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TITLE : MV270QUM-NM1

Product Specification Ver. P1

FUZHOU BOE OPTOELECTRONICS CO., LTD

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REVISION HISTORY

(●) Preliminary specification
() Final specification

Revision No.	Page	Description of changes	Date	Prepared
Ver. P0	-	Initial Release	2022.10.10	Tongbo
Ver. P1	PAGE 10&11	1.Power sequence Update 2.Add Input Signal truth table	2023.02.01	Shangxingce

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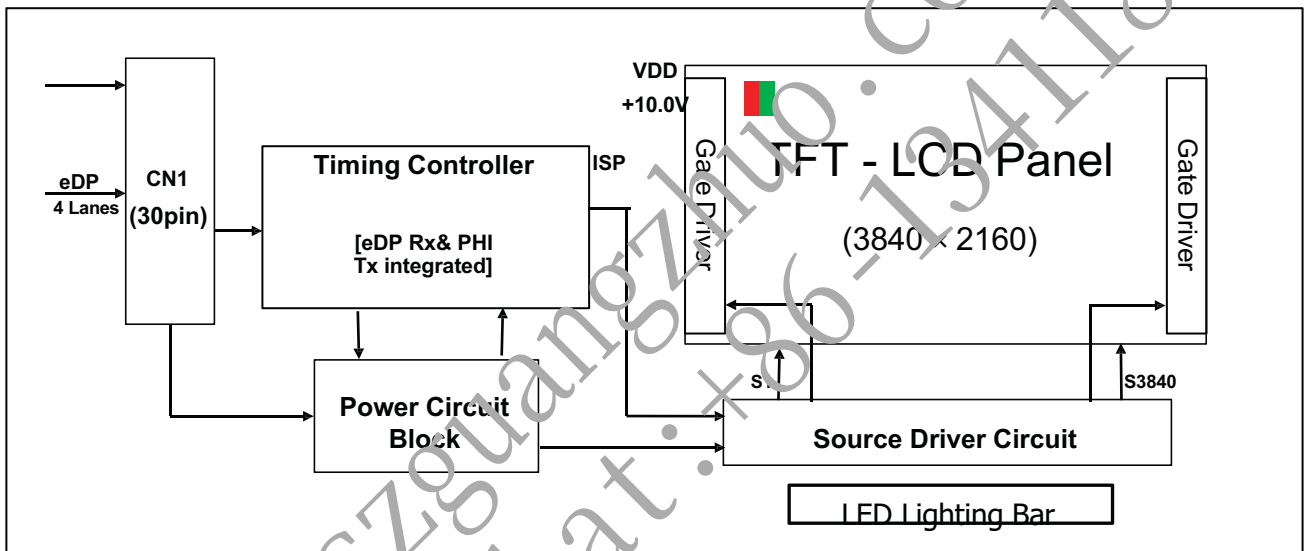
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1. GENERAL DESCRIPTION

2. Introduction

MV270QUM-NM1 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 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

- 4 lane eDP Interface with 5.4Gbps Link Rates
- 10-bit (input) color depth, display 1.07Bcolors (output 8bit+FRC)
- High luminance and contrast ratio, low reflection and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- Gamma Correction
- Reverse type
- HADs Display Mode

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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 MV270QUB-N53.

<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		
Display colors	1.07B	colors	8bit+FRC output
Display mode	Normally Black		
Dimensional outline	608.9(H) × 359.8(V)	mm	Detail refer to drawing
Weight	3.36	kg	
AA~Outline (L/R/U/D)	6.1/6.1/6.1/18.0	mm	
Surface Treatment	AG25, 3H		
Back-light	Mini LED direct back-light type with 1152 blocks		

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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]

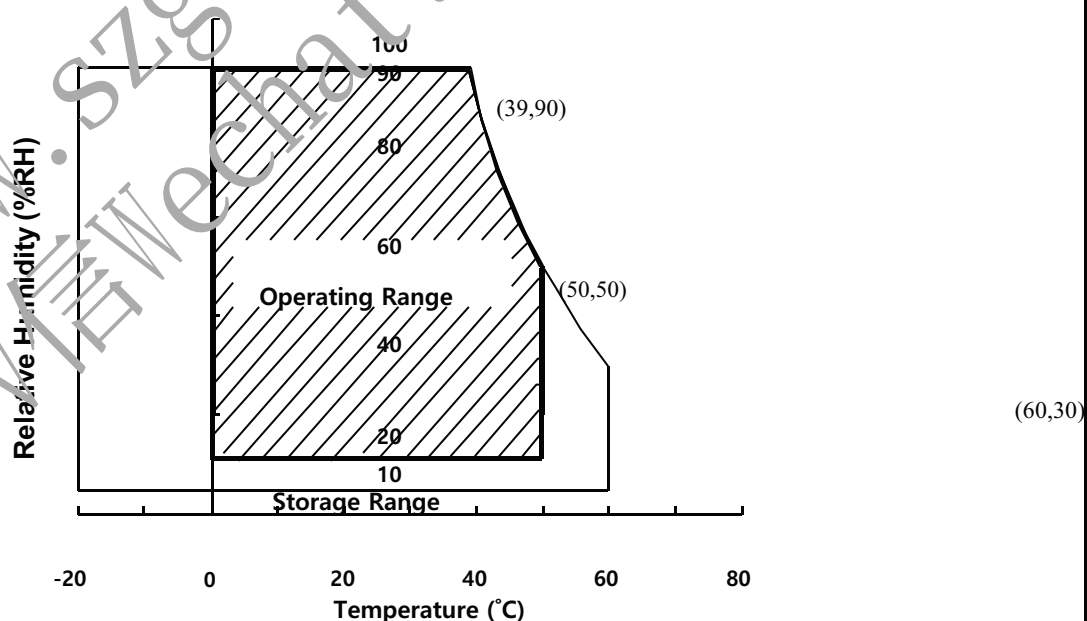
Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	-0.3	12	V	
Logic Supply Voltage	V _{IN}	VSS-0.3	V _{DD} +0.3	V	T _a = 25 °C
Operating Temperature	T _{OP}	0	+50	°C	1)
Storage Temperature	T _{ST}	-20	+60	°C	1)
LCM Surface Temperature (Operation)	T _{surface}	0	+48	°C	2)

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.

2) Panel Surface Temperature should be Min. 0°C and Max. +48°C under the

VDD = 12.0V, Frame rate = 60Hz, 25°C ambient Temp. no humidity control and LED string current is typical value.



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1. ELECTRICAL SPECIFICATIONS

2. Electrical Specifications

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

Parameter.		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	9.5	10.0	10.5	V	Note1
Power Supply Current	I _{DD}	-	900	1300	mA	
In-Rush Current	I _{RUSH}	-	2.0	3.0	A	Note 2
Permissible Input Ripple Voltage	V _{RF}	-	-	300	mV	Note1,3
Main link swing voltage	V _{ID}	100	-	1320	mV	-
Differential input common mode voltage	V _{cm}	0	-	-	-	-
Power Consumption	I _D	-	9.0	13.0	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

Clock frequency = 533MHz. Test Pattern of power supply current

- a) Typ : Color Bar
b) Max : Vertical sub line 255



(a)



(b)

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.

