TITLE :MV270QUM-N10

Preliminary Product Specification

Rev. P2

HEFEI XINSHENG OPTOELECTRONICS TECHNOLOGY

REVISION HISTORY

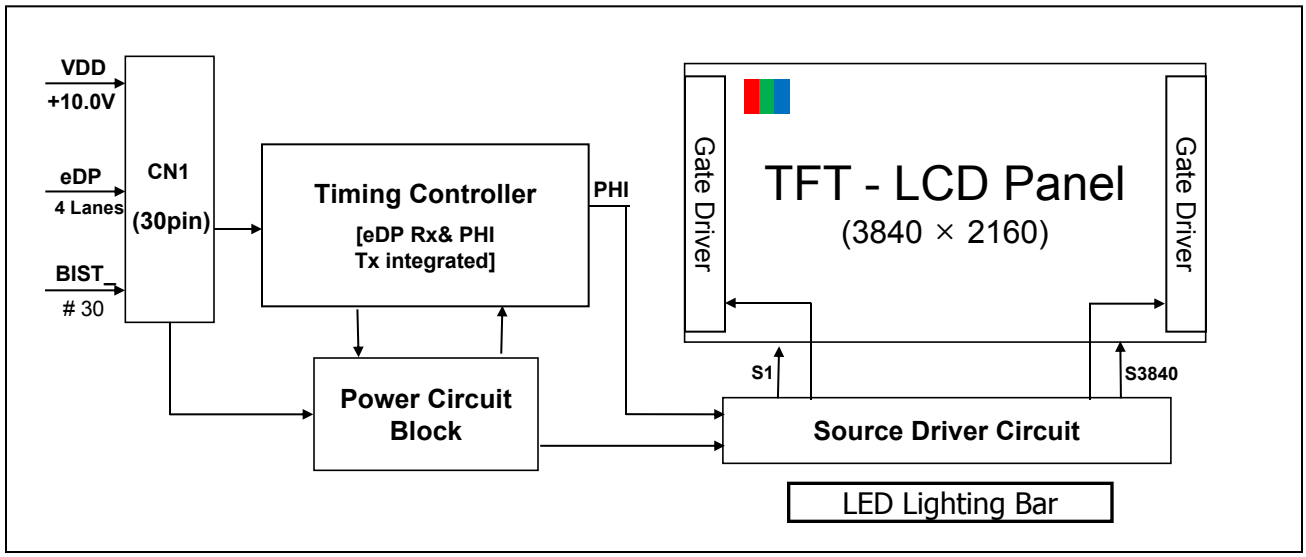
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
Rev. P0		Preliminary specification	2016.10.17	Zhang Wang
Rev. P1		Update VLED Min. 52.2V → 51.5V	2016.11.09	Li Jing
Rev. P2		Added Adaptive Sync 40~60Hz	2017.01.03	Wang Hongjun
		LED CNT:3709K-Q06N-00L→BM06B-SHJS-TB(HF)	2017.03.06	

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

MV270QUM-N10 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 diagonall y measured active area with UHD resolutions (3840 horizontal by 2160 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe a nd this module can display 1.07B colors. The TFT-LCD panel used for this module is adapte d for a low reflection and higher color type.



1.2 Features

- Reverse Type
- 4 lane eDP Interface with 5.4Gbps Link Rates
- 10bit (8bit+A-FRC) color depth, display 1.07B colors
- Incorporated edge type back-light (LED)
- Compatible with NTSC72%
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS/Halogen Free
- ES 7.0 compliant
- 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 MV270QUM-N10.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	597.736(H) × 335.664(V)	mm	
Number of pixels	3840(H) ×2160 (V)	pixels	
Pixel pitch	0.1554(H) ×0.1554(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Color Depth	1.07 B(8bit+A-FRC)	colors	
Display mode	Normally Black		
Dimensional outline	621.8(H) ×360.6 (V) × 13.5(Depth)	mm	Detail refer to drawing
Weight	3230 (typical)	g	
Bezel width (L/R/U/D)	9.9/9.9/9.9/9.9	mm	
Surface Treatment	Haze 25%, 3H		
Back-light	Down side, 1-LED Lighting Bar type		

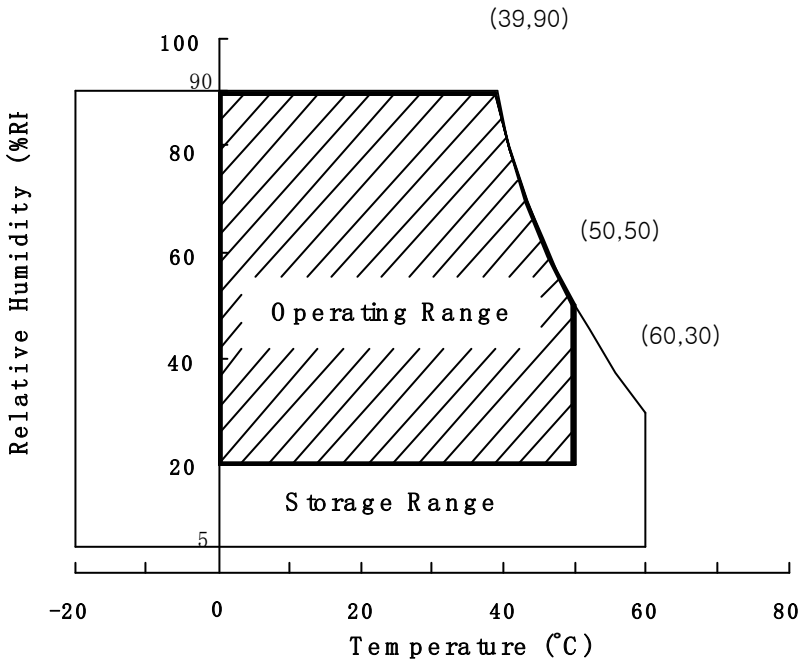
2.0 ABSOLUTE MAXIMUM RATINGS

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}	GND-0.3	12	V	Ta = 25 ℃
Logic Supply Voltage	V_{IN}	VSS-0.3	V_{DD}+0.3	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.



