TITLE : HV056WX1-100

Preliminary Product Specification

Rev. P0

BOE HYDIS TECHNOLOGY

REVISION HISTORY

REV.	ECN NO.	DESCRIPTION OF CHANGES	DATE	PREPARED
P0		▪ Initial Release	08.01.30	Y.J. Yoon

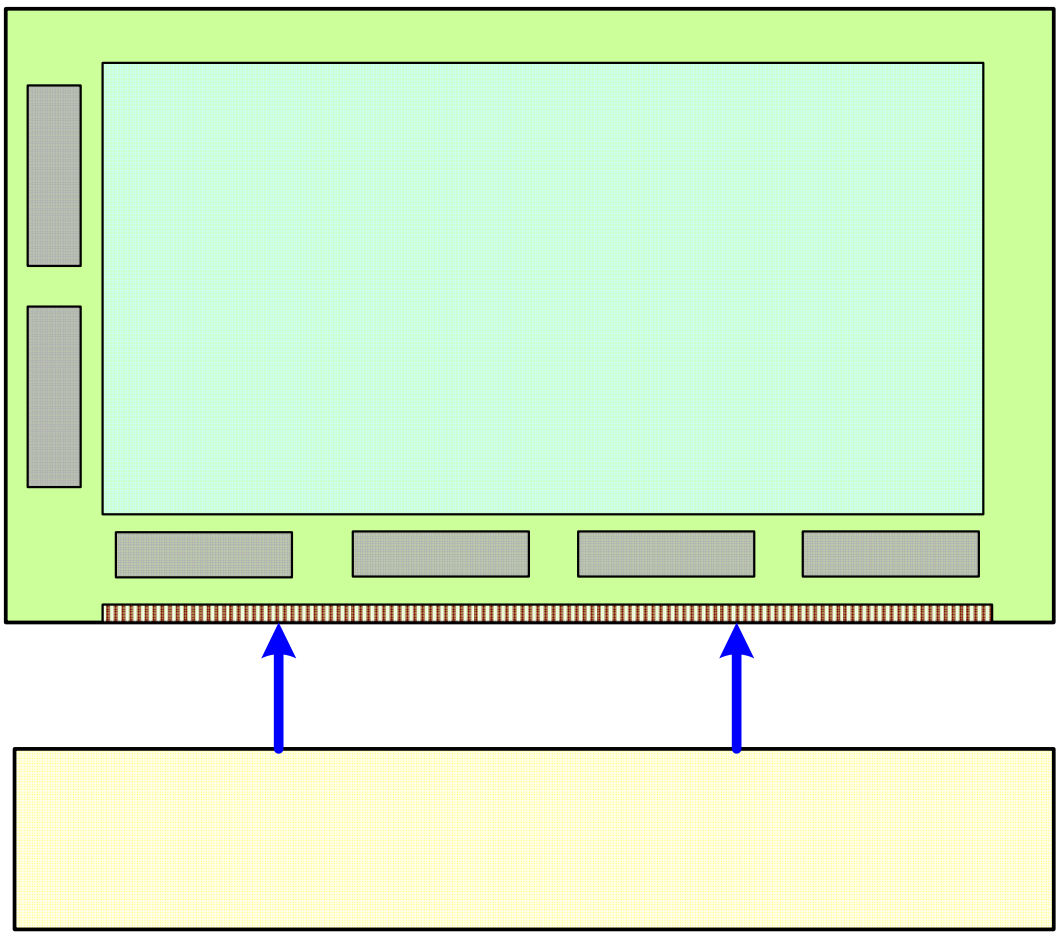
Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HV056WX1-100 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 5.6 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 adapted for a low reflection and higher color type.



1.2 Features

- High Resolution & Wide View (HFFS Technology)
- 3.3 V Logic Power & 12V LED Power Supply
- 1 Channel LVDS Interface
- 262,144 Colors
- Low Weight (Slimming Glass & Slim LGP LED Backlight Technology)
- Compact Design (Source & Gate IC of the COG Type)
- Green Product (RoHS Compliant)

1.3 Applications

- Display terminals for Ultra Mobility Personal Computer.

1.4 General Specification

The followings are general specification at the model HV056WX1-100.

< Table 1. General Specification >

Parameter	Specification	Unit	Remarks
Active area	120.96(H) × 75.60(V)	mm	
Number of pixels	1280(H) × 800(V)	pixels	
Pixel pitch	94.5(H) × 94.5(V)	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	262,144	colors	
Display mode	Normally Black		
Dimensional outline	131.7±0.4(H)×87.7±0.4(V)×4.7±0.3(T)	mm	
Weight	TBD (Typ.)	gram	
Back-light	Bottom edge side, 16-LEDs type		White LED

2.0 ABSOLUTE MAXIMUM RATINGS

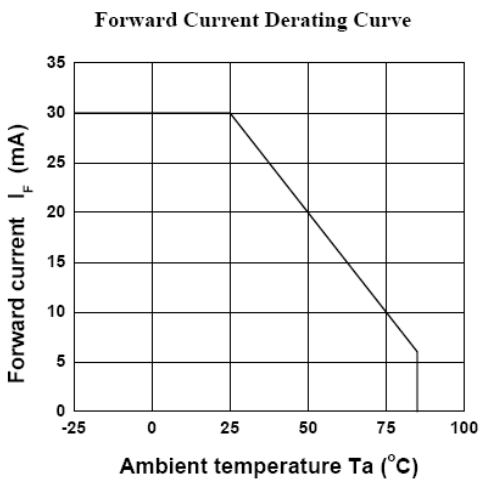
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