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3.2 LED Board Unit

< Table 4. LED Backlight Unit @Typ. Brightness >

Parameter		Min.	Typ.	Max.	Unit	Remarks
Driver Board Input Voltage	VIN	12.35	13	13.65	V	
Driver Board Input Current	IN	4.37	4.6	4.83	A	
Input Supply Voltage	VCC	9	10	11	V	Note③
Input Supply Current	Ivcc	-	-	0.25	mA	Note③
In Rush Current	Irush_VIN	/	/	10	A	
In Rush Current	Irush_VCC	/	/	2.0	A	Note③
Power Consumption	PBL	54	60	66	W	
SYS_BL_EN, SYS_LD_EN, SYS_VSYNC, SYS_CS, SYS_SCK, SYS_MISO, SYS_MOSI	High	2.7	3.3	3.6	V	
	Low	0	/	0.7	V	
SYS_VSYNC	Vsync	/	60	/	Hz	
Life-Time	-	30,000	-		Hrs	

Note : ① Single MLED Board contains 1152 blocks, one block consists of 1 LEDs in serial.

③ The Voltage and Current of VCC are only supply by Master Driving PCB.

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3.2 Electrical Specification @全屏Peak. brightness②

<Table 5. Electrical Specification BLU @全屏Peak. brightness>

Parameter		Min.	Typ.	Max.	Unit	Remarks
Driver Board Input Voltage	VIN	12.35	13	13.65	V	
Driver Board Input Current	IIN	10.45	11	11.55	A	Note③
Input Supply Voltage	VCC	9	10	11	V	
Input Supply Current	Ivcc	-	-	0.25	mA	
In Rush Current	Irush_VIN	-	-	15	A	
In Rush Current	Irush_VCC	-	-	2.0	A	
Power Consumption	PBL	129	143	157	W	Note③
SYS_BL_EN, SYS_LD_EN, SYS_VSYNC, SYS_CS, SYS_SCK, SYS_MISO, SYS_MOSI	High	2.7	3.3	3.6	V	
	Low	0	/	0.7	V	
SYS_VSYNC	Vsync	/	60	/	Hz	
Life-Time	-	30,000	-		Hrs	

Note ① Single MLED Board contains 1152 blocks, one block consists of 1 LEDs in serial.

② Peak brightness is used for HDR1000 test only. Long time use at peak brightness or reliability testing at peak brightness will affect product life and even cause issue

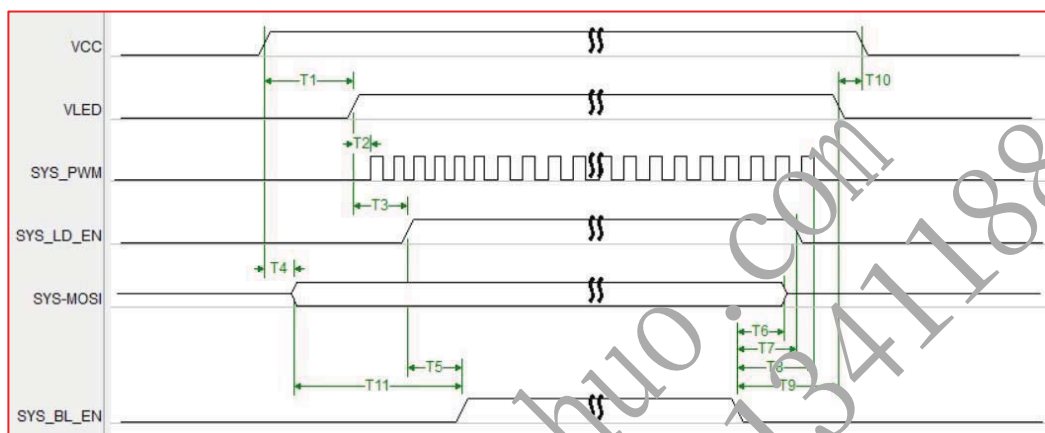
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3.3 LED Driver Power sequence

<Figure 3. LED Driver Power Sequence>



Parameter	Value			Unit	Note
	Min.	TYP.	MAX.		
T1	200	--	--	ms	
T2	0	--	50	ms	
T3	50	--	100	ms	
T4	20	--	--	ms	
T5	50	--	--	ms	
T6	50	--	--	ms	
T7	50	--	--	ms	
T8	50	--	--	ms	
T9	50	--	--	ms	
T10	20	--	--	ms	
T11	20	--	--	ms	

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3.4 Input Signal truth table						
LD_EN	SYS_PWM	SPI	BL_EN	Vsync	Pattern	Note
L	0-100%	Don't care	H	Don't care	Global Dimming	HDR OFF
H	H	keep Sending	H	Keep Sending -60Hz	Local Dimming	HDR ON
		Interrupt data		Interrupt	Hold on Last Pattern	
<Table 6. Input Signal truth table >						

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1. OPTICAL SPECIFICATION

2. Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) 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 $\theta_{0=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{0=90}$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{0=180}$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta_{0=270}$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , 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 10.0V +/-10% at 25°C . Optimum viewing angle direction is 6 'clock.

2. Optical Specifications

[VDD = 10.0V, Frame rate = 60Hz, Clock = 533MHz, $I_{B1} = 70 \times 8\text{mA}$, $T_A = 25 \pm 2^\circ\text{C}$]

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		1000	1200	-	-	Note 2
Luminance		Y		600 (typ)				
Uniformity		BU		75% (Min)				
Reproduction of color	White	W_x	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	0.283	0.313	0.343	-	Note 5 (with BOE KSF BLU)
		W_y		0.299	0.329	0.359	-	
	Red	R_x		0.6477	0.6777	0.7077	-	
		R_y		0.2878	0.3178	0.3478	-	
	Green	G_x		0.2207	0.2507	0.2807	-	
		G_y		0.6811	0.7111	0.7411	-	
	Blue	B_x		0.1271	0.1571	0.1871	-	
		B_y		0.0104	0.0404	0.0704	-	
Color Gamut	DCI P3		@CIE1976	95	99	-	%	
	Adobe RGB			95	99	-		
	SRGB		@CIE1931	-	99	-		%
Cell Transmittance			-	3.6	4.0	-	%	
Response Time	GTG	T_g	-	-	14	20	ms	Note 6
Gamma Scale		-	-	2.0	2.2	2.4	-	
Crosstalk		-	-	-	-		%	Fig.4

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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 $\theta = 0^\circ$ 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. 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. The BLU is used by BOE.
4. Response time T_g is the average time required for display transition by switching the input signal as below table and is based on Frame rate $f_V = 60\text{Hz}$ to optimize.
Each time in below table 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
Start	0																	
	15																	
	31																	
	47																	
	63																	
	79																	
	95																	
	111																	
	127																	
	143																	
	159																	
	175																	
	191																	
	207																	
	223																	
	239																	
255																		

5. Definition of Transmittance (T%) :

Module is with white(L255) signal input

$$\text{Transmittance} = \frac{\text{Luminance of LCD Module}}{\text{Luminance of BLU}} \times 100\%$$

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1. INTERFACE CONNECTION.