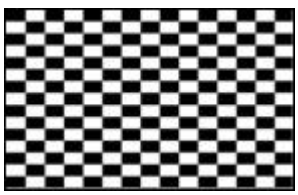
3.0 ELECTRICAL SPECIFICATIONS

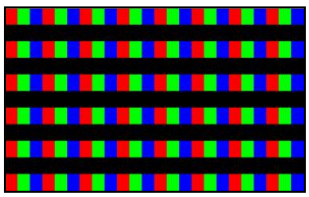
3.1Electrical Specifications

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

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	9	10.0	11	V	Note1
Power Supply Current	I_{DD}	-	460	900	mA	
In-Rush Current	I_{RUSH}	-	2.0	3.0	A	Note 2
Permissible Input Ripple Voltage	V_{RF}	-	-	400	mV	Note1,3
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	-	2		V_{IH}=100mV, V_{IL}=-100mV
Power Consumption	P_D	-	4.6	9	W	
	P_{BL}	15.66	17.28	20.196	W	
	P_{total}	-	21.88	-	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=10.0V, Frame rate=60Hz
Test Pattern of power supply curren
a) Typ : Mosaic Pattern
b) Max : 1 line Inversion





2. Duration of rush current is about 2 ms and rising time of VDD is 520 μs ± 20 %
3. Ripple Voltage should be covered by Input voltage Spec.
4. 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	51.5	54	59.4	V	Duty 100%
LED Light Bar Input Current Per Input Pin	IPIN	75	80	85	mA	Note1,2,
LED Power Consumption	P_{BL}	15.66	17.28	20.196	W	Note 3
LED Life-Time	-	30,000	-	-	Hrs	Note 4

LED bar consists of 72 LED packages,4 strings(parallel)18packages(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 80mA
Note3: P_{BL}=4Input 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=80mA 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 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 = 10.0V, Frame rate = 60Hz, Clock = 74.25MHz, I_{BL} = 260mA, Ta =25±2 ℃]

< Table 5. 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		200	250	-	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		0.612	0.642	0.672	-	
		R_y		0.310	0.340	0.370	-	
	Green	G_x		0.272	0.302	0.332	-	
		G_y		0.591	0.621	0.651	-	
	Blue	B_x		0.123	0.153	0.183	-	
		B_y		0.025	0.055	0.085	-	
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 3 and 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).

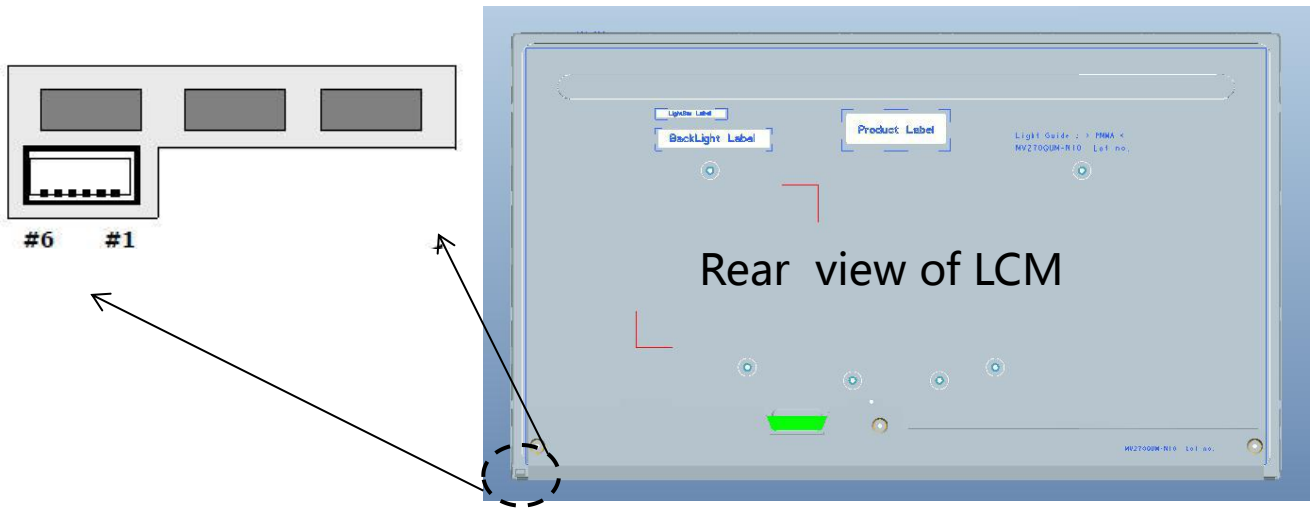
5.0 INTERFACE CONNECTION.

5.1 LED Light Bar

-LED connector：BM06B-SHJS-TB(HF) manufactured by JST, or Equivalent.

