BOE

TITLE : MV270QHM-N40

Preliminary Product Specification

Rev. P1

BEIJING BOE Display TECHNOLOGY

REVISION HISTORY

(●)preliminary specification
( )Final specification

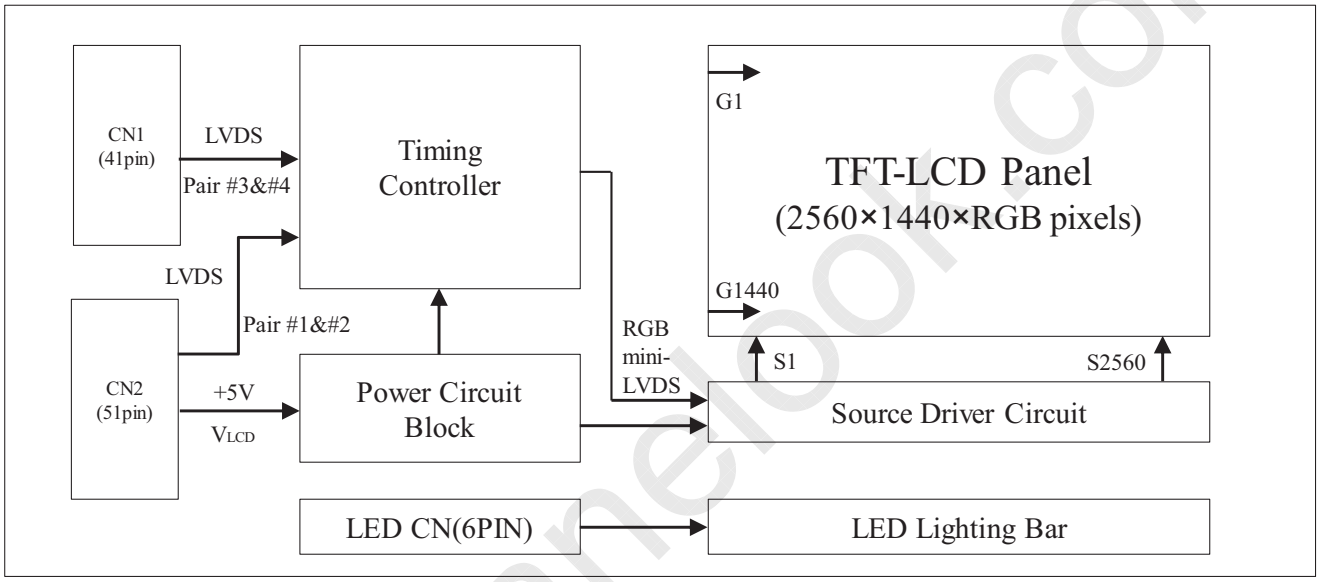
Revision No.	Page	Description of changes	Date	Prepared
Rev.P0		Initial Release	Aug.18.2018	zhangxiaoxiang
Rev.P1	P7-P9	Change LED Channel Current & Voltage Add LED Channel Max Current Update Power Consumption	Jan.25.2019	Geng Chen

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

MV270QHM-N40 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 inch diagonally measured active area with QHD resolutions (2560 horizontal by 1440 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M 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 4 pixel / clock
- High-speed response
- 0.5t Glass
- 8-bit (True) color depth, display 16. 7M colors
- Incorporated edge type back-light (One Light Bar)
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- ES 7.0 compliant
- Gamma Correction
- Reverse type

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 MV270QHM-N40.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	596.736(H) × 335.664(V)	mm	
Number of pixels	2560(H) ×1440(V)	pixels	
Pixel pitch	0.2331(H) x 0.2331(V)	mm	
Pixel arrangement	RGB Vertical stripe	-	
Display colors	16.7M	colors	
Display mode	Normally Black	-	
Dimensional outline	608.8(H) x 355.3(V)× 9.3(D) typ	mm	Detail refer to drawing
Weight	3.25	Kg	
Surface Treatment	Anti-glare, 3H	-	
Back-light	Down edge side 1-LED Light bar Type	-	

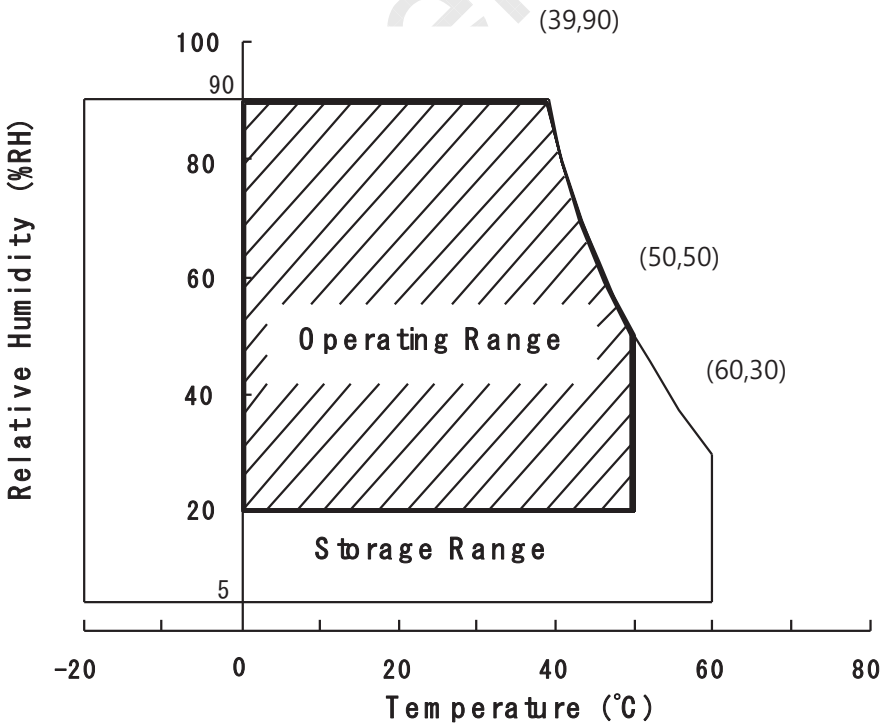
2.0 ABSOLUTE MAXIMUM RATINGS

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 °C
Logic Supply Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OP}	0	+50	°C	1)
Storage Temperature	T_{ST}	-20	+60	°C	1)

