TITLE :EV270QUM-N11

Preliminary Product Specification

Rev. 0

FU ZHOU OPTOELECTRONICS TECHNOLOGY

REVISION HISTORY

( )preliminary specification
(√)Final specification

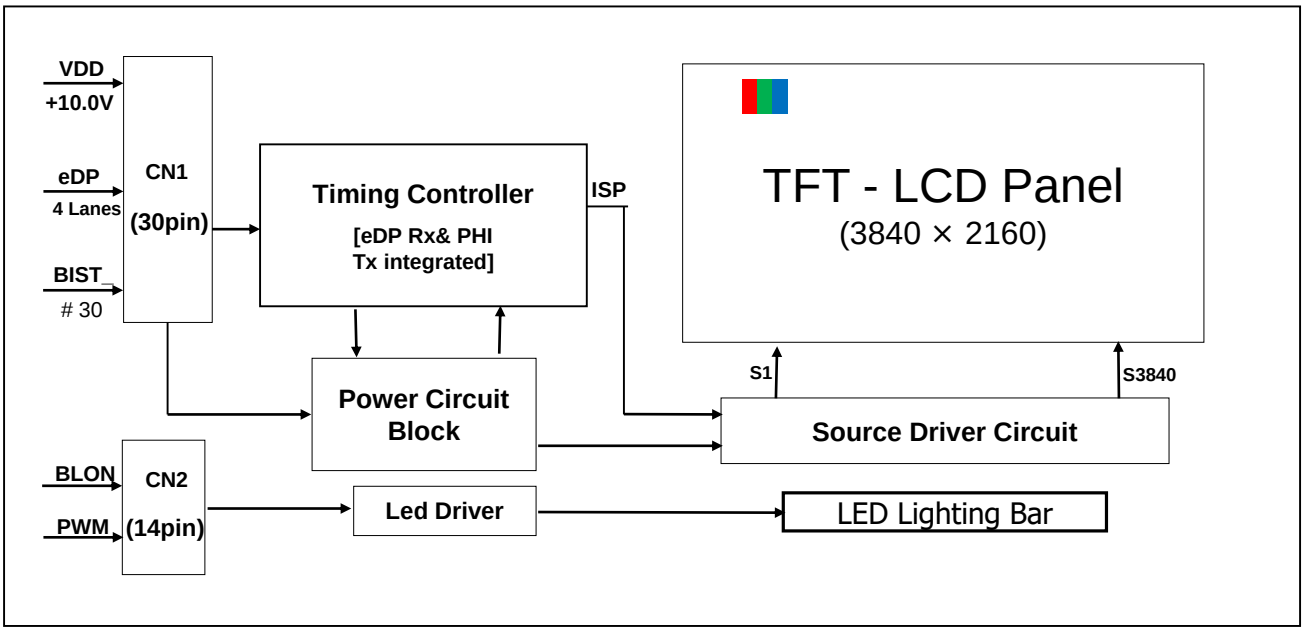
REV.	ECN No.	DESCRIPTION OF CHANGES	DATE	PREPARED
Rev. P0		Preliminary specification	2022.10.09	LiQiming

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

EV270QUM-N11 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 UHD resolutions (3840 horizontal by 2160 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

- Reverse Type
- 4 lane eDP Interface with 5.4Gbps Link Rates
- 10bit (8bit+FRC) color depth, display 1.07B colors
- Incorporated edge type back-light (LED)
- Compatible with NTSC90% and sRGB Matching Ratio 98%(Typ.) & Area Ratio 105%(Typ.)
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS/Halogen Free
- Gamma Correction

1.3 Application

- Surgical application

1.4 General Specification

The followings are general specifications at the model EV270QUM-N10.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	596.736(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+FRC)	colors	
Display mode	Normally Black		
Dimensional outline	630.0(H) ×368.2 (V) × 20.98(Depth)	mm	Detail refer to drawing
Weight	3340 (typical)	g	
Bezel width (L/R/U/D)	13.71/13.71/13.74/13.74	mm	
Surface Treatment	Haze 42%, 3H		
NTSC Ratio	Typ :90%		CIE1931
Back-light	Long side, 2-LED Lighting Bar type		
Display Orientation	Landscape Only		

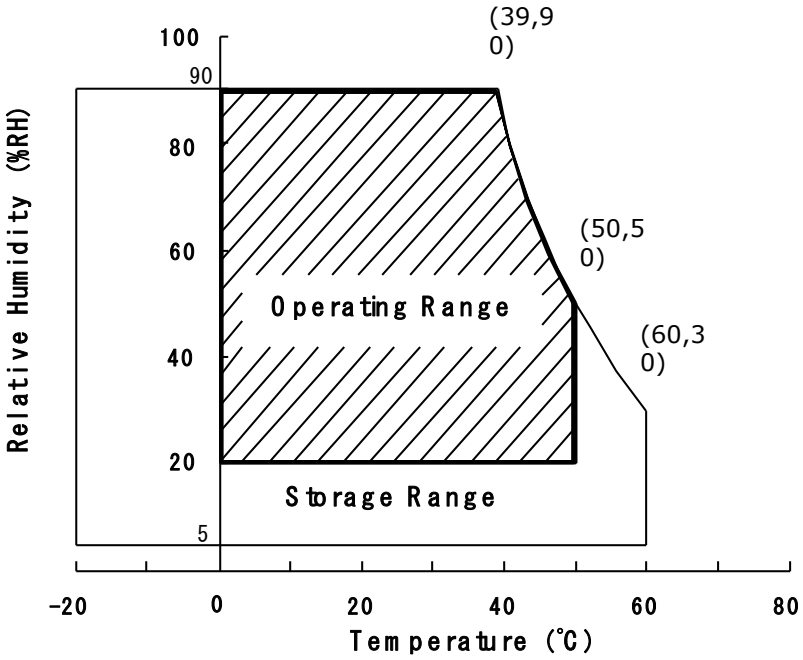
2.0 ABSOLUTE MAXIMUM RATINGS

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.