< Table 6. LED Light Bar>

Pin No	Symbol	Description
1	FB1	Channel1 Current Feedback
2	FB2	Channel2 Current Feedback
3	VLED	LED Power Supply
4	VLED	LED Power Supply
5	FB3	Channel3 Current Feedback
6	FB4	Channel4 Current Feedback



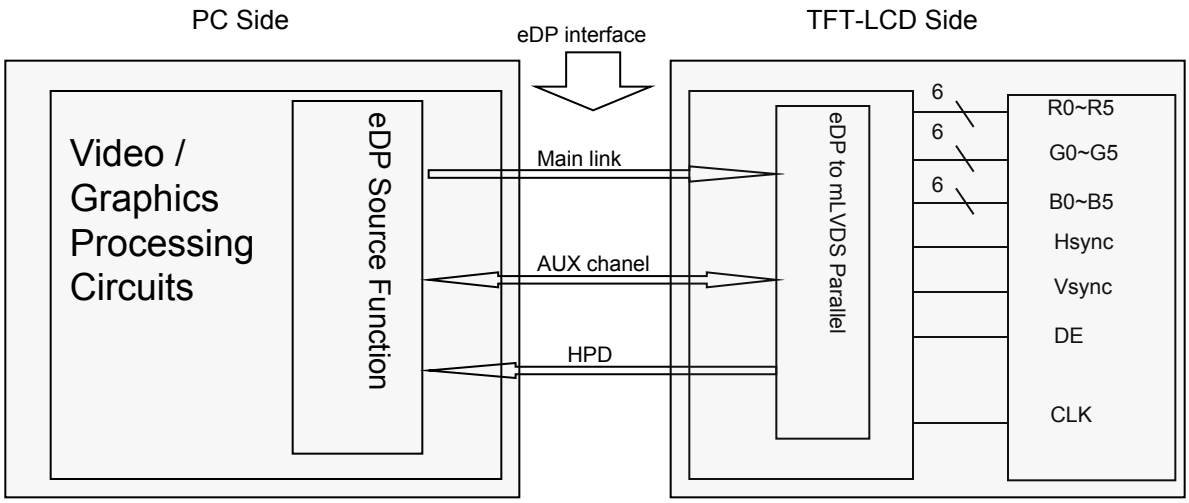
5.0 INTERFACE CONNECTION.

5.2 Electrical Interface Connection

● CN1 Module Side Connector : STM MSAK24025P30 or Equivalent

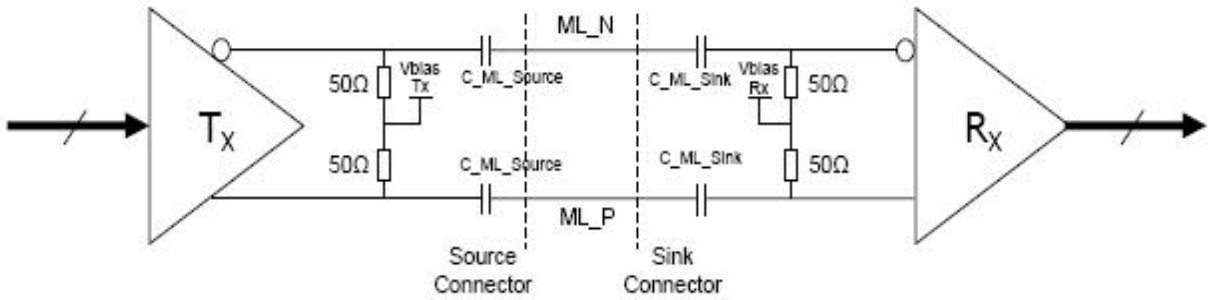
Pin No	Symbol	Function	Remark
1	VDD	Power Supply (10.0V)	
2	VDD	Power Supply (10.0V)	
3	VDD	Power Supply (10.0V)	
4	VDD	Power Supply (10.0V)	
5	VDD	Power Supply (10.0V)	
6	GND	Ground	
7	GND	Ground	
8	NC	SCL PGMA	
9	NC	SDA PGMA	
10	GND	Ground	
11	HPD	Hot Plug Detection Signal	
12	GND	Ground	
13	DAUXN	Negative Signal for Auxiliary Chanel	
14	DAUXP	Positive Signal for Auxiliary Chanel	
15	GND	Ground	
16	DRX0P	Positive Signal For eDP Lane0	
17	DRX0N	Negative Signal For eDP Lane0	
18	GND	Ground	
19	DRX1P	Positive Signal For eDP Lane1	
20	DRX1N	Negative Signal For eDP Lane1	
21	GND	Ground	
22	DRX2P	Positive Signal For eDP Lane2	
23	DRX2N	Negative Signal For eDP Lane2	
24	GND	Ground	
25	DRX3P	Positive Signal For eDP Lane3	
26	DRX3N	Negative Signal For eDP Lane3	
27	GND	Ground	
28	GND	Ground	
29	NC	No connection	
30	BIST	BIST Function	BIST

5.3.eDP Interface

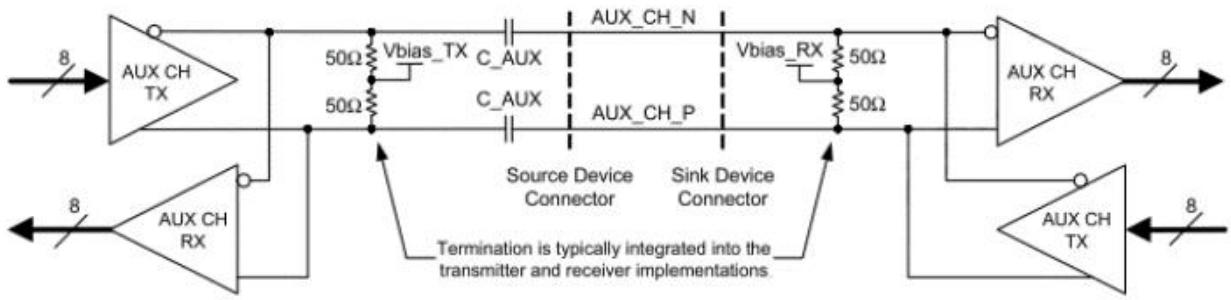


Note. Transmitter : Parade DP501or equivalent.

Transmitter is not contained in Module.