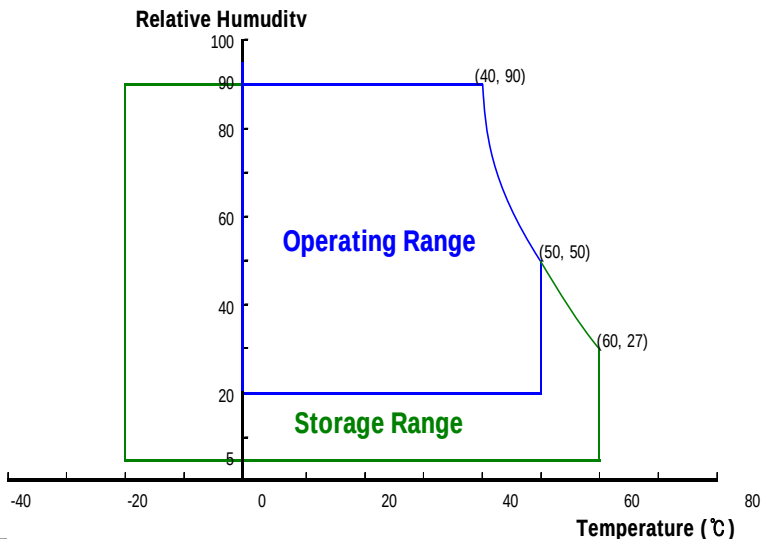
< Table 2. Absolute Maximum Ratings > [VSS=GND=0V]

Parameter		Symbol	Min.	Max.	Unit	Remarks
Logic Power Supply		V_{DD}	VSS-0.3	5.0	V	Ta = 25 ℃
Back-light Power Supply		HV_{DD}	-0.3	40.0	V	
Back-Light LED Reverse Voltage		V_R	-	5	V	
Back-light LED Current	+ 25 ℃	I_{LED}	-	30	mA	Note 1
	+ 50 ℃	I_{LED}	-	20	mA	
Operating Temperature		T_{OPR}	0	60	℃	Note 1, 2
Storage Temperature		T_{STG}	-20	70	℃	

Note :

1. Ambient temperature vs allowable forward current are shown in the figure below.
2. Temperature and relative humidity range are shown in the figure below.
   90% RH Max. (40℃ ≥ Ta)
   Maximum wet - bulb temperature at 39℃ or less. (> 40℃) No condensation.





3.0 OPTICAL SPECIFICATION

The test of Optical specification shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometric system and TOPCON 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.

< Table 3. Optical Specifications >

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Remark
Viewing Angle	Horizontal	Θ_3	CR > 10	80	85	-	Deg.	Note 1
		Θ_9		80	85	-	Deg.	
	Vertical	Θ_{12}		80	85	-	Deg.	
		Θ_6		80	85	-	Deg.	
Contrast ratio		CR	Θ = 0°	-	500	-		Note 2
Luminance of White		Y_w		250	300	-	cd/m²	Note 4,5
White Luminance uniformity		Δ Y9		75	-	-	%	
Reproduction of color	White	W_x	Θ = 0° (Center) Normal Viewing Angle		TBD			Note 3
		W_y			TBD			
	Red	R_x			TBD			
		R_y			TBD			
	Green	G_x			TBD			
		G_y			TBD			
	Blue	B_x			TBD			
		B_y			TBD			
Response Time (T_r + T_d)			Ta= 25° C		30		ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7

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 Figure1 in Appendix).

2. Contrast measurements shall be made at viewing angle of θ= 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 in Appendix) Luminance Contrast Ratio (CR) is defined mathematically as
   CR = Luminance when displaying a white raster / Luminance when displaying a black raster.

3. Reference only / Standard Front Surface Treatment Measured with green cover glass. The color chromaticity coordinates specified in Table 3 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.

4. The White luminance uniformity on LCD surface is then expressed as :
   ΔY = (Minimum Luminance of 9 points / Maximum Luminance of 9 points) * 100
   (See Figure 2 shown in Appendix).

5. The electro-optical response time measurements shall be made as Figure 3 shown in Appendix 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.

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
   (Refer to Figure 5 in Appendix)

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

4.0 ELECTRICAL SPECIFICATION

4.1 TFT LCD Module

< Table 4. LCD Module Electrical Specification > [Ta =25±2 ℃]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Logic Power Supply		V_{DD}	3.0	3.3	3.6	V	
Power Consumption	Window XP	P_{TYP}		TBD		mW	Note 1
	Vertical Sub Line	P_{MAX}		TBD		mW	
	EBL	P_{EBL}		TBD		mW	
Vsync Frequency		f_V	-	60	75	Hz	
Hsync Frequency		f_H		49.2		KHz	
Main Clock Frequency		fclk		71.1		MHz	
High Level Differential Input Signal		V_{IH}	-	-	+ 100	mV	V_{CM} =1.2V
Low Level Differential Input Signal		V_{IL}	- 100	-	-	mV	

Note :

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 : Window XP pattern, b) Max : Vertical Sub line pattern
c) EBL : Mosaic pattern (32 X 32)

4.2 Back-Light Unit

< Table 5. Back-Light Unit Electrical Specification > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Remark
		Min	Typ	Max		
Back-Light Power Supply	HV_{DD}	4.5	12.0	16.0	V	
Power Consumption	P_{BL}		TBD		mW	Note 1, 4
LED Driver's Efficiency	η	-	85	-	%	Note 2
Back-light PWM Frequency	F_{PWM}	100	200	1000	Hz	
High Level PWM Signal Voltage	V_{PWMH}	1.4	-	5.0	V	
Low Level PWM Signal Voltage	V_{PWML}	0	-	0.2	V	
Back-light LED Voltage / Back-light LED Total Voltage	V_{LED} /V_{BL}	-	3.3 / 26.4		V	Note 4
Back-light LED Current / Back-light LED Total Current	I_{LED} /I_{BL}	-	15 / 30		mA	Note 4
Life Time		10,000	-	-	Hrs	By LED

Note :

1. The power supply voltage and current is measured and specified at the interface connector of LCM including LED Driver.
2. Reference value, which is measured with LED Driver for 12V.
3. Reference value, which is measured without LED Driver.
4. Calculated value for reference (VLED × ILED × # of LEDs (16EA)).

4.3 PWM Duty Ratio vs Brightness

Note :

In case of duty ratio 0%, LED can't illuminate itself so this state is LED off.
In case of duty ratio 100%, the brightness of LED is maximum and the state is LED on.

