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NV140FHM-N69

HW:V8.0

Final Product Specification

Rev. 0

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BOE Optoelectronics Technology Co., Ltd

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( )Preliminary Specification

(√)Final Specification

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1.0 GENERAL DESCRIPTION

1.1 Introduction

NV140FHM-N69 V8.0 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 14.0 inch diagonally measured active area with Full-HD resolutions (1920 horizontal by 1080 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M(8bit) colors and color gamut sRGB 100%. The TFT-LCD panel used for this module is a low reflection and higher color type. Therefore, this module is suitable for Notebook PC. The LED driver for back-light driving is built in this model.
All input signals are eDP1.4b interface compatible.

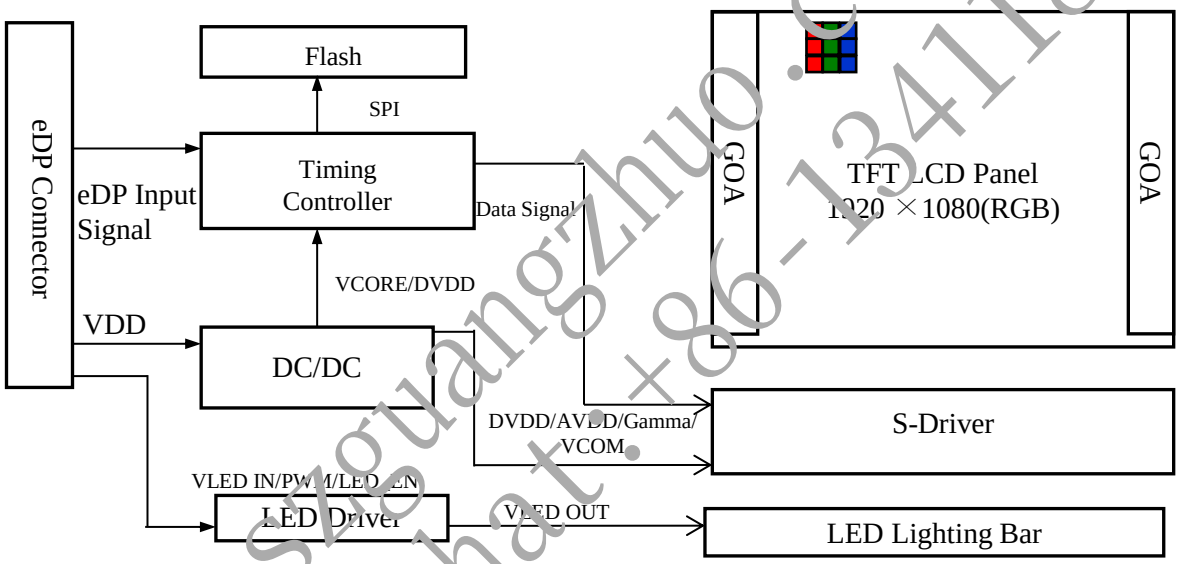

Figure 1. Drive Architecture

1.2 Features

- 2 lane eDP1.4b interface with 2.7Gbps link rates
- Thin and light weight, Low Blue Light
- 16.7M(8bit) color depth, color gamut sRGB100%
- Single LED lighting bar (Bottom side/Horizontal Direction)
- Data enable signal mode
- Green product (RoHS & Halogen free product)
- On board LED driving circuit
- Low driving voltage and low power consumption
- On board EDID chip
- DPCD Version 1.4
- Adjust backlight brightness with DC
- PSR2

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1.3 Application

- Notebook PC (Wide type)

1.4 General Specification

The followings are general specifications at the model NV140FHM-N69 V8.0. (listed in Table 1)

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	309.312 (H) ×173.988 (V)	mm	
Number of pixels	1920 (H) ×1080 (V)	pixels	
Pixel pitch	161.1(H) ×161.1(V)	um	
Pixel arrangement	RGB Vertical stripe		
Display colors	16.7M(8bit)		
Color gamut	sRGB 100% typ., sRGB 95% min.		CIE1931
Display mode	Normally Black		
Dimensional outline	315.81±0.3 (H)*186.07±0.3(V)(W/O PCB)*3 (Max) 315.81±0.3(H)*195.57±0.5(V) (W/PCB)*3(Max)	mm	
Weight	290(max)	g	
Surface treatment	Anti-Glare		
Surface hardness	3H		
Back-light	Bottom edge side, 1-LED lighting bar type		Note 1
Power consumption	P_D : 0.7(Max)	W	@Mosaic
	P_{BL} : 3.65(Max)	W	@VLED= 12V
	P_{Total} : 4.35(Max)	W	@Mosaic

Notes : 1. LED Lighting Bar (44*LED Array)

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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>

Ta=25+/-2°C

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V_{DD}	-0.3	4.0	V	Note 1
eDP input Voltage	V_{eDP}	0	2.0	V	
Logic Supply Voltage	V_{IN}	V_{SS}-0.3	V_{DD}+0.3	V	
Operating Temperature	T_{OP}	0	+50	°C	Note 2
Storage Temperature	T_{ST}	-20	+60	°C	

Notes :
1. Permanent damage to the device may occur if maximum values are exceeded functional operation should be restricted to the condition described under normal operating conditions.
2. Temperature and relative humidity range are shown in the figure below.
95 % RH Max. (40 °C ≥ Ta) Maximum wet - bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.

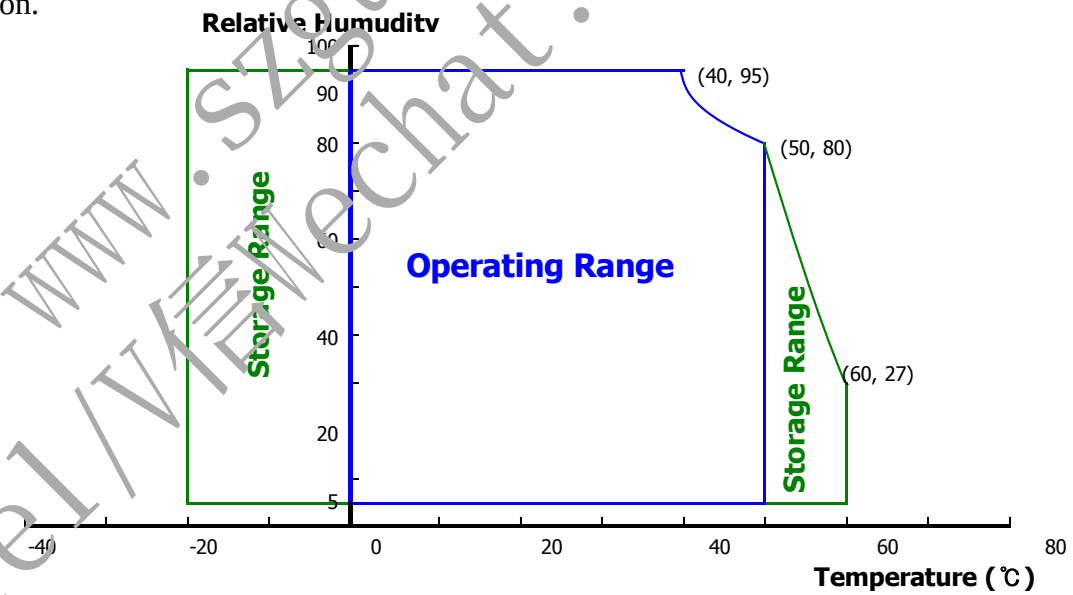

Figure 2. Temperature and Relative Humidity Range

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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical Specifications > Ta=25+/-2°C

Parameter			Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage		V_{DD}	3.0	3.3	3.6	V	Note 1
Permissible Input Ripple Voltage		V_{RF}	-10% VDD	-	+10% VDD	V	@VDD = 3.3V, note4
Power Supply Inrush Current		Inrush	-	-	2	A	Note3
Power Supply Current	Mosaic	I_{DD}	-	-	212	mA	Note 1
	RGB		-	-	364	mA	
Power Consumption	Mosaic	P_M	-	-	0.7	W	
	RGB	P_{RGB}	-	-	1.2	W	
	BLU	P_{BL}	-	-	3.65	W	Note 2
	Total	P_{Total}	-	-	4.35	W	@Mosaic

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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

Notes :

1. The supply voltage is measured and specified at the interface connector of LCM.
   The current draw and power consumption specified is for 3.3V at 25 ˚C.
   a) Mosaic pattern 8*8
   b) R/G/B patterns

(a) (b)

Figure 3. Power Measure Patterns

2. Calculated value for reference ($V_{LED} \times I_{LED}$) , The power consumption with LED Driver are under the VLED = 12.0V , 25℃, PWM Duty 100%
3. Measure condition (Figure 4)

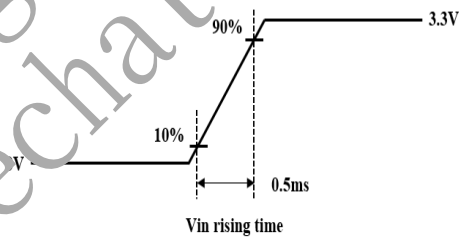

Figure 4. Inrush Measure Condition

4. Input voltage range:3.0~3.6V.Test condition: Oscilloscope bandwidth 20MHz, AC coupling

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3.2 Backlight Unit

< Table 4. LED Driving Guideline Specifications > Ta=25+/-2°C

Parameter			Min.	Typ.	Max.	Unit	Remarks
LED Forward Voltage		V_F	-	-	2.9	V	
LED Forward Current		I_F	-	21.8	-	mA	
LED Power Input Voltage		VLED	5	12	21	V	
LED Power Input Current		I_{LED}	-	-	304	mA	Note 1
LED Power Consumption		P_{LED}	-	-	3.65	W	
Power Supply Voltage for LED Driver Inrush		Iled inrush	-	-	2	A	Note 3
LED Life-Time		N/A	15,000	-	-	Hour	I_F = 21.8mA Note 2
EN Control Level	Backlight On	V_{BL_EN}	2.5	-	5.0	V	
	Backlight Off		0	-	0.5	V	
PWM Control Level	High Level	V_{BL_PWM}	2.5	-	5.0	V	
	Low Level		0	-	0.5	V	
PWM Control Frequency		F_{PWM}	200	-	2,000	Hz	
Duty Ratio			5	-	100	%	

Notes :
1. Power supply voltage12.V for LED driver.
   Calculator value for reference IF × VF ×44 /driver efficiency = PLED
2. The LED life-time define as the estimated time to 50% degradation of initial luminous.
3. Measure condition (Figure 5)

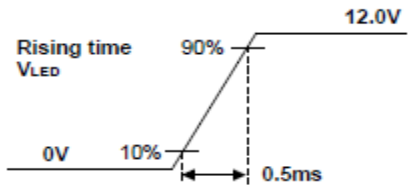

Figure 5. Inrush Measure Condition

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3.3 LED Structure

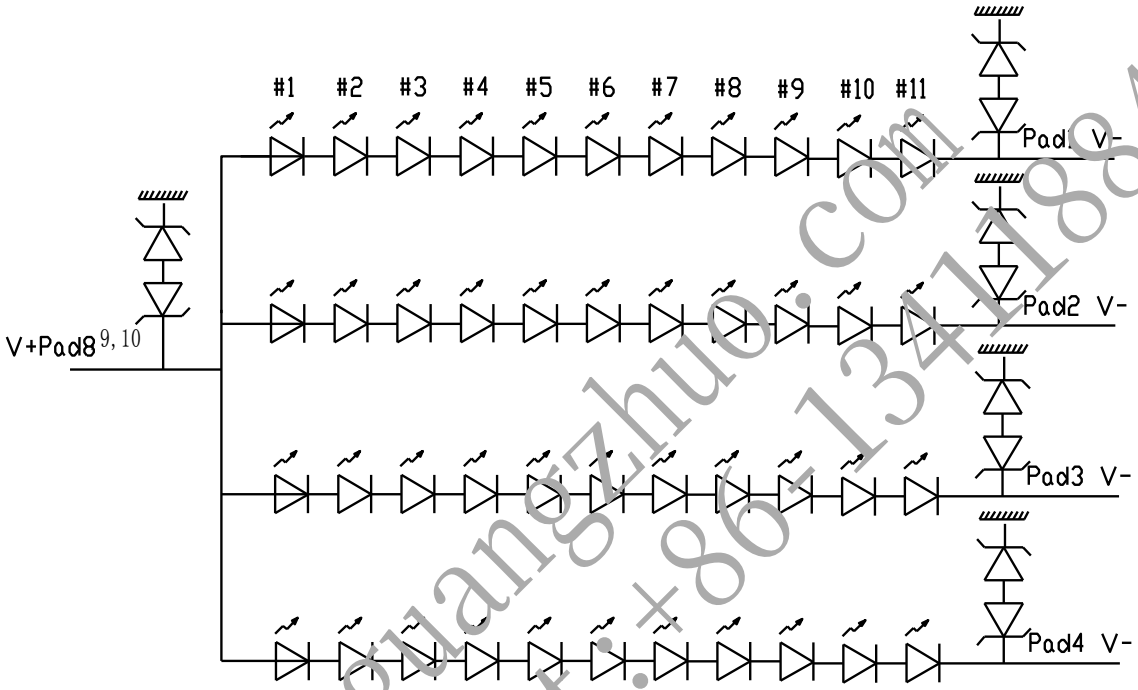

Figure 6. LED Structure

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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 (PR730&PR810) 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 θØ=0 (=θ3) as the 3 o'clock direction (the "right"), θØ=90 (= θ12) as the 12 o'clock direction ("upward"), θØ=180 (= θ9) as the 9 o'clock direction ("left") and θØ=270(= θ6) as the 6 o'clock direction ("bottom"). While scanning θand/or Ø, the center of the measuring spot on the display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.3+/- 0.3V at 25°C. Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