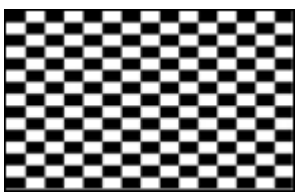
3.0 ELECTRICAL SPECIFICATIONS

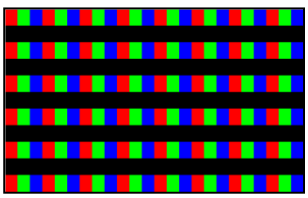
3.1Electrical Specifications

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

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	9	700	1200	V	Note1
Power Supply Current	I_{DD}	-	2.0	3.0	mA	
In-Rush Current	I_{RUSH}	-	-	400	A	Note 2
Permissible Input Ripple Voltage	V_{RF}	-	-	600	mV	Note1,3
High Level Differential Input Threshold Voltage	V_{IH}	-	-	2	mV	
Low Level Differential Input Threshold Voltage	V_{IL}	-100	7	12	mV	
Differential input voltage	$\|V_{ID}\|$	100	51.84	71.7	mV	
Differential input common mode voltage	Vcm	0	58.84	-		V_{IH}=100mV, V_{IL}=-100mV
Power Consumption	P_D	-	700	1200	W	
	P_{BL}	-	2.0	3.0	W	Note 4
	P_{total}	-	-	400	W	
LED Life Time	TLED	30000	-	-	Hrs	Note 5,6

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 converter loss.
5. The life time of LED, 30,000Hrs, is determined as the time at which luminance of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at 25 ± 2°C.
6. Only under the above operating conditions could the life time of LED be guaranteed.

3.2 Converter Electrical Characteristics

< Table 4. Converter Electrical Characteristics >

Parameter		Min.	Typ.	Max.	Unit	Remarks
Converter Power Supply Voltage	V_i	21.6	24.0	26.4	V	(Duty 100%)
Converter Power Supply Current	I_i	-	2.9	-	A	
In-Rush Current	$I_{RUSH\ LED}$	-	-	6.0	A	(Duty 100%)
BL Control Level	EN(ON)	2.0	3.3	5.0	V	
	EN(OFF)	0	0	0.8	V	
PWM Control Level	PWM (High Level)	2.0	3.3	5.0	V	Positive Dimming
	PWM (Low Level)	0	0	0.8	V	
PWM Control Duty Ratio		10	-	100	%	
PWM Control Frequency		100	200	500	Hz	

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

< Table 5. Module Optical >

[VDD = 10.0V, Frame rate = 60Hz, Clock = 74.25MHz, I_{BL} = 1320mA, Ta =25±2 °C]

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		800	1000	-	cd/m²	Note 3
White luminance uniformity		ΔY		80	85		%	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		0.646	0.676	0.706	-	
		R_y		0.279	0.309	0.339	-	
	Green	G_x		0.223	0.253	0.283	-	
		G_y		0.639	0.669	0.699	-	
	Blue	B_x		0.123	0.153	0.183	-	
		B_y		0.039	0.069	0.099	-	
Response Time	GTG	T_g			14	20	ms	Note 6
Cross Talk		CT		-	-	2.0	%	Note 7

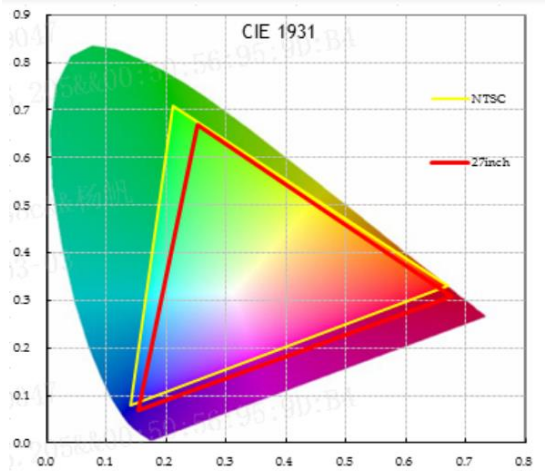
Note :

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. Definition of Color of CIE Coordinate and NTSC Ratio.

$$S = \frac{\text{area of RGB triangle}}{\text{area of NTSC triangle}} \times 100\%$$



7. 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)”
8. 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

- 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

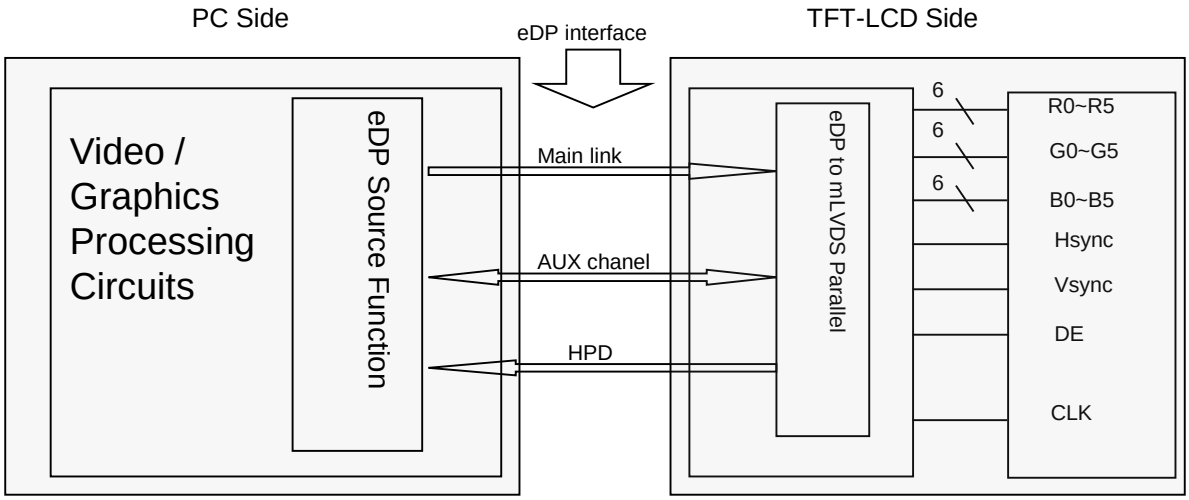
5.0 INTERFACE CONNECTION.