5.0 INTERFACE CONNECTION.

5.1 Electrical Interface Connection

< Table 6. Electrical Interface Connection Specification >

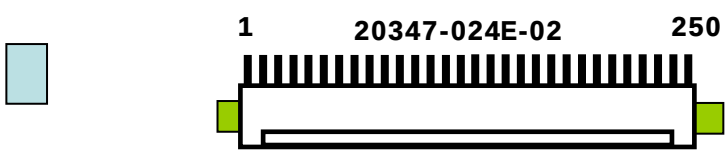
(CN1 :20347-025E-02, I-PEX)

Pin No	Symbol	Description	Pin No	Symbol	Description
1	LED_{VDD}	Back-light Power Supply	14	IN1+	LVDS Receiver Signal (+)
2	LED_{VDD}	Back-light Power Supply	15	IN2-	LVDS Receiver Signal (-)
3	NC	No Connection	16	IN2+	LVDS Receiver Signal (+)
4	LED_{GND}	Back-light Ground	17	CLK-	LVDS Receiver Clock Signal(-)
5	LED_{GND}	Back-light Ground	18	CLK+	LVDS Receiver Clock Signal(+)
6	PWM	PWM Brightness Control	19	GND	Ground
7	ON/OFF	LED Drive ON/OFF	20	TEST	TEST PIN
8	GND	GROUND	21	GND	GROUND
9	GND	GROUND	22	NC	NON-CONNECTION
10	GND	GROUND	23	VDD	Logic Power Supply
11	IN0-	LVDS Receiver Signal (-)	24	VDD	Logic Power Supply
12	IN0+	LVDS Receiver Signal (+)	25	VDD	Logic Power Supply
13	IN1-	LVDS Receiver Signal (-)			

Note :

1. NC : This pins are only used for BOE HYDIS internal operations
2. Start from left side

Rear view of LCM



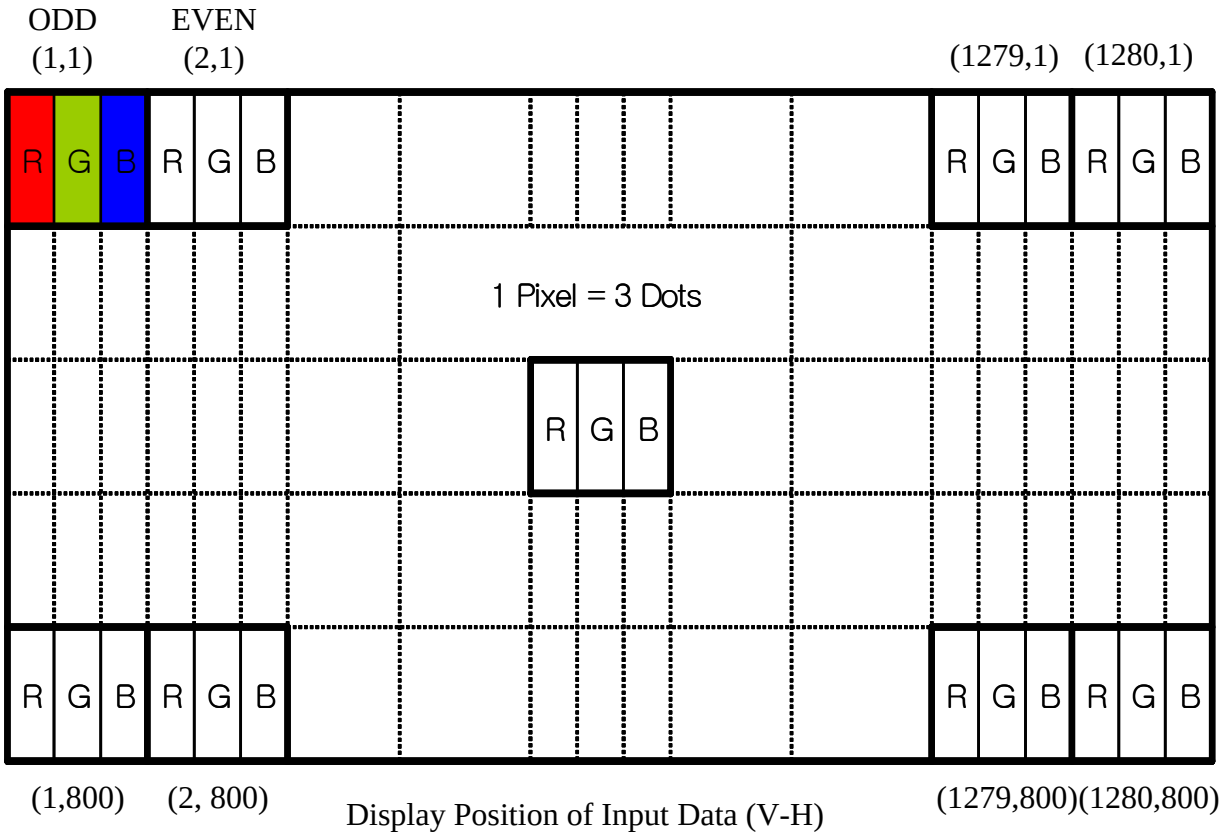
5.2 LVDS Interface

< Table 7. LVDS Interface Specification >

[LVDS Transmitter : THC63LVDM83A]

Input signal	Transmitter		Interface		20347-024E-02	Remark
	Pin No	Pin No	System (Tx)	TFT-LCD (Rx)	Pin No.	
R0	51	48 47	OUT0- OUT0+	IN0- IN0+	11 12	
R1	52					
R2	54					
R3	55					
R4	56					
R5	3					
G0	4					
G1	6	46 45	OUT1- OUT1+	IN1- IN1+	13 14	
G2	7					
G3	11					
G4	12					
G5	14					
B0	15					
B1	19					
B2	20	42 41	OUT2- OUT2+	IN2- IN2+	15 16	
B3	22					
B4	23					
B5	24					
HSYNC	27					
VSYNC	28					
DE	30					
MCLK	31	40	CLKOUT-	CLKIN-	17	
		39	CLKOUT+	CLKIN+	18	

5.3 Data Input Format



Display Position of Input Data (V-H)