<Table 5. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ_3	CR > 10	80	89	-	Deg.	Note 1
		Θ_9		80	89	-	Deg.	
	Vertical	Θ_{12}		80	89	-	Deg.	
		Θ_6		80	89	-	Deg.	
Luminance Contrast Ratio		CR	Θ = 0°	600	800	-		Note 2
Luminance of White	5 Points	Y_w	Θ = 0° I_{LED} = 21.8mA	340	400	-	cd/m^2	Note 3
White Luminance Uniformity	5 Points	ΔY5		80%	-	-	%	Note 4
	13 Points	ΔY13		62.5	71.4	-	%	
White Chromaticity		W_x	Θ = 0°	0.283	0.313	0.343		Note 5
		W_y		0.299	0.329	0.359		
Reproduction of Color	Red	R_x	Θ = 0°	Typ.-0.03	0.640	Typ.+0.03		
		R_y			0.330			
	Green	G_x			0.300			
		G_y			0.600			
	Blue	B_x			0.150			
		B_y			0.060			
Color Gamut		sRGB		95	100	-	%	CIE1931
Response Time (Rising + Falling)		T_{RT}	Ta= 25℃ Θ = 0°	-	30	35	ms	Note 6
Cross Talk		CT	Θ = 0°	-	-	2.0	%	Note 7
Gamma		-	-	2.0	2..2	2.4		

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Notes :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles 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 (see Figure 7).

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 7) 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 luminance values of 5 point average across 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 8 for a total of the measurements per display.

4. The White luminance uniformity on LCD surface is then expressed as : ΔY =Minimum Luminance of 5(or 13) points / Maximum Luminance of 5(or 13) points.(see Figure 8 and Figure 9).

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. The electro-optical response time measurements shall be made as Figure 10 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r, and 90% to 10% is T_f.

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 10±1mm diameter area, with all display pixels set to gray 127(of 0 to 255), to the luminance (YB) of that same area when any adjacent area is driven dark.The luminance ratio shall not exceed 1:1.05 (See Figure 11).

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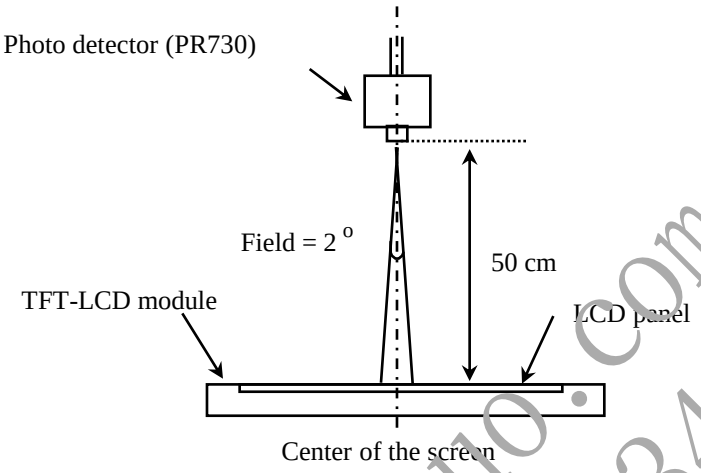
4.3 Optical Measurements



Optical characteristics measurement setup

Figure 7. Measurement Set Up

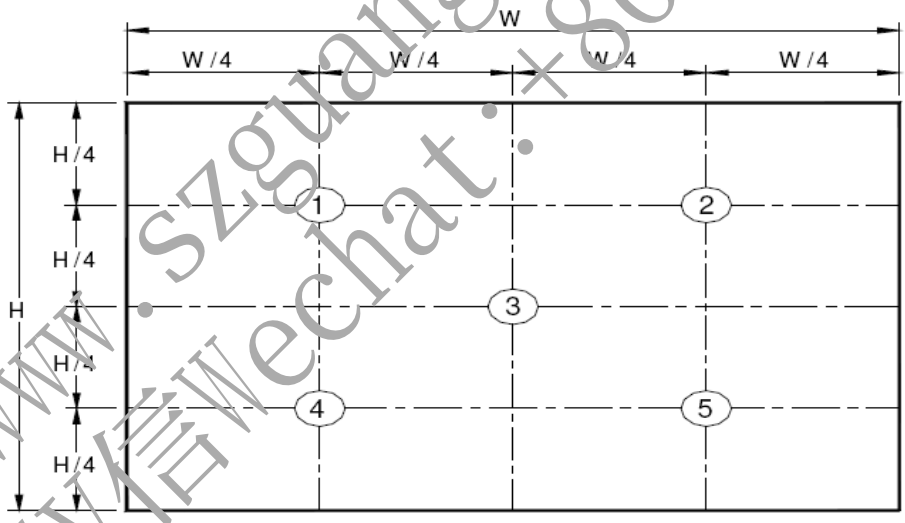


Figure 8. White Luminance and Uniformity Measurement Locations (5 points)

Center Luminance of white is defined as luminance values of center 5 points across 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 7 for a total of the measurements per display.

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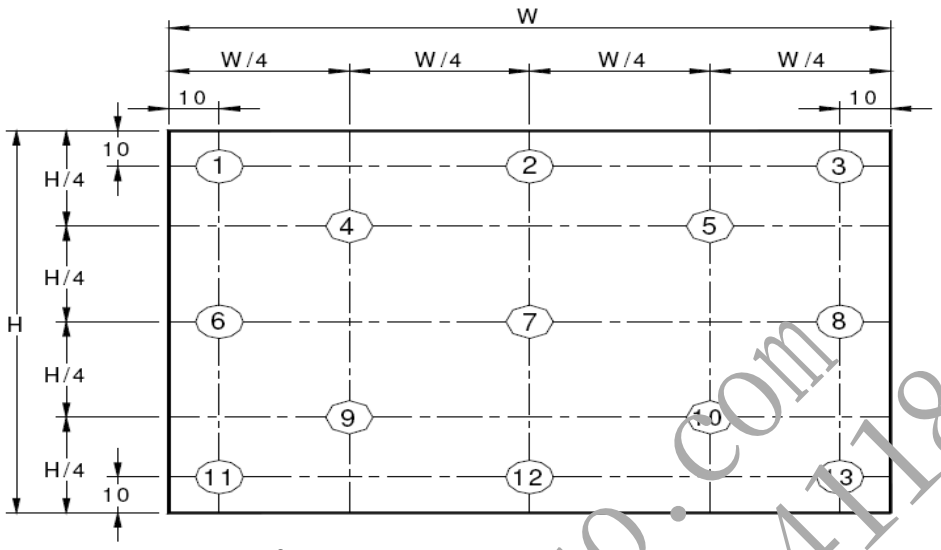

Figure 9. Uniformity Measurement Locations (13 points)

The White luminance uniformity on LCD surface is then expressed as : ΔY5 = Minimum Luminance of five points / Maximum Luminance of five points (see Figure 8) , ΔY13 = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see Figure 9)

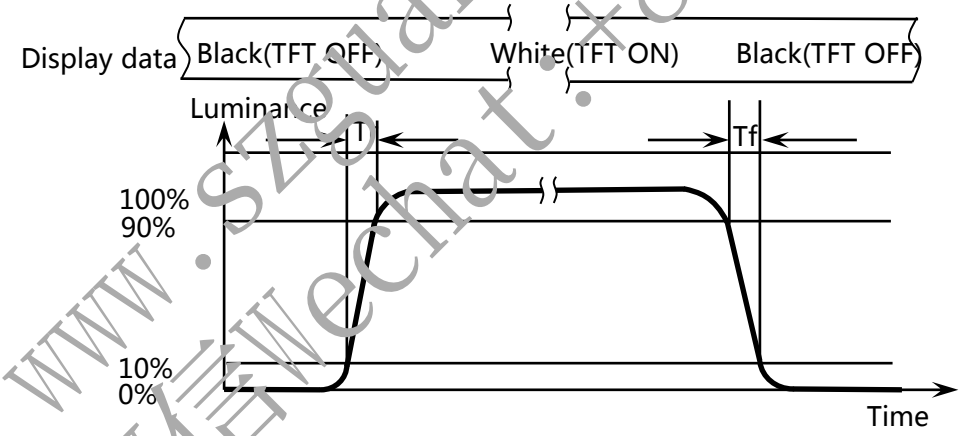

Figure 10. Response Time Testing

The electro-optical response time measurements shall be made as shown in Figure 10 by switching the "data" input signal ON and OFF. Tr: The luminance to change from 10% to 90% ,Tf: The luminance to change from 90% to 10% .

The test system : LMS PR810

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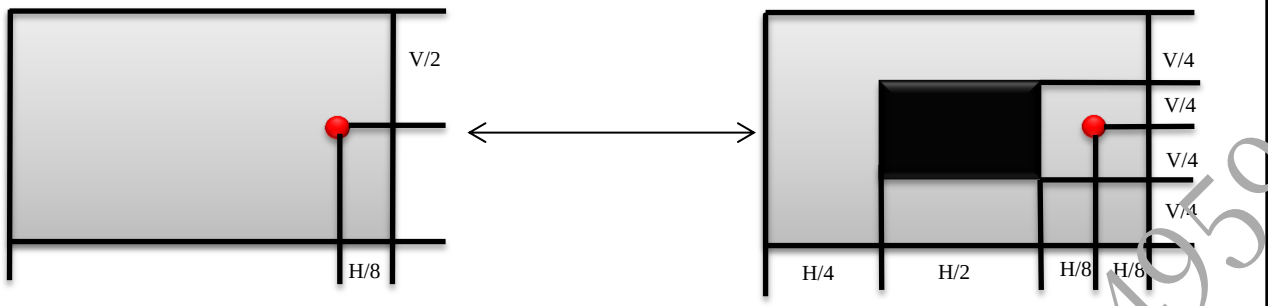

$$\text{Cross Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_B} \right| \times 100$$

Figure 11. Cross Talk Modulation Test Description

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. The test background gray is L127.

Cross Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 10±1mm diameter area, with all display pixels set to a gray level 127, to the luminance (YB) of that same area when any adjacent area is driven dark.(Refer to Figure 11)

The test system: PR730

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5.0 INTERFACE CONNECTION

5.1 Electrical Interface Connection

The electronics interface connector is IS050-L30B-C10.

The connector interface pin assignments are listed in Table 6.

