Product Specification
E270HVZ-701

☐ **Preliminary Specifications**

■ **Final Specifications**

Module	27 Inch Color TFT-LCD
Model Name	**E270HVZ-701** (HR270WU1-200)
Document Version	Rev.01

Coutomer

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Approved by ______________ Date ______________

Notice : This Specification is subject to change without notice.

Approved By	Prepared By
Tony	Zoe

REVISION HISTORY

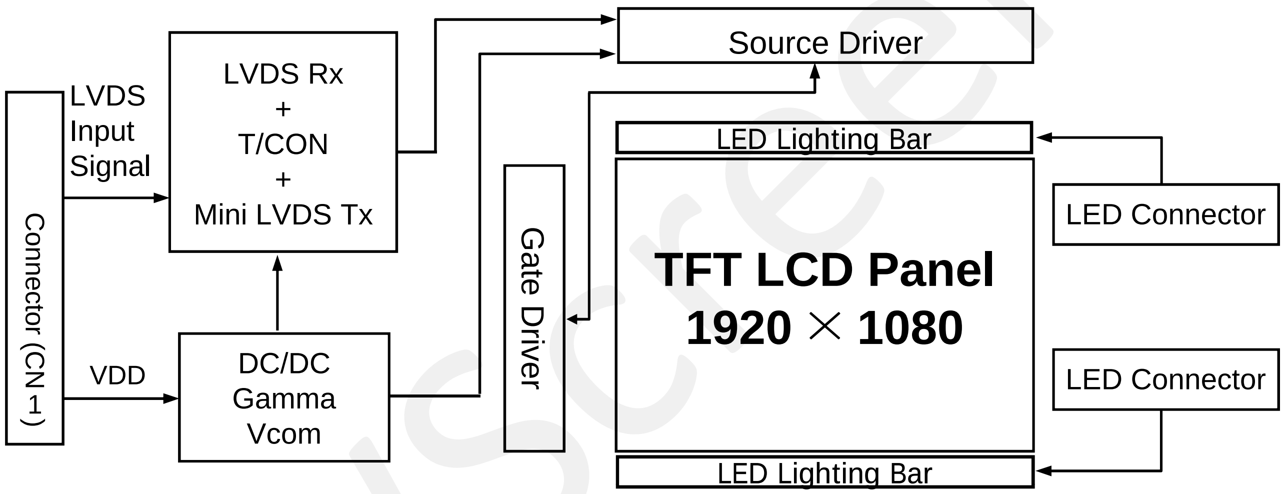
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
Rev.0	-	Initial Release	Feb.05. 15’	Yan Kai

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

HR270WU1-200 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 27.0 inch diagonally measured active area with FHD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 1.07B colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2 Features

- LVDS Interface with 2 pixel / clock
- High-speed response
- 10-bit (Real) color depth, display 1.07B colors
- Incorporated edge type back-light (LED)
- sRGB
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- Gamma Correction

1.3 Application

- Desktop Type of PC & Workstation Use
- Slim-Size Display for Stand-alone Monitor
- Display Terminals for Control System
- Monitors for Process Controller

1.4 General Specification

The followings are general specifications at the model HR270WU1-200.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	597.888(H) × 336.312(V)	mm	
Number of pixels	1920(H) ×1080(V)	pixels	
Pixel pitch	0.3114(H) ×0.3114(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	1.07B	colors	
Display mode	Normally Black		
Dimensional outline	630(H) ×368.2(V) ×15.2 (D) typ.	mm	
Weight	3000 (Typ.)	g	
Surface Treatment	Haze 25%, 3H		
Back-light	Upper & lower edge side, 2-LED Lighting Bar type		Note 1
Power Consumption	P_D : 8W (max)		
	P_{BL} : 45.7W (max)		Note 2
	P_{total} : 53.7(max)		

Notes : 1. LED Lighting Bar (8*input pins)
2. P_{LED}=Input pins* VPIN×IPIN

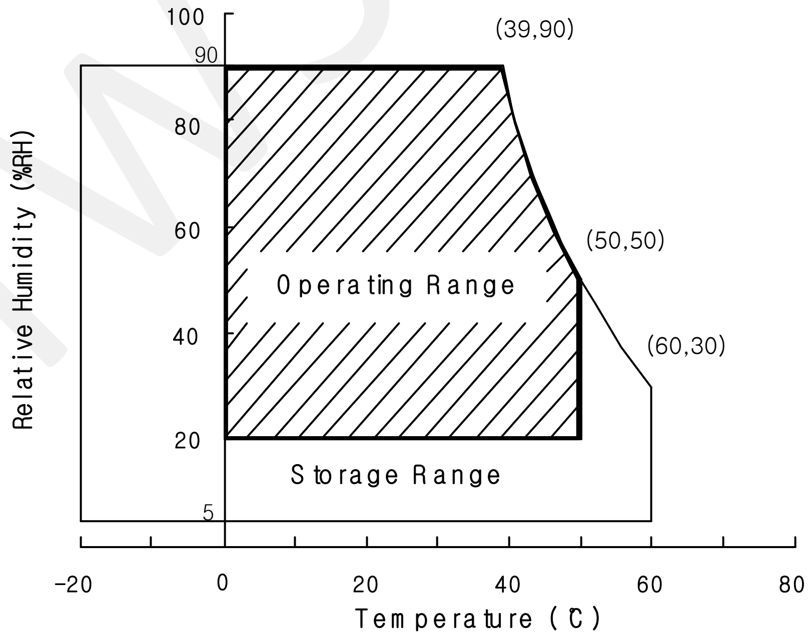
2.0 ABSOLUTE MAXIMUM RATINGS

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
Power Supply Voltage	V_{DD}	-0.3	6.0	V	Ta = 25 ℃
Logic Supply Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
LED Light Bar Current Per Input Pin	IPIN	-	125	mA	
LED Light Bar Voltage Per Input Pin	VPIN	-	49	V	
Operating Temperature	T_{OP}	0	+50	℃	1)
Storage Temperature	T_{ST}	-20	+60	℃	1)