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



3.0 ELECTRICAL SPECIFICATIONS

3.1Electrical Specifications

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

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	4.5	5.0	5.5	V	**Note1**
Power Supply Current	I_{DD}	-	TBD	1000	mA	
In-Rush Current	I_{RUSH}	-	2.0	3	A	**Note 2**
Permissible Input Ripple Voltage	V_{RF}	-	-	300	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	$\|V_{ID}\|$	100	-	600	mV	
Differential input common mode voltage	Vcm	0.7	-	1.6		
LED Voltage	V_L	2.8	3.0	3.1	V	
LED Channel Voltage	V_L	47.6	51	52.7	V	
LED Channel Current	I_L	-	106	109	mA	
LED Lifetime		30,000	-	-	Hrs	I_L=106 mA
Power Consumption	P_D	-	3.5	-	W	75Hz
	P_{BL}	-	21.62	-	W	I_L=106mA, **Note 3**
	P_{total}	-	25.12	-	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=75Hz. Test Pattern of power supply current

a) Typ : Color Bar pattern
b) Max : Vertical Subline pattern

2. Duration of rush current is about 2 ms and rising time of VDD is 520 µs ± 20 %
3. Calculated value for reference (VL × IL) ×4(channel) excluding driver loss. (LED Light bar: : 17S4P)

Parameter		Min.	Typ.	Max.	Unit	Remarks
LED Light Bar Input Voltage Per Input Pin	VPIN	47.6	51	52.7	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	-	106	109	mA	Note1,2,
LED Power Consumption	PBL	-	21.62	22.34	W	Note 3
LED Life-Time	-	30,000	-		Hrs	Note 4

LED bar consists of 68LED packages,4 strings(parallel)*17packages(serial)
Note1: There are one light bar ,and the specified current is input LED chip 100% duty current
Note2: The sense current of each input pin is 106mA
Note3: PBL=4 Input pins*V_{PIN} ×I_{PIN}
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=106mA 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°C) with the equipment of Luminance meter system (Goniometer system and TOPCONE PR730) 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} = 424mA, Ta =25±2 °C]

< Table 4. Module Optical >

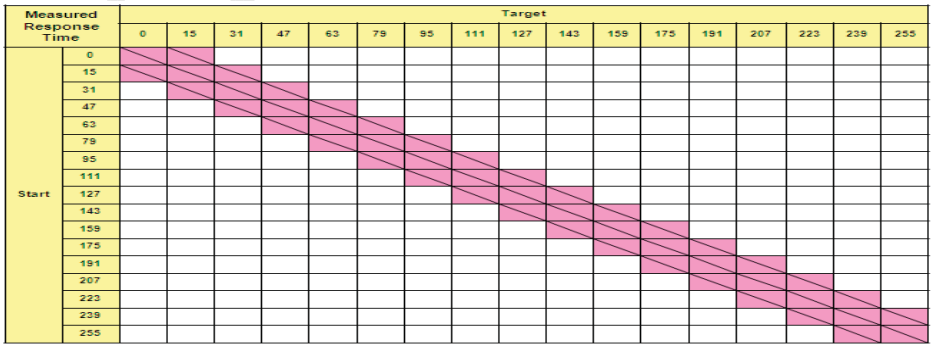
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	Θ_3	CR > 10	85	89	-	Deg.	Note 1
		Θ_9		85	89	-	Deg.	
	Vertical	Θ_{12}		85	89	-	Deg.	
		Θ_6		85	89	-	Deg.	
Luminance Contrast ratio		CR	Θ = 0° (Center) Normal Viewing Angle	700	1000			Note 2
Luminance of White		Y_w		280	350	-	cd/m^2	Note 3
White luminance uniformity		ΔY		75	-	-	%	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		TBD	TBD	TBD	-	
		R_y					-	
	Green	G_x					-	
		G_y					-	
	Blue	B_x					-	
		B_y					-	
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 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. 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 appendix Figure 3and shall be measured by switching the input signal for "any level of gray(bright)"and "any level of gray(dark)".



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

-LED connector : 10035WS-H06D manufactured by YEONHO or 3712K-Q06M-00R manufactured by Entery or EQUIVALENT

< Table 5. LED Light Bar>

Pin No	Symbol	Description
1	IRLED1	LED current sense for string1
2	IRLED2	LED current sense for string2
3	VLED	LED power supply
4	VLED	LED power supply
5	IRLED3	LED current sense for string3
6	IRLED4	LED current sense for string4