5.2 Electrical Interface Connection

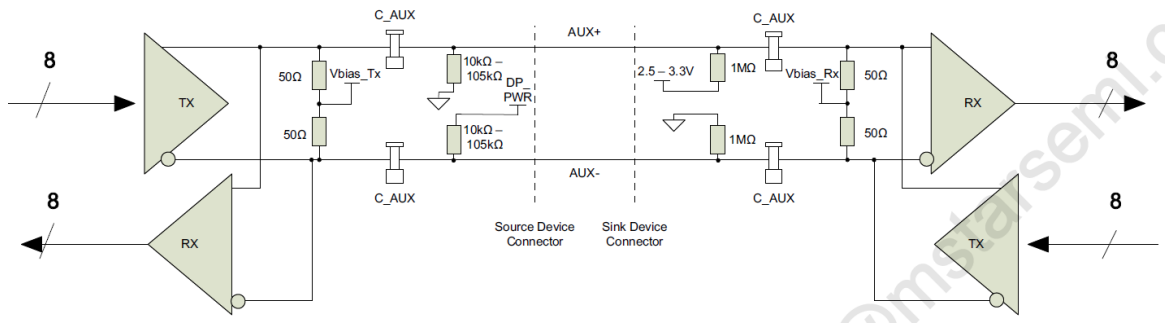
- CN101 BLU Side Connector : CviLux CIO114M1HR0-NH or Equivalent

Pin No	Symbol	Function	Remark
1	VBL	Power Supply (24.0V)	
2	VBL	Power Supply (24.0V)	
3	VBL	Power Supply (24.0V)	
4	VBL	Power Supply (24.0V)	
5	VBL	Power Supply (24.0V)	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	NC	No connection	
12	EN	Enable(0V:Disable,2.5V~5V:Dnable)	
13	PWM	Duty :10%~100%	
14	NC	No connection	

5.3.eDP Interface



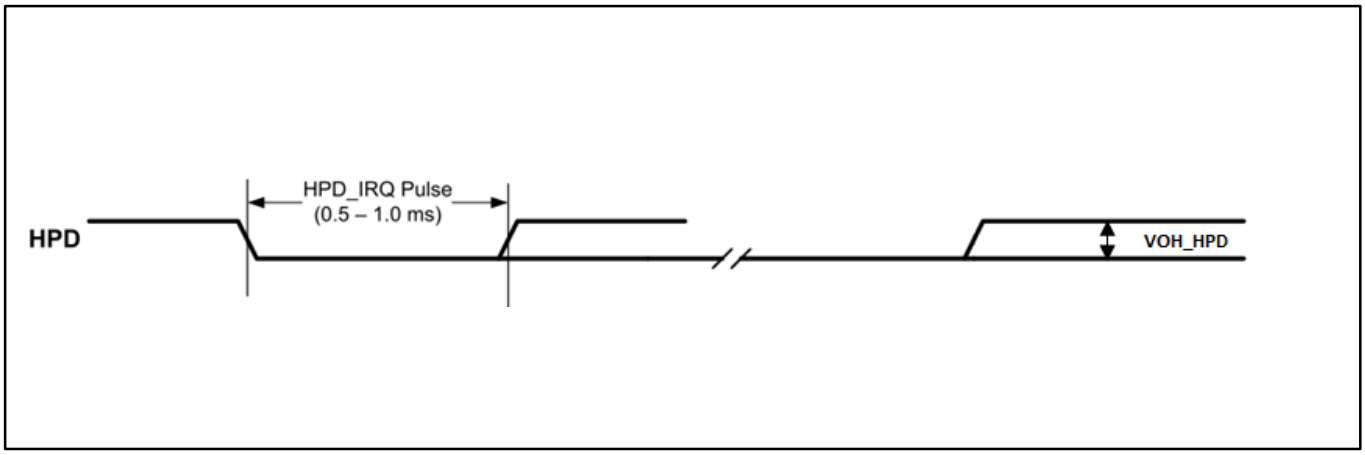
5.4 eDP AUX Channel Signal



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



Item	Symbol	Min	Typ	Max	Unit	Remark
HPD voltage	VHPD	3.135	3.3	3.465	V	
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	ms	正确
HPD_TimeOut		2.0			ms	HPD Unplug Event

6.0 SIGNAL TIMING SPECIFICATION

Item	Symbols		Min.	Typ.	Max.	Unit	Note
DCLK	Period	tCLK	1.8	1.9	2.2	ns	
	Frequency	-	444	533	551	MHz	
HSync	Horizontal Period（Total）	tHP	3950	4000	4088	tCLK	
	Horizontal Valid	tHV	3840			tCLK	
	Horizontal Blank	tHB	110	160	248		
	Frequency	fH	111	133.3	137	KHz	
VSync	Vertical Period（Total）	tVP	2213	2222	2290	tHP	Note1
	Vertical Valid	tVV	2160			tHP	
	Vertical Blank	tVB	53	62	130	tHP	Note1
	Frequency	fV	50	60	62	Hz	Adaptive sync:40~60HZ