2. Electrical Interface Connection

1. Driver Board

- **Input connector : 20022WR-H14B2 manufactured by YEONHO or equivalent.**
- **SPI connector : CI4412M1HR0-NH manufactured by Cvilux or equivalent.**

< Table 7. Driver Board >

Master Board Power CNT pinmap-CN1&CN2

Pin No	Symbol	Description
1	VIN	Power supply
	VIN	Power supply
3	VIN	Power supply
4	VIN	Power supply
5	VIN	Power supply
6	AGND	Power Ground
7	AGND	Power Ground
8	AGND	Power Ground
9	AGND	Power Ground
10	AGND	Power Ground
11	SGND	Signal Ground
12	VCC	Power supply 10V
13	SYS_BL_EN	Back Light_EN
14	SYS_BL_PWM	BL Global PWM dimming

< Table 8. Driver Board >

Master Board SPI CNT pinmap-CN3

Pin No	Symbol	Description
1	SYS_LD_EN	Local Dimming_EN
2	SYS_BL_EN	Back Light_EN
3	SYS_CS	SPI CS
4	SGND	Signal Ground
5	SYS_SCK	SPI Clock
6	SGND	Signal Ground
7	SYS_MISO	Driver data output
8	SGND	Signal Ground
9	SYS_MOSI	Driver data input
10	SGND	Signal Ground
11	SYS_VSYNC	VSYNC
12	SGND	Signal Ground

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5.2 LED Driver Interface SPI Parameter

SPI Protocol

Figure 4. The default state of signals (SYS_BL_EN) controlled by SOC

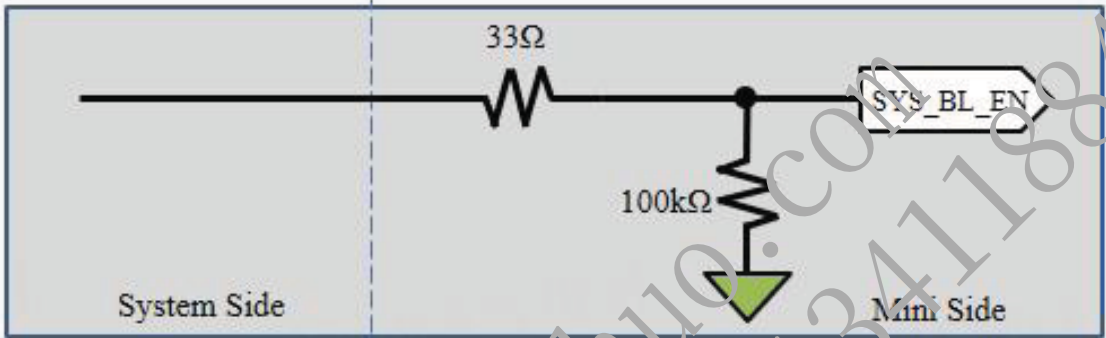


Figure 5. The default state of signals (SYS_LD_EN) controlled by SOC

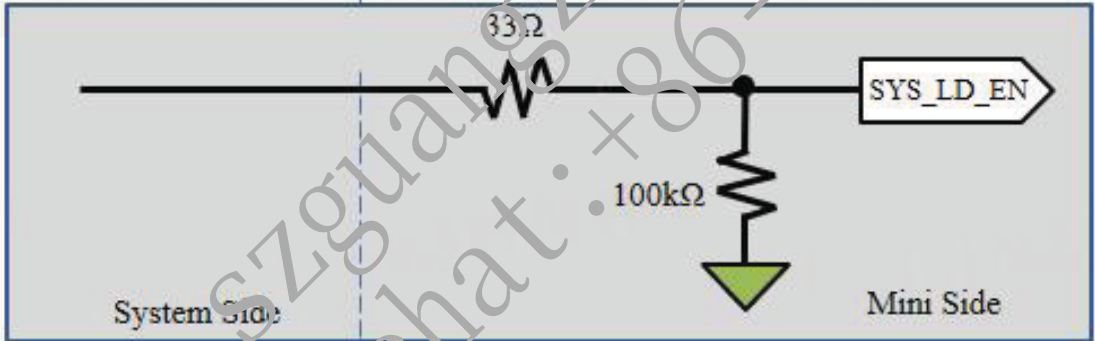
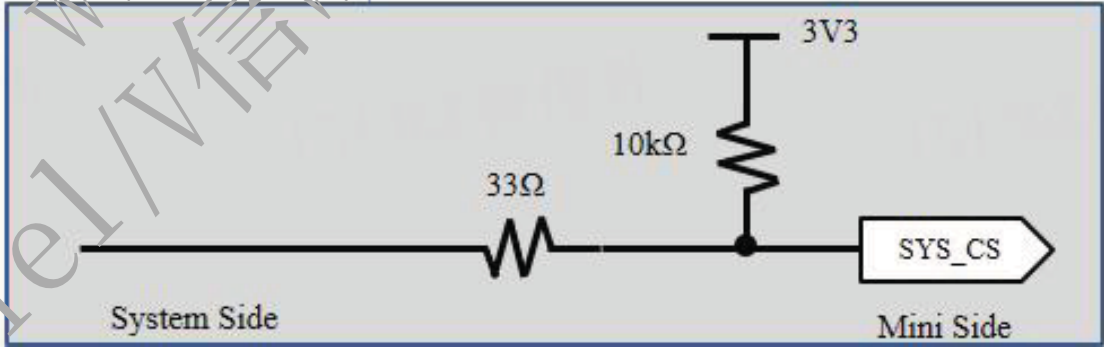


Figure 6. The default state of signals (SYS_VSYNC / SYS_CS / SYS_MOSI / SYS_MISO / SYS_SCK / SYS_BL_PWM) controlled by SOC



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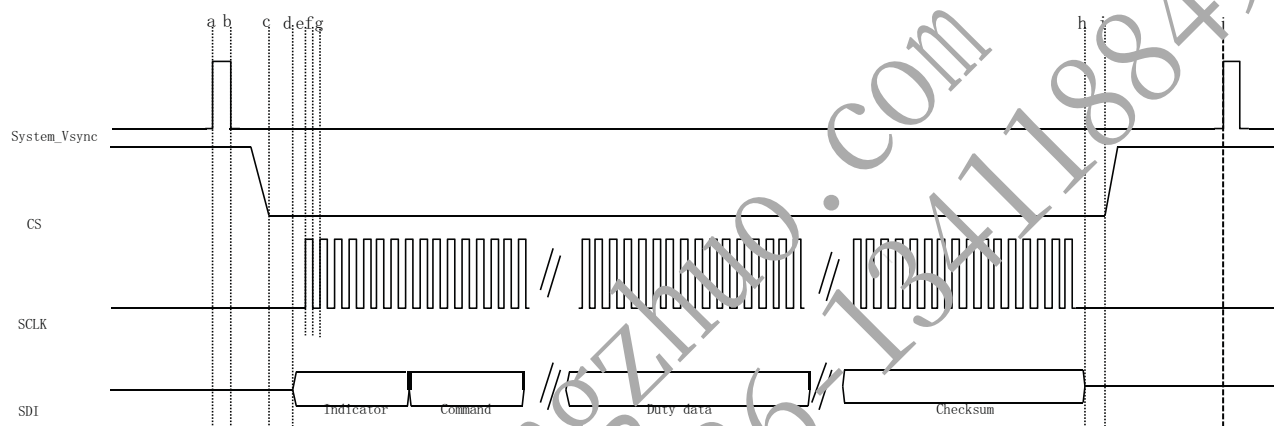
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5.3 LED Driver Interface SPI Parameter

The specification of the LED Driver SPI parameter is shown in Table 7.