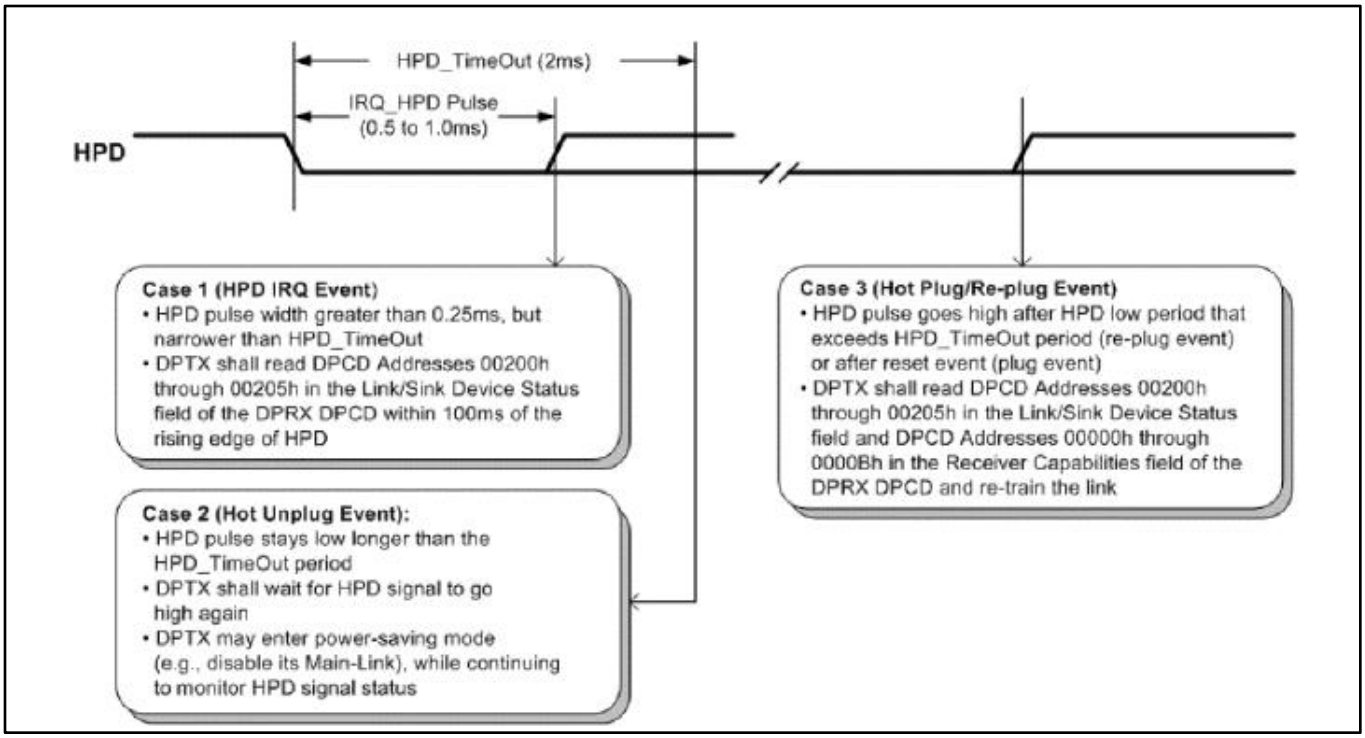
5.4 eDP AUX Channel Signal



Recommended eDP AUX Channel Differential Pair

Parameter	Symbol	Min	Typ	Max	Unit	Notes
AUX Unit Interval	UI	0.4	-	0.6	us	
AUX Jitter at Tx IC Package Pins	T_{jitter}	-	-	0.04	UI	
AUX Jitter at Rx IC Package Pins		-	-	0.05	UI	
AUX Peak-to-peak voltage at Connector Pins of Receiving	$V_{AUX-DIFFP-P}$	0.27	-	1.36	V	
AUX Peak-to-peak voltage at Connector Pins of Transmitting		0.29	-	1.38	V	
AUX EYE Width at Connector Pins of Tx and Rx		0.98	-	-	UI	
AUX DC common mode voltage	V_{AUX-CM_RX}	0	-	1.2	V	
	V_{AUX-CM_TX}	0	-	1.2	V	
AUX AC Coupling Capacitor	$C_{SOURCE-AUX}$	75	-	200	nF	

5.5 eDP HPD Signal



Parameter	Symbol	Min	Typ	Max	Unit	Notes
HPD Voltage	HPD	2.25	-	3.6	V	Sink side Driving
HOT Plug Detection Threshold		2.0	-	-	V	Source side Detecting
HOT Unplug Detection Threshold		-	-	0.8	V	
HPD_IRQ Pulse Width	HPD_IRQ	0.5	-	1.0	ms	
HPD_TimeOut		2.0	-	-	ms	HPD Unplug Event

6.0 SIGNAL TIMING SPECIFICATION

6.1 The MV270QUM-N10 is operated by the DE only.

Item		Symbol	Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	1.8	1.9	2.2	ns	
	Frequency	fCLK	444	533	551	MHz	
Hsync	Period	tHP	3950	4000	4088	tCLK	
	Width-Active	tWH	18	28	36		
Vsync	Period	tVP	2213	2222	2290	tHP	
	Frequency	fv	50	60	62	HZ	Adaptive Sync :40~60Hz
	Width-Active	tWV	6	8	12	tHP	
Data Eenlabe	Horizontal valld	tHV	3840	3840	3840	tCLK	
	Horizontal Back Porch	tHBP	32	54	112		
	Horizontal Front Porch	tHFP	60	78	100		
	Horizontal Blank	-	110	160	248		tWH+tHBP+tHFP
	Vertial valld	tVV	2160	2160	2160	tHP	
	Vertial Back Porch	tVBP	5	7	18		
	Vertial Front Porch	t_{VFP}	42	47	100		
	Vertial Blank	-	53	62	130		$t_{WV}+t_{VBP}+t_{VFP}$