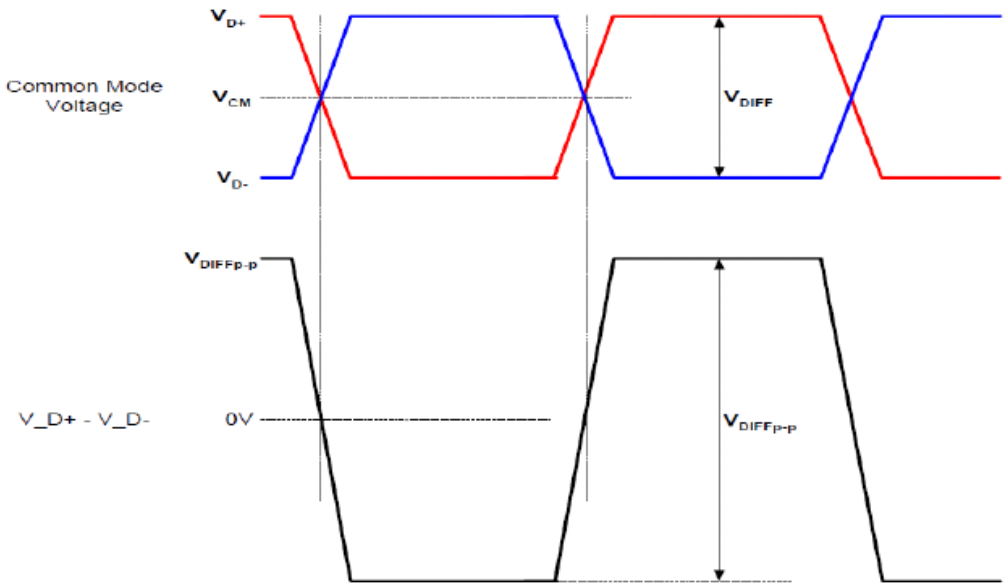
Note:
1.This panel supports adaptive sync timing(40~60Hz) only under moving picture in room temperature(25±5℃).

6.2 eDP Rx Interface Timing Parameter

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

<Table 6. 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	



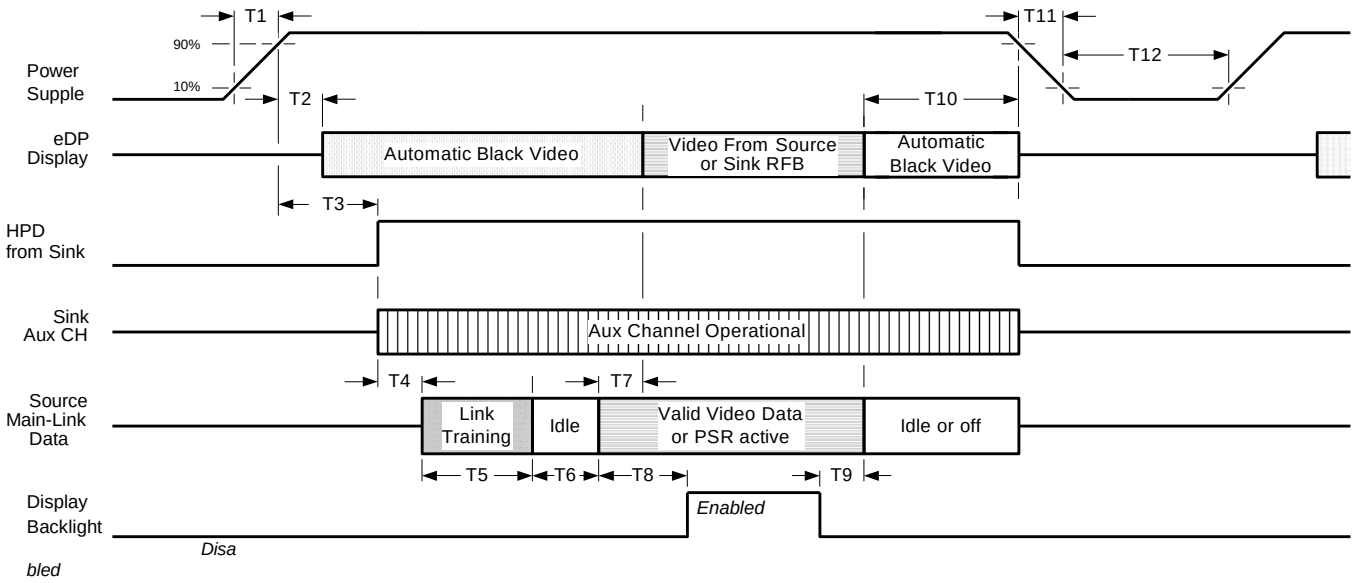
* Vdiff = (RXz+)-(RXz-),…. ,(RXCLK+)-(RXCLK-)

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

Color & Gray Scale		RED DATA								GREEN DATA								BLUE DATA							
		R9	R8	R7	--	R3	R2	R1	R0	G9	G8	G7	--	G3	G2	G1	G0	B9	B8	B7	--	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