5.2 Electrical Interface Connection

- CN1 Module Side Connector : IS050-C41B-C39-S or Equivalent

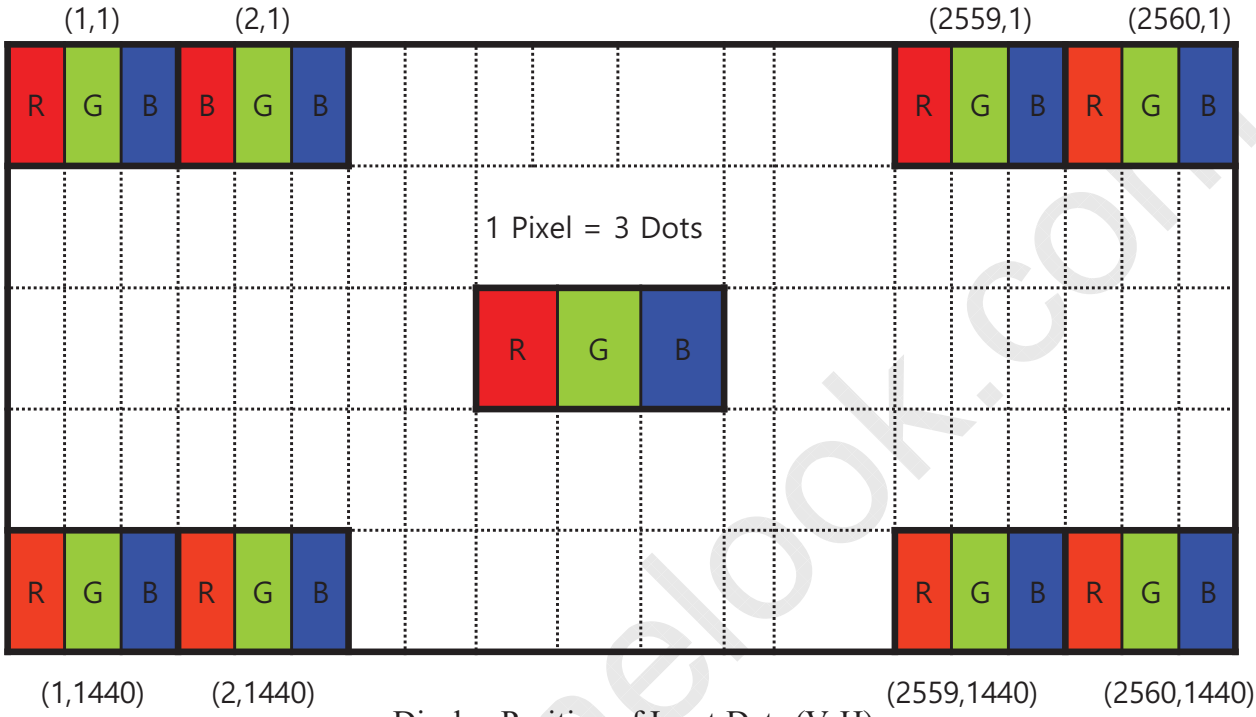
Pin No	Symbol	Function	Pin No	Symbol	Function
1	NC	No. Connection	22	NC	No. Connection
2	NC	No. Connection	23	NC	No. Connection
3	NC	No. Connection	24	GND	Power Ground
4	NC	No. Connection	25	GND	Power Ground
5	NC	No. Connection	26	DLV0N	Port4 Negative Transmission data of Pixel 0
6	NC	No. Connection	27	DLV0P	Port4 Positive Transmission data of Pixel 0
7	NC	No. Connection	28	DLV1N	Port4 Negative Transmission data of Pixel 1
8	NC	No. Connection	29	DLV1P	Port4 Positive Transmission data of Pixel 1
9	GND	Power Ground	30	DLV2N	Port4 Negative Transmission data of Pixel 2
10	CLV0N	Port3 Negative Transmission data of Pixel 0	31	DLV2P	Port4 Positive Transmission data of Pixel 2
11	CLV0P	Port3 Positive Transmission data of Pixel 0	32	GND	Power Ground
12	CLV1N	Port1 Negative Transmission data of Pixel 1	33	DLVCLKN	Port4 Negative Transmission Clock
13	CLV1P	Port3 Positive Transmission data of Pixel 1	34	DLVCLKP	Port4 Positive Transmission Clock
14	CLV2N	Port3 Negative Transmission data of Pixel 2	35	GND	Power Ground
15	CLV2P	Port3 Positive Transmission data of Pixel 2	36	DLV3N	Port4 Negative Transmission data of Pixel 3
16	GND	Power Ground	37	DLV3P	Port4 Positive Transmission data of Pixel 3
17	CLVCLKN	Port3 Negative Transmission Clock	38	NC	No. Connection
18	CLVCLKP	Port3 Positive Transmission Clock	39	NC	No. Connection
19	GND	Power Ground	40	GND	Power Ground
20	CLV3N	Port3 Negative Transmission data of Pixel 3	41	GND	Power Ground
21	CLV3P	Port3 Positive Transmission data of Pixel 3			

5.2 Electrical Interface Connection

- CN2 Module Side Connector : IS050-C51B-C39-S or Equivalent

Pin No	Symbol	Function	Pin No	Symbol	Function
1	GND	Power Ground	27	NC	No. Connection
2	NC	No. Connection	28	BLV0N	Port2 Negative Transmission data of Pixel0
3	NC	Reserved for LCD manufacturer's	29	BLV0P	Port2 Positive Transmission data of Pixel 0
4	NC	Reserved for LCD manufacturer's	30	BLV1N	Port2 Negative Transmission data of Pixel1
5	NC	No. Connection	31	BLV1P	Port2 Positive Transmission data of Pixel 1
6	GND	Power Ground	32	BLV2N	Port2 Negative Transmission data of Pixel2
7	GND	Power Ground	33	BLV2P	Port2 Positive Transmission data of Pixel 2
8	NC	No. Connection	34	GND	Power Ground
9	NC	No. Connection	35	BLVCLKN	Port2 Negative Transmission Clock
10	NC	No. Connection	36	BLVCLKP	Port2 Positive Transmission Clock
11	GND	Power Ground	37	GND	Power Ground
12	ALV0N	Port1Negative Transmission data of Pixel 0	38	BLV3N	Port2 Negative Transmission data of Pixel3
13	ALV0P	Port1 Positive Transmission data of Pixel 0	39	BLV3P	Port2 Positive Transmission data of Pixel 3
14	ALV1N	Port1 Negative Transmission data of Pixel1	40	NC	No. Connection
15	ALV1P	Port1 Positive Transmission data of Pixel 1	41	NC	No. Connection
16	ALV2N	Port1 Negative Transmission data of Pixel2	42	NC	No. Connection
17	ALV2P	Port1 Positive Transmission data of Pixel 2	43	NC	No. Connection
18	GND	Power Ground	44	GND	Power Ground
19	ALVCLKN	Port1 Negative Transmission Clock	45	GND	Power Ground
20	ALVCLKP	Port1 Positive Transmission Clock	46	GND	Power Ground
21	GND	Power Ground	47	NC	No. Connection
22	ALV3N	Port1 Negative Transmission data of Pixel3	48	VIN	Power Supply: +5V
23	CLV3P	Port3 Positive Transmission data of Pixel 3	49	VIN	Power Supply: +5V
24	NC	No. Connection	50	VIN	Power Supply: +5V
25	NC	No. Connection	51	VIN	Power Supply: +5V
26	GND	Power Ground			

5.2 Data Input Format



Display Position of Input Data (V-H)

5.3 Back-light Interface Connection

-LED connector : 10035WS-H06D manufactured by YEONHO or 3712K-Q06M-00R manufactured by Entery or EQUIVALENT