<Figure 7. LED Driver SPI parameter>



<Table 9. LED Driver SPI parameter Specification>

Parameter	Value			Units	Note
	Min	Typ	Max		
Tab	20	--	--	us	
Tbc	--	100	--	us	
Tcd	--	100	--	us	
Tef	--	31.25	--	ns	
Teg	--	62.5	--	ns	
Thi	50	100	--	us	

Note: SCLK Rising edge validity

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5.4 LED Driver Interface SPI Parameter SPI Data Format: <table><tr><td>Indicator</td><td>Command</td><td>Data1</td><td>Data2</td><td>...</td><td>DataN</td><td>Checksum</td><td>0x00</td></tr></table> Definition: 1. Indicator (1Byte) 0xAA : 8bit 2. Command (1Byte) 0x81 : 8bit 3. Data1~DataN: 1Byte per Rec_Data, 8bits local dimming Rec_Data 4. Checksum: 1Byte 8bits XOR ID^Command^Data1^Data2^...^DataN(^:Exclusive XOR,N=1152)					Indicator	Command	Data1	Data2	...	DataN	Checksum	0x00
Indicator	Command	Data1	Data2	...	DataN	Checksum	0x00					
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5. Electrical Interface Connection

- CN1 Module Side Connector : STM MSAK24025P30 or IPEX 20455-030E-66.

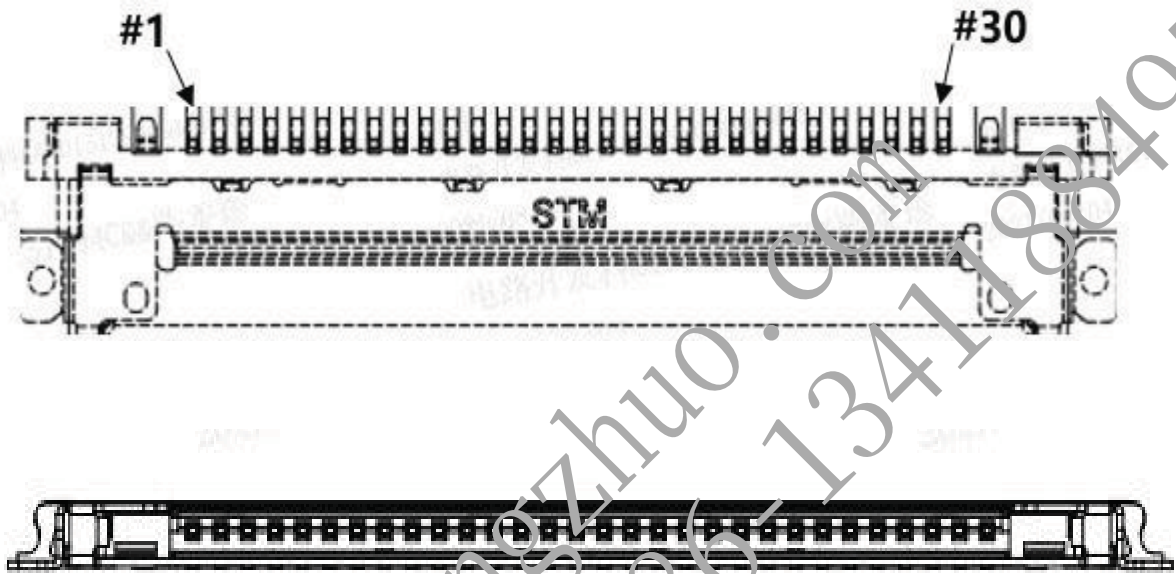
Pin No	Symbol	Function	Remark
1	VDD	Power Supply (10.0V)	
	VDD	Power Supply (10.0V)	
3	VDD	Power Supply (10.0V)	
4	VDD	Power Supply (10.0V)	
5	VDD	Power Supply (10.0V)	
6	NC	No connection	
7	GND	Ground	
8	NC	No connection	
9	NC	No connection	
10	GND	Ground	
11	HPD	Hot Plug Detection Signal	
12	GND	Ground	
13	DAUXN	Negative Signal for Auxiliary Channel	
14	DAUXP	Positive Signal for Auxiliary Channel	
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	NC	No connection	
29	NC	No connection	
30	NC	No connection	Reserved for BIST Function

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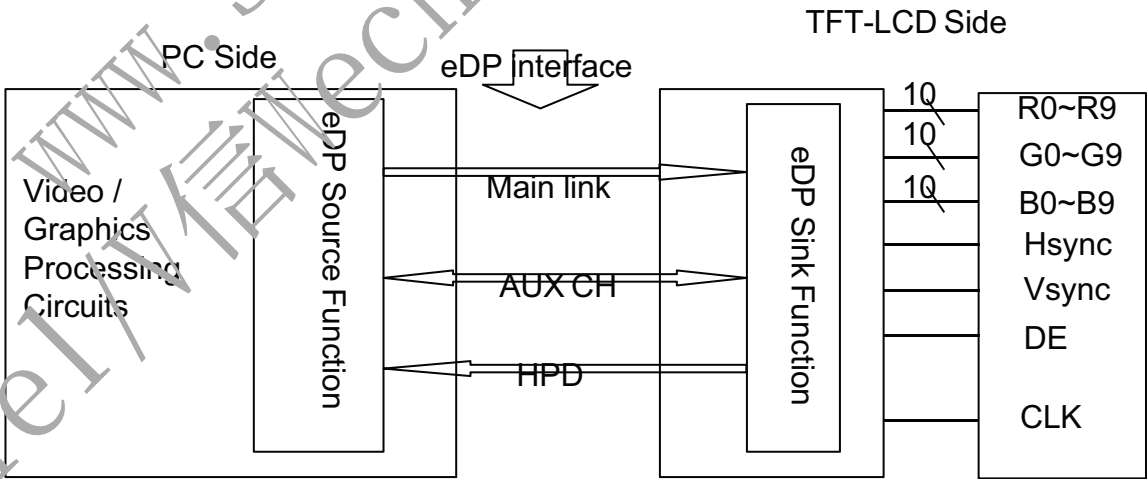
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5.5.1 Connector Diagram