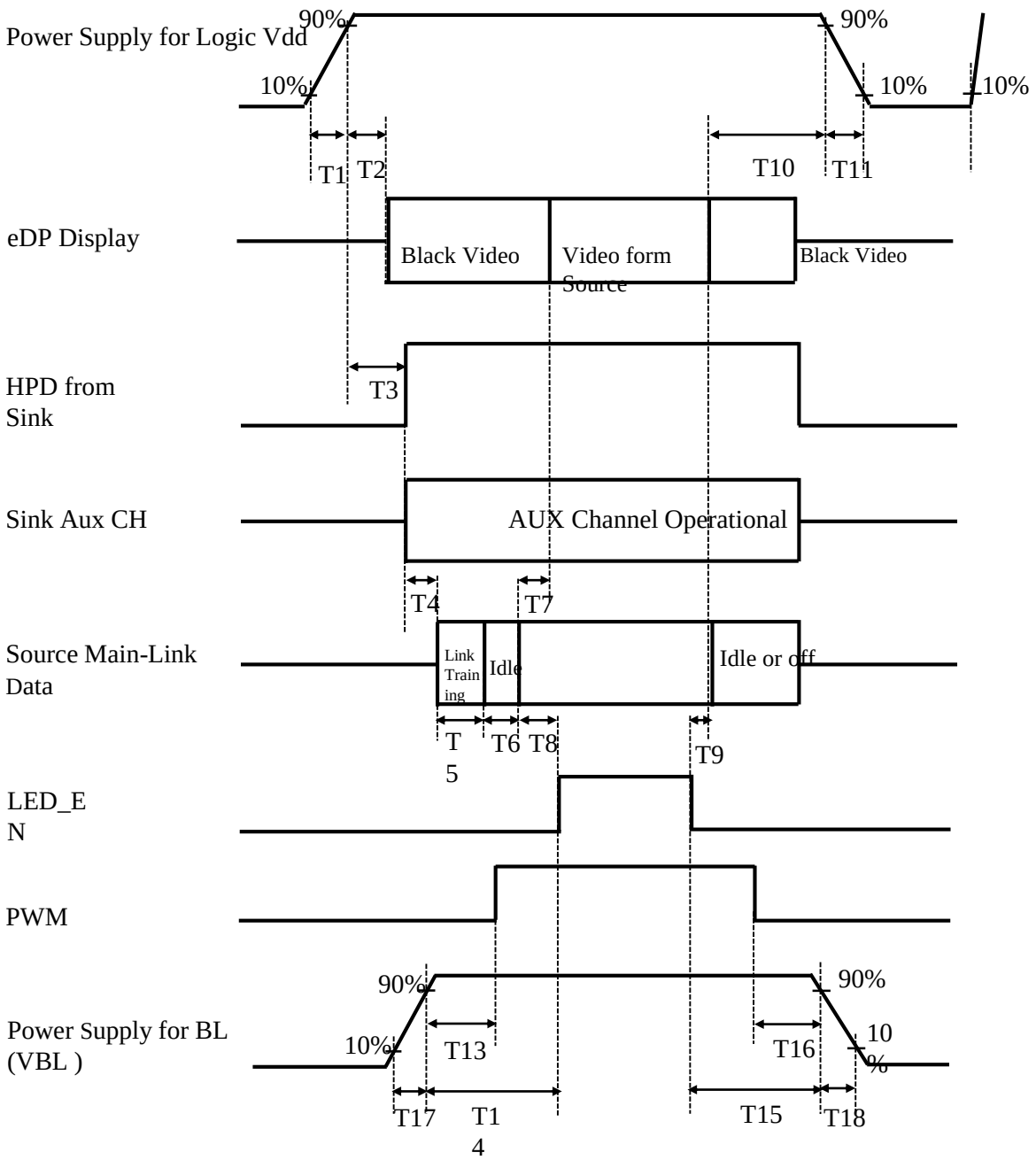
To prevent a latch-up or DC operation of the LCD module, the power on/off sequence shall be as shown in below



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

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



8.0 POWER SEQUENCE

Parameter	Values			Units	Remark
	Min	Typ	Max		
T1	0.5	-	10	ms	
T2	0	-	200	ms	Automatic Black Video generation prevents display noise
T3	0	-	200	ms	Sink AUX Channel must be operational upon HPD high
T4	-	-	-	ms	During T4 Period, eDP link training time by customer's system.
T5	-	-	-	ms	
T6	-	-	-	ms	
T7	0	-	50	ms	
T8	50	-	-	ms	The Source must assure display video is stable
T9	0	-	-	ms	背光关闭到有效数据结束时间
T10	0		500	ms	有效数据结束到VDD关闭时间
T11	0.5	-	10	ms	
T12	500	-	-	ms	
T13	0	-	-	ms	
T14	0	-	-	ms	
T15	0	-	-	ms	
T16	0	-	-	ms	
T17	0.5	-	-	ms	
T18	0.5	-	-	ms	

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 EV270QUM-N10. Other parameters are shown in Table 8.

<Table7. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	630.0(H) × 368.2(V) × 20.98(Depth)	mm
Weight	3340 (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	Long Side, 2-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 8 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

Please pay attention to the followings when you use this TFT LCD Module.

11.1 Mounting Precautions

- Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- You must mount a module using specified mounting holes (Details refer to the drawings).
- You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress)is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- Do not apply mechanical stress or static pressure on module; Abnormal display cause by pressing some parts of module during assembly process , do not belong to product failure, the press should be agreed by two sides.
- Determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- Do not apply mechanical stress or static pressure on module , and avoid impact, vibration and falling.
- Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- Protection film for polarizer on the module should be slowly peeled off before display.
- Be careful to prevent water & chemicals contact the module surface.
- You should adopt radiation structure to satisfy the temperature specification.
- Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
  Do not touch the surface of polarizer for bare hand or greasy cloth.(Some cosmetics are detrimental to the polarizer.)

- When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzine. Normal-hexane & alcohol is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene , because they cause chemical damage to the polarizer.
- Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- This module has its circuitry PCB' s on the rear side and Driver IC, should be handled carefully in order not to be stressed.
- Avoid impose stress on PCB and Driver IC during assembly process ,Do not drawing, bending, COF package & wire.
- Do not disassemble the module.

11.2 Operating Precautions

- Do not connector or disconnect the cable to/from the Module at the "Power On" Condition.
- When the module is operating, do not lose CLK, ENAB signals. If any one of these signals is lost, the module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Do not allow to adjust the adjustable resistance or switch.
- The electrochemical reaction caused by DC voltage will lead to LCD module degradation, so DC drive should be avoided.
- The LCD modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipment to protect against static electricity.
- Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.