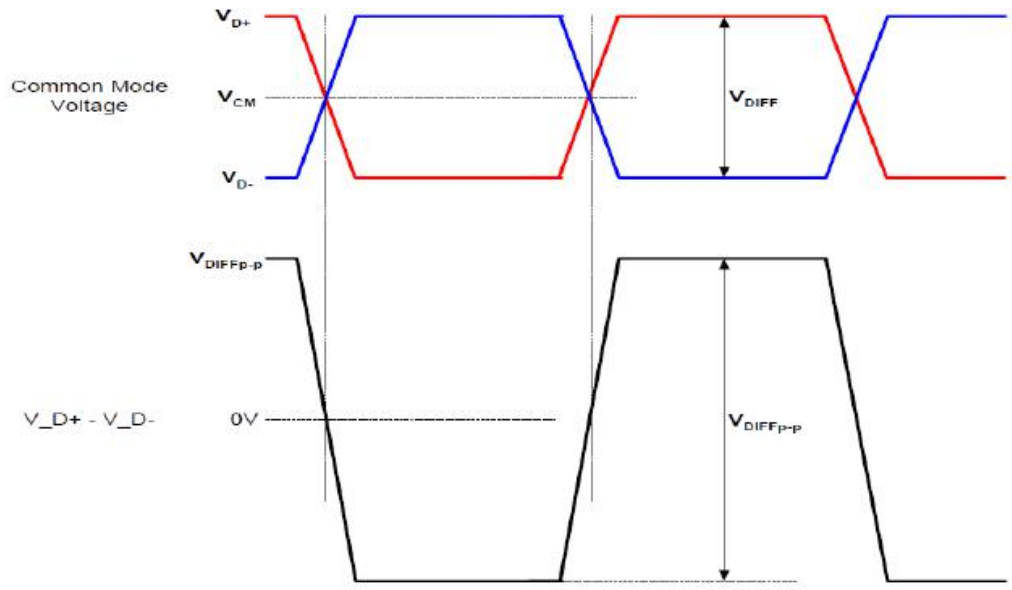
Note:
1.This panel supports adaptive sync timing(40~60Hz) only under moving picture in room temperature(25±5℃).

6.2 eDP Rx Interface Timing Parameter

The specification of the eDP Rx interface timing parameter is shown in Table 7.

<Table 7. eDP Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock	ssc	0	-	0.5	%	
Differential peak-to-peak input voltage at package pins	$V_{RX-DIFFp-p}$	120	-	-	mV	
Rx input DC common mode voltage	$V_{RX\_DC\_CM}$	-	GND	-	V	
Differential termination resistance	$R_{RX-DIFF}$	80	-	100	Ω	
Single-ended termination resistance	R_{RX-SE}	40	-	60	Ω	
Rx short circuit current limit	I_{RX_SHORT}	-	-	20	mA	
Intra-pair skew at Rx package pins (HBR) RX intra-pair skew tolerance at HBR	$L_{RX\_SKEW\_INTRA\_PAIR}$	-	-	150	ps	



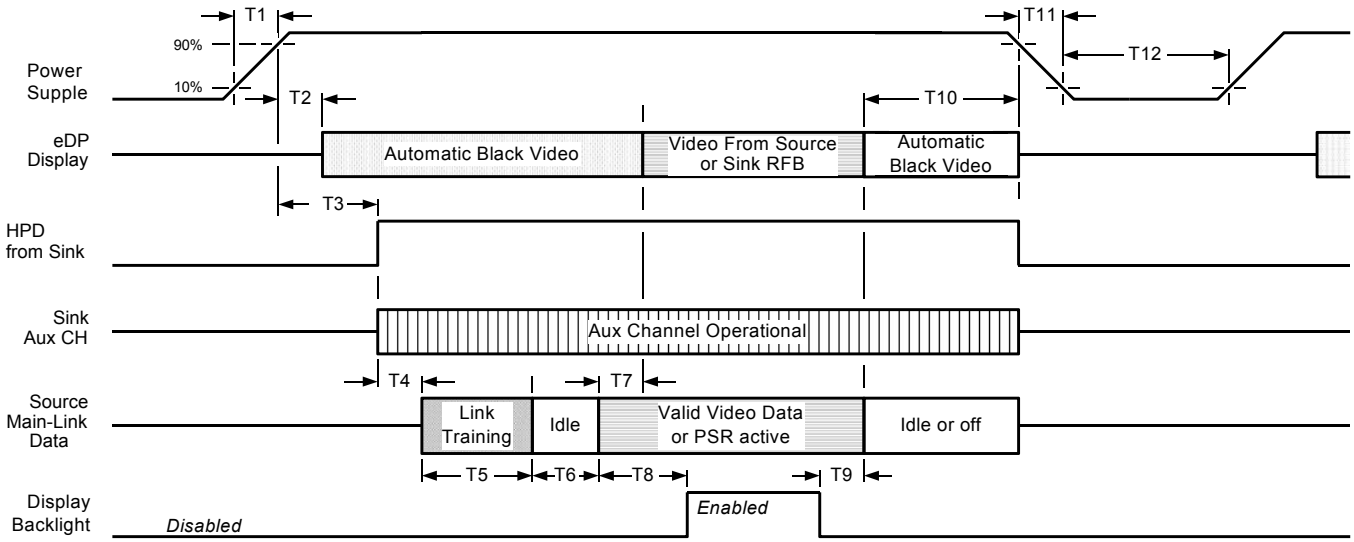
* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

7.0 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

8.0 POWER SEQUENCE

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



Timing Parameter	Description	Required By	Limits		Notes
			Min	Max	
T1	Power rail rise time, 10% to 90%	Source	0.5ms	10ms	
T2	Delay from Power Supple to automatic Black Video generation	Sink	0ms	200ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source
T3	Delay from Power Supple to HPD high	Sink	0ms	200ms	Sink AUX Channel must be operational upon HPD high
T4	Delay from HPD high to link training initialization	Source	-	-	Allows for the Source to read Link capability and initialize
T5	Link training duration	Source	-	-	Dependant on the Source link training protocol
T6	Link idle	Source	-	-	Min accounts for required BS-Idle Pattern. Max allows for Source frame synchronization.

