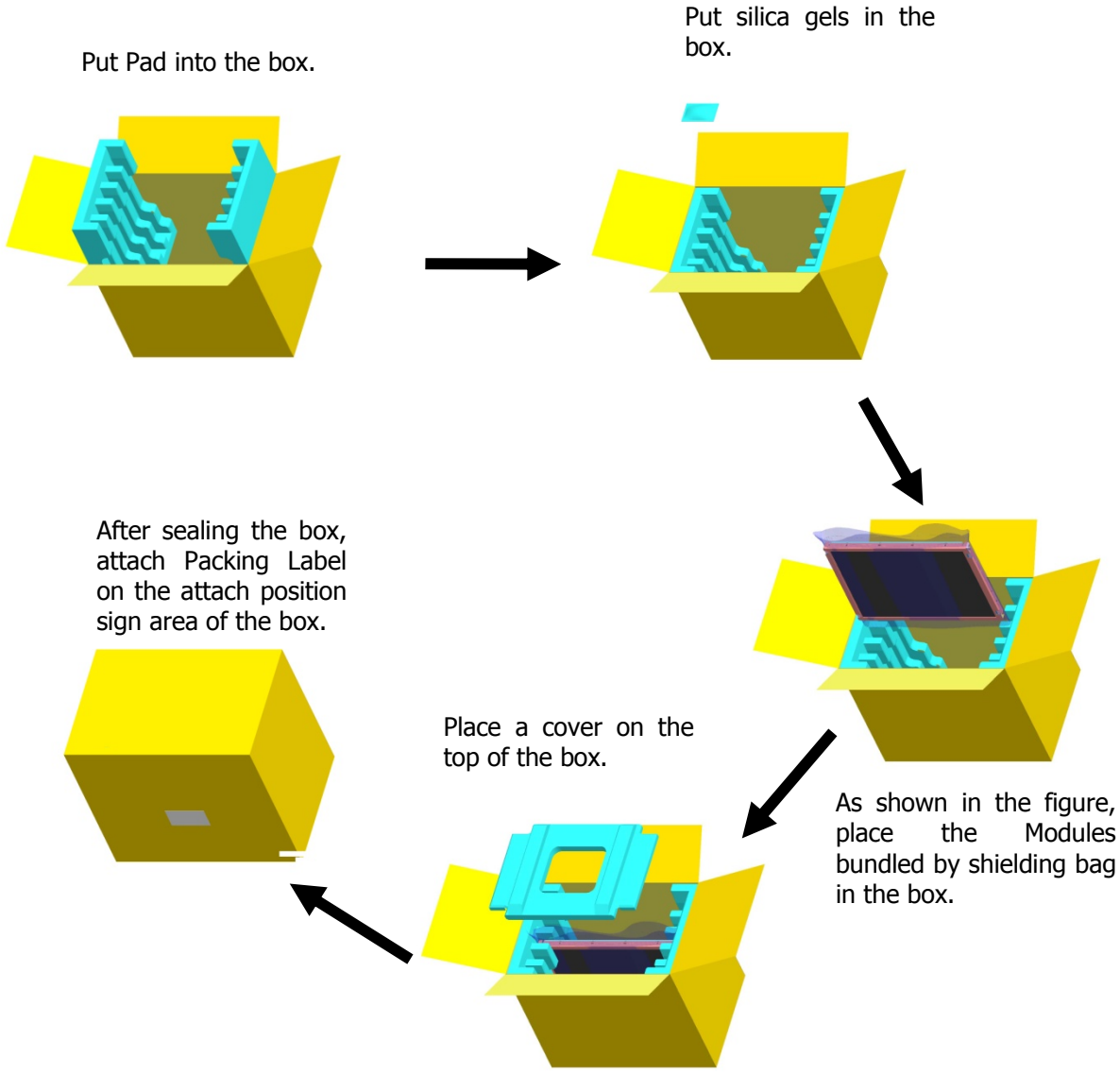
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

12.6 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 using the original shipping packages.