5.6.eDP Interface



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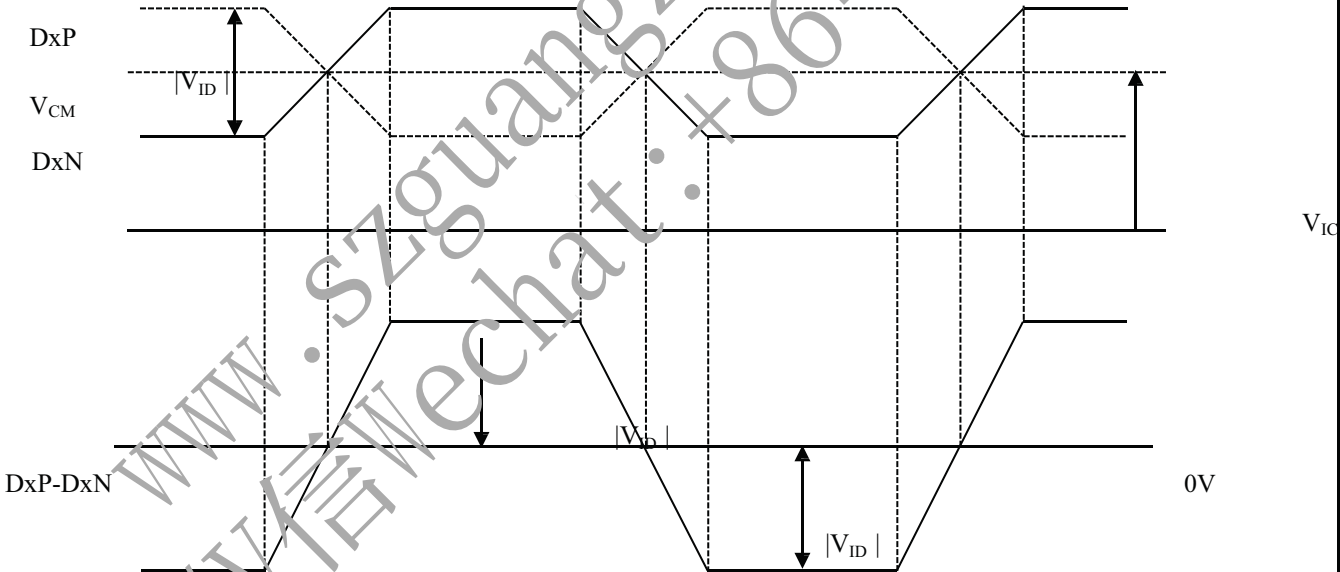
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7. eDP Rx Interface Timing Parameter

1. Main link Signal

Item	Symbols	Min	Typ	Max	Unit	Remark
Spread spectrum clock	SSC	-0.5	-	+0.5	%	
Main link swing voltage	$ V_{ID} $	100	-	1320	mV	
Main link common mode voltage	V_{IC}	0	-	2.0	V	



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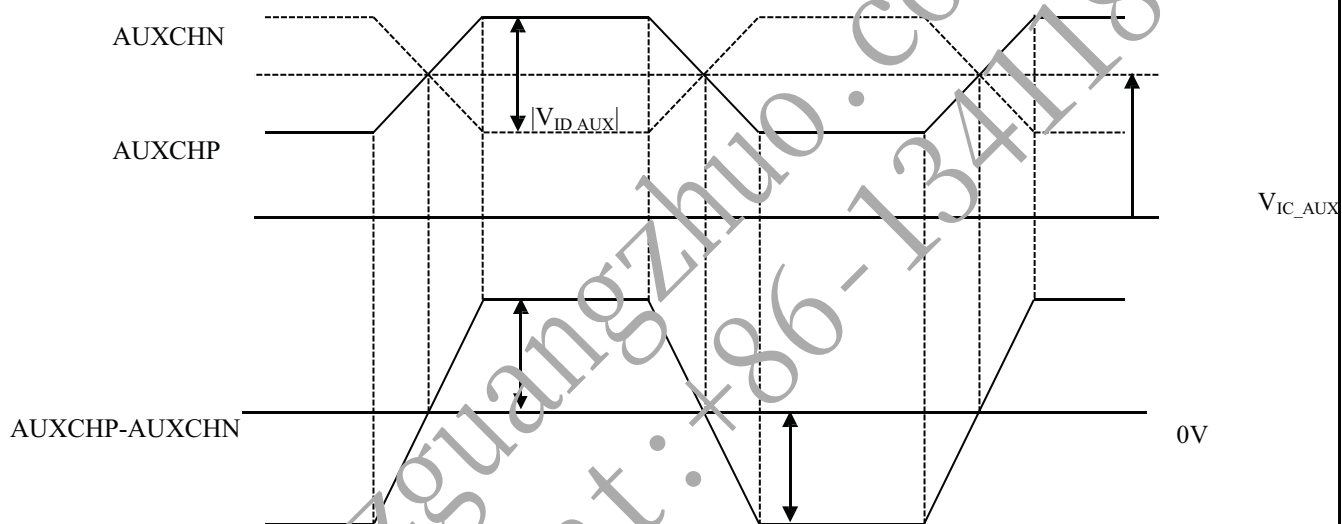
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2. AUX_CH Signal

Item	Symbols	Min	Typ	Max	Unit	Remark
AUX Peak-to-peak voltage at Connector Pins of Receiving	$ V_{ID_AUX} $	0.27	-	1.36	V	
AUX DC common mode voltage	V_{AUX-CM}	0	-		V	



3. HDP Signal

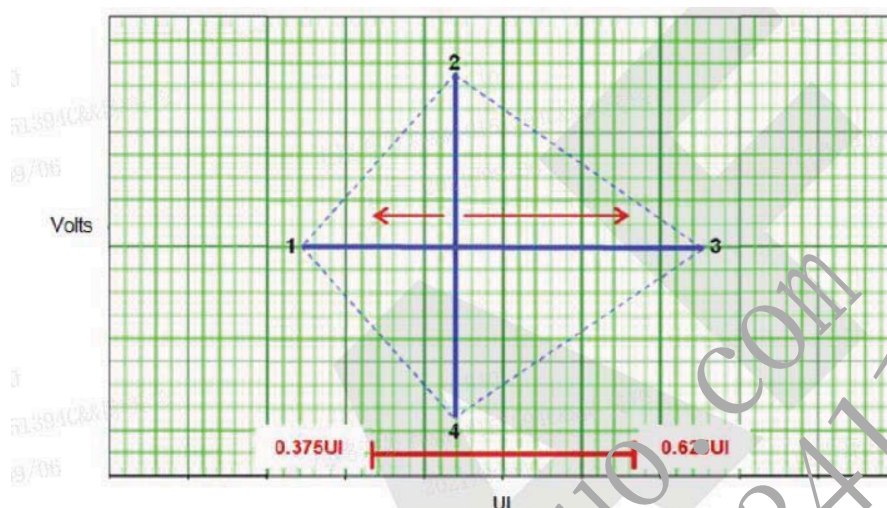
Item	Symbols	Min	Typ	Max	Unit	Remark
HPD Voltage	VHPD	3.135	3.3	3.465	V	