6.0 SIGNAL TIMING SPECIFICATION

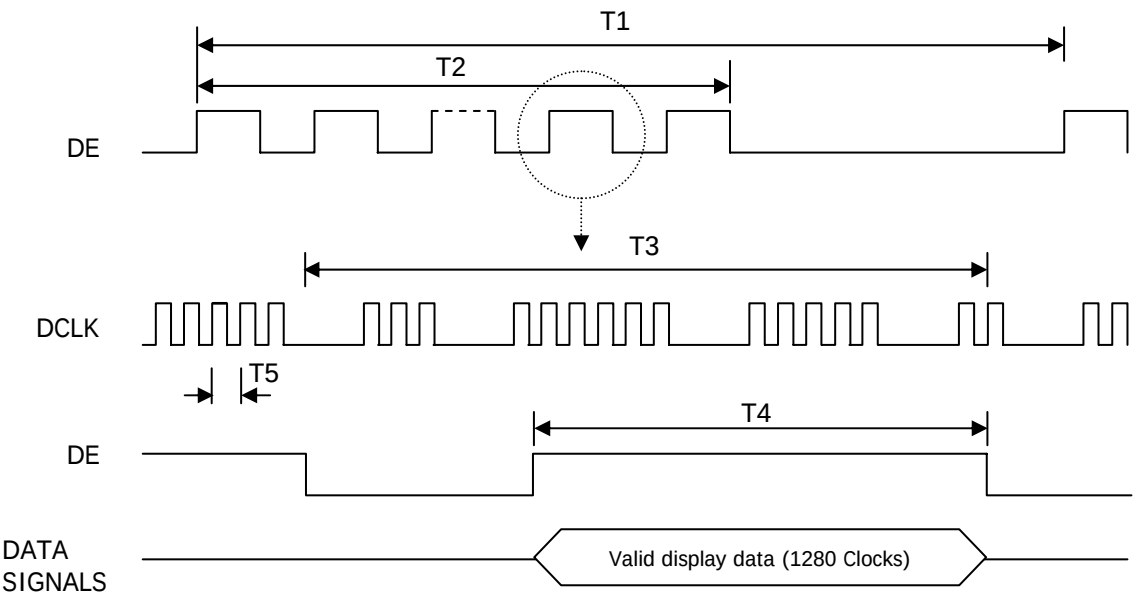
6.1 Timing Parameters of TFT LCD Module Input Signal

< Table 8. Input Timing Parameters Specification >

[DE only, VDD=3.3V, GND=0V, TA=25℃]

Parameter	Symbol	Min	Typ	Max	Unit	Note
Frame Period	T1	810	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	-	71.1	-	MHz	

6.2 Timing Waveforms of TFT LCD Module Input Signal

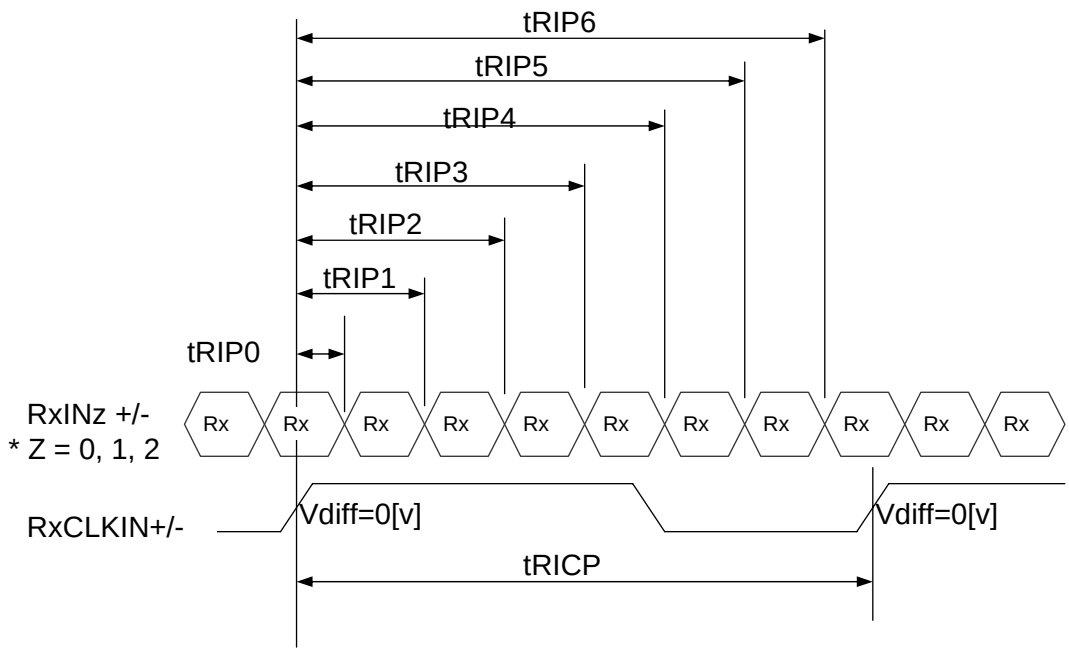


6.3 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter

< Table 9. LVDS Rx Interface Timing Specification>

Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
CLKIN Period	tRICP	12.50	14.43	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	



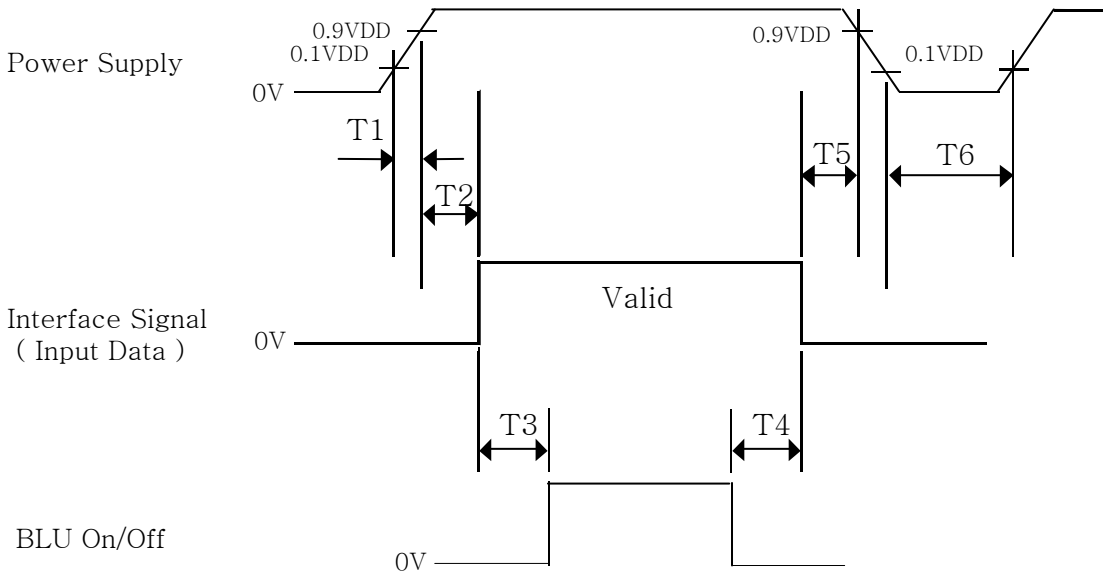
6.4 Input Signals, Basic Display Colors & Gray Scale Of Colors