- The cables should be as short as possible between System Board and PCB interface.
- Connectors are precision devices to transmit electrical signals, and operators should plug in parallel.
- Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.

11.3 Electrostatic Discharge Precautions

- Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
- Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc.
- Do not close to static electricity to avoid product damage.
- Do not touch interface pin directly.

11.4 Precautions for Strong Light Exposure

- Do not leave the module operation or storage in Strong light . Strong light exposure causes degradation of polarizer and color filter.

11.5 Precautions for Storage

A. Atmosphere Requirement

ITEM	UNIT	MIN	MAX
Storage Temperature	(℃)	5	40
Storage Humidity	(%rH)	40	75
Storage Life	6 months		
Storage Condition	• The storage room should be equipped with a dark and good ventilation facility. • Prevent products from being exposed to the direct sunlight, moisture and water. • The product need to keep away from organic solvent and corrosive gas. • Be careful for condensation at sudden temperature change. • Storage condition is guaranteed under packing conditions.		

B. Package Requirement

- The product should be placed in a sealed polythene bag.
- Product Should be placed on the pallet, Which is away from the floor, Be cautions not to pile the product up.
- The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
- As the original protective film, do not use the adhesive protective film to avoid change of Pol color and characteristic.

11.6 Precautions for protection film

- Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.
- People who peeled off the protection film should wear anti-static strap and grounded well.

11.7 Appropriate Condition for Commercial Display

-Generally large-sized LCD modules are designed for consumer applications . Accordingly, long-term display like in Commercial Display application, can cause uneven display including image sticking. To optimize module's lifetime and function, several operating usages are required.

1. Normal operating condition

- Temperature: 20±15℃
- Operating Ambient Humidity : 55±20%
- Display pattern: dynamic pattern (Real display)
- Well-ventilated place is recommended to set up Commercial Display system

2. Special operating condition

a. Ambient condition

- Well-ventilated place is recommended to set up Commercial Display system.

b. Power and screen save

- Periodical power-off or screen save is needed after long-term display.

c. As the low temperature, the response time is greatly delayed. As the high temperatures (higher than the operating temperature) the LCD module may turn black screen. The above phenomenon cannot explain the failure of the display. When the temperature returns to the normal operating temperature, the LCD module will return to normal display.

d. When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCD module may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD module 's surface which may affect the operation of the polarizer and LCD module .

e. Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

f. Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions such as high temperature, high humidity, high altitude, special display images, running time, long time operation, outdoor operation, etc. It is strongly recommended to contact BOE for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and controlling systems.

3. Operating usages to protect against image sticking due to long-term static display.
   a. Suitable operating time: under 20 hours a day.
   b. Static information display recommended to use with moving image.
   - Cycling display between 5 minutes' information(static) display and 10 seconds' moving image.
   c. Background and character (image) color change
   - Use different colors for background and character, respectively.
   - Change colors themselves periodically.
   d. Avoid combination of background and character with large different luminance.
   1) Abnormal condition just means conditions except normal condition.
   2) Black image or moving image is strongly recommended as a screen save
4. Lifetime in this spec. is guaranteed only when Commercial Display is used according to operating usages.

11.8 Other Precautions

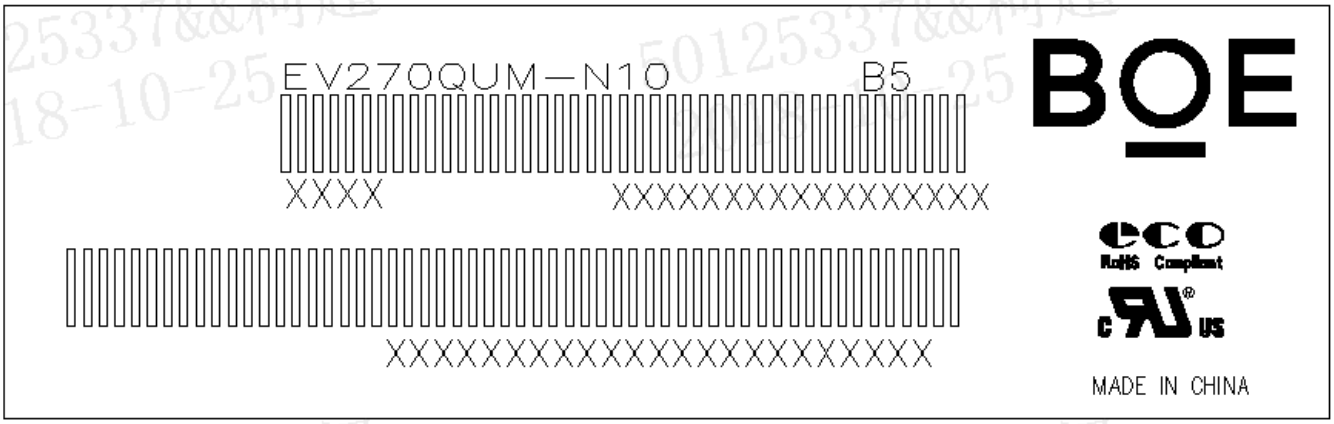
A. LC Leak

- If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.
- If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.
- If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

- 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:

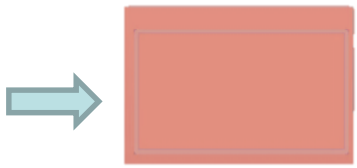
Digit / Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	S	L	S	5	1	2	3	5	9	4	2	0	0	0	1	D	B
Description	Model Code /GBN		Grade	Line	Year		Month	Model Extension Code (Last 4 Digits Of FGCOD)				Serial No 00001-ZZZZZZ					