<Table 6. Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	NC	No Connection
2	H_GND	Ground
3	LANE1_N	eDP RX Channel 1 Negative
4	LANE1_P	eDP RX Channel 1 Positive
5	H_GND	Ground
6	LANE0_N	eDP RX Channel 0 Negative
7	LANE0_P	eDP RX Channel 0 Positive
8	H_GND	Ground
9	AUX_CH_P	eDP AUX CH Positive
10	AUX_CH_N	eDP AUX CH Negative
11	H_GND	Ground
12	LCD_VCC	Power Supply, 3.3V (typ.)
13	LCD_VCC	Power Supply, 3.3V (typ.)
14	NC	No Connection
15	H_GND	Ground
16	H_GND	Ground
17	HPD	Hot Plug Detect Output
18	BL_GND	LED Ground
19	BL_GND	LED Ground
20	BL_GND	LED Ground
21	BL_GND	LED Ground
22	BL_ENABLE	LED Enable Pin(+3.3V Input)
23	BL_PWM	System PWM Signal Input
24	NC	No Connection
25	NC	No Connection
26	BL_POWER	LED Power Supply 5V-21V
27	BL_POWER	LED Power Supply 5V-21V
28	BL_POWER	LED Power Supply 5V-21V
29	BL_POWER	LED Power Supply 5V-21V
30	NC	No Connection

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5.2 eDP Interface

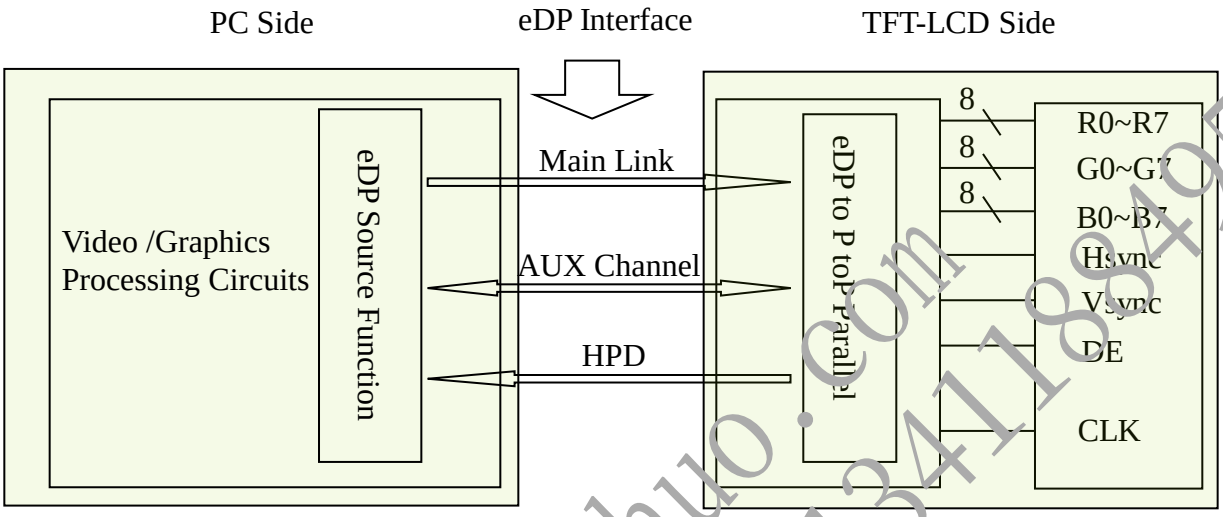

Figure 12. eDP Interface Architecture

Note:
Transmitter : Parade DP501 or equivalent
Transmitter is not contained in module.

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5.3 Data Input Format

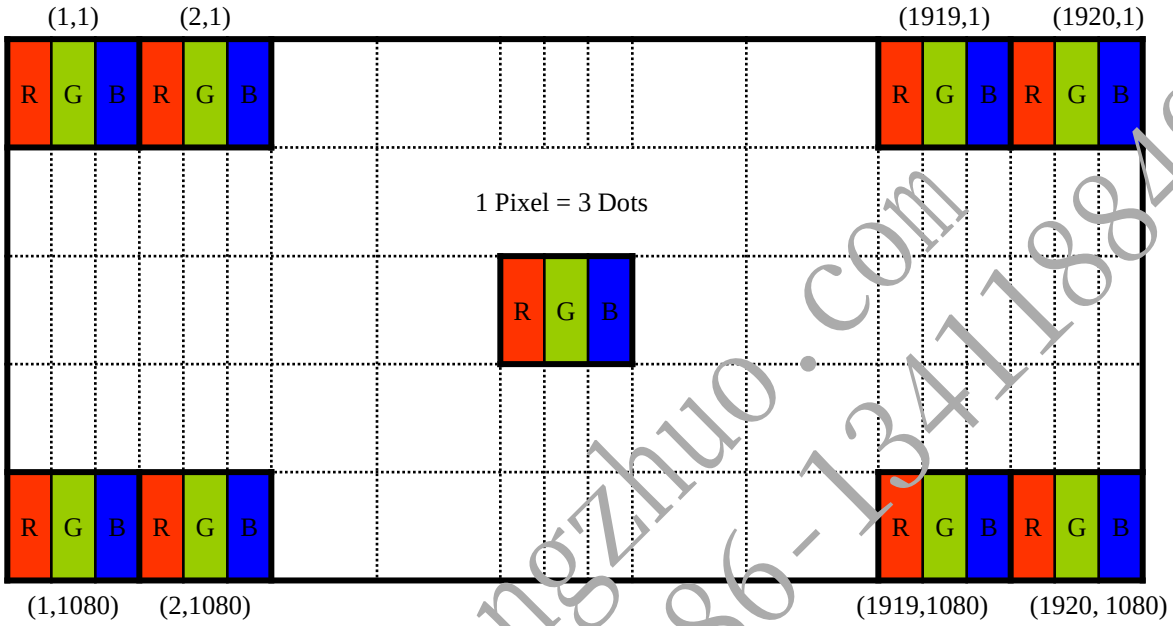

Figure 13. Display Position of Input Data (V-H)

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5.4 Back-light & LCM Interface Connection

BLU Interface Connector: MSAK24037P12D.

<Table 7. Pin Assignments for the BLU Connector>

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	Vout	LED anode connection	7	NC	No Connection
2	Vout	LED anode connection	8	NC	No Connection
3	Vout	LED anode connection	9	LED	LED cathode connection
4	NC	No Connection	10	LED	LED cathode connection
5	GND	Ground	11	LED	LED cathode connection
6	NC	No Connection	12	LED	LED cathode connection

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6.0 SIGNAL TIMING SPECIFICATION

6.1 The NV140FHM-N69 V8.0 Is Operated By The DE Only

< Table 8. Signal Timing Specification >

Item		Symbols	Min	Typ	Max	Unit
Clock	Frequency	1/Tc	146.41	147.06	147.70	MHz
Frame Period		Tv	1135	1140	1145	lines
			-	60	-	Hz
			-	16.67	-	ms
Vertical Display Period		Tvd		1080	-	lines
One line Scanning Period		Th	2145	2150	2155	clocks
Horizontal Display Period		Thd	-	1920	-	clocks

Note : The above is as optimized setting.

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6.2 eDP Rx Interface Timing Parameter

The specification of the eDP Rx interface timing parameter is shown in Table 9.

<Table 9. eDP Main-Link RX TP4 Package Pin Parameters>

Item	Symbol	Min	Typ	Max	Unit	Remark
Spread spectrum clock (Link clock down-spreading)	ssc	0	-	0.5	%	
Differential peak-to-peak input voltage at package pins	$V_{RX-DIFFp-p}$	120	-	1200	mV	
Rx input DC common mode voltage	$V_{RX_DC_CM}$	0	-	2	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	$L_{RX_SKEW_INTRA_PAIR}$	-	-	60	ps	
AC Coupling Capacitor	C_{SOURCE_ML}	75		200	nF	Source side

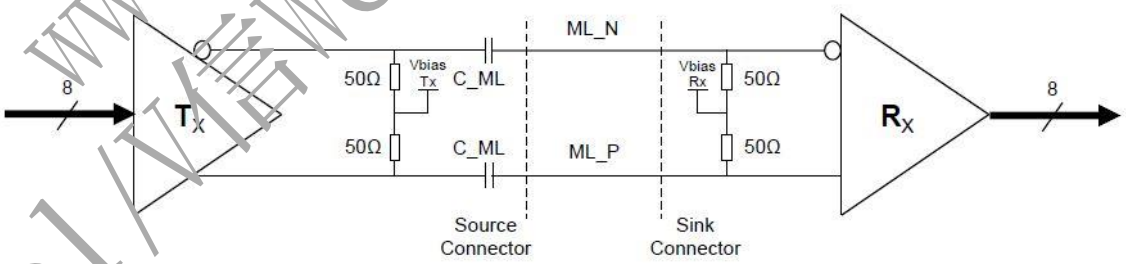

Figure 14. Main link differential pair

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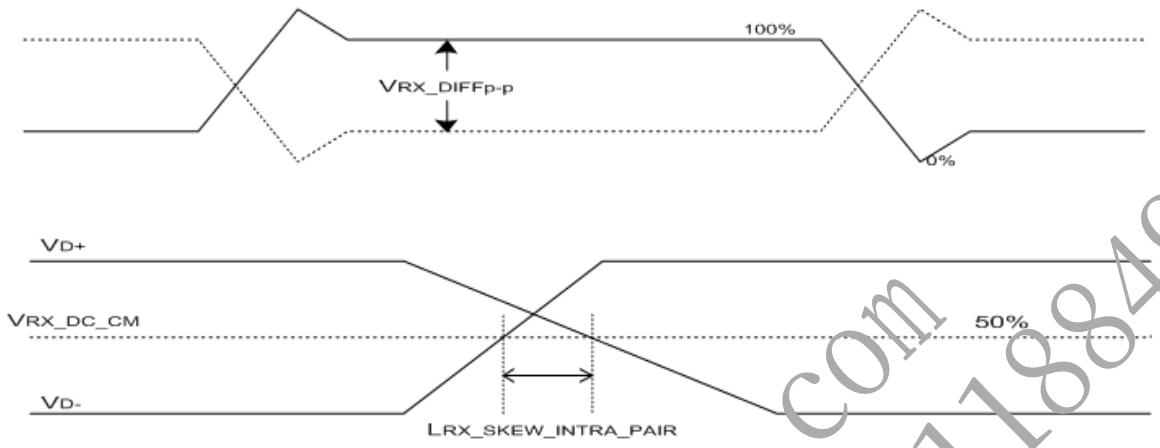

Figure 15. VRX-DIFFp-p & LRX_SKEW_INTRA_PAIR

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<Table 10. HPD Characteristics>

Item	Symbol	Min	Typ	Max	Unit	Remark
HPD voltage	V_{HPD}	2.25	-	3.6	V	
Hot Plug Detection Threshold	-	2.0	-	-	V	Source side Detecting
Hot Unplug Detection Threshold	-	-	-	0.8V	V	
HPD_IRQ Pulse Width	HPD_IRQ	0.5	-	1	ms	
HPD_TimeOut	-	2.0	-	-	ms	

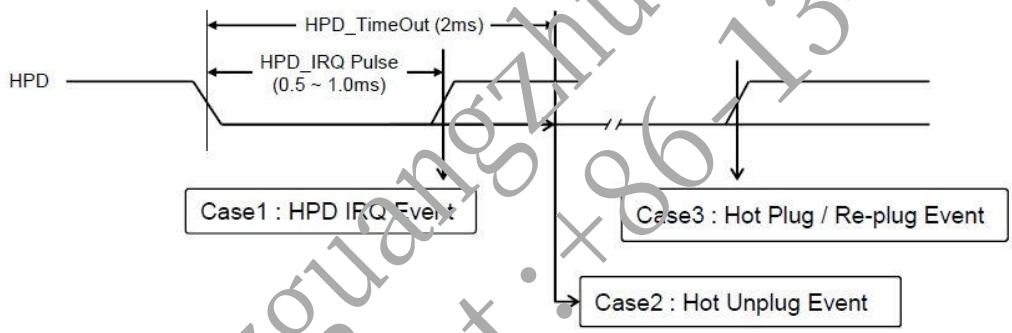

Figure 16. HPD Events

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<Table 11. AUX Characteristics>

Item	Symbol	Min	Typ	Max	Unit	Remark
AUX unit interval	UIAUX	0.4	0.5	0.6	Us	
AUX peak-to-peak input differential voltage	VAUX-RX-DIFFp-p	0.29	-	1.38	V	
AUX CH termination DC resistance	RAUX-TERM	80	100	120	Ohm	
AUX DC common mode voltage	VAUX-DC-CM	0	-	2	V	
AUX turn around common mode voltage	VAUX-TURN-CM	-	-	0.3	V	
AUX short circuit current limit	IAUX-SHORT	-	-	90	mA	
AUX AC Coupling Capacitor	CSOURCE-AUX	75	-	200	nf	Source side

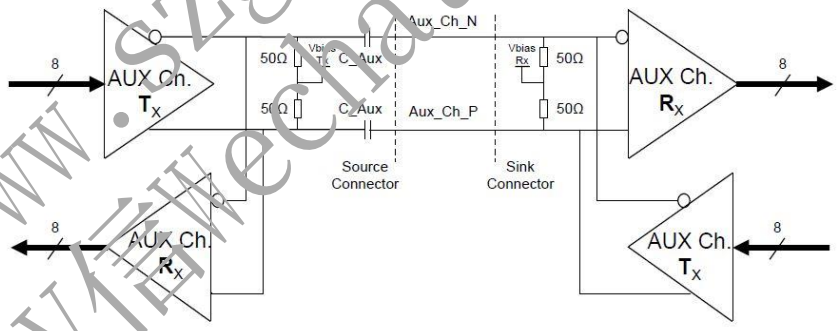

Figure 17. AUX differential pair

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

<Table 12. Input Signal & Basic Display Colors & Gray Scale of Colors >

	Colors & Gray scale	Data signal																											
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
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
	Light Blue	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
	Purple	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
	△	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△				↑								↑								↑				
	▽				↓								↓								↓				
	Brighter	1	0	1	1	1	1	1	1	0	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
	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△				↑								↑								↑				
	▽				↓								↓								↓				
	Brighter	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	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
	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	1	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	△				↑								↑								↑				
	▽				↓								↓								↓				
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	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	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
	△	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	△				↑								↑								↑				
	▽				↓								↓								↓				
	Brighter	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	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
	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

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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.