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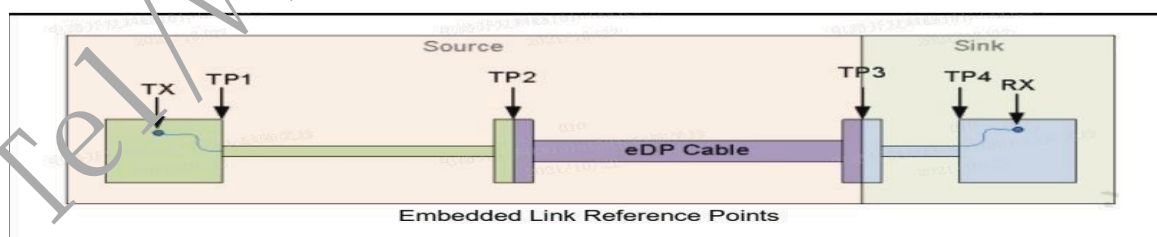
4. Main Link Eye Diagram



Point	HBR2@ TP3_EQ EYE Mask Vertices	Voltage(V)
1	Any UI location(x),where the EYE width is open from x to x+0.5UI	0.0000
2	Any passing UI location between 0.375 and 0.625 UI	0.0375
3	Point 1+0.5UI	0.0000
4	Same as Point 2	-0.0375

[eDP TP3_EQ EYE Mask Vertices]

Remark: TP3_EQ-After Reference RX Equalizer



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BOE	PRODUCT GROUP				REV	ISSUE DATE	
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1. SIGNAL TIMING SPECIFICATION							
2. The MV270QUB-N50 is operated by the DE only.							
Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	1.8	1.9	2.2	ns	
	Frequency	-	444	533	551	MHz	
Hsync	Period	tHP	3950	4000	4088	tCLK	
	Horizontal Valid	tHV	3840			tCLK	
	Horizontal Blank	tHB	110	160	248	tCLK	
	Frequency	fH	111	133.3	137	KHz	
Vsync	Period	tVP	2213	2222	2290	tHP	
	Vertical Valid	tVV	2160			tHP	
	Vertical Blank	tVB	53	62	130	tHP	
	Frequency	fV	50	60	62	Hz	Adaptive sync: 40-60Hz

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

Color	Gray Level	RED										GREEN										BLUE									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
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
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
L511	-	0	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
Red	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	1023	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
Green	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	1023	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	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	0	0	0	0	0	0	0	0	0	0	0
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	1023	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

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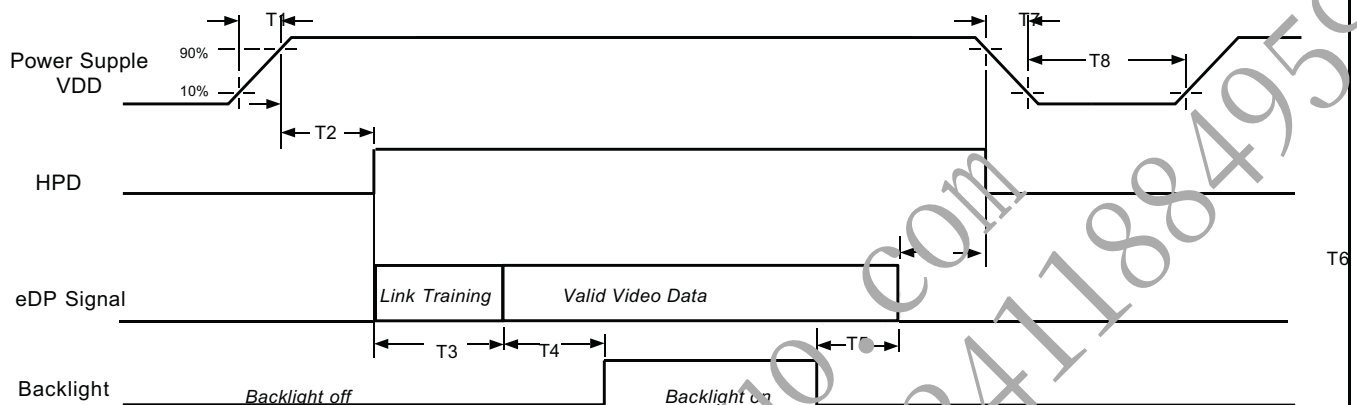
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1. POWER SEQUENCE

VDD power,eDP signal and backlight on/off sequence are as following. eDP signals from any system shall be Hi-Z state when VDD is off.



Timing Parameter	Value			Remarks
	Min.	Typ.	Max.	
T1	0.5ms	-	10ms	
T2	0ms	-	200ms	
T3	0ms	-	-	During T3 Period, eDP link training time by customer's system.
T4	500ms	-	-	
T5	100ms	-	-	
T6	0ms	-	50ms	Recommend setting T6=0ms to avoid electronic noise when VDD is off. During T6 period, please keep the level of input eDP signals with Hi-Z state.
T7	0ms	-	10ms	T7 decreases smoothly, there is none re-bouncing voltage.
T8	1000ms	-	-	

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.

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1. MECHANICAL CHARACTERISTICS

2. Dimensional Requirements

FIGURE 6 (located in Appendix) shows mechanical outlines for the model MV270QUB-N50.
Other parameters are shown in Table 10.

<Table 10. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	608.9(H) × 359.8(V)	mm
Weight	TBD	kg
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	Mini LED direct back-light type with 1152 blocks	

2. Mounting

See FIGURE 5. (shown in Appendix)

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

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10.0 RELIABILITY TEST

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

<Table 11. Reliability Test Parameters >

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 °C, 240 hrs	
	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 30min
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	

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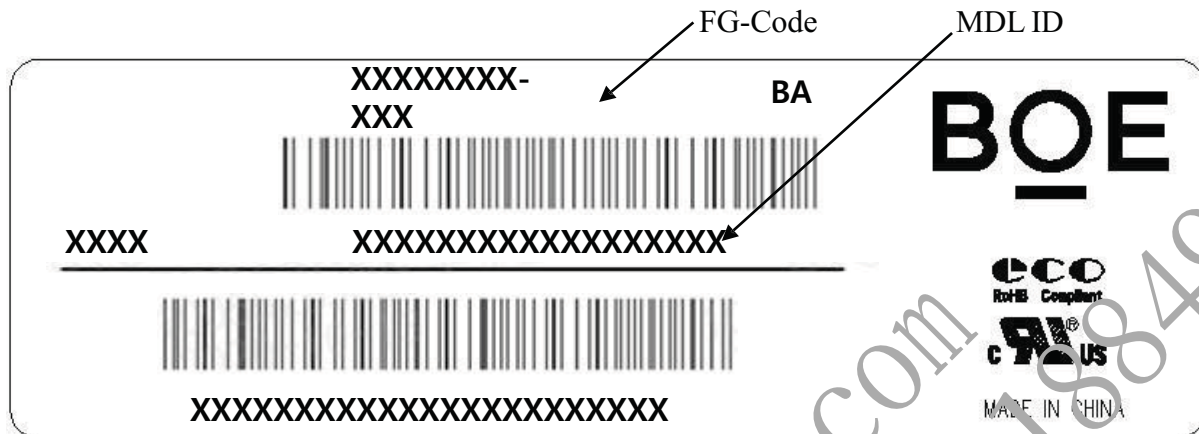
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1. HANDLING & CAUTIONS (1) Cautions when taking out the module • Pick the pouch only, when taking out module from a shipping package. (2) Cautions for handling the module • As the electrostatic discharges may break the LCD module, handle the LCD module 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.			
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12.0 PRODUCT SERIAL NUMBER