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



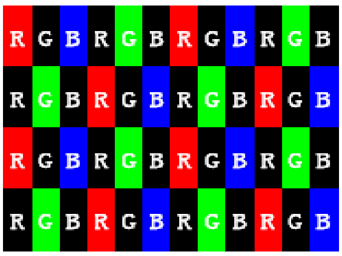
3.0 ELECTRICAL SPECIFICATIONS

3.1Electrical Specifications

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

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	4.5	5.0	5.5	V	Note1
Power Supply Current	I_{DD}	-	1300	1600	mA	
In-Rush Current	I_{RUSH}	-	2.0	3.0	A	Note 2
Permissible Input Ripple Voltage	V_{RF}	-	-	100	mV	V_{DD} = 5.0V
High Level Differential Input Threshold Voltage	V_{IH}	-	-	+100	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	-	-	mV	
Differential input voltage	$\|V_{ID}\|$	200	-	600	mV	
Differential input common mode voltage	Vcm	1.0	1.2	1.5		V_{IH}=100mV, V_{IL}=-100mV
Power Consumption	P_D	-	6.5	8	W	
	P_{BL}	-	43.0	45.7	W	Note 3
	P_{total}	-	49.5	53.7	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 VDD=5.0V, Frame rate=60Hz
Clock frequency = 74.25 MHz. Test Pattern of power supply current
a) Typ : Color Test
b) Max : Skip Subpixel255



2. Duration of rush current is about 2 ms and rising time of VDD is 520 µs ± 20 %
3. Calculated value for reference (Input pins*VPIN ×IPIN) excluding inverter loss.

3.2 Backlight Unit

< Table 4. LED Backlight Unit >

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPIN	-	44.8	47.6	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	-	120	-	mA	Note1,2,
LED Power Consumption	P_{BL}	-	43.0	45.7	W	Note 3
LED Life-Time	-	30,000	-		Hrs	Note 4

Note1: There are two light bars ,and the specified current is input LED chip 100% duty current
Note2: The sense current of each input pin is 120mA
Note3: P_{BL}=8 Input pins*VPIN ×IPIN
Note4: The lifetime is determined as the time at which luminance of LED become 50% of the initial brightness or not normal lighting at IPIN=120mA on condition of continuous operating at 25 ±2 ℃

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 measurement shall be executed after 30 minutes warm-up period. VDD shall be 5.0V +/-10% at 25°C. Optimum viewing angle direction is 6 ’clock.

4.2 Optical Specifications

[VDD = 5.0V, Frame rate = 60Hz, Clock = 74.25MHz, I_{BL} = 120mA*8, Ta =25±2 ℃]

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	75	89	-	Deg.	Note 1
		Θ_9		75	89	-	Deg.	
	Vertical	Θ_{12}		70	89	-	Deg.	
		Θ_6		70	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	700	1000	-		Note 2
Luminance of White		Y_w		725	-	-	cd/m²	Note 3
White luminance uniformity		ΔY		75	80	-	%	Note 4
Reproduction of color	White	W_x		0.283	0.313	0.343	-	Note 5
		W_y		0.299	0.329	0.359	-	
	Red	R_x		0.615	0.645	0.675	-	
		R_y		0.298	0.328	0.358	-	
	Green	G_x		0.273	0.303	0.333	-	
		G_y		0.588	0.618	0.648	-	
	Blue	B_x		0.118	0.148	0.178	-	
		B_y		0.030	0.060	0.090	-	
Response Time	GTG	T_g			14	20	ms	Note 6
Cross Talk		CT		-	-	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.
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 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. Center Luminance of white is defined as 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.
4. The White luminance uniformity on LCD surface is then expressed as :
 ΔY = (Minimum Luminance of 9points / Maximum Luminance of 9points) * 100
 (See FIGURE 2 shown in Appendix).
5. 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.
6. Response time Tg is the average time required for display transition by switching the input signal as below table and is based on Frame rate fV =60Hz to optimize.
 Each time in below table is defined as Figure 3and shall be measured by switching the input signal for “any level of gray(bright)”and “any level of gray(dark)”.

Measured Response Time		Target																
		0	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
	0																	
	15																	
	31																	
	47																	
	63																	
	79																	
	95																	
	111																	
Start	127																	
	143																	
	159																	
	175																	
	191																	
	207																	
	223																	
	239																	
	255																	

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (Y_A) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (Y_B) 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

5.1.1 LED Light Bar

< Table 1. LED Light Bar>

Pin No	Description
1	LED current sense for string1
2	LED current sense for string2
3	LED power supply
4	LED power supply
5	LED current sense for string3
6	LED current sense for string4
7	LED current sense for string5
8	LED current sense for string6
9	LED power supply
10	LED power supply
11	LED current sense for string7
12	LED current sense for string8
CONNECTOR	3707K-Q06N-08X