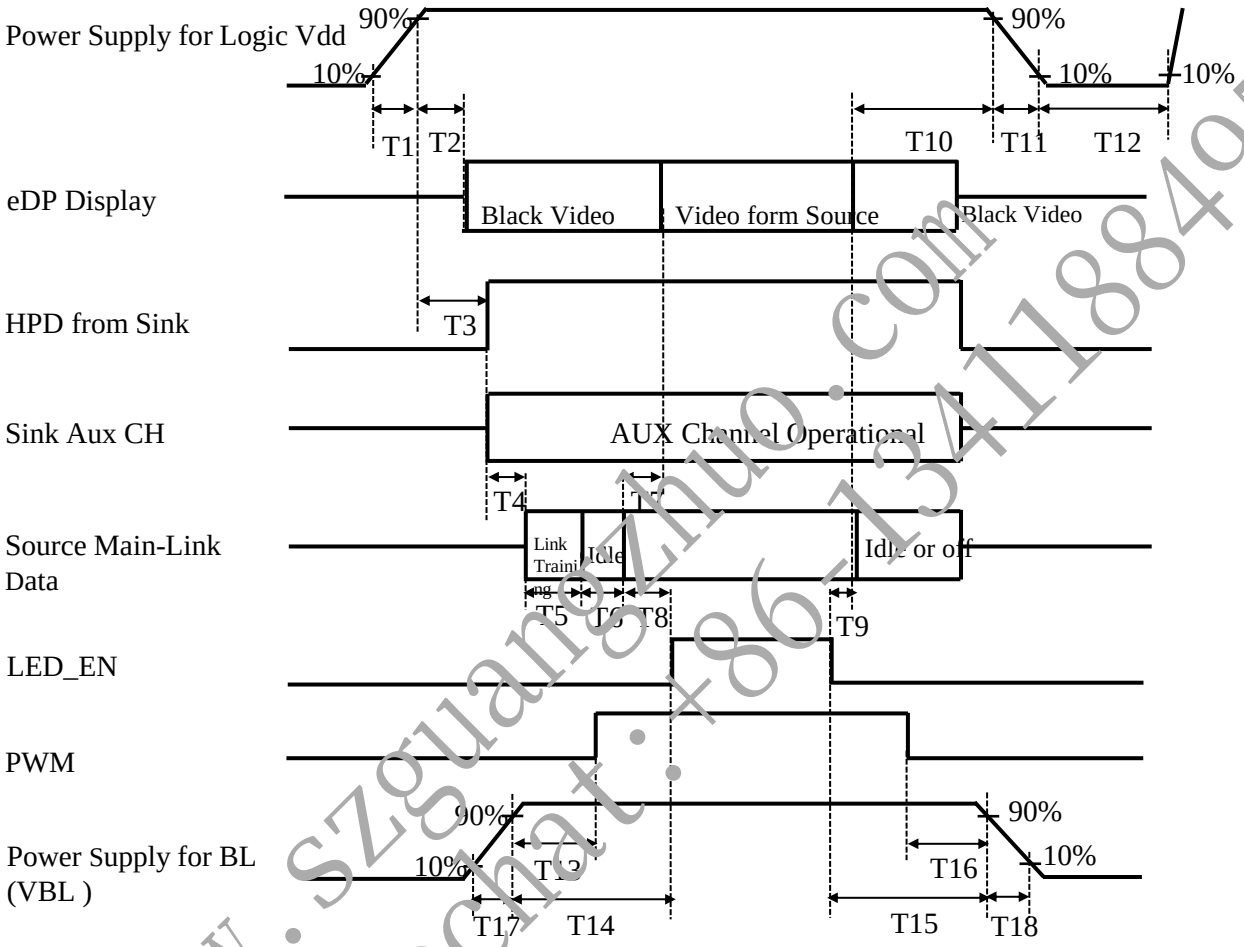

Figure 18. Power Sequence

- 0.5ms ≤ T1 ≤ 10 ms
- 0ms < T2 ≤ 200 ms
- 0ms < T3 ≤ 200 ms
- T4+T5+T6+T8>80ms
- 0ms < T7 ≤ 50ms
- 50ms < T8
- 0ms < T9
- 100ms < T10 < 500 ms
- 0.5ms ≤ T11 ≤ 10 ms
- 500ms ≤ T12
- 0ms < T13
- 0ms < T14
- 0ms < T15
- 0ms < T16
- 0.5ms ≤ T17
- 0.5ms ≤ T18

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. Back Light must be turn on after power for logic and interface signal are valid.

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9.0 Connector Description

Physical interface is described as for the connector on LCM.
These connectors are capable of accommodating the following signals and will be following components.

9.1 TFT LCD Module

< Table 13. Signal Connector >

Connector Name /Description	For Signal Connector
Manufacturer	UJU
Type/ Part Number	IS050-L30B-C10
Mating Housing/ Part Number	I-PEX 20454-030T

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10.0 MECHANICAL CHARACTERISTICS

10.1 Dimensional Requirements

Figure 23shows mechanical outlines for the model NV140FHM-N69 V8.0.
Other parameters are shown in Table 14.

<Table 14. Dimensional Parameters>

Parameter	Specification	Unit
Active Area	309.312 (H) ×173.988 (V)	mm
Number of pixels	1920 (H) X 1080 (V) (1 pixel = R + G + B dots)	pixels
Pixel pitch	161.1(H) ×161.1(V)	um
Pixel arrangement	RGB Vertical stripe	
Display colors	16.7M(8bit)	
Display mode	Normally Black	
Dimensional outline	315.81±0.3 (H)*186.07±0.3(V) (W/O PCB)*3.0 (Max) 315.81±0.3(H)*195.57±0.3(V) (W/PCB)*3.0(Max)	mm
Weight	290 (max)	g

10.2 Mounting

See Figure 23.

10.3 Anti-Glare and Polarizer Hardness.

The surface of the LCD has an Anti-Glare coating to minimize reflection and a coating to reduce scratching. The Polarizer hardness is 3H.

10.4 Light Leakage

There shall not be visible light from the back-lighting system around the edges of the screen as seen from a distance 50cm from the screen with an overhead light level of 350lux.

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11.0 RELIABILITY TEST

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

<Table 15. Reliability Test>

No	Test Items	Conditions	Remark
1	High temperature storage test	Ta = 60˚C , 60%RH, 240 hrs	
2	Low temperature storage test	Ta = -20˚C , 240 hrs	
3	High temperature & high humidity operation test	Ta = 50˚C , 80%RH, 240 hrs	
4	High temperature operation test	Ta = 50˚C , 60%RH, 240 hrs	
5	Low temperature operation test	Ta = 0˚C , 240 hrs	
6	Thermal shock	Ta = -20 ˚C ↔ 60 ˚C (0.5 hr), 60%±3%RH, 100 cycle	
7	Vibration test (non-operating)	Ta = 25˚C , 60%RH, 1.5G, 10~500Hz, Sine X,Y,Z / Sweep rate : 1 hour	Note 1
8	Shock test (non-operating)	Ta = 25˚C , 60%RH, 220G, Half Sine Wave 2msec ±X, ±Y, ±Z Once for each direction	Note 1
9	Electro-static discharge test (operating)	Air : 150 pF, 330Ω, ±15 KV Contact : 150 pF, 330Ω, ±8 KV Ta = 25˚C , 60%RH,	Note 2

Notes :

1. The fixture must be hard enough , so that the module would not be twisted or bent.
2. Self- recovery and restart recovery is allowed. No hardware failures.

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12.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module
- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module
- As the electrostatic discharges may break the LCD module, handle the LCD module with care. Peel a protection sheet off from the LCD panel surface as slowly as possible.
- As the LCD panel and back - light element are made from fragile glass material, impulse and pressure to the LCD module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the LCD module is operating.
- Put the module display side down on a flat horizontal plane.
- Handle connectors and cables with care.

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

(4) Cautions for the atmosphere
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the LCD module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.

(5) Cautions for the module characteristics
- Do not apply fixed pattern data signal to the LCD module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(6) Other cautions
- Do not disassemble and/or re-assemble LCD module.
- Do not re-adjust variable resistor or switch etc.
- When returning the module for repair or etc. Please pack the module not to be broken. We recommend to use the original shipping packages.

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13.0 LABEL

(1) Product Label

Figure 19. Product Label

Module ID Naming Rule:

<Table 16. Module ID Naming Rule>

Digit / Code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Code	B	9	A	F	1	7	3	8	D	3	1	0	0	0	0	6	8
Description	Product Name		Product Grade	B8	Year		Month	Model Extension Code (Last 4 Digits of FG CODE)				Serial No. 00001-ZZZZZZ					

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(2) High voltage caution label

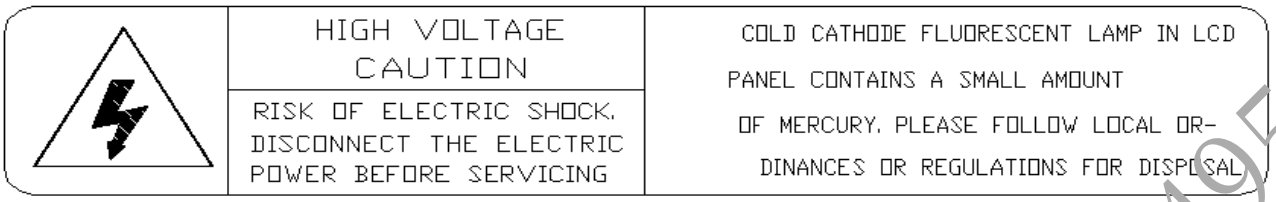

Figure 20. High Voltage Caution Label

(3) Box label

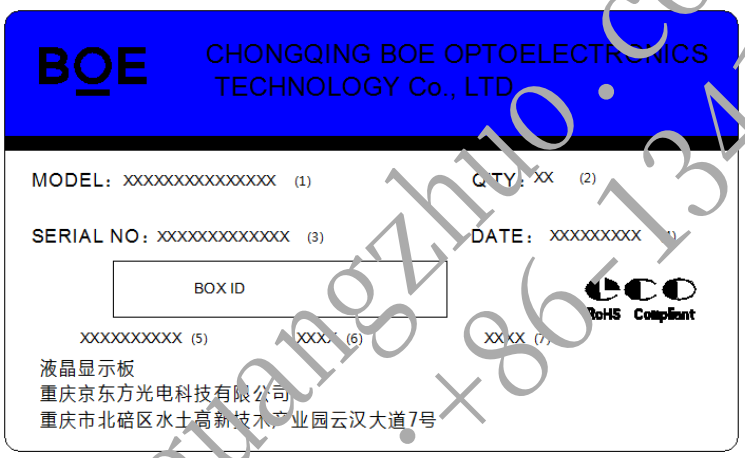

Figure 21. Box Label

Serial number marked part needs to print, show as follows:

1. FG-CODE(Before 12 bit)
2. Product quantity
3. Box ID
4. Date
5. The client section material number(The client)
6. FG-Code After four
7. The supplier code

Total Size:100×50mm

<Table 17. Box Label Naming Rule >

Digit / Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	B	9	A	F	1	7	8	N	0	0	3	2	7
Description	Product Name		Product Grade	B8	Year		Month	Revision	BOX Serial Number				