13.0 PACKING

13.1 Packing Order



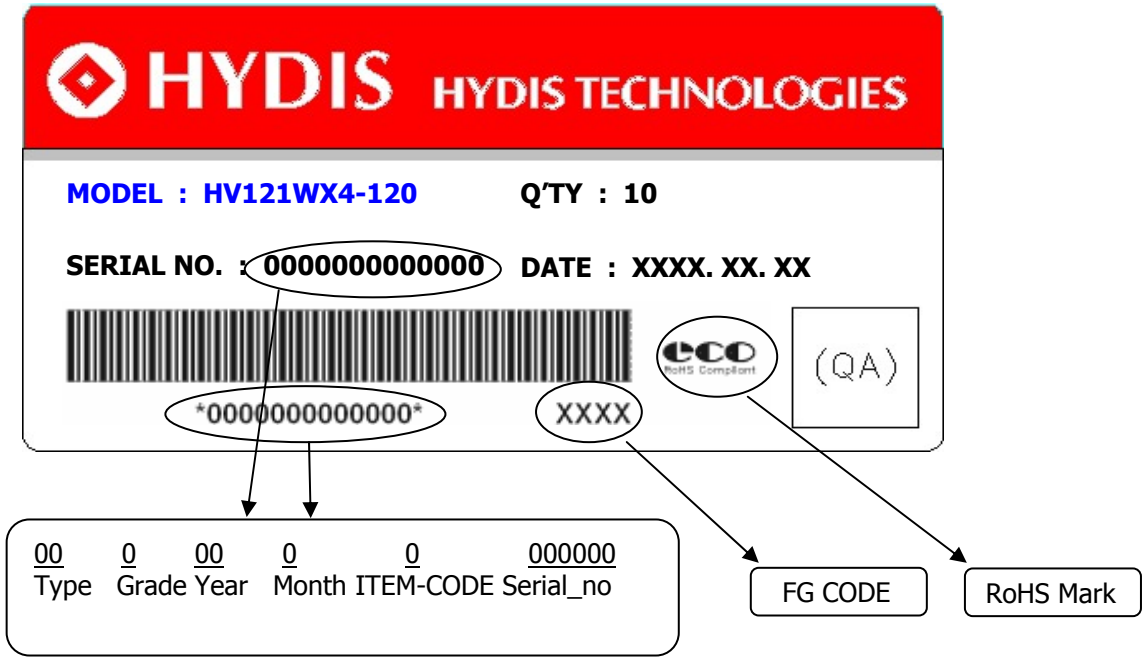
Notes

- Box Dimension: 261mm(W) X 349mm(D) X 311mm(H)
- Package Quantity in one Box: 10pcs

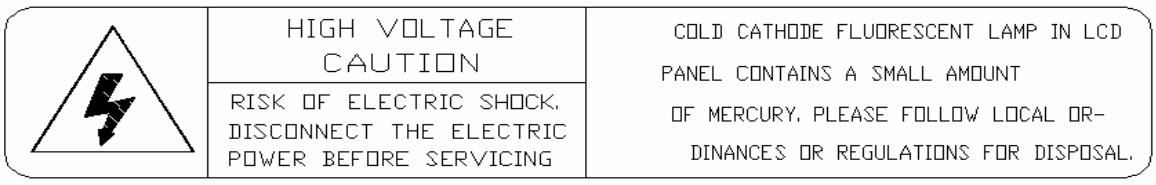
14.0 Environment & Safety

14.1 Packing Label

Label Size: 108 mm (L) × 56 mm (W)
Contents
Model: HV121WX4-120
Q`ty: Module Q`ty in one box
Serial No.: Box Serial No. See next figure for detail description.
Date: Packing Date
FG Code: FG Code of Product