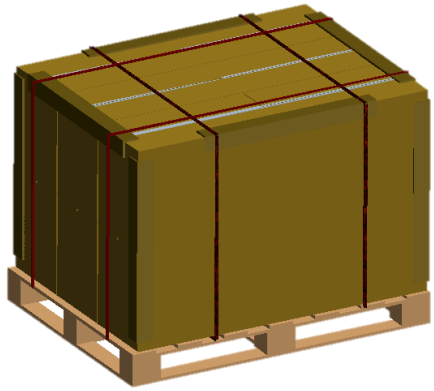
13.0 Packing

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:5pcs Panel/Inner Box





3.-Put 6EA Box on surface of Pallet, pile 2 layers in total.
-Use 8 Paper Corner to protect, Strapping tapes to fix and wrap film to package the Boxes
-Capacity: 6EA Box/layer;2 layers in total;60pcs/ Pallet

4.-Put the Pallet into Truck with 2 rows and 2 layers
-Capacity:44EA Pallet/Truck, 2640pcs Panel/Truck

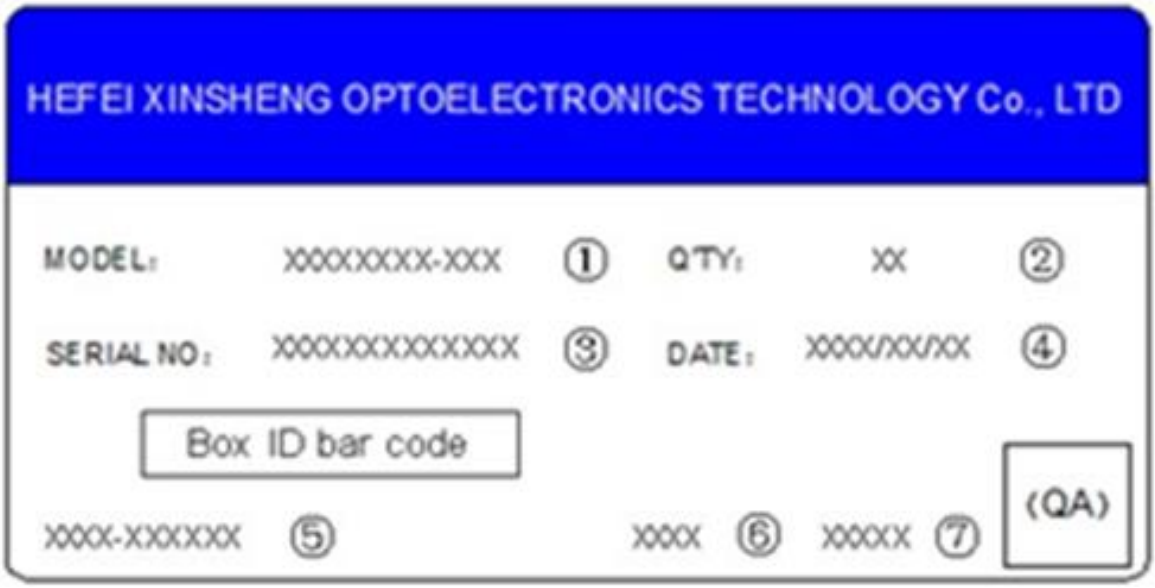
13.2 Packing Note

- Box Dimension : 711mm(L) × 269mm(W) × 472mm(H)
- Package Quantity in one Box : 5pcs