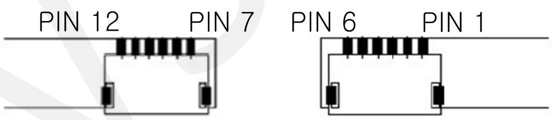


Figure1. Top View of LED Bar Connector

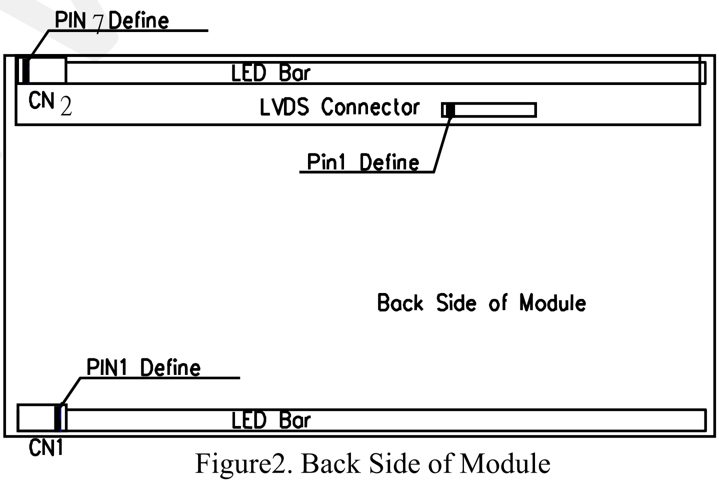


Figure2. Back Side of Module

5.1 2Electrical Interface Connection

- CN1 Module Side Connector : UJU IS050-C51B-C39-S or Equivalent

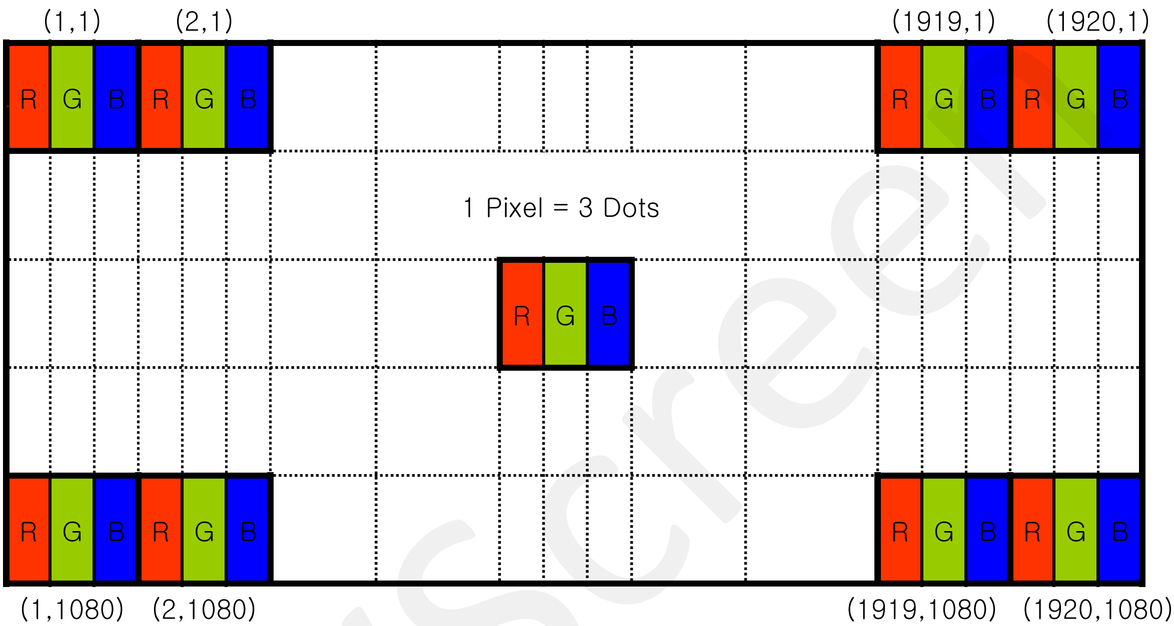
NO.	Symbol	Description	NO.	Symbol	Description
1	NC	not connection	27	NC	not connection
2	NC	not connection	28	2LVDSAN	SECOND LVDS Receiver Signal (A-)
3	SDAPG	SDA_P-Gamma	29	2LVDSAP	SECOND LVDS Receiver Signal (A+)
4	SCLPG	SCL_P-Gamma	30	2LVDSBN	SECOND LVDS Receiver Signal (B-)
5	BISTSEL	Bist selection	31	2LVDSBP	SECOND LVDS Receiver Signal (B+)
6	NC	not connection	32	2LVDSCN	SECOND LVDS Receiver Signal (C-)
7	NC	not connection	33	2LVDSCP	SECOND LVDS Receiver Signal (C+)
8	NC	not connection	34	GND	ground
9	NC	not connection	35	2CLKN	SECOND LVDS Receiver Clock Signal (-)
10	NC	not connection	36	2CLKP	SECOND LVDS Receiver Clock Signal (+)
11	GND	ground	37	GND	ground
12	1LVDSAN	FIRST LVDS Receiver Signal (A-)	38	2LVDSDN	SECOND LVDS Receiver Signal (D-)
13	1LVDSAP	FIRST LVDS Receiver Signal (A+)	39	2LVDSDP	SECOND LVDS Receiver Signal (D+)
14	1LVDSBN	FIRST LVDS Receiver Signal (B-)	40	2LVDSEN	SECOND LVDS Receiver Signal (E-)
15	1LVDSBP	FIRST LVDS Receiver Signal (B+)	41	2LVDSEP	SECOND LVDS Receiver Signal (E+)
16	1LVDSCN	FIRST LVDS Receiver Signal (C-)	42	NC	not connetion
17	1LVDSCP	FIRST LVDS Receiver Signal (C+)	43	NC	not connetion
18	GND	ground	44	GND	ground
19	1CLKN	FIRST LVDS Receiver Clock Signal(-)	45	GND	ground
20	1CLKP	FIRST LVDS Receiver Clock Signal(+)	46	GND	ground
21	GND	ground	47	NC	not connetion
22	1LVDSDN	FIRST LVDS Receiver Signal (D-)	48	Power	power supply
23	1LVDSDP	FIRST LVDS Receiver Signal (D+)	49	Power	power supply
24	1LVDSEN	FIRST LVDS Receiver Signal (E-)	50	Power	power supply
25	1LVDSEP	FIRST LVDS Receiver Signal (E+)	51	Power	power supply
26	GND	ground			

5.2 LVDS Interface (Tx; THC63LVD1023B or Equivalent)

5.2.1 LVDS Interface

	Input Signal	Transmitter		Interface		HR270WU1-200	Remark
		Pin No.	Pin No.	System(Tx)	TFT-LCD (Rx)	(CN1)Pin No.	
L V D S	R4	80	70,71	OUT0- OUT0+	RX0- RX0+	12,13	
	R5	81					
	R6	84					
	R7	85					
	R8	86					
	R9	87					
	G4	92					
	G5	95	68,69	OUT1- OUT1+	RX1- RX1+	14,15	
	G6	96					
	G7	97					
	G8	98					
	G9	99					
	B4	106					
	B5	107					
	B6	108	64,65	OUT2- OUT2+	RX2- RX2+	16,17	
	B7	110					
	B8	111					
	B9	112					
	HS	7					
	VS	8					
	DE	9					
	MCLK	15	62,63	CLK OUT- CLK OUT-	RX CLK- RX CLK+	19,20	
		16					
	R2	78	58,59	OUT3- OUT3+	RX3- RX3+	22,23	
	R3	79					
	G2	90					
	G3	91					
	B2	102					
	B3	103					
	-						
	R0	76	56,57	OUT4- OUT4+	RX4- RX4+	24,25	
	R1	77					
	G0	88					
	G1	89					
	B0	100					
	B1	101					
	-						

5.3 Data Input Format



Display Position of Input Data (V-H)