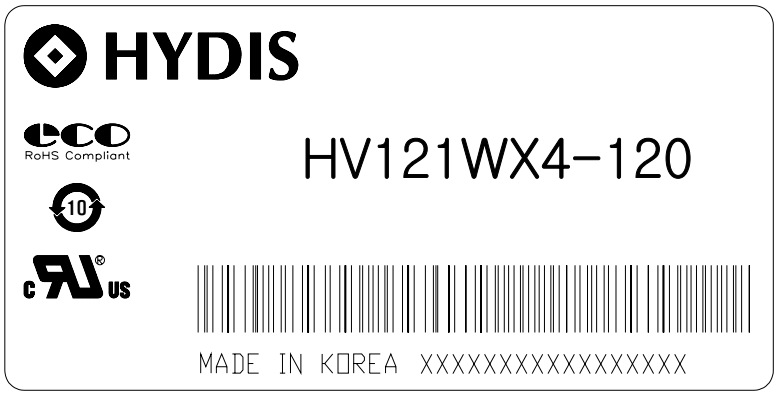


14.2 Mercury disposal & High voltage caution



14.3 Product 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. Company (H:HYDIS)

No 4. Year (5 : 2005, 6: 2006, ...)

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

No 6. Product Identification (FG)

No 7. Serial Number

15.0 APPENDIX

Figure 1. Measurement Set Up

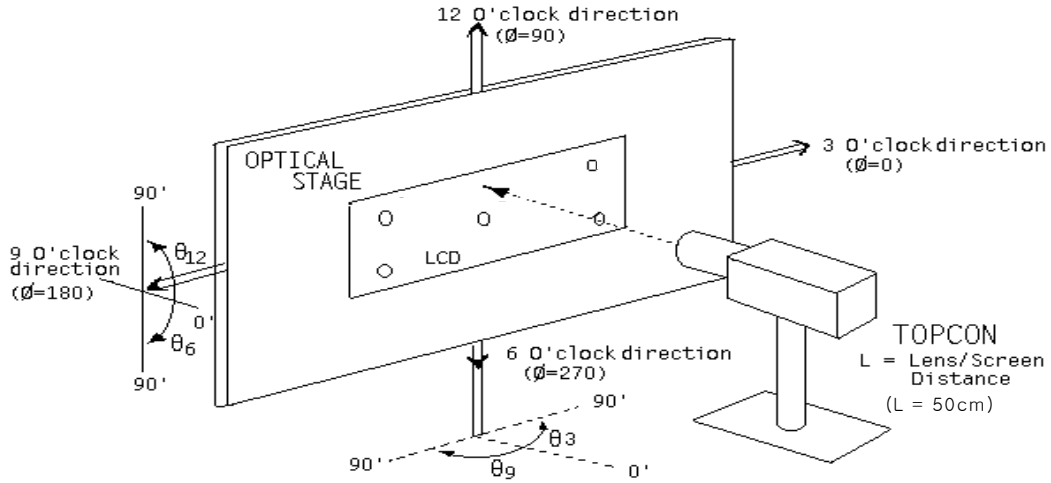


Figure 2. Average Luminance Measurement Locations & Uniformity Measurement Locations