8.0 POWER SEQUENCE

T7	Delay from valid video data from Source to video on display	Sink	0ms	50ms	Max value allows for the Sink to validate video data and timing. At the end of T7, the Sink will indicate the detection of valid video data by setting the SINK_STATUS bit to logic 1 (DPCD 00205h, bit 0), and the Sink will no longer generate automatic Black Video.
T8	Delay from valid video data from Source to backlight enable	Source	-	-	The Source must assure display video is stable
T9	Delay from backlight disable to end of valid video data	Source	-	-	The Source must assure backlight is no longer illuminated. At the end of T9, the Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and the Sink will automatically display Black Video.
T10	Delay from end of valid video data from Source to power off	Source	0ms	500ms	
T11	Power rail fall time, 90% to 10%	Source	-	10ms	
T12	Power off time	Source	500ms	-	

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.

9.0 MECHANICAL CHARACTERISTICS

9.1 Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model MV270QUM-N10. Other parameters are shown in Table 8.

<Table 8. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	621.8(H) × 360.6(V) × 13.5(Depth)	mm
Weight	3230 (typical)	gram
Active area	596.736(H) × 335.664 (V)	mm
Pixel pitch	0.1554 (H) × 0.1554(V)	mm
Number of pixels	3840(H)×2160 (V) (1 pixel = R + G + B dots)	pixels
Back-light	Down side, 1-LED Lighting Bar type	

9.2 Anti-Glare and Polarizer Hardness.

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

9.3 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 350lux.

10.0 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 ℃, 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	Packing Vibration test (non-operating)	Frequency Gravity / AMP Period	Random,1 ~ 200 Hz, 30 min/Axis 1.2 Grms X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, Half 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	

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.

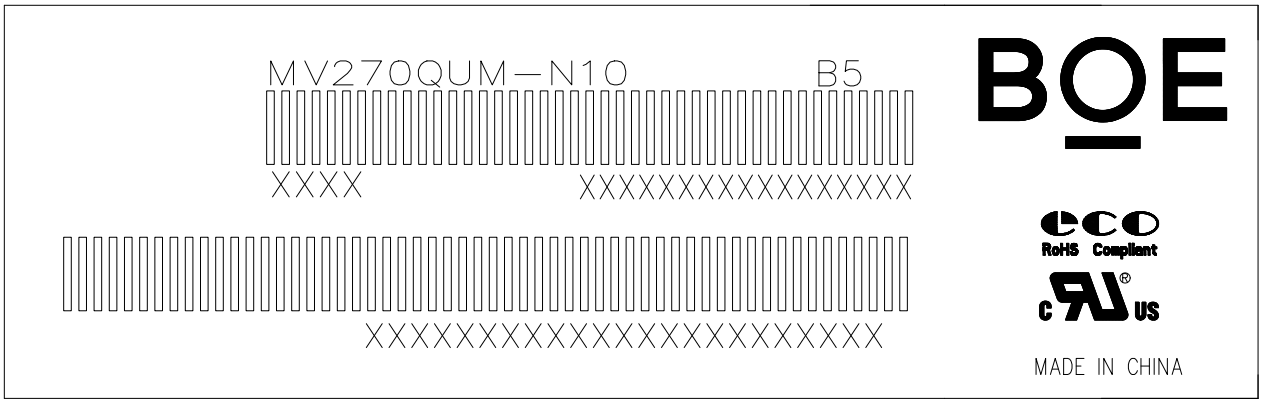
(3) Cautions for the operation
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the LCD panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.

(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 PRODUCT SERIAL NUMBER



MDL ID Naming Rule:

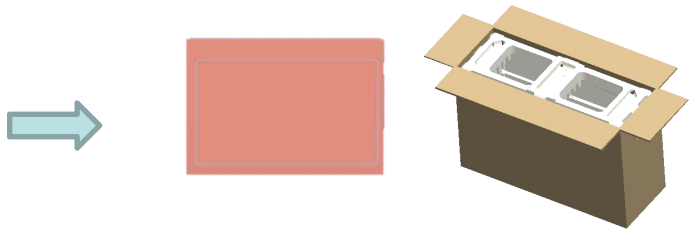
Digit / Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	S	L	S	5	1	2	3	5	9	4	2	0	0	0	1	D	B
Description	Model Code /GBN		Grade	Line	Year		Month	Model Extension Code (Last 4 Digits Of FGCOD)				Serial No 00001-ZZZZZZ					

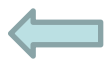
13.0 Packing

13.1 Packing Order

1.Put Bottom into the box

2.-Put Protection Film on Panel , Put MDL in PE Bag
-Put MDL in groove in order, keeping Panel side the same with arrow , Put 1ea Cover on top of Bottom
-Capacity:6pcs Panel/Inner Box





3.-Put 4EA Box on surface of Pallet, pile 2 layers in total.
-Use 6 Paper Corner to protect, Strapping tapes to fix and wrap film to package the Boxes
-Capacity:4 EA Box/layer;2 layers in total;48pcs/ Pallet

4.-Put the Pallet into Truck with 3 rows and 2 layers
-Capacity:66EA Pallet/Truck,3168pcs Panel/Truck