Pin	Function
1	Channel 1 Current Feedback
2	Channel 2 Current Feedback
3	LED Power Supply
4	LED Power Supply
5	Channel3 Current Feedback
6	Channel4 Current Feedback

6.0 SIGNAL TIMING SPECIFICATION

6.1 The MV270FHM-N40 is operated by the DE only.

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	12.12	16.56	20.71	ns	
	Frequency	-	48.3	60.4	82.5	MHz	
Hsync	Period	tHP	679	680	709	tCLK	
	Horizontal Valid	tHV	640	640	640	tCLK	
	Horizontal Blank	tHB	39	40	69		
	Frequency	fH	74	88.9	112	KHz	
Vsync	Period	tVP	1452	1481	1550	tHP	
	Vertical Valid	tVV	1440	1440	1440	tHP	
	Vertical Blank	tVB	12	41	110	tHP	
	Frequency	fV	48	60	75	Hz	2)
LVDS Receiver clock	Input spread spectrum ratio	SSr	-3	-	+3	%	

Note 1 : 1). This DCLK range at last line of V-blanking should be set in 0~987.

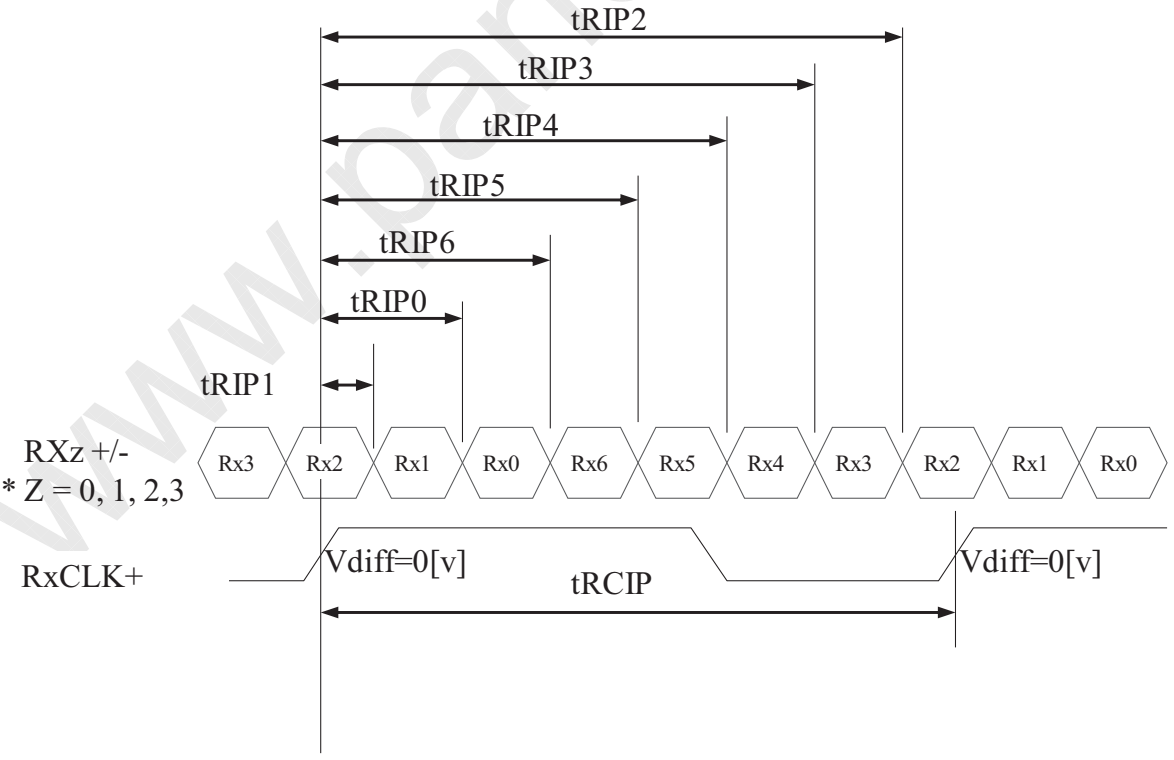
2). The Vsync Frequency maximum can reach 77Hz when the resolution is applied @ 1152*900, 1280*1024.

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>

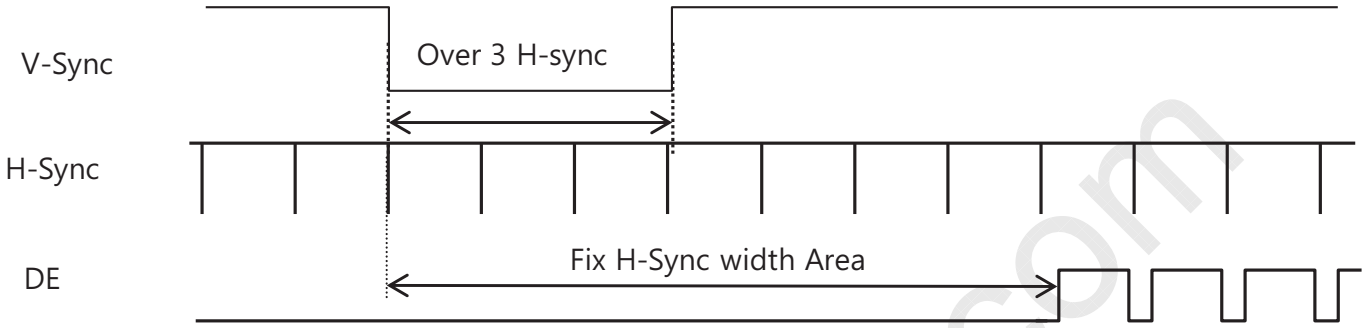
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	13.24	16.55	20.68	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRCIP/7-0.4	tRCIP/7	tRCIP/7+0.4	nsec	
Input Data 2	tRIP6	2 ×tRCIP/7-0.4	2 ×tRCIP/7	2 ×tRCIP/7+0.4	nsec	
Input Data 3	tRIP5	3 ×tRCIP/7-0.4	3 ×tRCIP/7	3 ×tRCIP/7+0.4	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-)