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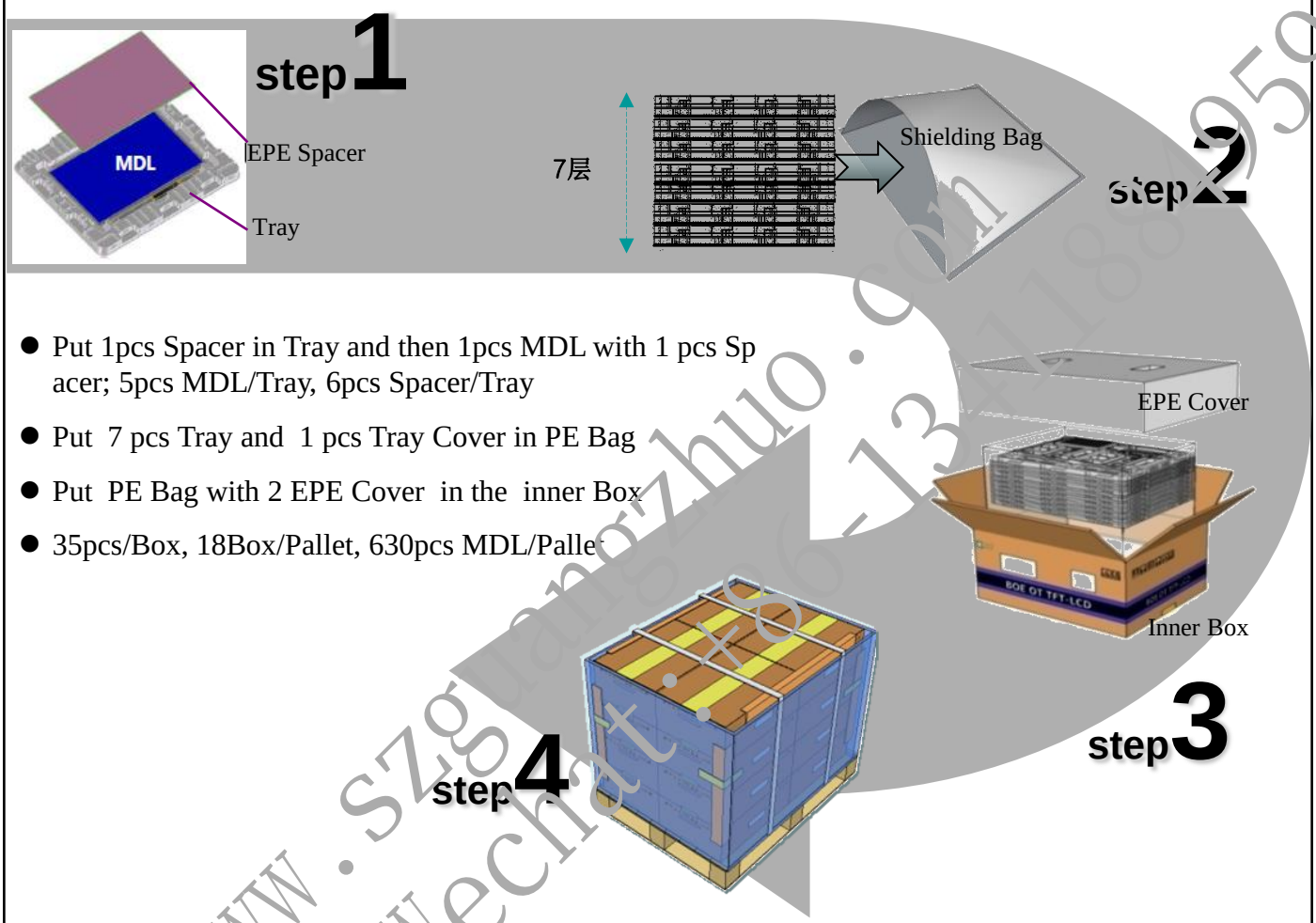
14.0 PACKING INFORMATION

14.1 Packing Order



- Put 1pcs Spacer in Tray and then 1pcs MDL with 1 pcs Spacer; 5pcs MDL/Tray, 6pcs Spacer/Tray
- Put 7 pcs Tray and 1 pcs Tray Cover in PE Bag
- Put PE Bag with 2 EPE Cover in the inner Box
- 35pcs/Box, 18Box/Pallet, 630pcs MDL/Pallet

Figure 22. Packing Order

14.2 Note

- Box dimension: 480mm*350mm*285mm
- Package quantity in one box: 35pcs
- Total weight: 12.9kg/Box (Typ.)

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15.0 MECHANICAL OUTLINE DIMENSION

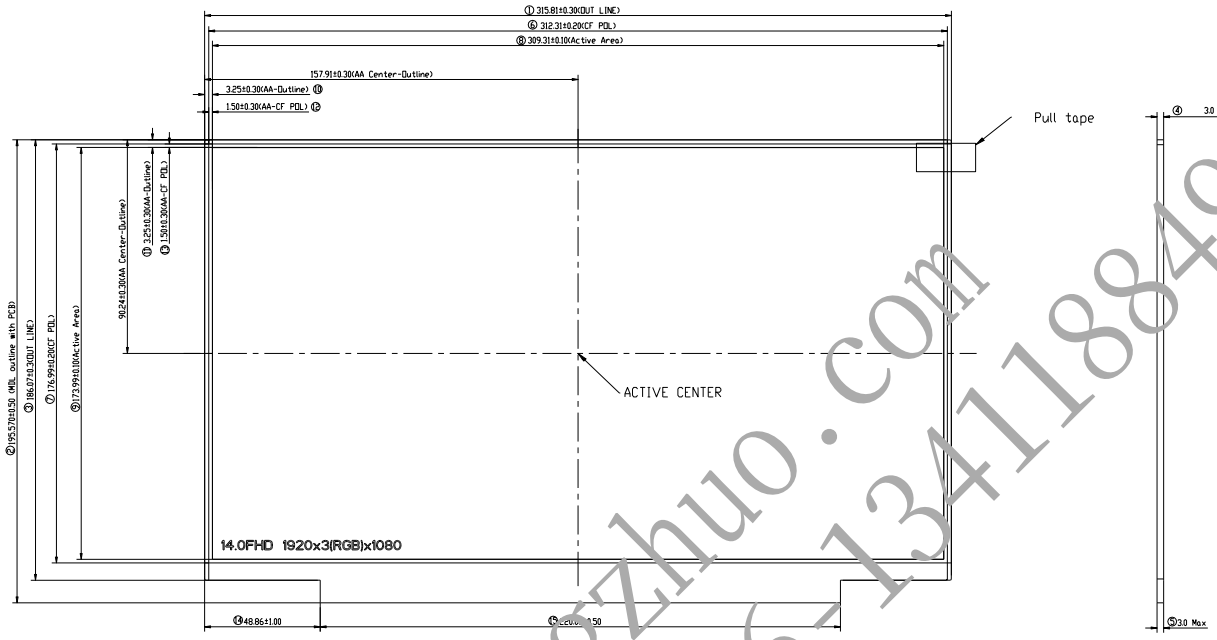

Figure 23. TFT-LCD Module Outline Dimension (Front View)

Notes:

1. The eDP connector is measured at PIN 1 and mating line.
2. Unspecified tolerance refer to ±0.3 mm.
3. Top polarizer is the highest portion.
4. Critical dimension: 1 ~ 17 CPK: 1 ~ 5
5. Do not have light leakage on four corners of module.
6. Measurement method refer to Appendix A
7. System matching refer to Appendix B
8. "()"marks the reference dimensions.

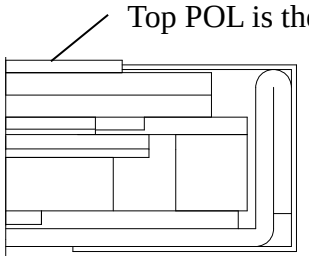

Figure 24. Highest Point Position

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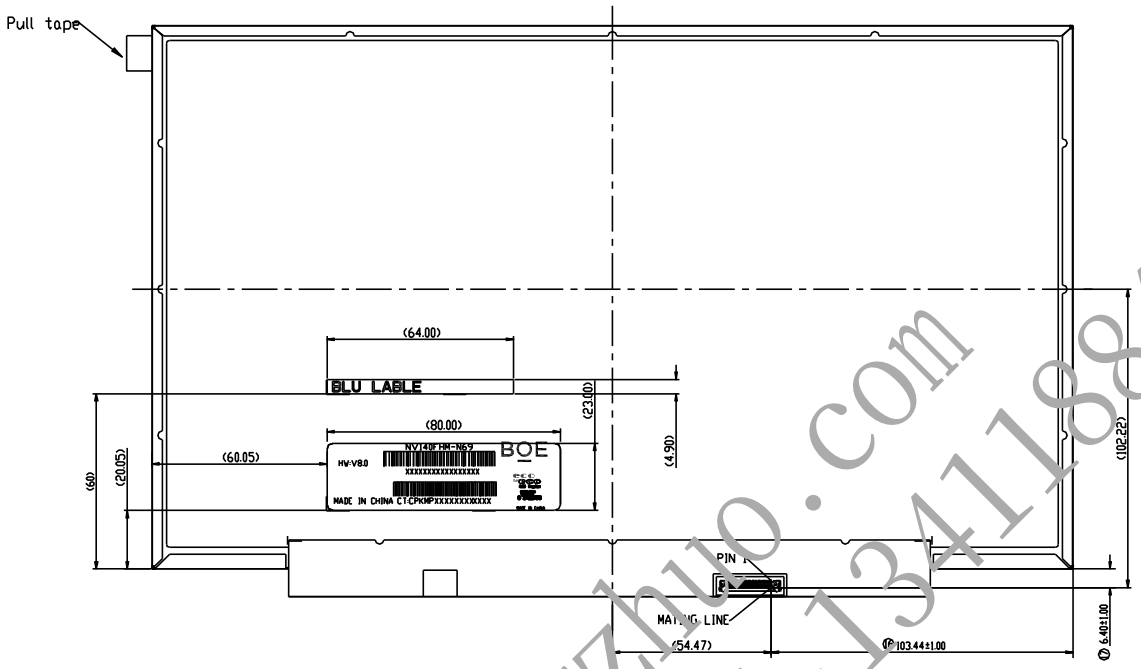

Figure 25. TFT-LCD Module Outline Dimensions (Rear view)

Notes:
1. The eDP connector is measured at PIN 1 and mating line.
2. Unspecified tolerance refer to ±0.3 mm.
3. Top polarizer is the highest portion.
4. Critical dimension: 1 ~ 17 CPK: 1 ~ 5
5. Do not have light leakage on four corners of module.
6. Measurement method refer to Appendix A
7. System matching refer to Appendix B
8. “()”marks the reference dimensions.

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16.0 EDID Table

Check		Address (HEX)	Function	Hex	Dec	crc	Input values.	Notes
FAE	QE							
-	-	00	Header	00	0		0	EDID Header
-	-	01		FF	255		255	
-	-	02		FF	255		255	
-	-	03		FF	255		255	
-	-	04		FF	255		255	
-	-	05		FF	255		255	
-	-	06		FF	255		255	
-	-	07		00	0		0	
V		08	ID Manufacturer Name	09	9		BOE	ID = BOE
V		09		E5	229			
	V	0A	ID Product Code	AA	170		2730	ID = 2730
	V	0B		0A	10			
V		0C	32-bit serial No.	00	0		0	
V		0D		00	0		0	
V		0E		00	0		0	
V		0F		00	0		0	
V		10	Week of manufacture	22	34		34	
V		11	Year of Manufacture	1F	31		2021	Manufactured in 2021
V		12	EDID Structure Ver.	01	1		1	EDID Ver 1.0
V		13	EDID revision #	04	4		4	EDID Rev. 0.4
V	V	14	Video input definition	A5	165		-	Refer to right table
	V	15	Max H image size	1F	31		31	30.9312 cm (Approx)
	V	16	Max V image size	11	17		17	17.3988 cm (Approx)
	V	17	Display Gamma	78	120		2.2	Gamma curve = 2.2
V		18	Feature support	03	3		-	Refer to right table
	V	19	Red/Green low bits	EE	238		-	Red / Green Low Bits
	V	1A	Blue/White low bits	95	149		-	Blue / White Low Bits
	V	1B	Red x high bits	A3	163	655	0.64	Red (x) = 10100011 (0.64)
	V	1C	Red y high bits	54	84	338	0.33	Red (y) = 01010100 (0.33)
	V	1D	Green x high bits	4C	76	307	0.3	Green (x) = 01001100 (0.3)
	V	1E	Green y high bits	99	153	614	0.6	Green (y) = 10011001 (0.6)
	V	1F	Blue x high bits	26	38	154	0.15	Blue (x) = 00100110 (0.15)
	V	20	BLue y high bits	0F	15	61	0.06	Blue (y) = 00001111 (0.06)
	V	21	White x high bits	50	80	321	0.313	White (x) = 01010000 (0.313)
	V	22	White y high bits	54	84	337	0.329	White (y) = 01010100 (0.329)
V		23	Established timing 1	00	0		-	Refer to right table
V		24	Established timing 2	00	0		-	
V		25	Established timing 3	00	0		-	