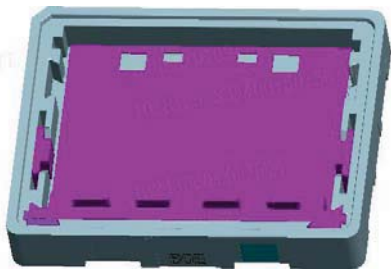
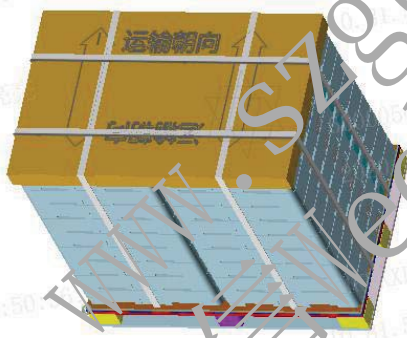


MDL ID Naming Rule:

Digit	1		3		4		5		6			7				
Code	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Des.	1. Model Code GBN 2. Grade 3. Line 4. Year(2016:16, 2017:17, ...) 5. Month(1, 2, 3, ..., 9, X, Y, Z) 6. Model Extension Code 7. Serial Number															

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1. Packing 2. Packing Order  Put an EPE pad in the EPO bottom.  Put one open cell, then put EPE pad ..., totally 13 pcs open cells and 14 pcs EPE pads in the EPO bottom.  Place paper cover and wrap film around the box. Pack with 4 packing belts.  Put totally 16ea boxes and 2ea cover per pallet			
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2. Packing Note • Box Dimension : 760mm(L) × 300mm(W) × 126mm(H) • Package Quantity in one Box : 13pcs 3. Box label • Label Size :70mm (L) × 30 mm (W) • Contents Model : MV270QUB-N53 Q`ty : Module 13 Q`ty in one box Serial No. : Box Serial No. See next page for detail description. Date : Packing Date												
BOE FUZHOU BOE OPTOELECTRONICS TECHNOLOGY Co.,LTD MODEL: XXXXXXXXX-XXX QTY: XXX SERIAL NO: XXXXXXXXXXXXX DATE: XXXX.XX.XX XXXXXXXXXXXXXX RoHS Compliant XXXX RoHS Mark Internal CODE												
Digit	1		2	4		5	6	7				
Code	x	x	x	x	x	x	x	x	x	x	x	x
Des.	1. Model Code GBN 2. Grade 3. Line 4. Year(2016:16, 2017:17, ...) 5. Month(1, 2, 3, ..., 9, X, Y, Z) 6. Revision Code 7. Serial Number											
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14.0 APPENDIX

Figure 1. Measurement Set Up

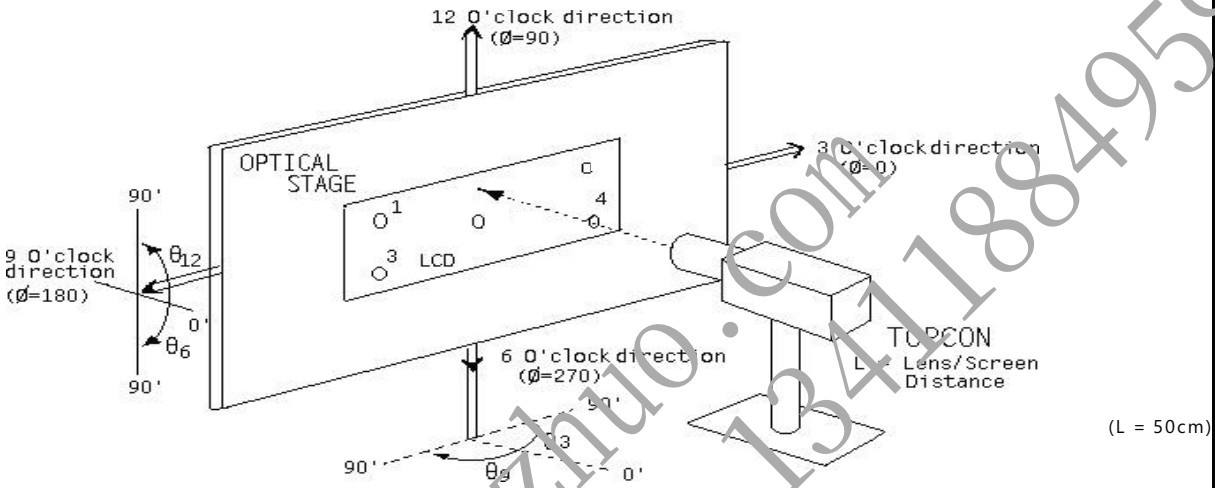
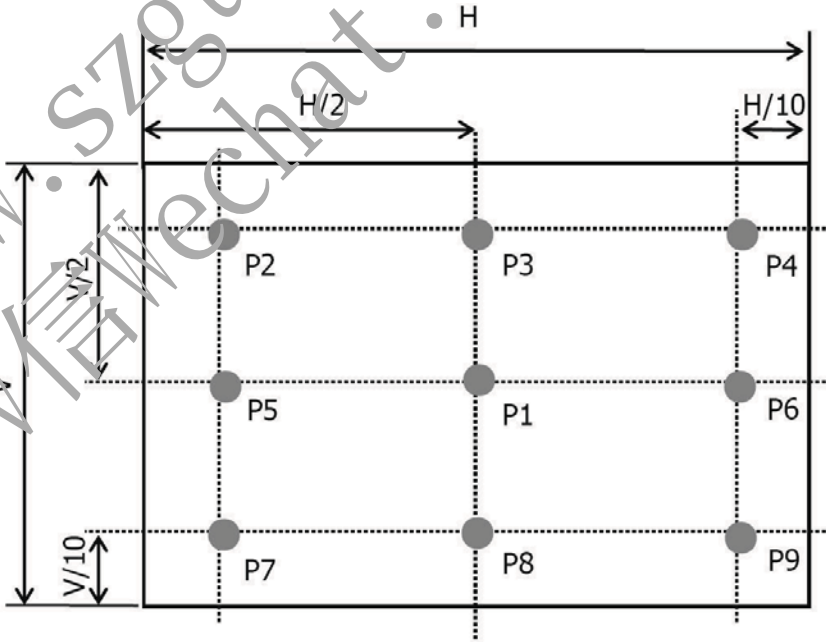


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)



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Figure 3. Response Time Testing