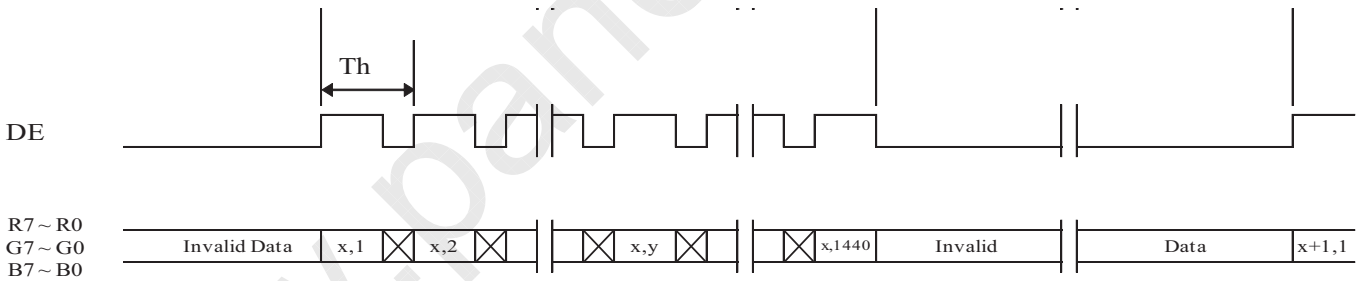
7.0 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL

7.1 Sync Timing Waveforms

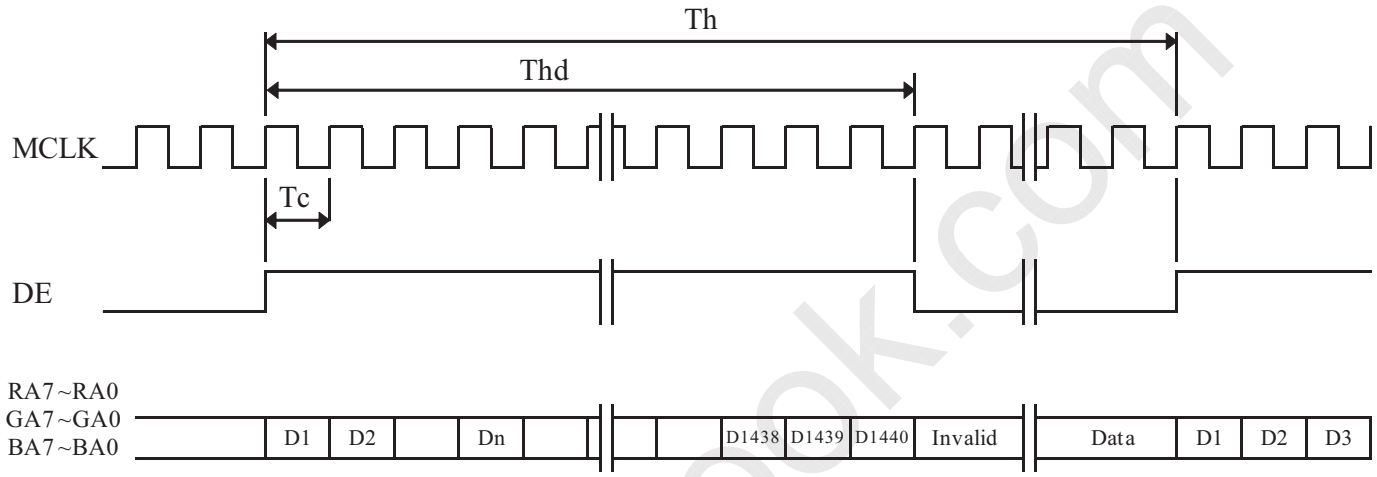


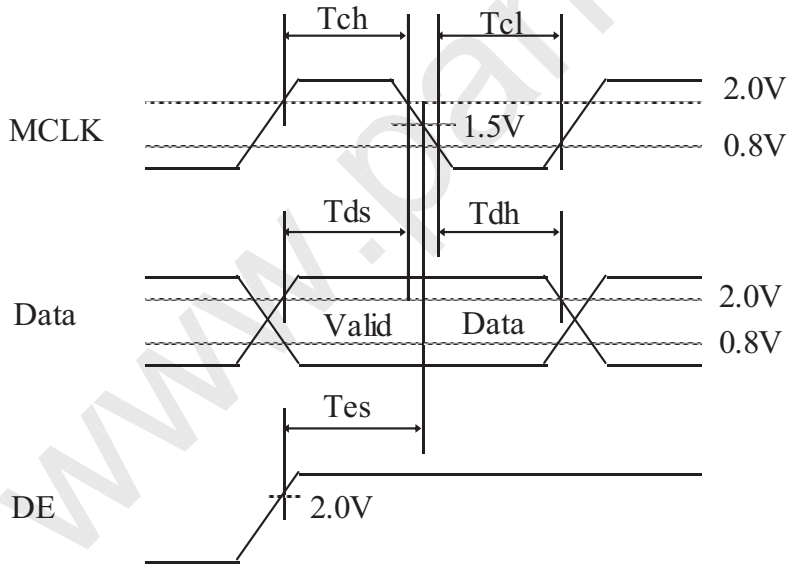
1) Need over 3 H-sync during V-Sync Low
2) Fix H-Sync width from V-Sync falling edge to first rising edge