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V		26	Standard timing #1	01	1			Not Used
V		27		01	1			
V		28	Standard timing #2	01	1			Not Used
V		29		01	1			
V		2A	Standard timing #3	01	1			Not Used
V		2B		01	1			
V		2C	Standard timing #4	01	1			Not Used
V		2D		01	1			
V		2E	Standard timing #5	01	1			Not Used
V		2F		01	1			
V		30	Standard timing #6	01	1			Not Used
V		31		01	1			
V		32	Standard timing #7	01	1			Not Used
V		33		01	1			
V		34	Standard timing #8	01	1			Not Used
V		35		01	1			
	V	36	Detailed timing/monitor descriptor #1	72	114		147.1	147.06MHz Main clock
	V	37		39	57			
	V	38		80	128		1920	Hor Active = 1920
	V	39		E6	230		230	Hor Blanking = 230
	V	3A		70	112		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
	V	3B		38	56		1080	Ver Active = 1080
	V	3C		3C	60		60	Ver Blanking = 60
	V	3D		40	64		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
	V	3E		30	48		48	Hor Sync Offset = 48
	V	3F		20	32		32	H Sync Pulse Width = 32
	V	40		36	54		3	V sync Offset = 3 line
	V	41		00	0		6	V Sync Pulse width : 6 line
	V	42		35	53		309	Horizontal Image Size = 309.312 mm (Low 8 bits)
	V	43		AE	174		174	Vertical Image Size = 173.988 mm (Low 8 bits)
	V	44		10	16		-	4 bits of Hor Image Size + 4 bits of Ver Image Size
	V	45		00	0		0	Hor Border (pixels)
	V	46		00	0		0	Vertical Border (Lines)
	V	47		1A	26		-	Refer to right table

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V		48	Detailed timing/monitor descriptor #2	4C	76		98.0	98.04MHz Main clock
V		49		26	38			
V		4A		80	128		1920	Hor Active = 1920
V		4B		E6	230		230	Hor Blanking = 230
V		4C		70	112		-	4 bits of Hor. Active + 4 bits of Hor. Blanking
V		4D		38	56		1080	Ver Active = 1080
V		4E		3C	60		60	Ver Blanking = 60
V		4F		40	64		-	4 bits of Ver. Active + 4 bits of Ver. Blanking
V		50		30	48		48	Hor Sync Offset = 48
V		51		20	32		32	H Sync Pulse Width = 32
V		52		36	54		3	V sync Offset = 3 line
V		53		00	0		6	V Sync Pulse width : 6 line
V		54		35	53		309	Horizontal Image Size = 309.312 mm (Low 8 bits)
V		55		AE	174		174	Vertical Image Size = 173.938 mm (Low 8 bits)
V		56		10	16		-	4 bits of Hor Image Size + 4 bits of Ver Image Size
V		57		00	0		0	Hor Border (pixels)
V		58		00	0		0	Vertical Border (Lines)
V		59		1A	26			Refer to right above table
V		5A	Detailed timing/monitor descriptor #3	00	0		0	Reserved
V		5B		00	0		0	
V		5C		00	0		0	
V		5D		00	0		0	
V		5E		00	0		0	
V		5F		00	0		0	
V		60		00	0		0	
V		61		00	0		0	
V		62		00	0		0	
V		63		00	0		0	
V		64		00	0		-	
V		65		00	0		-	
V		66		00	0		-	
V		67		00	0		-	
V		68		00	0		-	
V		69		00	0		-	
V		6A		00	0		-	
V		6B		00	0		-	

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V		6C	Detailed timing/monitor descriptor #4	00	0			Detailed Timing Description #4
V		6D		00	0			Flag
V		6E		00	0			Reserved
V		6F		03	3			For Brightness Table and Power consumption
V		70		00	0			Flag
V		71		0D	13		-	PWM % [7:0] @ Step 0
V		72		28	40		-	PWM % [7:0] @ Step 5
V		73		FF	255		-	PWM % [7:0] @ step 10
V		74		0A	10		-	Nits [7:0] @ Step 0
V		75		3C	60		-	Nits [7:0] @ Step 5
V		76		C8	200		-	Nits [7:0] @ Step 10
V		77		11	17		-	Panel Electronics Power @32x32 Chess Pattern = 700mW
V		78		0E	14		-	Backlight Power @60 nits = 579.705882352941mW
V		79		2D	45		-	Backlight Power @Step 10 = 2650mW
V		7A		C8	200		-	Nits @ 100% PWM Duty = 400nit
V		7B		00	0			Nits [7:0] @ 100% PWM Duty = (0x0001 = 2 nits, 0x00FF = 510 nits, 0x09C4 = 5000 nits)
V		7C		00	0			Nits [15:8] @ Step 10 (0x0001 = 2 nits, 0x00FF = 510 nits, 0x09C4 = 5000 nits)
V		7D		00	0			
V	V	7E	Extension flag	01	1			
-	-	7F	Checksum	**D5**	**213**	**213**	-	
		80	DID Extension Header	**70**	112		112	DisplayID EDID Extension Block tag
		81		**20**	32		32	DisplayID Version/Revision = 2.0
		82		**79**	121		121	Section Size (byte) = 121 bytes
		83		**00**	0		0	Display Product Primary Use Case
		84		**00**	0			Extension count
		85	DID Block #1 Header	**25**	37		37	DID2.0 Data block tag[25h] = Dynamic Video Timing Range Limits
		86		**01**	1		1	Block revision = Revision 1
		87		**09**	9		9	Number of Payload Bytes in block= 9 Bytes
		88	DID DATA Block #1	**F7**	247		98.0	Minimum Pixel Clock (Low bit, Range = 0.001Mhz (000000h) ~ 16,777.216Mhz (FFFFFFh))
		89		**7E**	26			Minium Pixel Clock (Middle bit)
		8A		**01**	1			Minium Pixel Clock (High bit)
		8B		**73**	115		147.1	Maximum Pixel Clock (Low bit, Range = 0.001Mhz (000000h) ~ 16,777.216Mhz (FFFFFFh))
		8C		**3E**	62			Maximum Pixel Clock (Middle bit)
		8D		**02**	2			Maximum Pixel Clock (High bit)
		8E		**28**	40		40	Min. Vertical Rate : 40 Hz (Range : 0Hz (00h) ~ 255Hz (FFh)
		8F		**3C**	60		60	Max. Vertical Rate : 60 Hz (Range : 0Hz (000h) ~ 255Hz (FFh))
		90		**80**	128		128	Seamless Dynamic Video Timing Support : Seamless Dynamic Video Timing change shall be supported with a fixed horizontal pixel rate and dynamic vertical blanking.
		91	DID Block #2 Header	**81**	129		129	DID2.0 Data block tag[81h] = CTA DisplayID
		92		**00**	0		0	Block revision = Revision 0
		93		**13**	19		19	Number of Payload Bytes in block= 19 Bytes

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		94	DID DATA Block #2	**72**	114		114	CTA Block1 Tag Code and Block1 Length = Vendor Specific Data Block(03h), Size(byte) = 18 bytes
		95		**1A**	26		26	AMD IEEE OUI value (0x00001A)
		96		**00**	0			(Hex. LSB first)
		97		**00**	0			(Hex. LSB first)
		98		**03**	3		3	AMD VSDB Version 3
		99		**01**	1		1	Freesync Capability : Seamless Local Dimming Disable Control Not Supported , Seamless Native Color Space & Transfer Switching Curve Not Supported , Seamless Variable Frame Rate Switching Supported
		9A		**28**	40		40	Min Refresh Rate
		9B		**3C**	60		60	Max Refresh Rate
		9C		**00**	0		0	Freesync MCCS VCP Code
		9D		**00**	0		0	Support WCG and HDR features , Gamma 2.2 EOTF Not Supported , PQ EOTF Not Supported
		9E		**00**	0		0	Max Luminance 1 (for HDR) = 300 Cd/m2
		9F		**00**	0		0	Min Luminance 1 (for HDR) = 0.4 Cd/m2
		A0		**00**	0		0	Max Luminance 2 (for HDR) = 300 Cd/m2
		A1		**00**	0		0	Min Luminance 2 (for HDR) = 0.4 Cd/m2
		A2		**3C**	60		60	Bits 7...0 - FreeSync Maximum Refresh Rate (MSB)
		A3		**00**	0		0	Bits 7...0 - MSB FreeSync Maximum Refresh rate [Hz]
		A4		**00**	0		0	Reseved
		A5		**00**	0		0	Reseved
		A6		**00**	0		0	Reseved
		A7	DID Block #3 Header	**00**	0		0	Reseved
		A8		**00**	0		0	Reseved
		A9		**00**	0		0	Reseved
		AA	DID DATA Detailed Timing Para Block #3	**00**	0		0	Reseved
		AB		**00**	0		0	Reseved
		AC		**00**	0		0	Reseved
		AD		**00**	0		0	Reseved
		AE		**00**	0		0	Reseved
		AF		**00**	0		0	Reseved
		B0		**00**	0		0	Reseved
		B1		**00**	0		0	Reseved
		B2		**00**	0		0	Reseved
		B3		**00**	0		0	Reseved
		B4		**00**	0		0	Reseved
		B5		**00**	0		0	Reseved
		B6		**00**	0		0	Reseved
		B7		**00**	0		0	Reseved
		B8		**00**	0		0	Reseved
		B9		**00**	0		0	Reseved
		BA		**00**	0		0	Reseved
		BB		**00**	0		0	Reseved
		BC		**00**	0		0	Reseved
		BD		**00**	0		0	Reseved

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		BE		**00**	0		0	Reseved
		BF		**00**	0		0	Reseved
		C0		**00**	0		0	Reseved
		C1		**00**	0		0	Reseved
		C2		**00**	0		0	Reseved
		C3		**00**	0		0	Reseved
		C4		**00**	0		0	Reseved
		C5		**00**	0		0	Reseved
		C6		**00**	0		0	Reseved
		C7		**00**	0		0	Reseved
		C8		**00**	0		0	Reseved
		C9		**00**	0		0	Reseved
		CA		**00**	0		0	Reseved
		CB		**00**	0		0	Reseved
		CC		**00**	0		0	Reseved
		CD		**00**	0		0	Reseved
		CE		**00**	0		0	Reseved
		CF		**00**	0		0	Reseved
		D0		**00**	0		0	Reseved
		D1		**00**	0		0	Reseved
		D2		**00**	0		0	Reseved
		D3		**00**	0		0	Reseved
		D4		**00**	0		0	Reseved
		D5		**00**	0		0	Reseved
		D6		**00**	0		0	Reseved
		D7		**00**	0		0	Reseved
		D8		**00**	0		0	Reseved
		D9		**00**	0		0	Reseved
		DA		**00**	0		0	Reseved
		DB		**00**	0		0	Reseved
		DC		**00**	0		0	Reseved
		DD		**00**	0		0	Reseved
		DE		**00**	0		0	Reseved
		DF		**00**	0		0	Reseved
		E0		**00**	0		0	Reseved
		E1		**00**	0		0	Reseved
		E2		**00**	0		0	Reseved
		E3		**00**	0		0	Reseved
		E4		**00**	0		0	Reseved
		E5		**00**	0		0	Reseved
		E6		**00**	0		0	Reseved
		E7		**00**	0		0	Reseved
		E8		**00**	0		0	Reseved
		E9		**00**	0		0	Reseved
		EA		**00**	0		0	Reseved
		EB		**00**	0		0	Reseved
		EC		**00**	0		0	Reseved
		ED		**00**	0		0	Reseved
		EE		**00**	0		0	Reseved
		EF		**00**	0		0	Reseved
		F0		**00**	0		0	Reseved
		F1		**00**	0		0	Reseved
		F2		**00**	0		0	Reseved
		F3		**00**	0		0	Reseved
		F4		**00**	0		0	Reseved
		F5		**00**	0		0	Reseved
		F6		**00**	0		0	Reseved
		F7		**00**	0		0	Reseved
		F8		**00**	0		0	Reseved
		F9		**00**	0		0	Reseved
		FA		**00**	0		0	Reseved
		FB		**00**	0		0	Reseved
		FC		**00**	0		0	Reseved
		FD		**00**	0		0	Reseved
		FE		**67**	103			DisplayID section checksum (81h~FDh)
		FF		**90**	144			Extended block checksum (80h~FEh)

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17.0 GENERAL PRECAUTIONS

17.1 HANDLING

(1) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist or bend the modules.

(2) Refrain from strong mechanical shock or any force to the module. Otherwise, it may cause improper operation or damage to the module.

(3) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than 1 HB pencil lead.

(4) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage to the polarizer due to chemical reaction.

(7) 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, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static , it may cause damage to the module.

(9) Use fingerstalls with soft gloves to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Do not pull or fold the LED FPC.

(l2) Do not touch any component which is located on the back side.

(13) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(14) Pins of connector shall not be touched directly with bare hands.

17.2 STORAGE

(1) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃ and relative humidity of less than 70%.

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

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17.3 OPERATION

(1) Do not connect, disconnect the module in the " Power On" condition.

(2) Power supply should always be turned on/off by following item 8.0 " Power on/off sequence ".

(3) 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 minimize the interference.

(4) The standard limited warranty is only applicable when the module is used for general notebook applications. If used for purposes other than as specified, BOE is not to be held reliable for the defective operations. It is strongly recommended to contact BOE to find out fitness for a particular purpose.