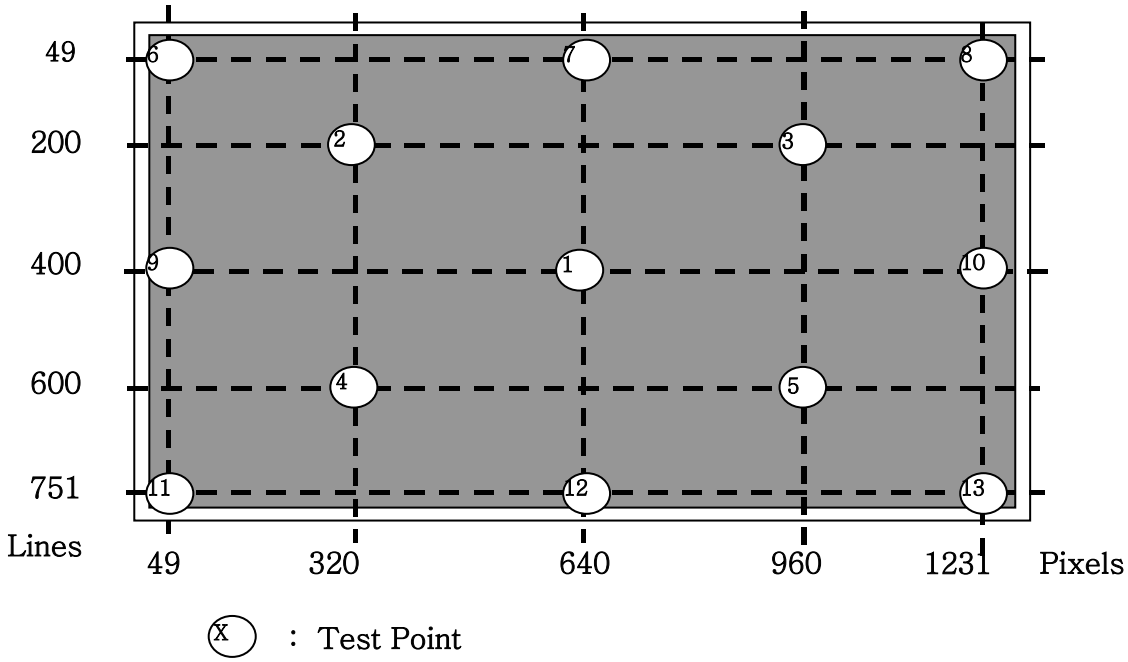


Figure 3. Response Time Testing

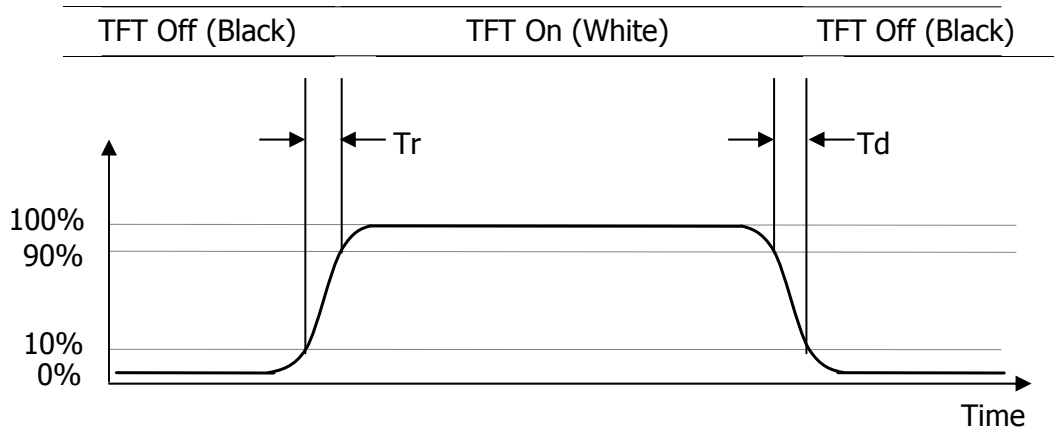
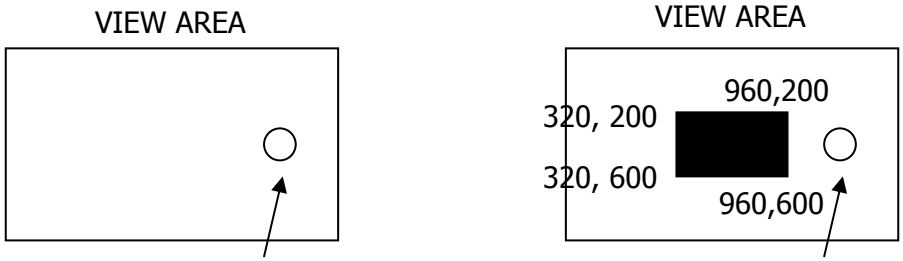


Figure 4. Cross Modulation Test Description



$$\text{Cross-Talk} = \left| \frac{YB - YA}{YA} \right| \times 100$$

Where:
Y_A = Initial luminance of measured area (cd/m^2)
Y_B = Subsequent luminance of measured area (cd/m^2)
The location measured will be exactly the same in both patterns.