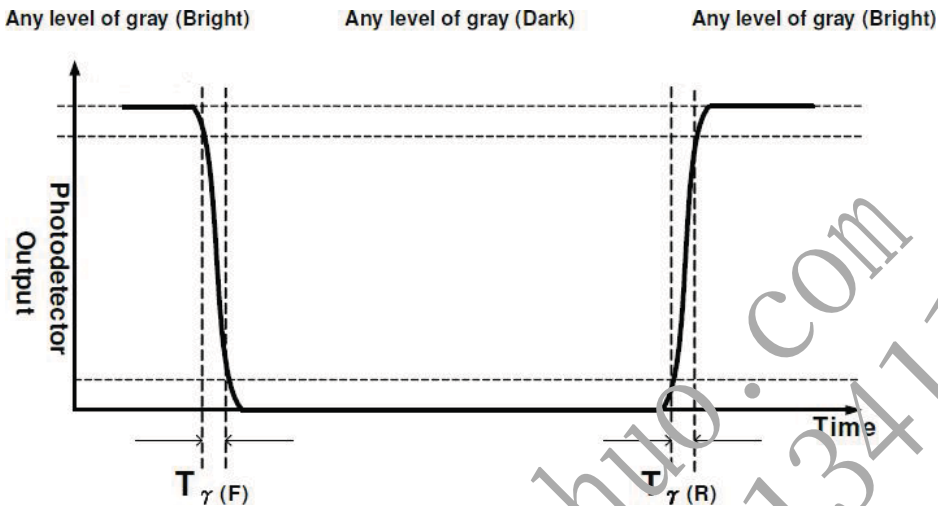
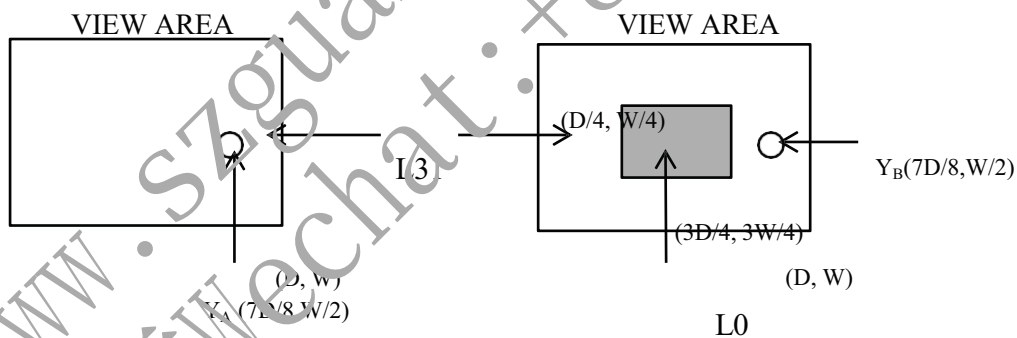


Figure 4. Cross Modulation Test Description



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

Where: Y_A = Initial luminance of measured area (cd/m²)
 Y_B = Subsequent luminance of measured area (cd/m²)
The location measured will be exactly the same in both patterns

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Figure 5. TFT-LCD Panel Outline Dimensions (Front view) Technical drawing of a TFT-LCD panel showing front view outline dimensions. The drawing includes a top view, a front view, and a side view. The front view shows a rectangular panel with a central active area and a surrounding bezel. Dimensions are provided in millimeters. The top view shows the panel's width and height. The side view shows the panel's thickness. A watermark 'www.szguangzhuo.com' and 'Tel: +86-13411884959' are overlaid on the drawing. <table><tr><th>Dimension</th><th>Value (mm)</th></tr><tr><td>Top View Width</td><td>359.8 (OUTLINE)</td></tr><tr><td>Top View Height</td><td>596.736 (A/A)</td></tr><tr><td>Front View Width</td><td>335.664 (A/A)</td></tr><tr><td>Front View Height</td><td>561.05</td></tr><tr><td>Side View Thickness</td><td>17.65 (A/A)</td></tr><tr><td>Active Center</td><td>186.5</td></tr><tr><td>Bezel Width (Left)</td><td>18.0</td></tr><tr><td>Bezel Width (Right)</td><td>6.1</td></tr><tr><td>Bezel Width (Bottom)</td><td>6.1</td></tr><tr><td>Bezel Width (Top)</td><td>6.1</td></tr><tr><td>Bezel Width (Left - Inner)</td><td>11.9</td></tr><tr><td>Bezel Width (Left - Outer)</td><td>37.3</td></tr><tr><td>Bezel Width (Left - Total)</td><td>49.2</td></tr><tr><td>Bezel Width (Right - Inner)</td><td>6.1</td></tr><tr><td>Bezel Width (Right - Outer)</td><td>6.1</td></tr><tr><td>Bezel Width (Right - Total)</td><td>12.2</td></tr><tr><td>Bezel Width (Bottom - Inner)</td><td>6.1</td></tr><tr><td>Bezel Width (Bottom - Outer)</td><td>6.1</td></tr><tr><td>Bezel Width (Bottom - Total)</td><td>12.2</td></tr><tr><td>Bezel Width (Top - Inner)</td><td>6.1</td></tr><tr><td>Bezel Width (Top - Outer)</td><td>6.1</td></tr><tr><td>Bezel Width (Top - Total)</td><td>12.2</td></tr></table>				Dimension	Value (mm)	Top View Width	359.8 (OUTLINE)	Top View Height	596.736 (A/A)	Front View Width	335.664 (A/A)	Front View Height	561.05	Side View Thickness	17.65 (A/A)	Active Center	186.5	Bezel Width (Left)	18.0	Bezel Width (Right)	6.1	Bezel Width (Bottom)	6.1	Bezel Width (Top)	6.1	Bezel Width (Left - Inner)	11.9	Bezel Width (Left - Outer)	37.3	Bezel Width (Left - Total)	49.2	Bezel Width (Right - Inner)	6.1	Bezel Width (Right - Outer)	6.1	Bezel Width (Right - Total)	12.2	Bezel Width (Bottom - Inner)	6.1	Bezel Width (Bottom - Outer)	6.1	Bezel Width (Bottom - Total)	12.2	Bezel Width (Top - Inner)	6.1	Bezel Width (Top - Outer)	6.1	Bezel Width (Top - Total)	12.2
Dimension	Value (mm)																																																
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Top View Height	596.736 (A/A)																																																
Front View Width	335.664 (A/A)																																																
Front View Height	561.05																																																
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Figure 5. TFT-LCD Panel Outline Dimensions (Back view) The diagram illustrates the back view of a TFT-LCD panel with various dimensions and components. Key features include: Dimensions: - Overall width: 2-266.25 - Overall height: 2-196.25 - Top edge dimensions: 2-16.25, 2-116.25, 2-196.25 - Right edge dimensions: 2-83.5, 2-16.25, 2-94.5 - Internal vertical dimensions: 39.4, 36.1 - Internal horizontal dimensions: 10.3, 80 Components: - Master Board - Power CNT CN1 - Power CNT CN2 - SPT CNT CN3 - O/C CNT			
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