13.3 Box label

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

  Model : EV270QUM-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

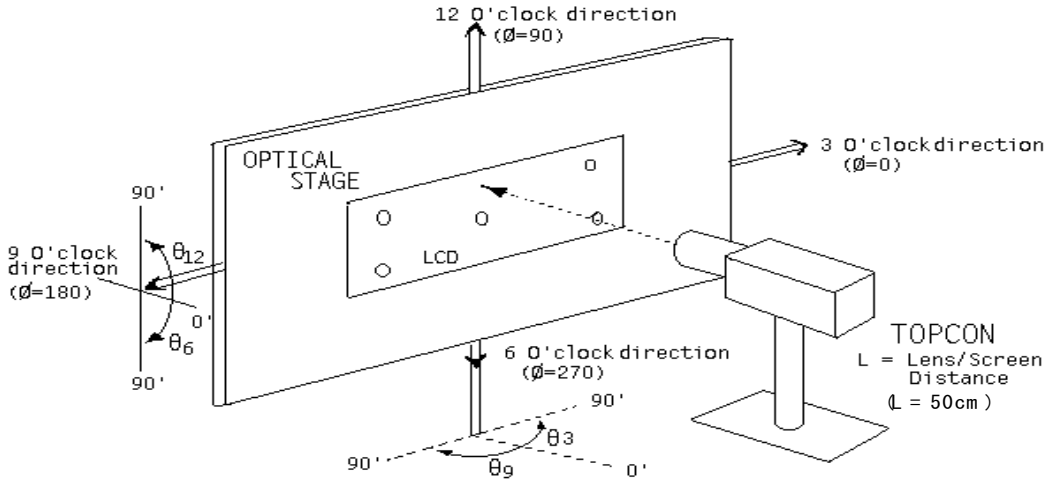


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

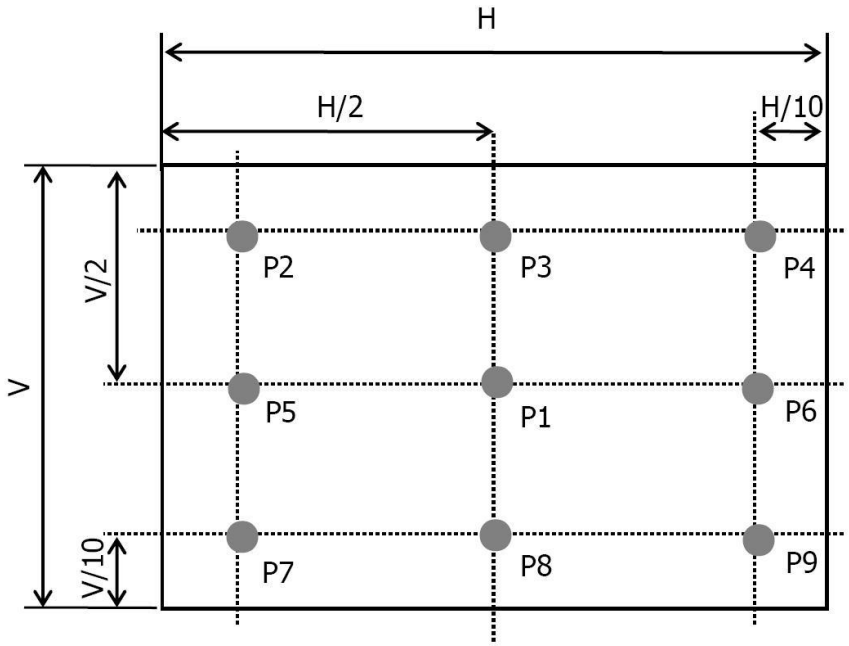
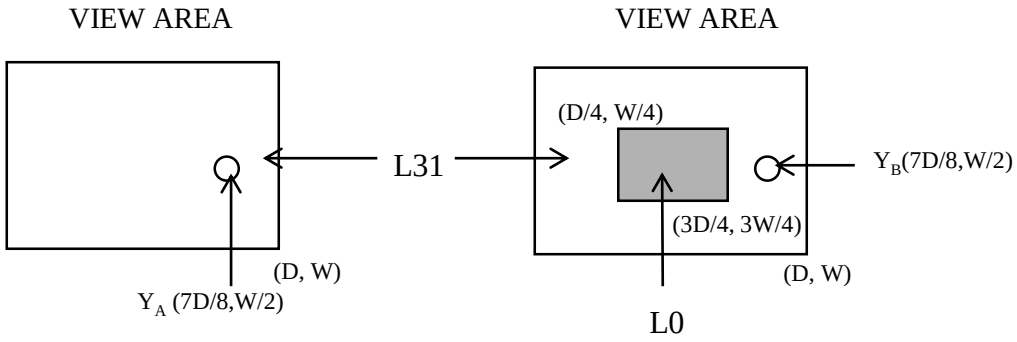


Figure 3. Response Time Testing

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
(Landscape Front View Front & Side view)

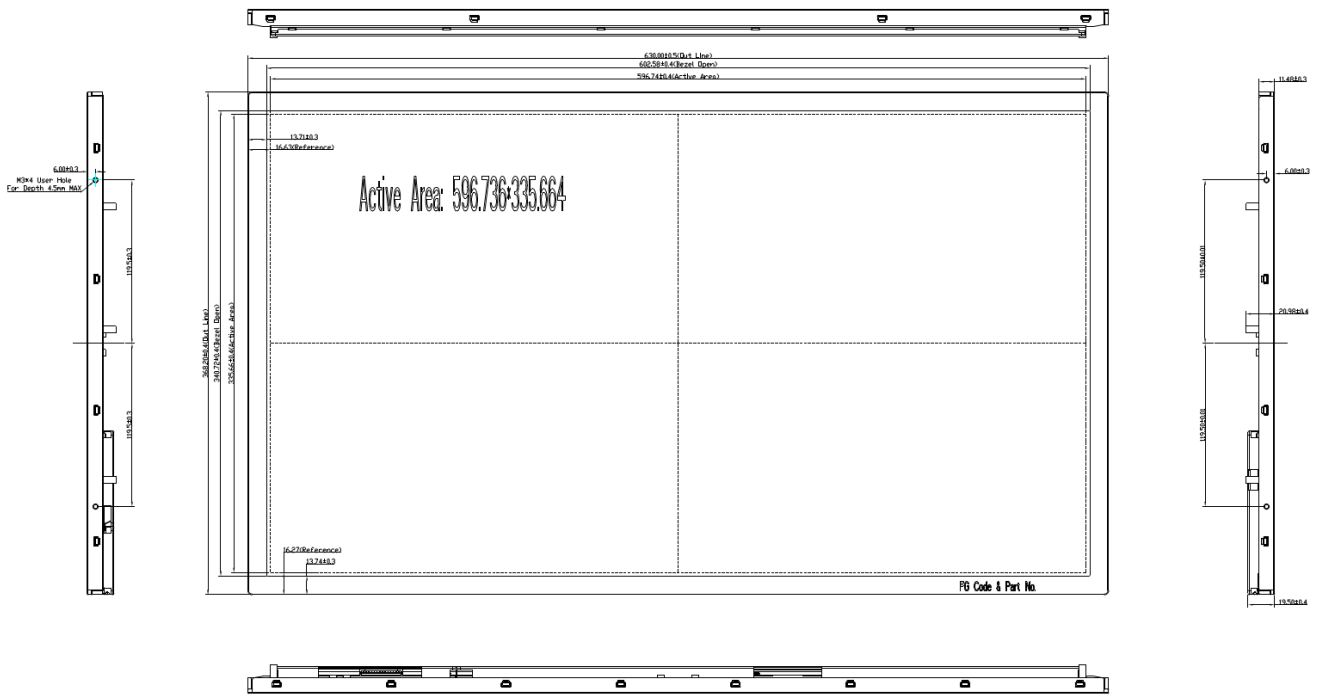


Figure 6. TFT-LCD Module Outline Dimensions
(LandscapeBack View Rear view)