17.4 OTHERS

(1) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

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

(3) If the module displays the same pattern continuously for a long period of time, it can be the situation when The " image sticks" to the screen.

(4) This module has its circuitry PCB's on the rear or bottom side and should be handled carefully to avoid being stressed.

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Appendix A

The Measurement Methods for the Dimensions of Module

Caliper:
a. Length of Outline
b. Width of Outline (Without/With PCB)
c. Thickness of Outline (Without/ With PCB)

Coordinate Measuring Machine:
CF Polarizer Size
Active Area Size
Active Area to Outline (Without Tape Wrinkle or Bulged)
Active Area to CF Polarizer
The Distance of Bracket Holes
P-Cover to Outline (Without Tape Wrinkle or Bulged)
Length of P-Cover
Connector Pin 1 to Outline (Without Tape Wrinkle or Bulged)

Height Gauge: The Different Height of Root and Top on the Bracket
(Need to Calculate From Bracket Angle Spec.)

Feeler Gauge: The Warpage Spec. of Module

Notes:
Except the Critical Dimensions as Above, Other Dimensions are Measured by Coordinate Measuring Machine If Necessary.

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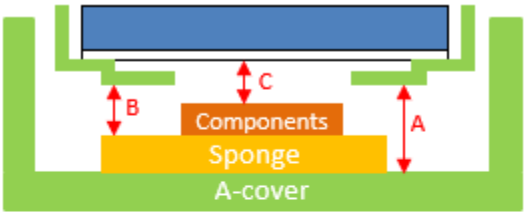
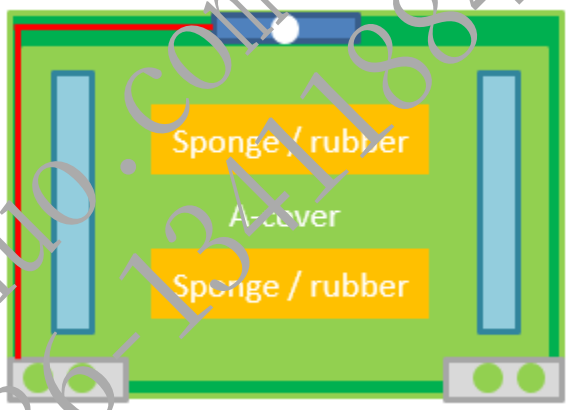
Appendix B

LCM to A-Cover / sponges Z-gap



	Plastic Cover	Metal Cover
A	≥ 1.0mm	≥ 0.8mm
B	≥ 0mm	
C	> 0.5mm	



Purpose	The reflector area is very sensitive, BOE would suggest that design enough z-gap to decrease the risk of water ripple, white spots and other abnormal display

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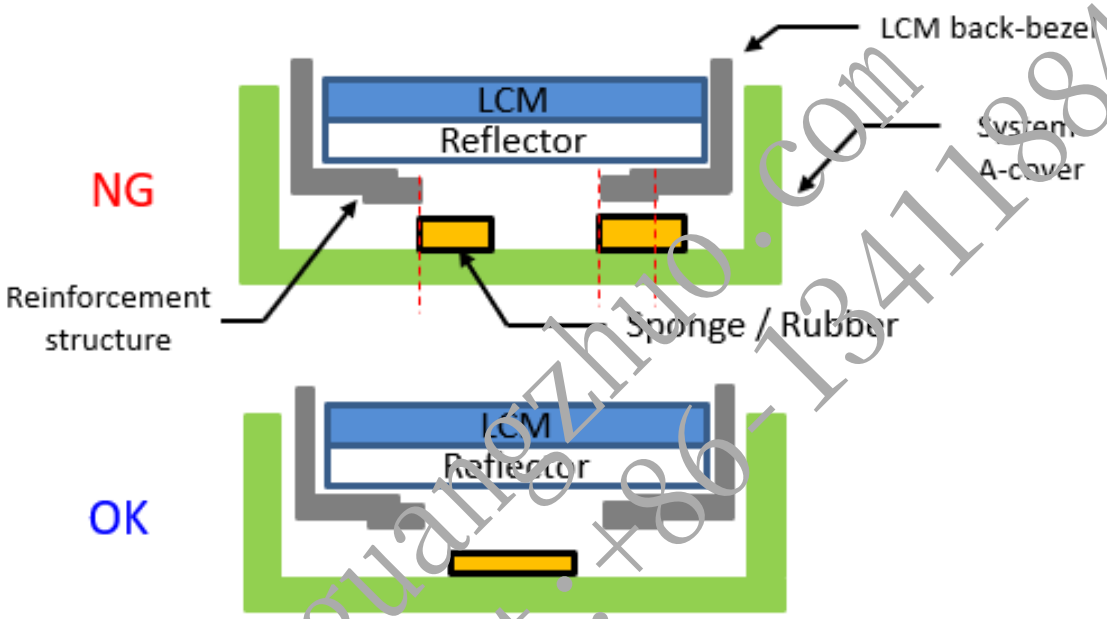

Purpose	If attach sponges or rubbers which correspond to white reflector area, it may cause white spot, pooling or other relative issues. BOE would suggest that attach wide range sponges / rubbers which can cover the LCM back-bezel opening

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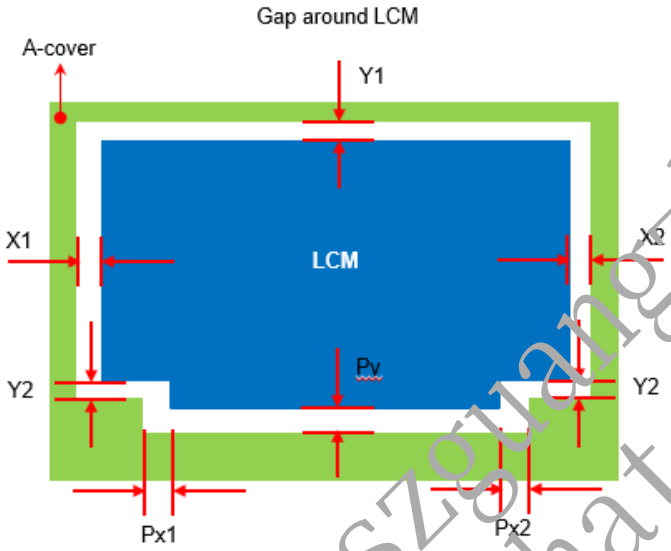
Appendix B

LCM to side wall / protrusions



	Normal border (screws)	Narrow border (fix by tapes)
X1 / X2	Min: 0.45mm	Min: 0.35mm
Y1 / Y2	Min: 0.45mm	Min: 0.35mm
Px1 / Px2	Min: 0.55mm	
Pv		

Purpose	BOE would suggest that design enough gap around LCM to prevent shock test failure, or interference, cell crack, abnormal display…etc. in the reliability test

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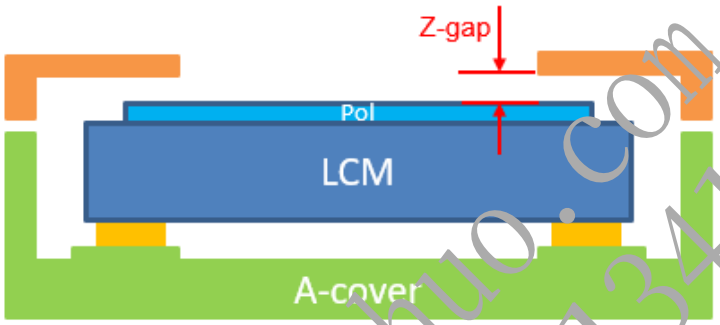
Appendix B

LCM to B-cover z-gap



Bezel Tape	Z-Gap
Without	0.15 ~ 0.25mm
With	0.15 ~ 0.20mm

Purpose	Too less z-gap between system B-cover and LCM top pol has high risk that may cause cell crack, pooling, light leakage and other issues

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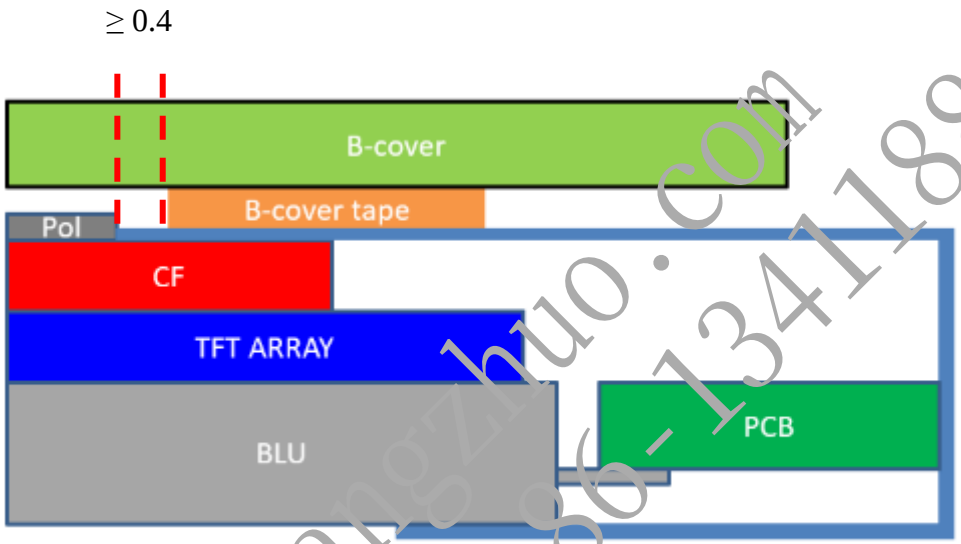
Appendix B

B-cover tape to top pol edge



If attach b-cover and LCM with tapes,
Please let tapes to be located out of top pol edges 0.4mm away on 4 sides

Purpose	To avoid the B-cover tape override top pol then cause pooling or light leakage issue

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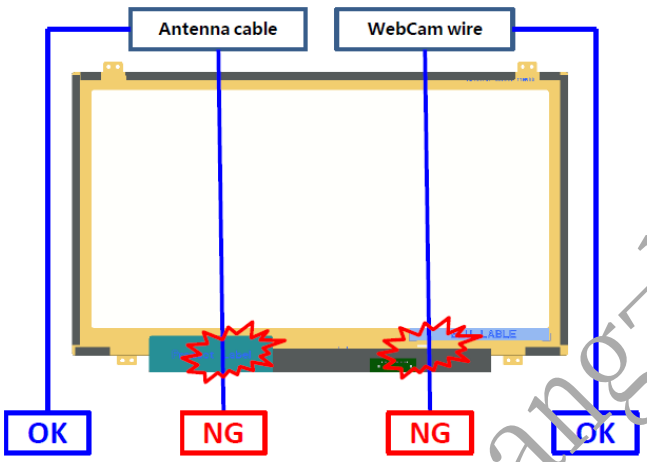
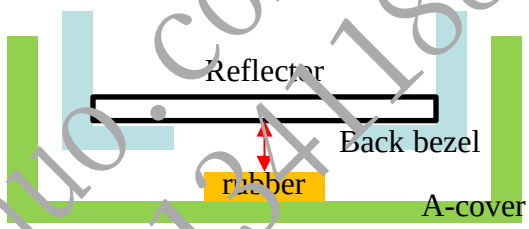
Appendix B

Antenna Cable & Webcam wire





If sponge within the reflector area is necessary, we suggest that the gap between reflector and sponge is more than 0.5mm

Purpose	1. BOE would suggest that do not set Antenna or WebCam cable / wire go behind LCM to avoid backpack test, hinge test ,twist test or pogo test with abnormal display 2. If the cable / wire is necessary to go behind LCM, please make a groove with rounds or chamfers to protect the cable / wire, or attach with higher sponges / rubbers adjacent to the cable / wire route 3. Suggest that attach the cable / wire with tapes to A-cover 4. Do not attach anything with LCM reflector area. If attach cable / wire with LCM reflector area, it may cause pooling, white spot, light leakage and other related issues