7.2 Vertical Timing Waveforms



7.3 Horizontal Timing Waveforms



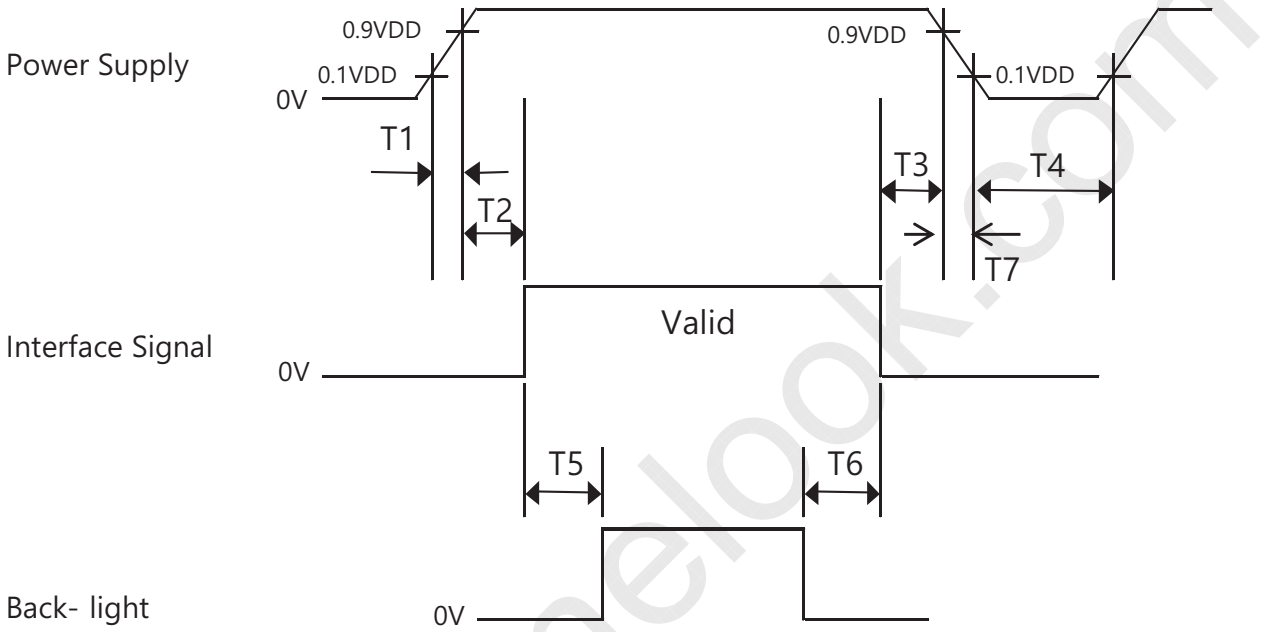


8.0 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		RED DATA								GREEN DATA								BLUE DATA							
		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

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.
4. T7 decreases smoothly, there is none re-bouncing voltage.

10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

FIGURE 5 (located in Appendix) shows mechanical outlines for the model MV270FHM-N40. Other parameters are shown in Table 8.

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	608.8(H) x 355.3(V)× 9.3(D) typ	mm
Weight	3.25	Kg
Active area	596.736(H) × 335.664(V)	mm
Pixel pitch	0.2331H) x 0.2331(V)	mm
Number of pixels	2560(H) ×1440(V)(1 pixel = R + G + B dots)	pixels
Back-light	Down edge side 1-LED Light bar Type	

10.2 Mounting

See FIGURE 5 . (shown 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 9 Reliability Test Parameters >

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 °C, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 °C, 240hrs	
5	Low temperature operation test	Ta = 0°C, 240hrs	
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency	Random,10 ~ 300 Hz, 30 min/Axis
		Gravity\ AMP	1.5 Grms
		Period	X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, sine wave
		Direction	±X, ±Y, ±Z Once for each
9	Electro-static discharge test	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.

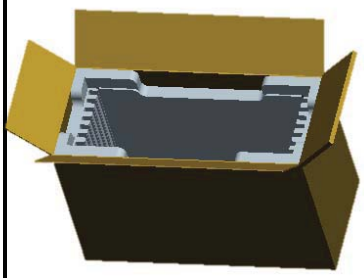
13.0 PRODUCT SERIAL NUMBER

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

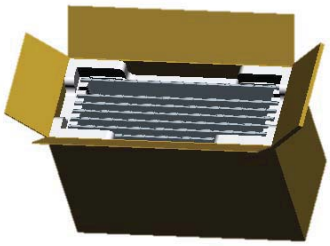
1. Control Number
2. Rank / Grade
3. Line Classification
4. Year (2001 : 01, 2002 : 02, …)
5. Month (1,2,3, … , 9, X, Y, Z)
6. Internal Use
7. Serial Number

14.0 Packing

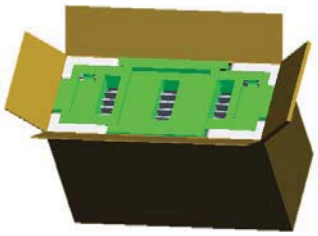
14.1 Packing Order



Put 1 EPO bottom in to the inner box.

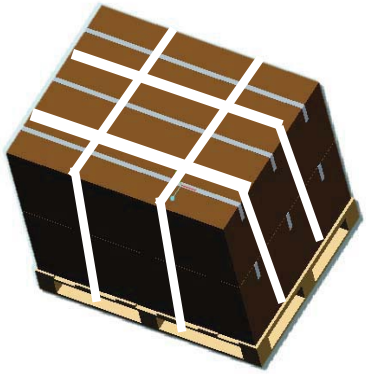


Put each module into a PE bag.
Insert 7Pcs MDL into each box.



Put 1 EPO cover in and seal the box.

Put the boxes on the pallet (12ea b oxes per ballet)



Place paper corners and wrap film arou nd the boxes.
Pack with 4 packing belts.