6.0 SIGNAL TIMING SPECIFICATION

6.1 The HR270WU1-200 is operated by the DE only.

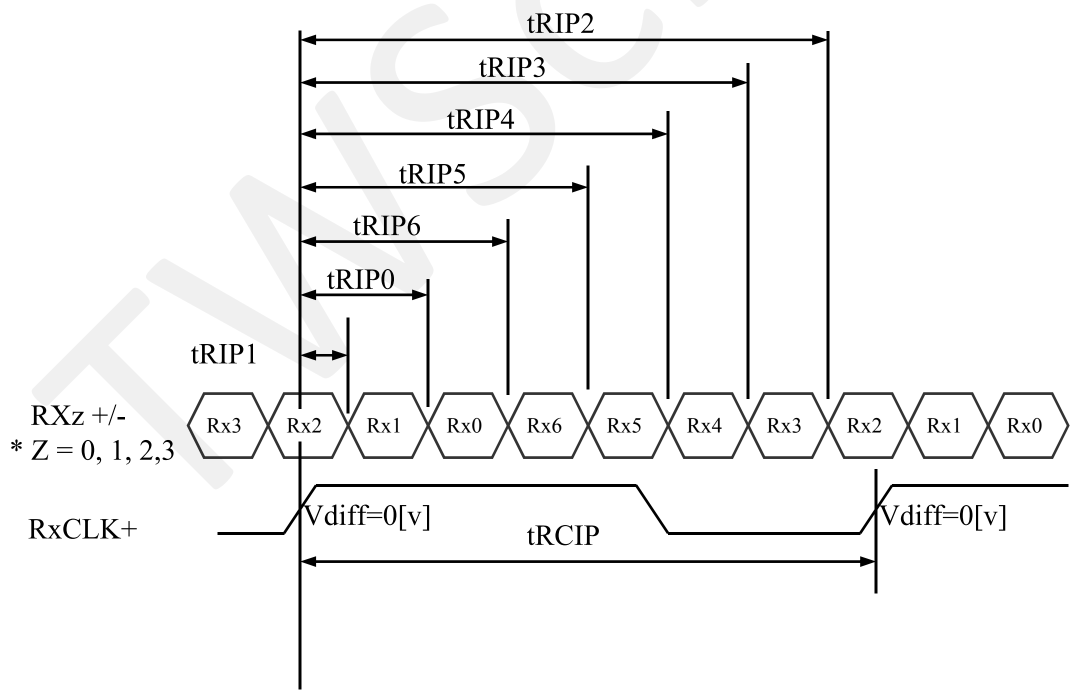
Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	-	74.25	-	MHz
	High Time	Tch	-	4/7Tc	-	
	Low Time	Tcl	-	4/7Tc	-	
Frame Period		Tv	-	1126	-	lines
			-	60	-	Hz
			-	16.7	-	ms
Vertical Display Period		Tvd	-	1080	-	lines
One line Scanning Period		Th	-	1100	-	clocks
Horizontal Display Period		Thd	-	960	-	clocks

6.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 4.

<Table 4. LVDS Rx Interface Timing Specification>

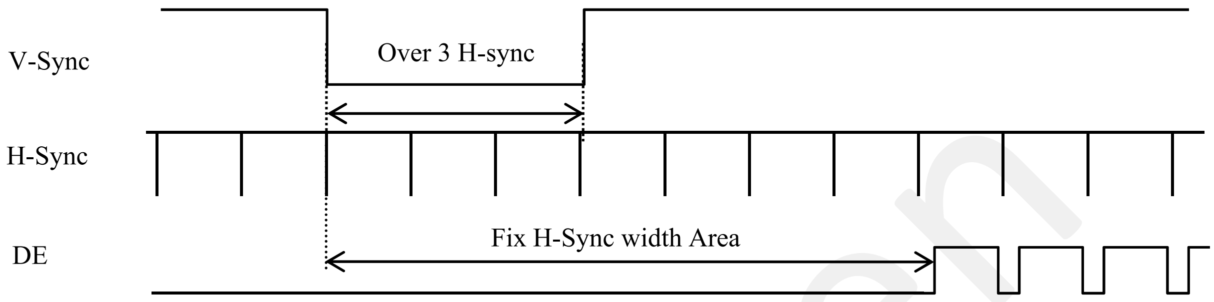
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	10.20	13.47	17.08	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	nsec	
Input Data 4	tRIP4	4 ×tRCIP/7-0.4	4 ×tRCIP/7	4 ×tRCIP/7+0.4	nsec	
Input Data 5	tRIP3	5 ×tRCIP/7-0.4	5 ×tRCIP/7	5 ×tRCIP/7+0.4	nsec	
Input Data 6	tRIP2	6 ×tRCIP/7-0.4	6 ×tRCIP/7	6 ×tRCIP/7+0.4	nsec	



* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

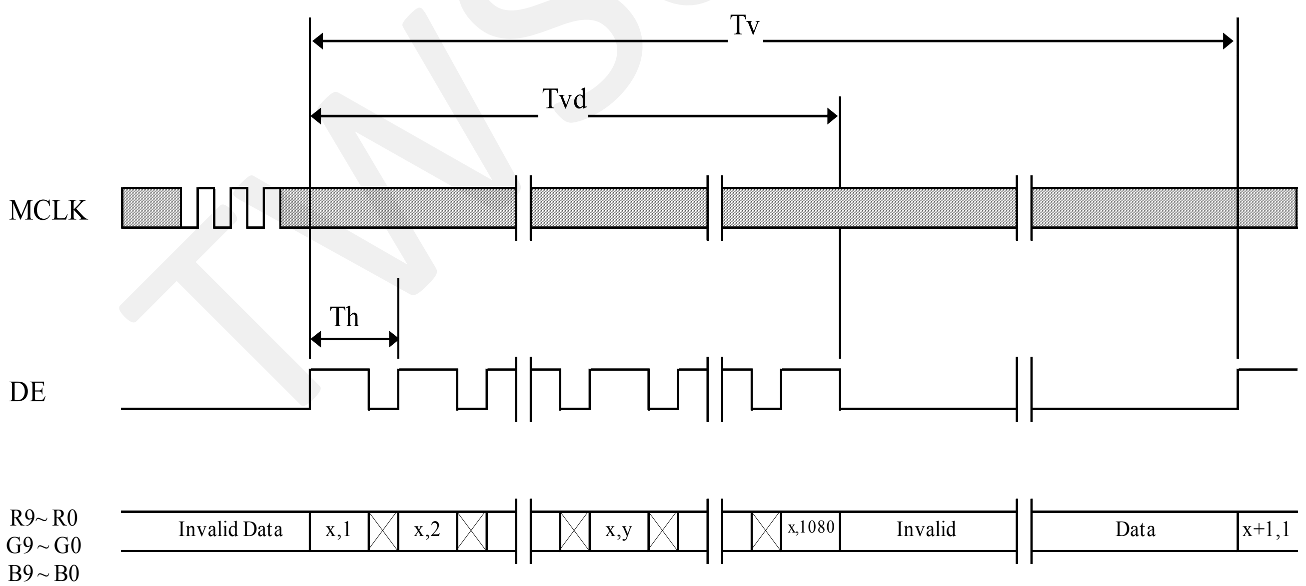
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms