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

6.5 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	0.5	-	10	ms
T2	0.5	-	50	ms
T3	200	-	-	ms
T4	200	-	-	ms
T5	0.5	-	50	ms
T6	3.0	-	-	s

Note :

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.

7.0 MECHANICAL CHARACTERISTICS

7.1 Dimensional Requirements

Figure 5 (located in Appendix) shows mechanical outlines for the model HV056WX1-100. Other parameters are shown in Table 10.

<Table 10. Dimensional Parameters Specification >

Parameter	Specification	Unit
Dimensional outline	131.7±0.4(H)×87.7±0.4(V)×4.7±0.3(T)	mm
Weight	66 (typ)	gram
Active area	120.96(H) × 75.60(V)	mm
Pixel pitch	94.5(H) ×94.5(V)	um
Number of pixels	1280(H) × 800(V) (1 pixel = R + G + B dots)	pixels
Back-light	Edge side 16-LEDs type (2 X 8 Array)	

7.2 Clearness and Polarizer Hardness.

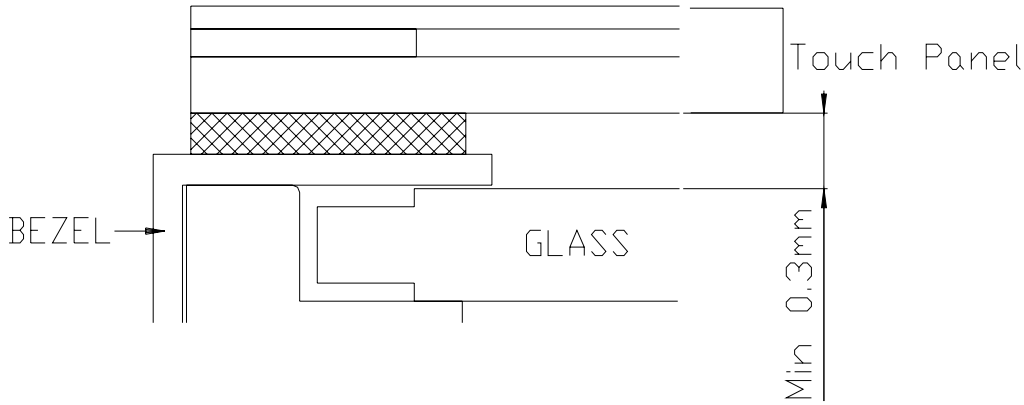
The surface of the LCD has an clear film to increase visibility and a hard coating to reduce scratching.

7.3 Light Leakage

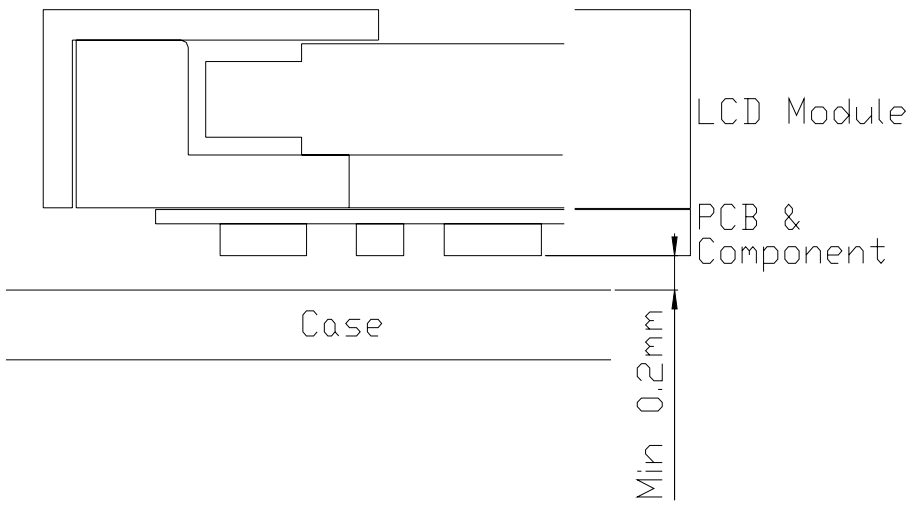
There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350 [lux.]

7.4 Design Guide

Give enough clearance (over 0.3mm) Between the Touch Panel and LCD Module glass to protect a display



Give enough clearance (over 0.2mm) Between the Case and LCD Module component to protect a display