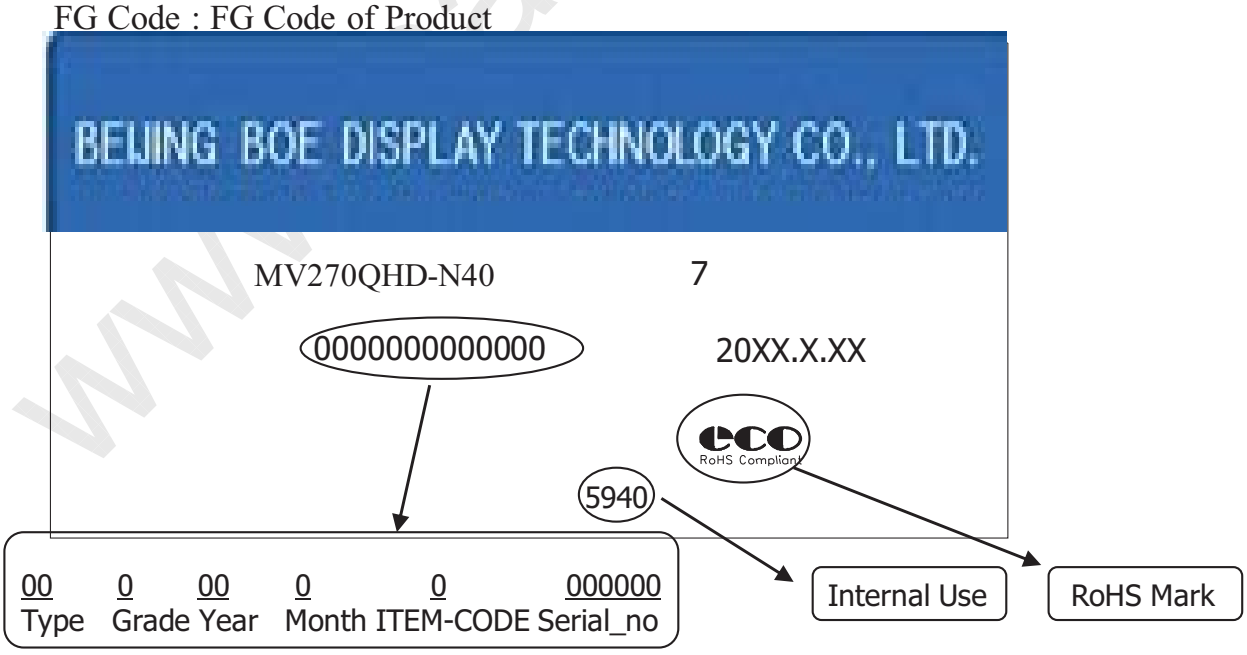
14.3 Packing Specification and Note

Item	Specification			Remark
	Q'ty	Dimension(mm)	Weight (kg)	
MDL	1	608.8(H)*355.3(V)*9.3.(D) typ.	3.25	-
Cushion	-	-	-	-
Box	1	675(L)×277(W)×449(H)	0.71	without Panel & cushion
Packing Box	7pcs/Box	687(L)×289W)×461(H)	24.8	with panel & cushion
Pallet	1	1380(L)×900(W)×130(H)	25	-
Packing Pallet	12Box/Pallet	1380(L)×900(W)×1052(H)	325.78	-

14.3 Box label

- Label Size : 110 mm (L) × 55 mm (W)
- Contents

Model : MV270QHM-N40
Q`ty : Module 7Q`ty in one box
Serial No. : Box Serial No. See next page for detail description.
Date : Packing Date
FG Code : FG Code of Product