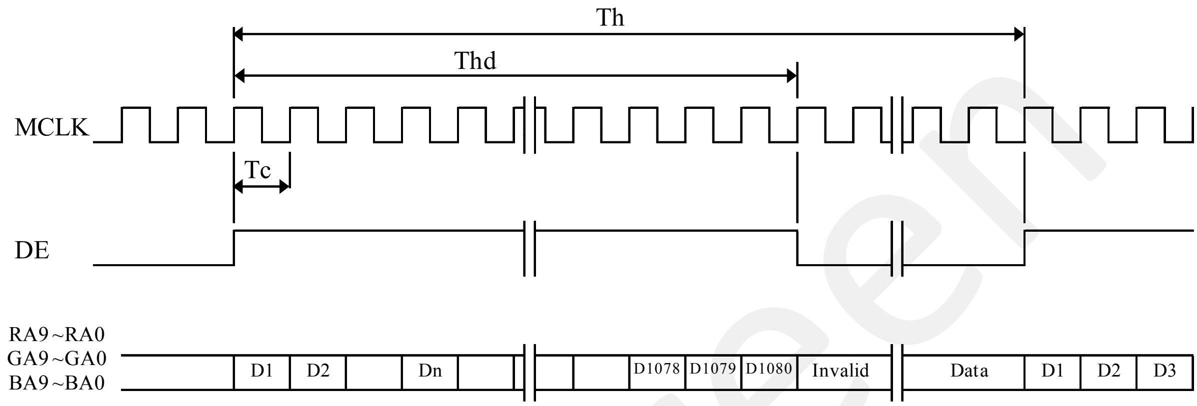


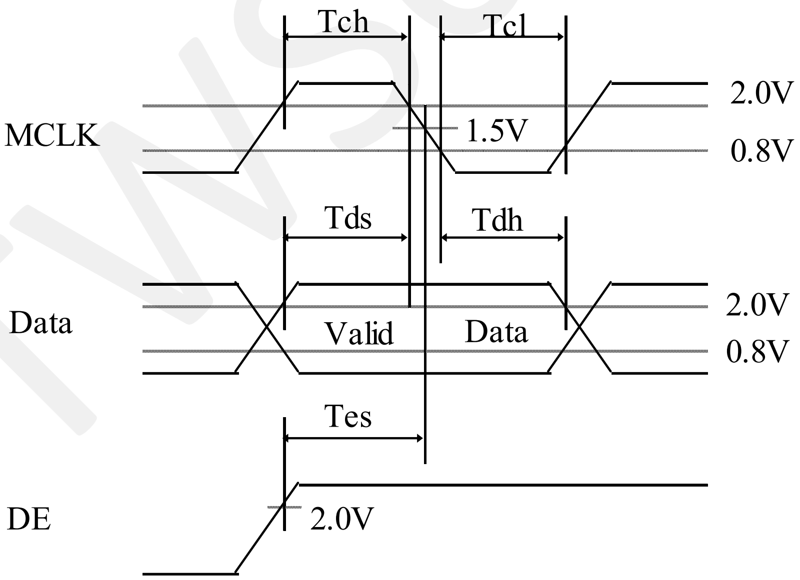
1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



7.3 Horizontal Timing Waveforms



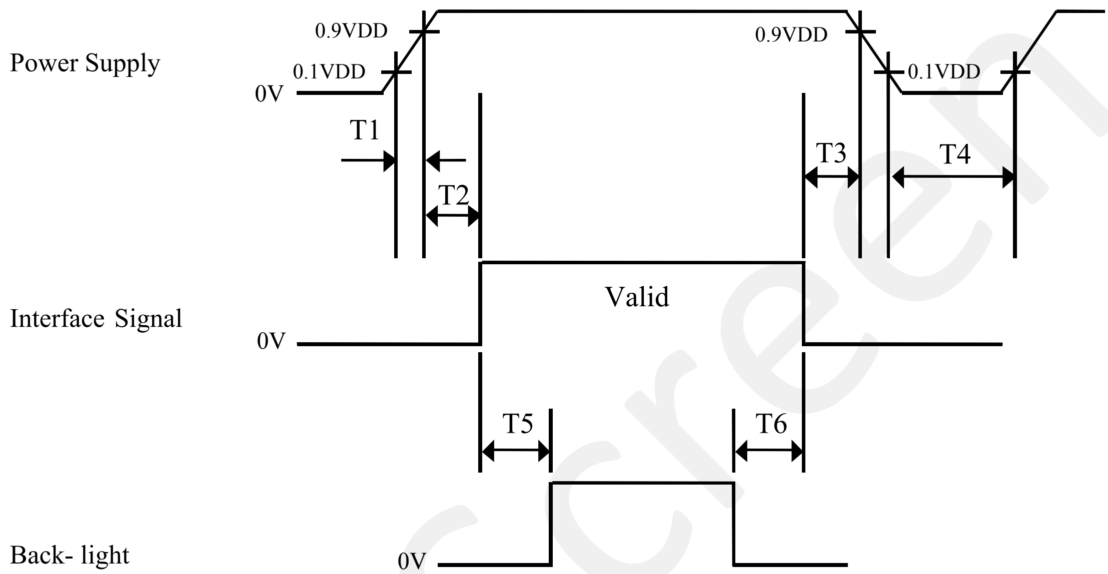


8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		RED DATA										GREEN DATA										BLUE DATA									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	R9	R8	G7	G6	G5	G4	G3	G2	G1	G0	R9	R8	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	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	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	1	1	0	0	0	0	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	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	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	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	0	0	0	0
	Darker	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	0	0	0	0	0
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	1	1	1	1	1	1	1	1	1	0	0	0	0	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	1	1	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Darker	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
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	▽	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	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	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	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	0	0	0	0	1	1	1	1	1	1	1	1	0	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	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	0	0	0	0	1	1	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	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
	△	↑										↑										↑									
	▽	↓										↓										↓									
	Brighter	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	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	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



- 0.5 ms ≤ T1 ≤ 10 ms
- 0 ≤ T2 ≤ 50 ms
- 0 ≤ T3 ≤ 50 ms
- 1 sec ≤ T4
- 200 ms ≤ T5
- 200 ms ≤ T6

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 6 (located in Appendix) shows mechanical outlines for the model HR270WU1-200. Other parameters are shown in Table 5.