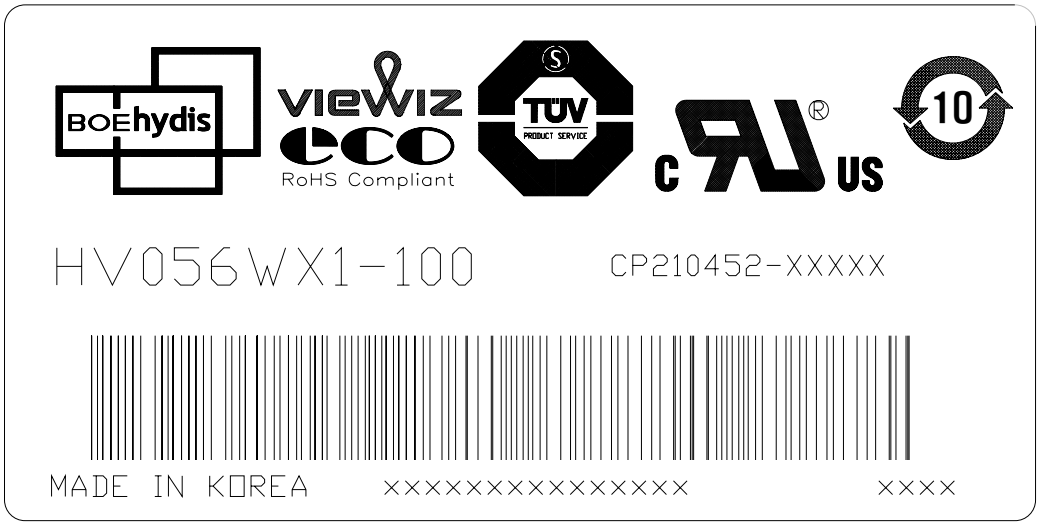
8.0 RELIABLITY TEST

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

<Table 12. Reliability Test Conditions >

No	Test Item	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

9.0 Product Serial Number



BOE HYDIS Barcode

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

No 1. Control Number

No 2. Rank / Grade

No 3. Line Classification
(BOE HYDIS : H, LCM : L, BOE OT : A/B/C)

No 4. Year (8 : 2008, 9 : 2009, …)

No 5. Month (1, 2, 3,…, 9, X, Y, Z)

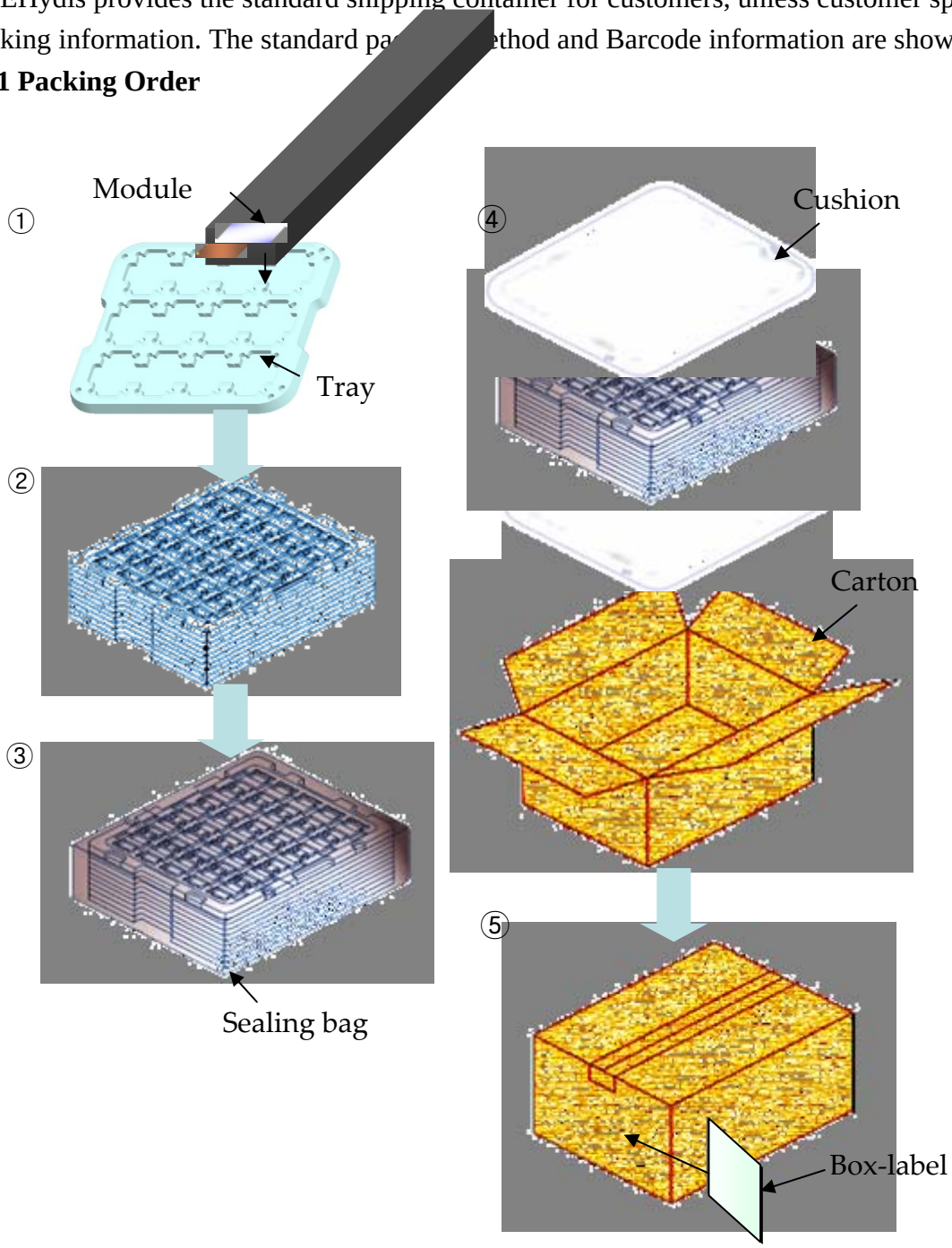
No 6. FG Code

No 7. Serial Number

10.0 PACKING INFORMATION

BOEHydis provides the standard shipping container for customers, unless customer specifies their packing information. The standard pa ethod and Barcode information are shown in below.