Figure 5. TFT-LCD Module Outline Dimensions (Front view)

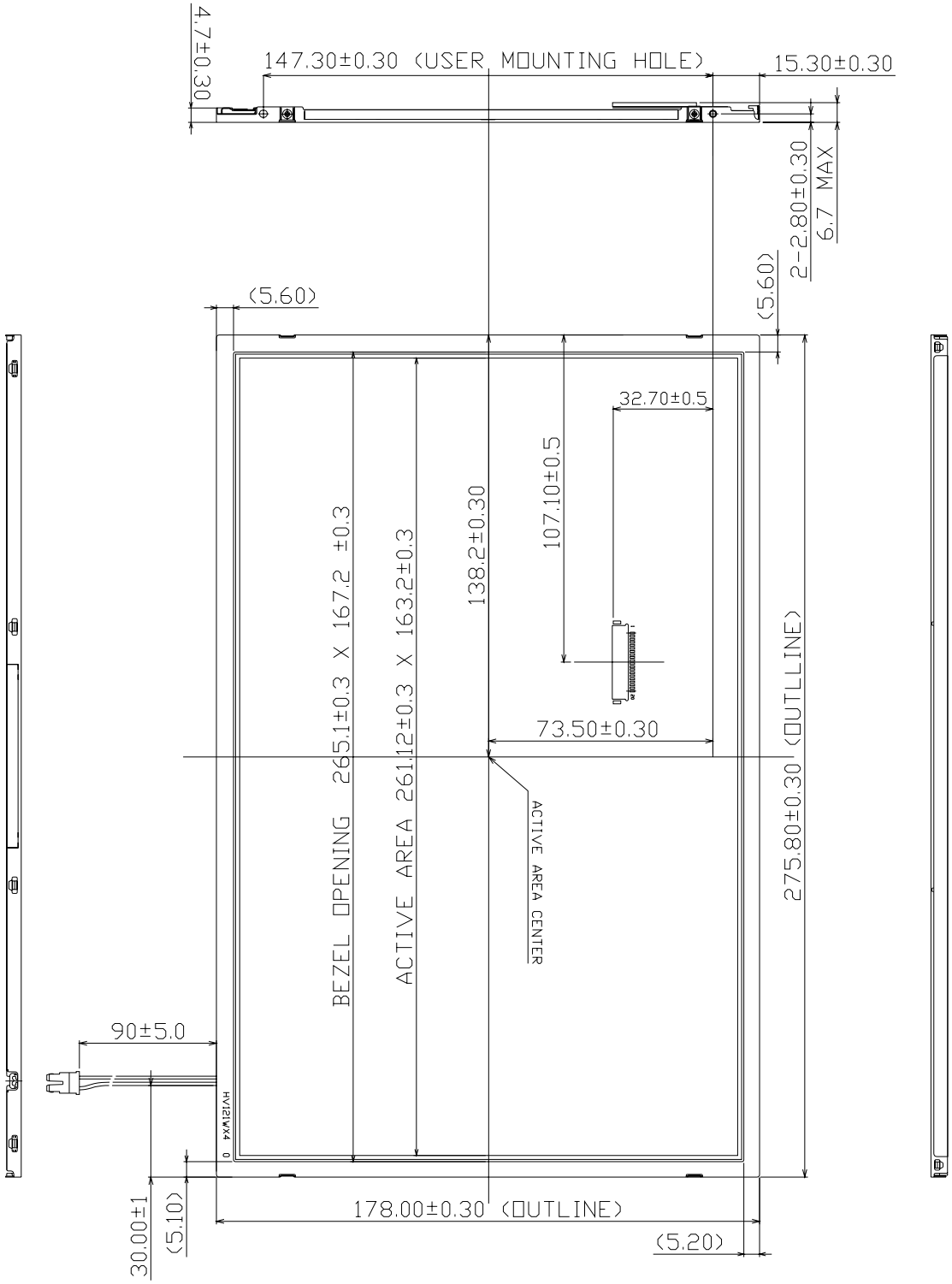