<Table 5. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	630(H) ×368.2(V) ×15.2(D) typ	mm
Weight	3000(typ)	gram
Active area	597.888 (H) × 336.312 (V)	mm
Pixel pitch	0.3114 (H) ×0.3114 (V)	mm
Number of pixels	1920 (H)×1080 (V) (1 pixel = R + G + B dots)	pixels
Back-light	Up & lower edge side, 2-LED Lighting Bar type	

10.2 Mounting

Refer to Figure 5 (Show in Appendix).

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an anti-glare coating to minimize reflection and a coating to reduce scratching.

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 50cm from the screen with an overhead light level of 350lux.

11.0 RELIABLITY TEST

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

<Table 6. Reliability Test Parameters >

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 ℃, 240 hrs	
2	Low temperature storage test	Ta = -20 ℃, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 ℃, 240hrs	
5	Low temperature operation test	Ta = 0℃, 240hrs	
6	Thermal shock	Ta = -20 ℃ ↔ 60 ℃ (0.5 hr), 100 cycle	
7	On/Off Operation Test	1min(on) / 1min(off), 30000cycle	
8	Vibration test (non-operating)	Frequency	Random,10 ~ 300 Hz, 30 min/Axis
		Gravity / AMP	1.5 Grms
		Period	X, Y, Z 30 min
9	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	±X, ±Y, ±Z Once for each
10	Packing Vibration(Module)	1.2Grms, 1~200Hz, Random +Z/60min, X/30min, Y/30min	
11	Drop Test（Module）	1Angle,3Edge,6Face. Height: Based on JIS-Z-0200	
12	Electro-static discharge test (non-operating)	Air : 150 pF, 330Ω, 15 KV Contact : 150 pF, 330Ω, 8 KV	

12.0 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.

13.0 PRODUCT SERIAL NUMBER

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

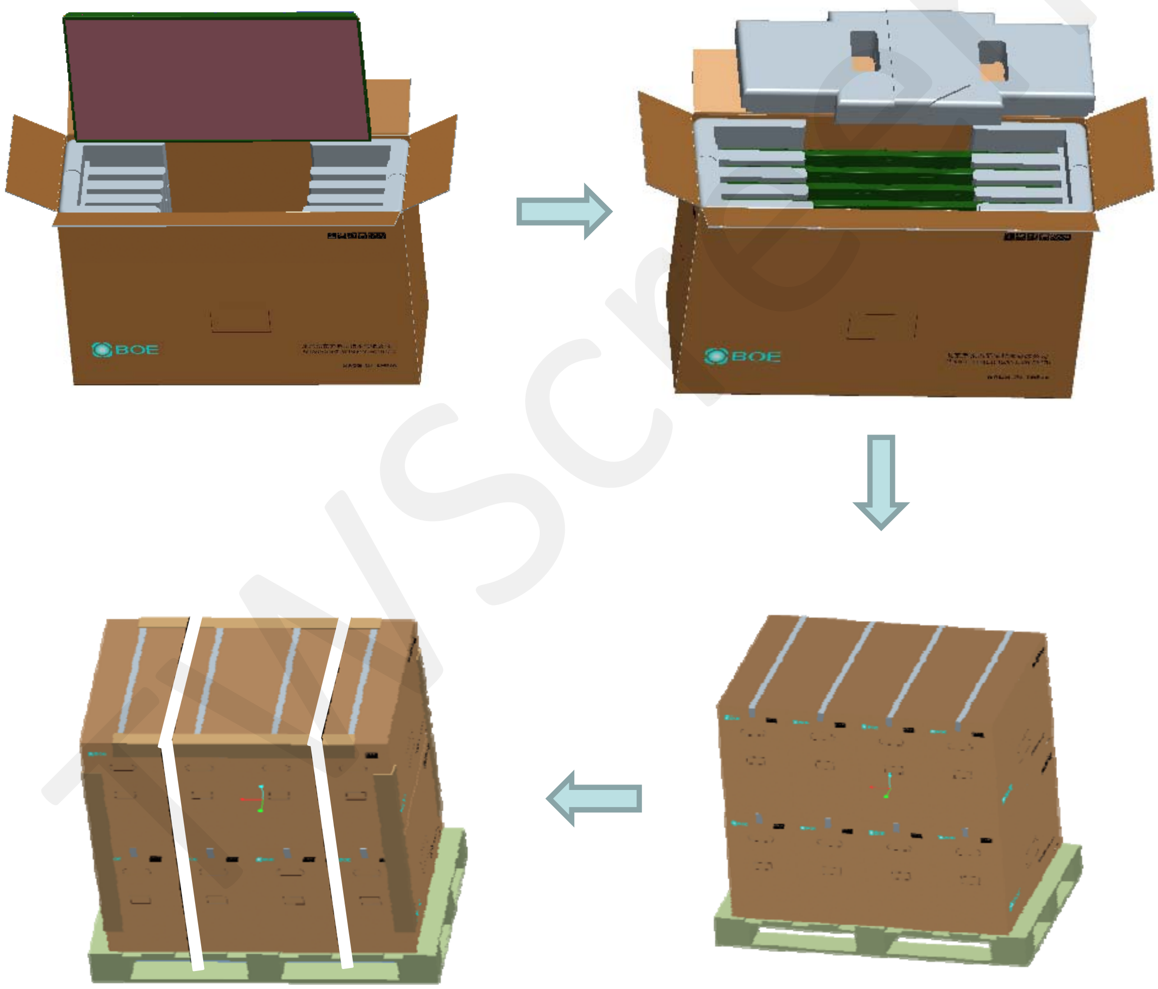
1. Control Number
2. Rank / Grade
3. Line Classification
4. Year (2001 : 01, 2002 : 02, …)
5. Month (1,2,3, … , 9, X, Y, Z)
6. Internal Use
7. Serial Number