10.1 Packing Order



10.2 Packing Note

- Box Dimension : 387 X 335 X 130 mm
- Package Quantity in one Box :

10.3 Box label

- Label Size : 108 mm (L) X 56 mm (W)
- Contents

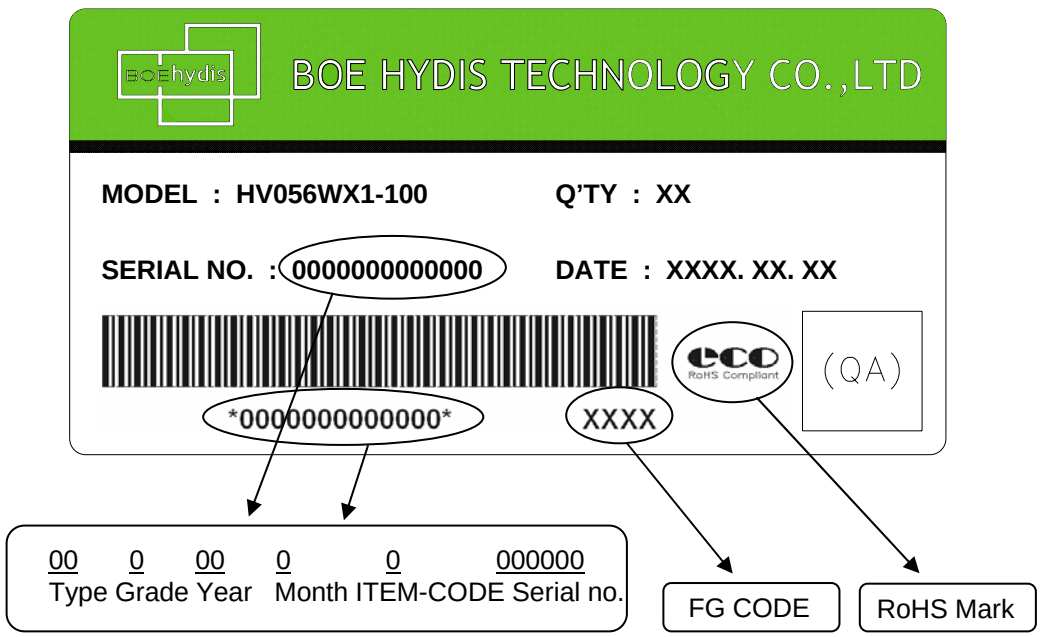
  Model : HV056WX1-100

  Q`ty : Module Q`ty in one box

  Serial No. : Box Serial No. See next page for detail description.

  Date : Packing Date

  FG Code : FG Code of Product



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

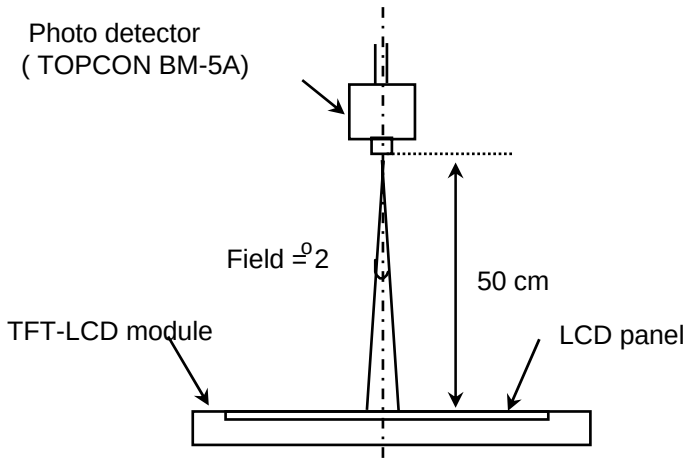
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(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 APPENDIX