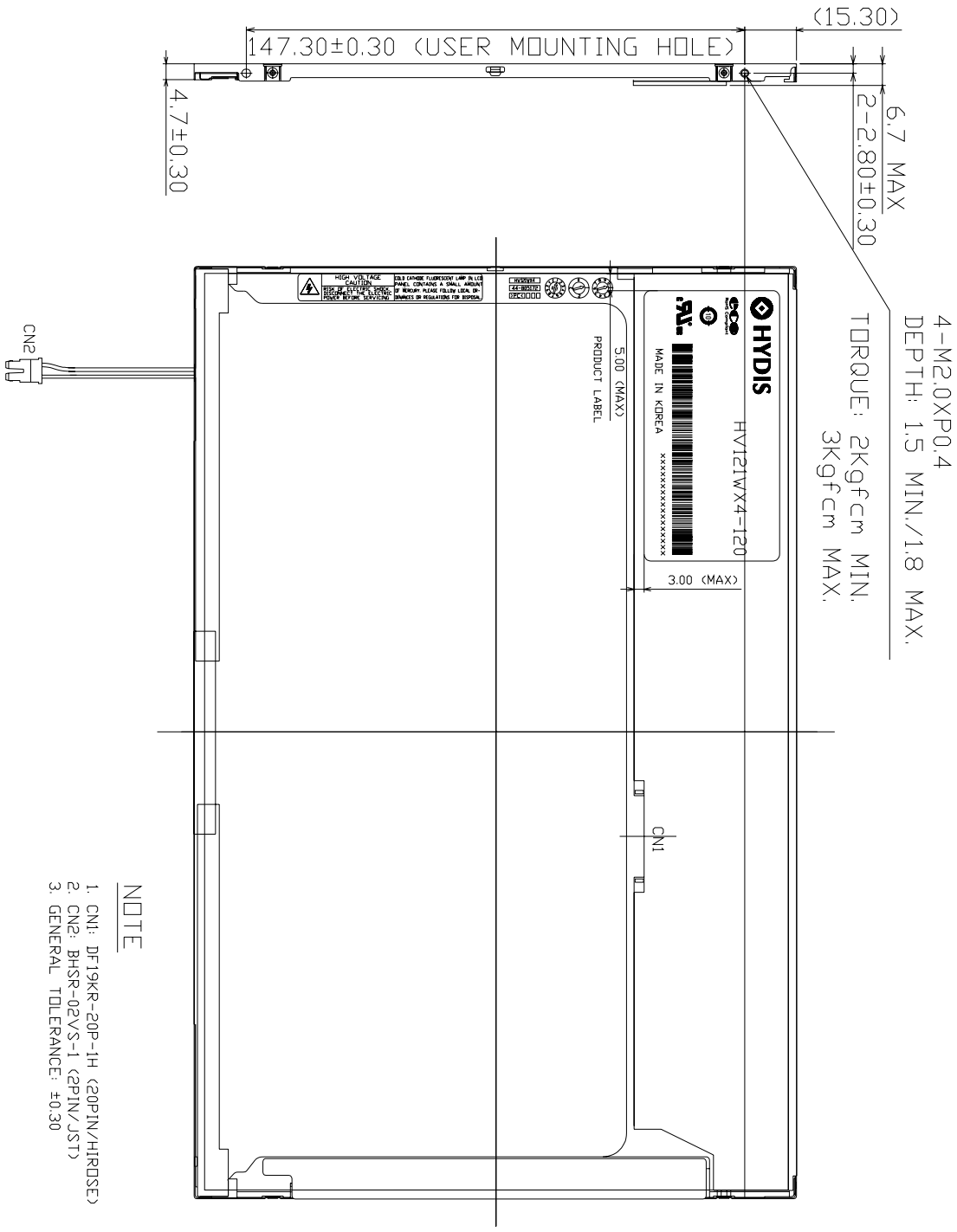



Figure 6. TFT-LCD Module Outline Dimensions (Rear view)