14.0 Packing

14.1 Packing Order

Place the modules into the box;
Notice front and rear , 5 modules per box

place a cover on the top of the box



8ea box per pallet

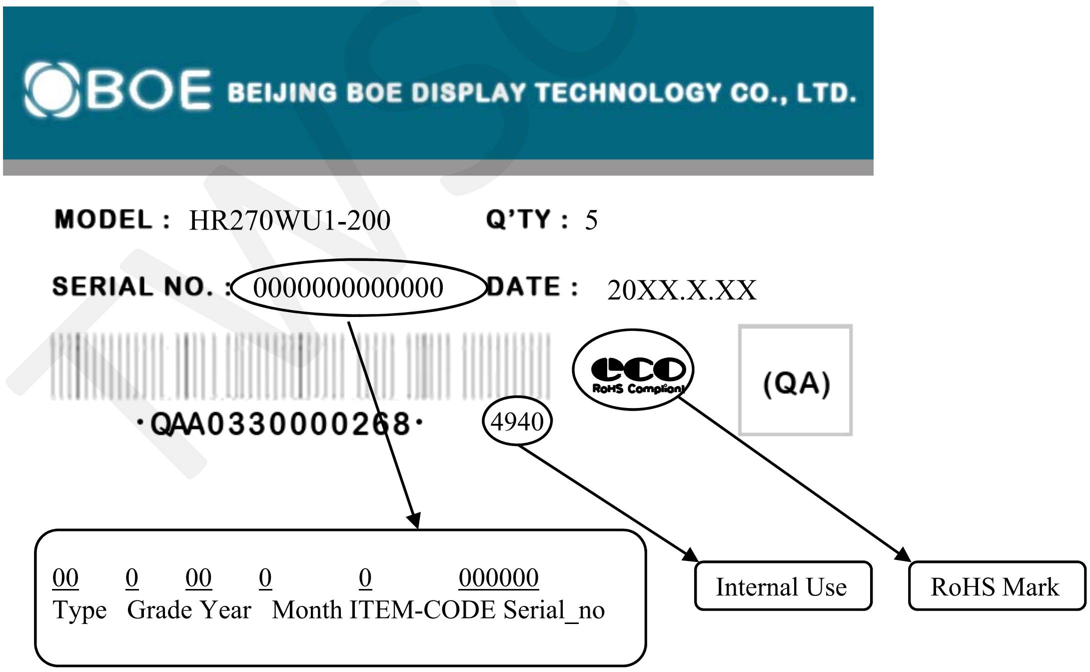
After sealing the box, put the box on the pallet

14.2 Packing Note

- . See next page for detail description.
  Date : Packing DateBox Dimension : 235mm(W) × 715mm(L) × 485mm(H)
- Package Quantity in one Box : 5 pcs

14.3 Box label

- Label Size : 108 mm (L) × 56 mm (W)
- Contents
  Model : HR270WU1-200
  Q`ty : Module Q`ty in one box
  Serial No. : Box Serial No