Figure 1. Measurement Set Up



Optical characteristics measurement setup

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

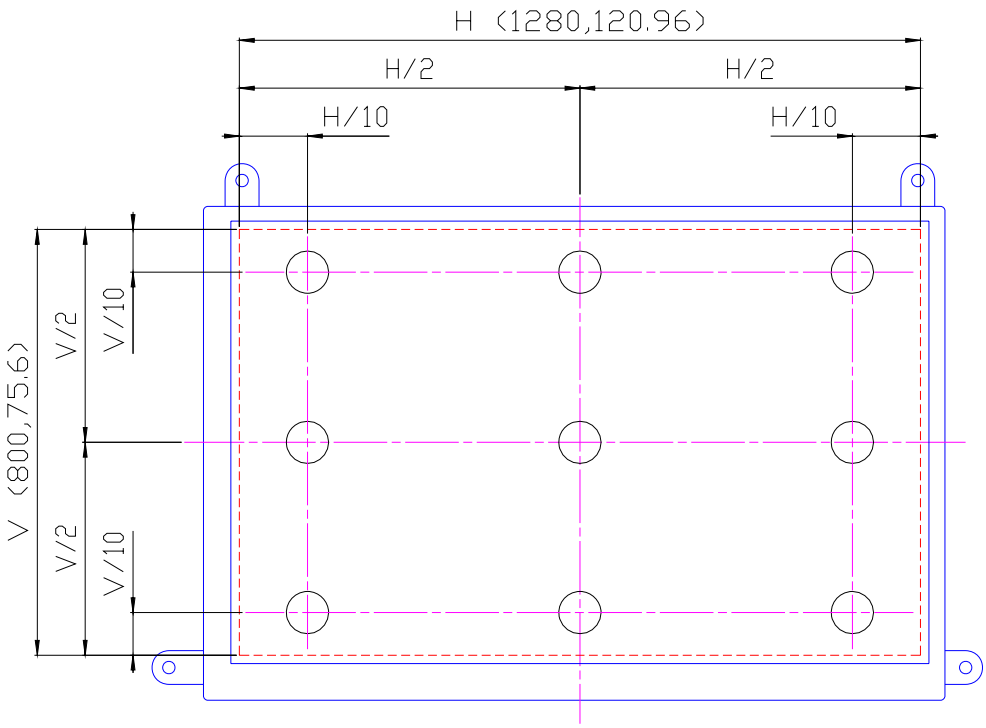


Figure 3. Response Time Testing

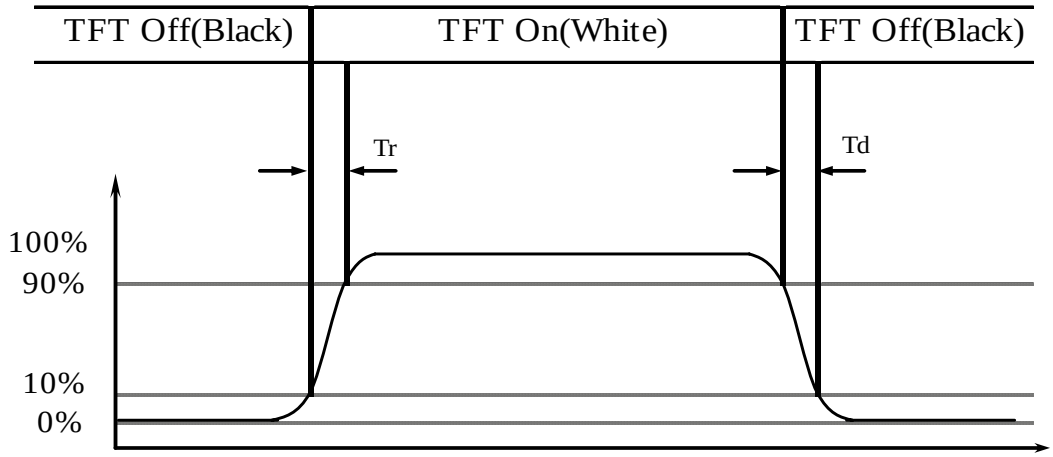
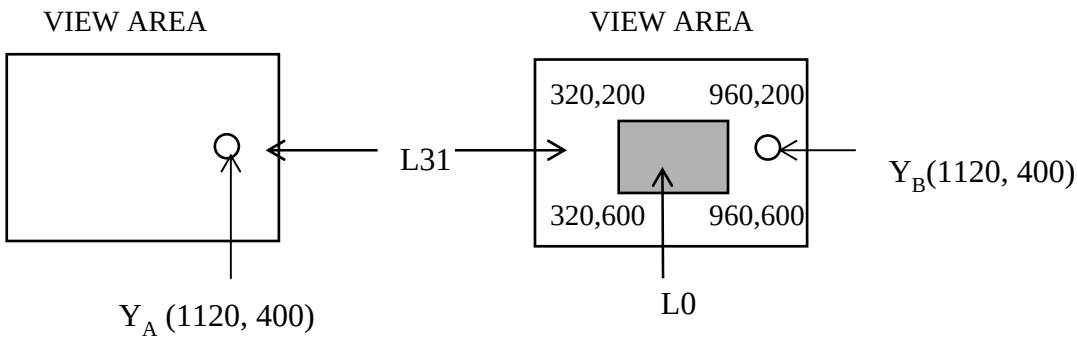


Figure 4. Cross Modulation Test Description



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

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 Dimension (Front View)

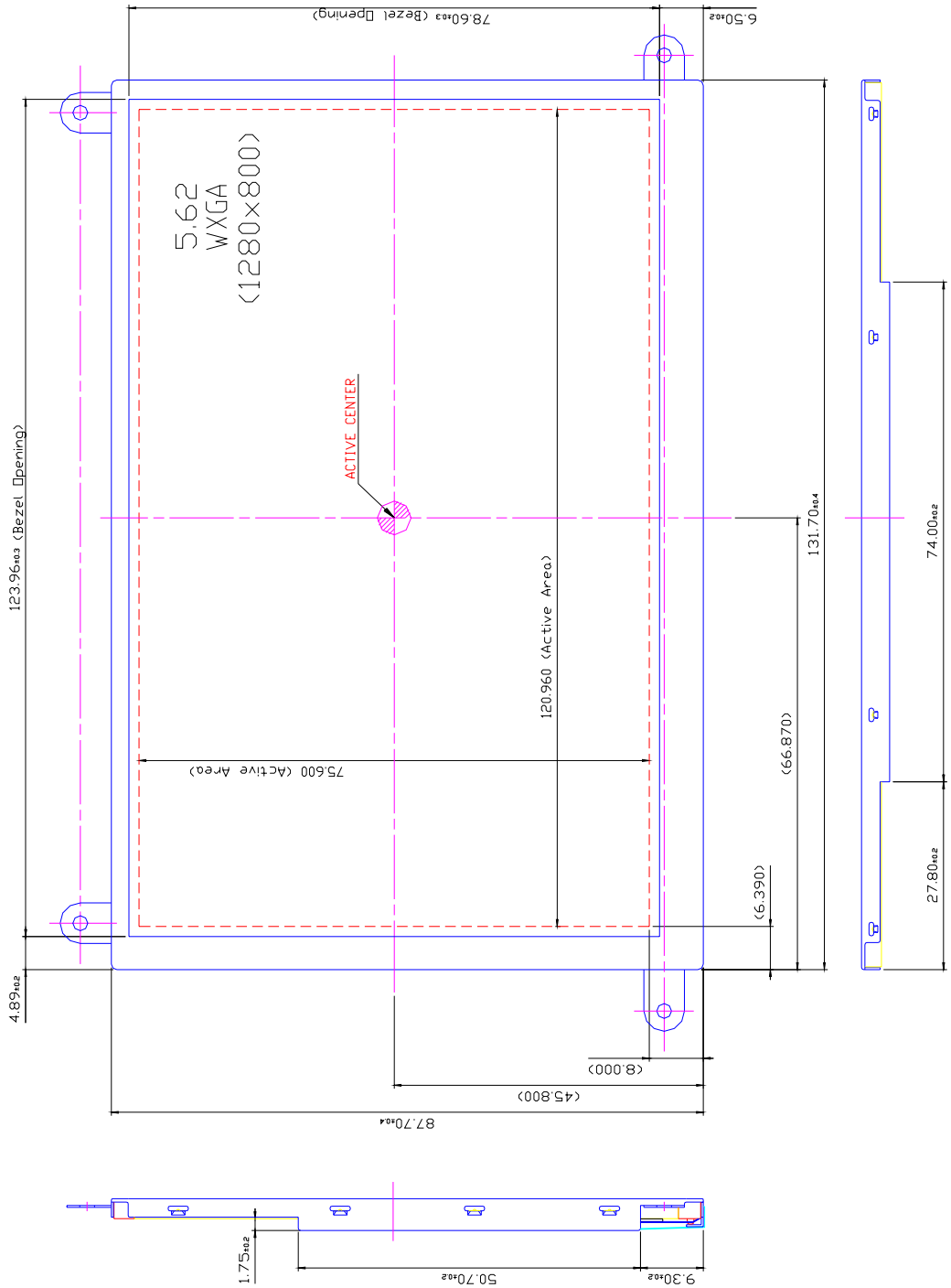


Figure 6. TFT-LCD Module Outline Dimension (Rear View)