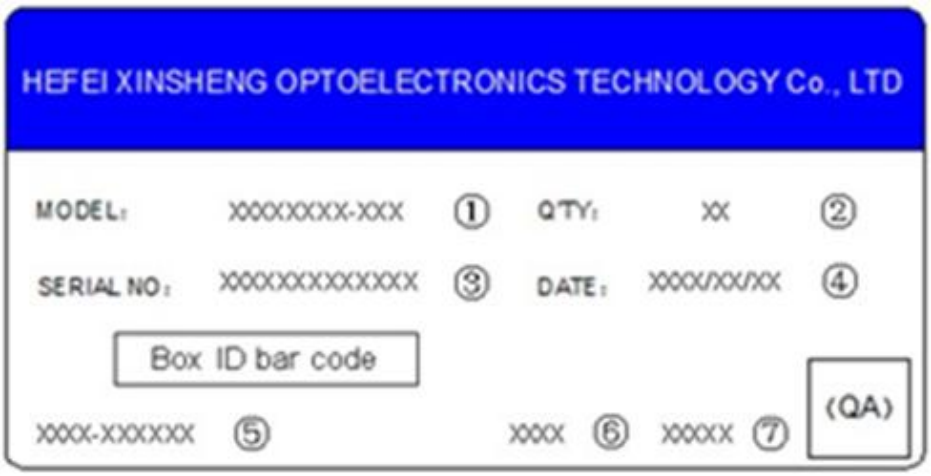
13.2 Packing Note

- Box Dimension : 696mm(L) × 234mm(W) × 444mm(H)
- Package Quantity in one Box : 6pcs

13.3 Box label

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

  Model : MV270QUM-N10
  Q`ty : Module * Q`ty in one box
  Serial No. : Box Serial No.
  Date : Packing Date



The printed part follow as:

1. **FG-CODE**
2. **Quantity**
3. **Box ID**
4. **Packing Date**
4. **Customer Code**
8. **FG-CODE(the last four number)**
7. **Vendor Code**