15.0 APPENDIX

Figure 1. Measurement Set Up

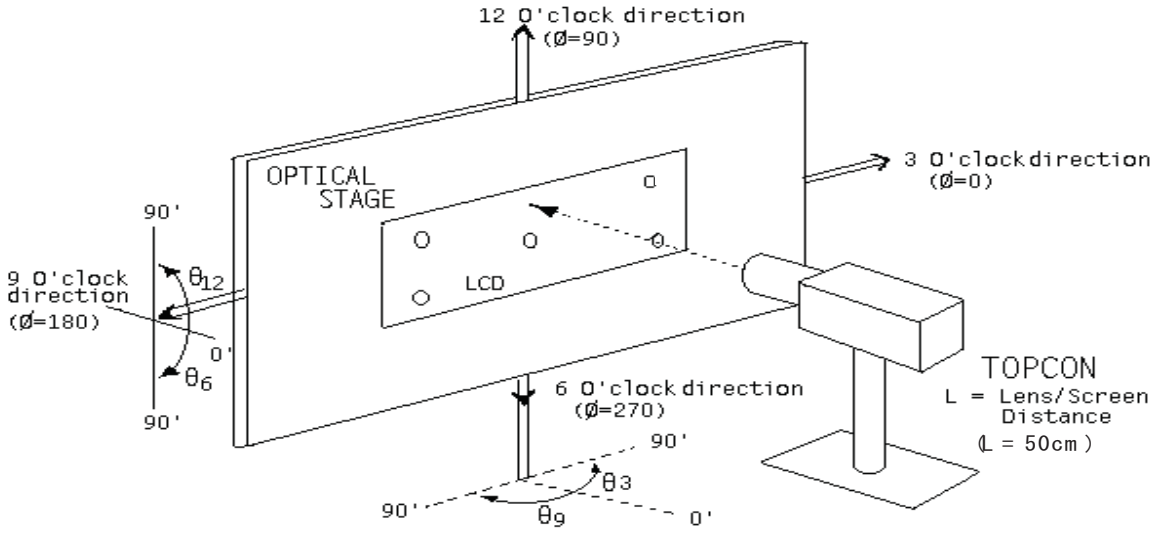


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

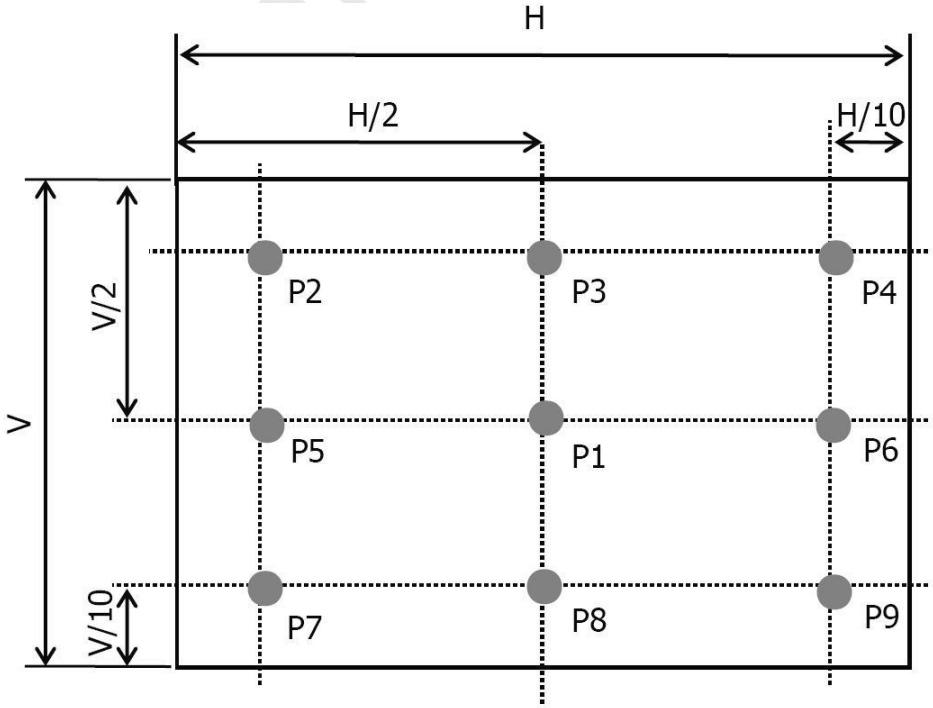
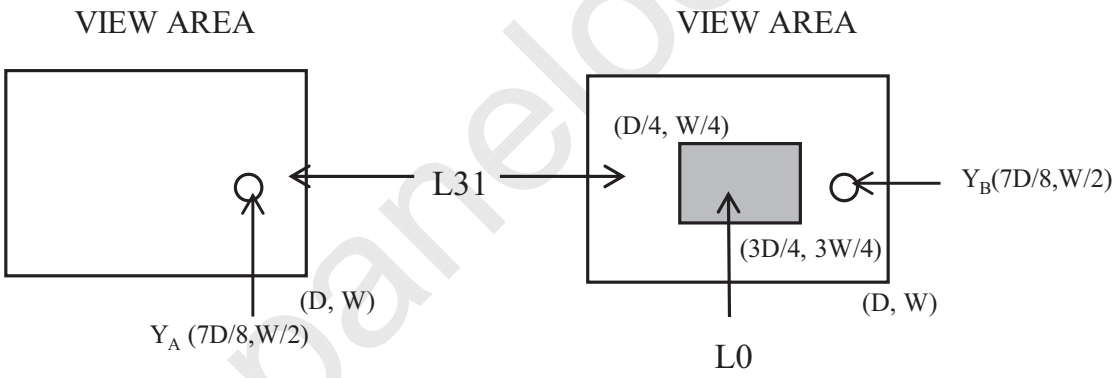


Figure 3. Response Time Testing

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)

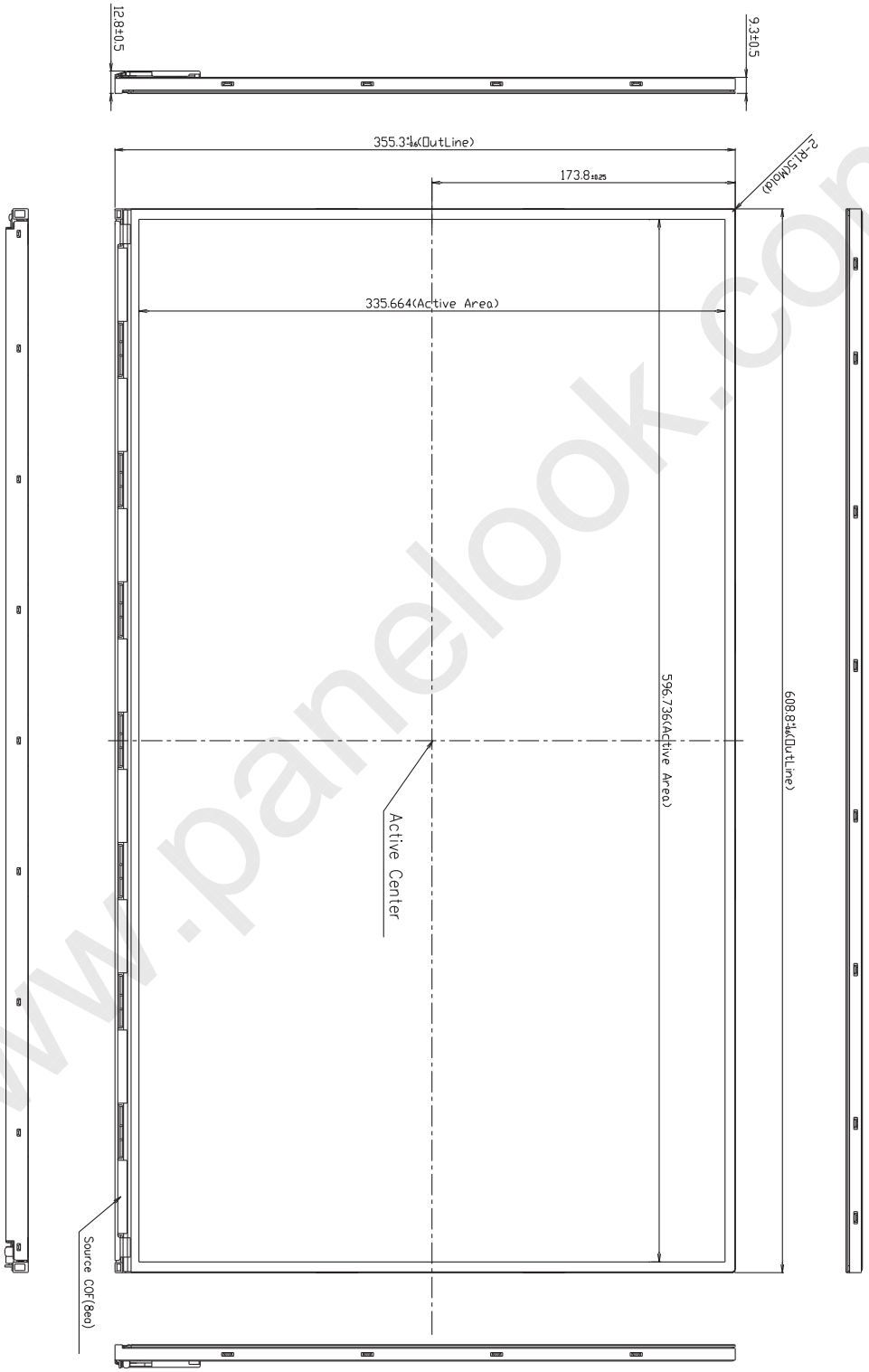


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)