15.0 APPENDIX

Figure 1. Measurement Set Up

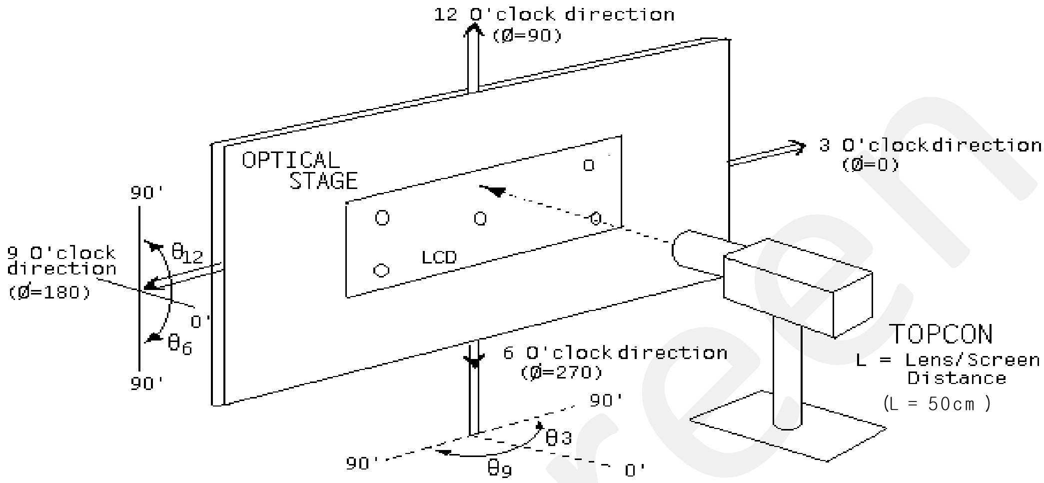


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

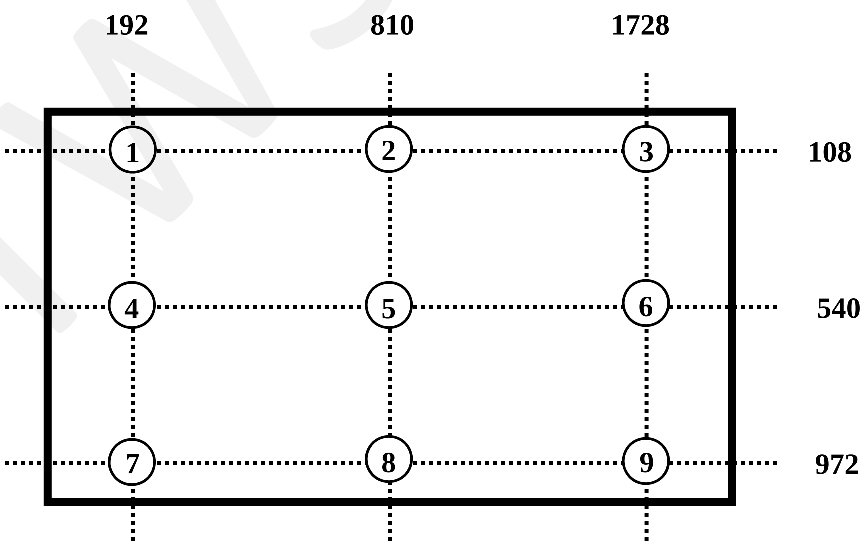


Figure 3. Response Time Testing

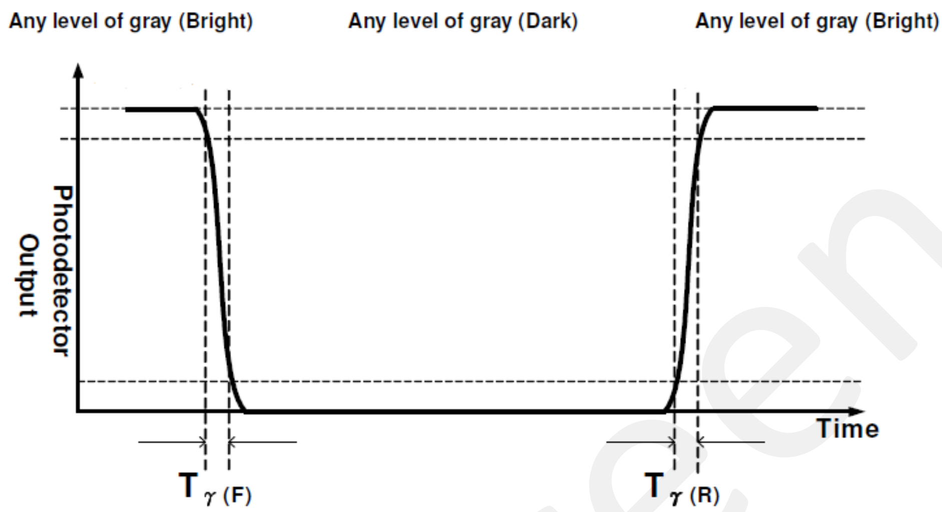
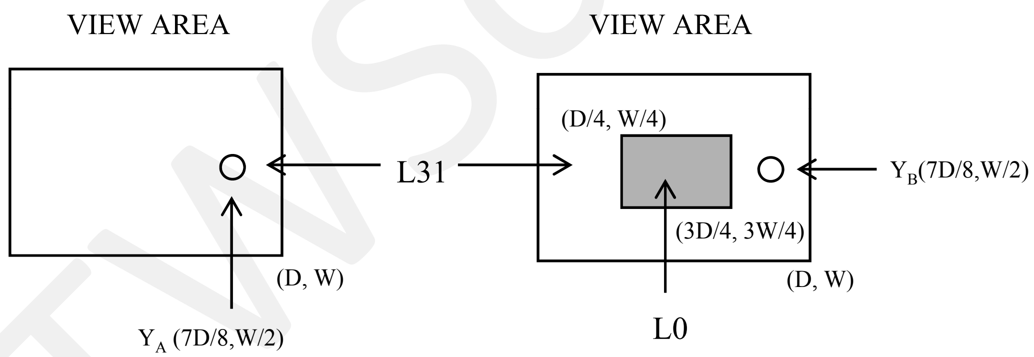


Figure 4. Cross Modulation Test Description



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

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)

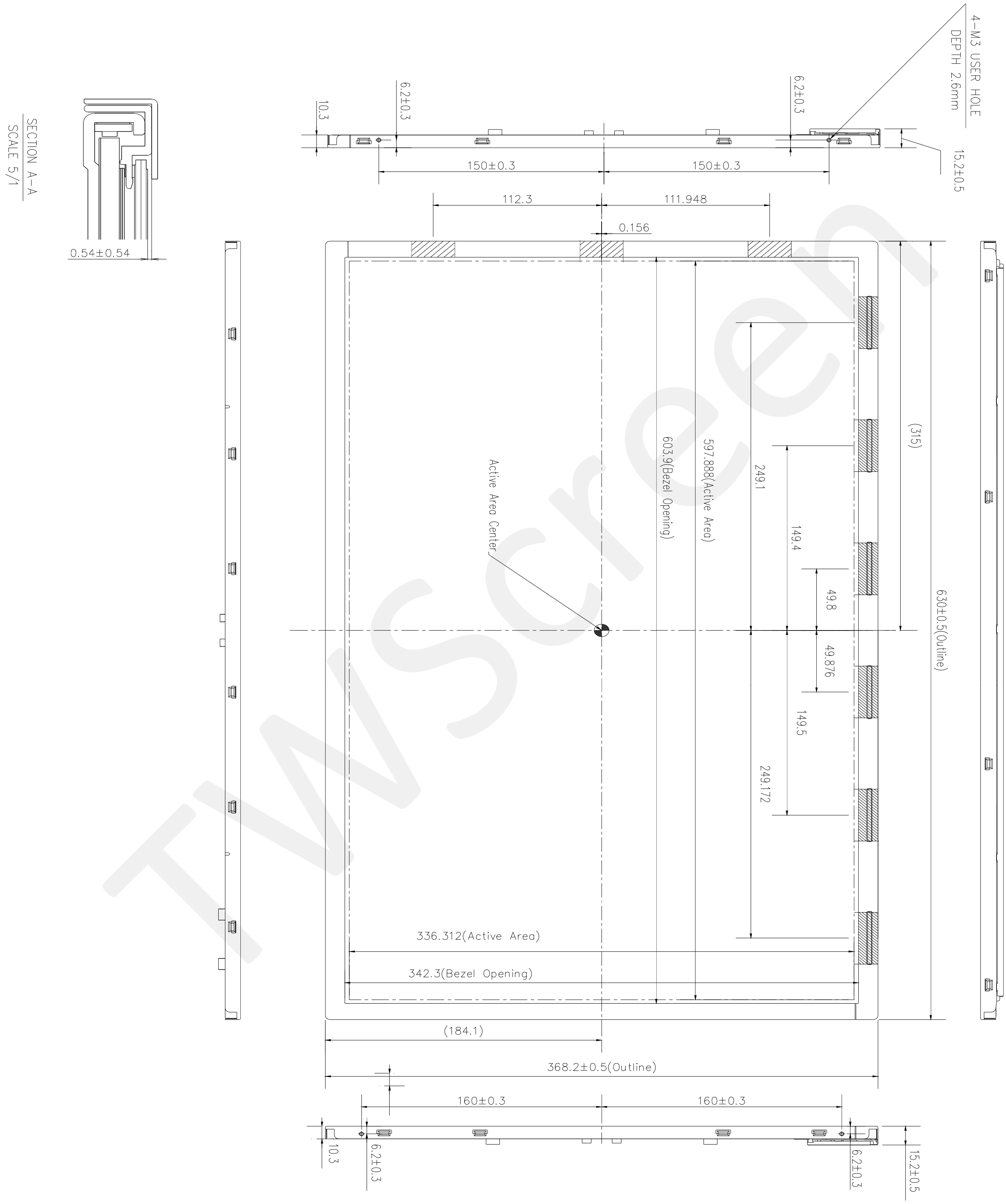


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)