14.0 APPENDIX

Figure 1. Measurement Set Up

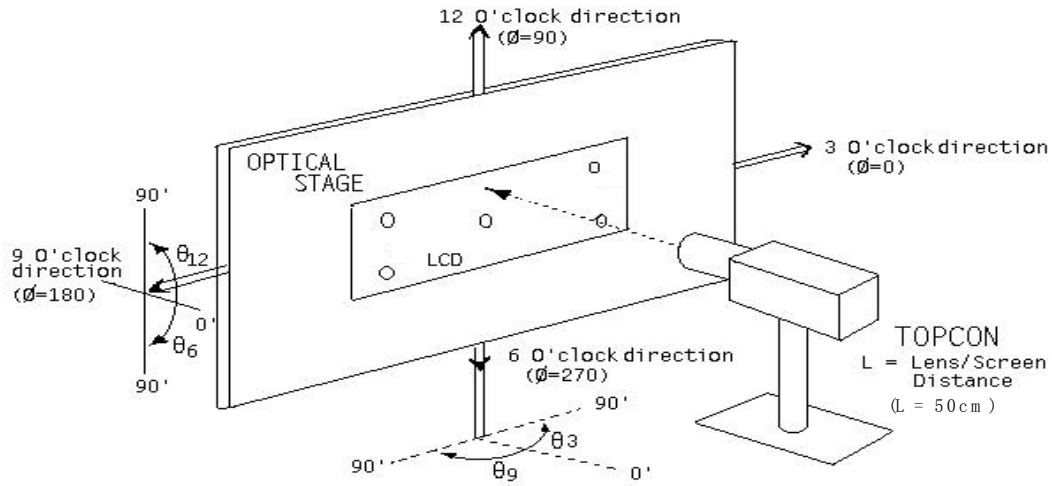


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

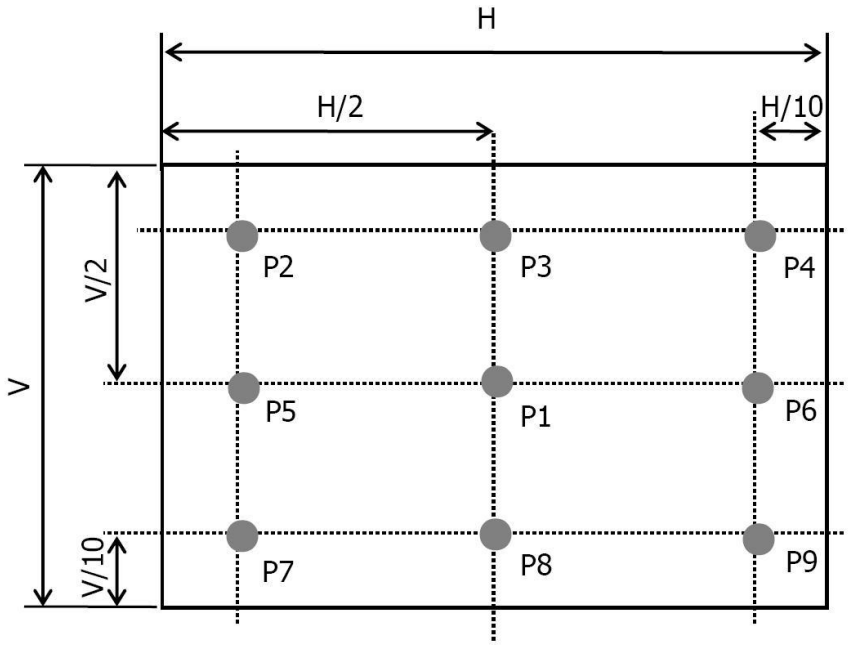


Figure 3. Response Time Testing

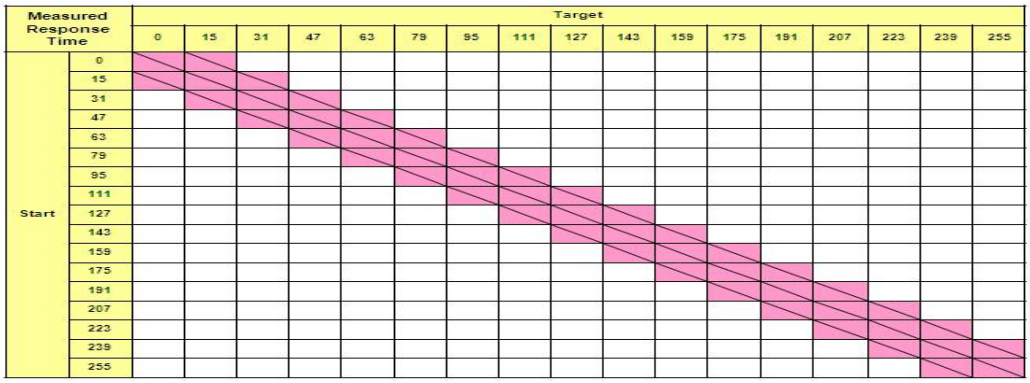
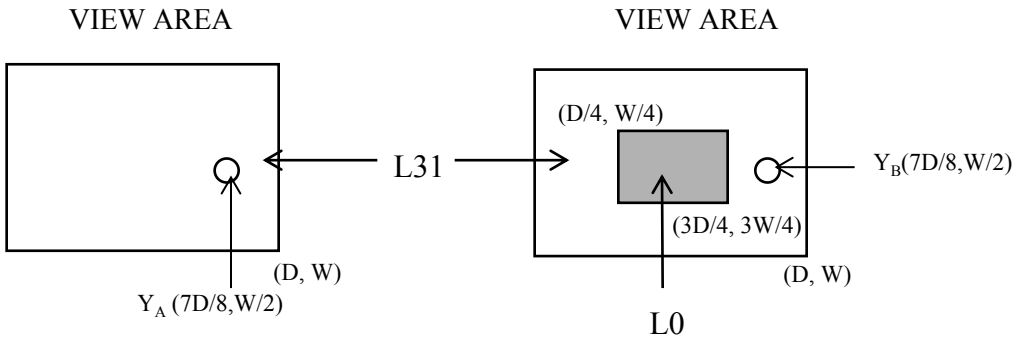


Figure 4. Cross Modulation Test Description



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

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 & Side view)

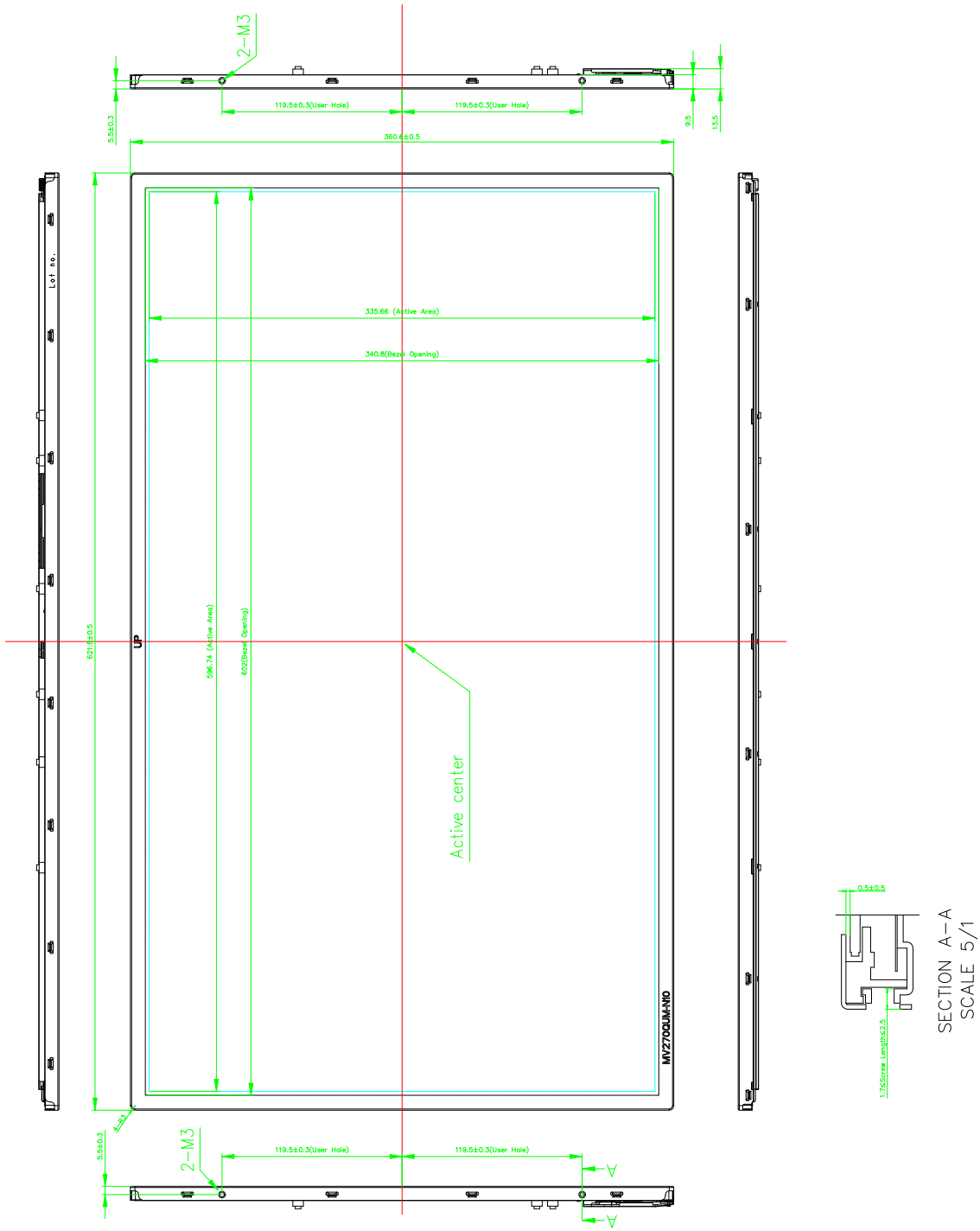


Figure 6. TFT-LCD Module Outline Dimensions (Rear view)