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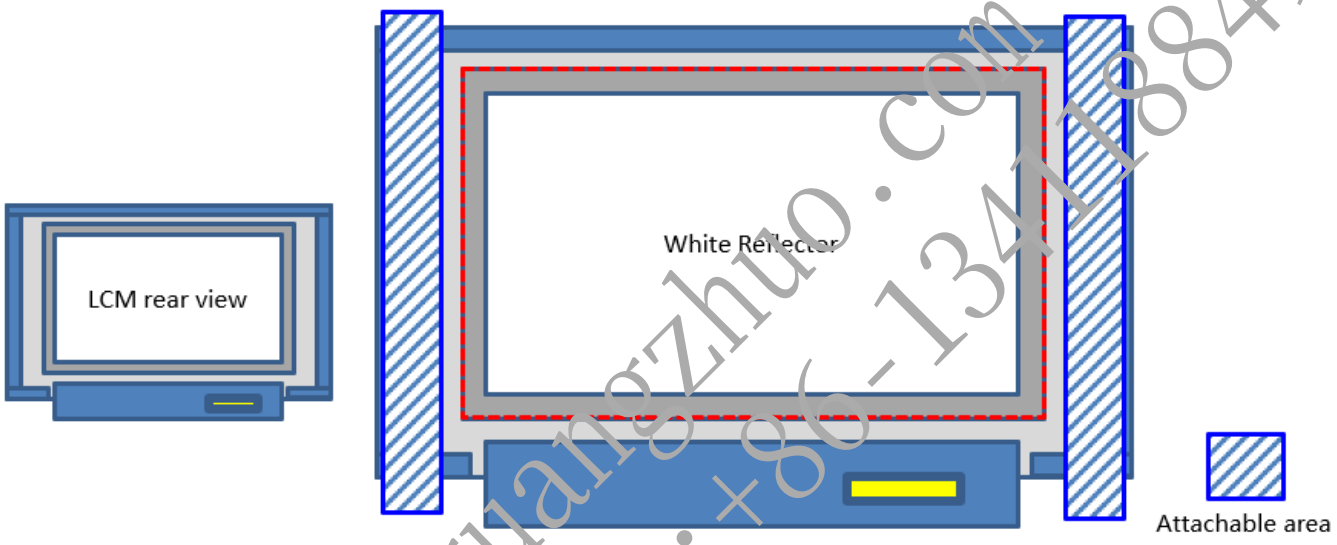
Appendix B

LCM paste area



Purpose	If use the stretch remove tapes to fix LCM with A-cover, please set the stretch remove tapes correspond to the LCM back-bezel and do not let the tapes override the back-bezel's level step of opening

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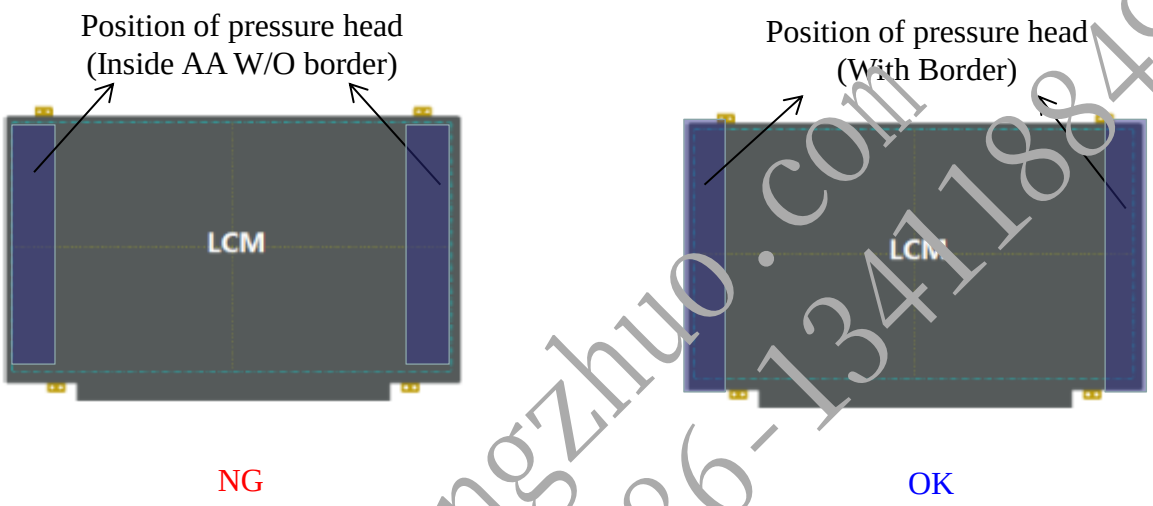
Appendix B

LCM pressable area



NG OK

Purpose	1. If LCM is fixed on A-cover by using the press jig during assembling. 2. To avoid panel broken the design of pressure head of press jig can not only pin on cell panel. The pressure head needs to pin on the LCM frame, which the LCM frame can share the pressure of the pressing head.

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Appendix B

Wire setting

Purpose	Wires should be placed between protrusions/side wall and A-cover. If place the wires between LCM and Protrusions/side wall, it may interfere with LCM when assembling, or even cause LCM broken in reliability test.

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Appendix B

A-cover strength

Purpose	1. BOE would recommend that structural Rib/Bracket height is higher than LCM, in order to avoiding pressures to LCM. 2. The L-shape Bracket is recommended.

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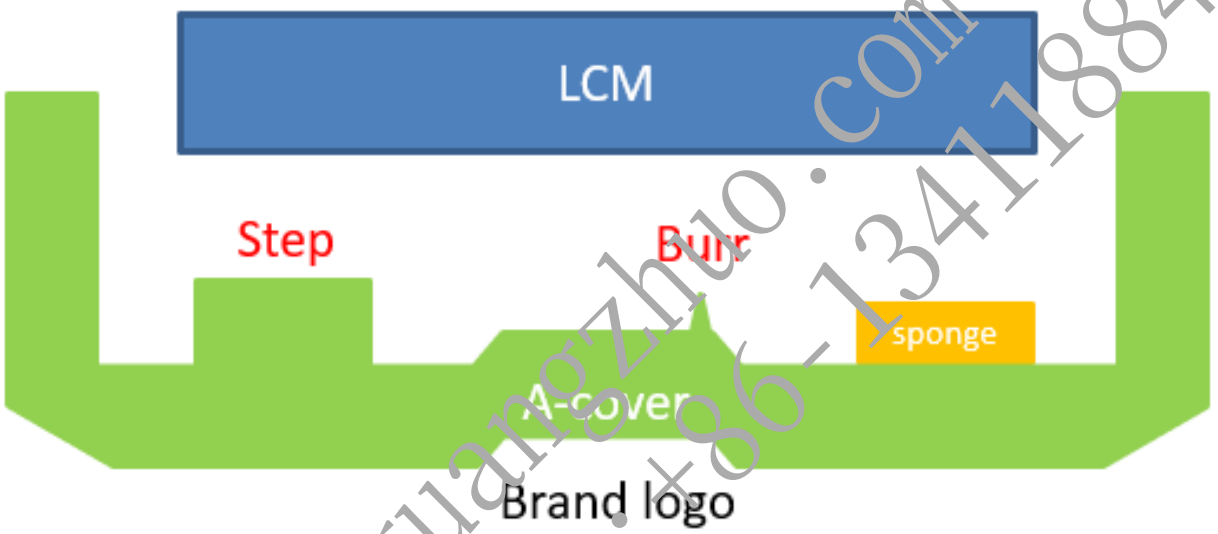
Appendix B

System A-cover Inner Surface



Purpose	There should not exist any burr, segment gap or protrusions beside Logo, which may cause White Spot or Glass Broken by stress concentration.

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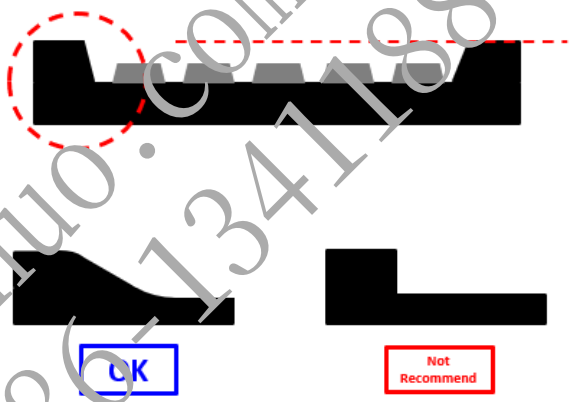
Appendix B

Keyboard area & Mouse pad



Purpose	The transition surface between keyboard and mouse pad should be smooth and without vertical steps\ too large level steps

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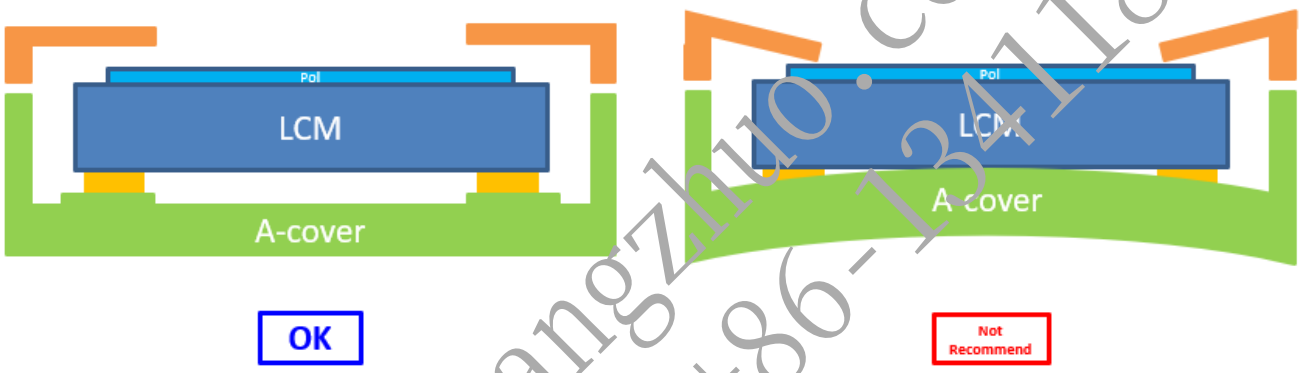
Appendix B

System cover reliability



Purpose	1. No interference between system and LCM in assembly process except compressible grounding gaskets 2. The permanent deformation which caused by Reliability test is not allowed to contact LCM

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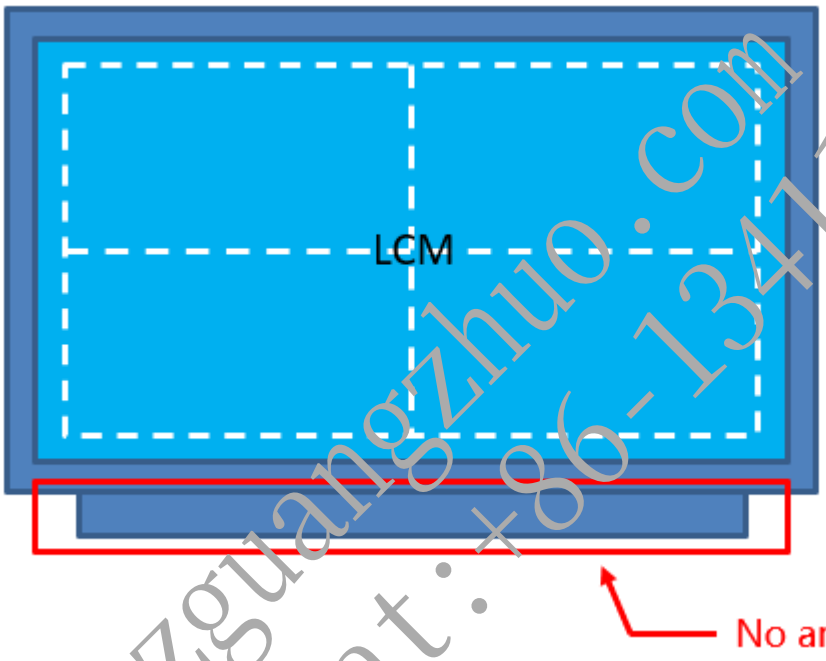
Appendix B

A/B-cover near LCD PCBA



Purpose	There should not been any magnet object close to LCM PCBA, it may cause physical or electricity noise issue

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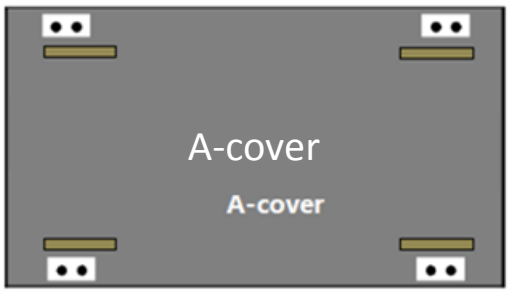
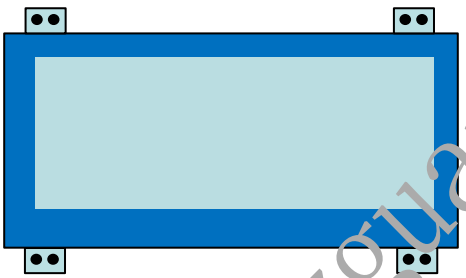
Appendix B

A-cover add sponges on Boss side wall





Purpose	BOE would suggest to attach Sponges to the side-wall of the Boss column of A-cover to reduce the risk of panel broken in assembling process.

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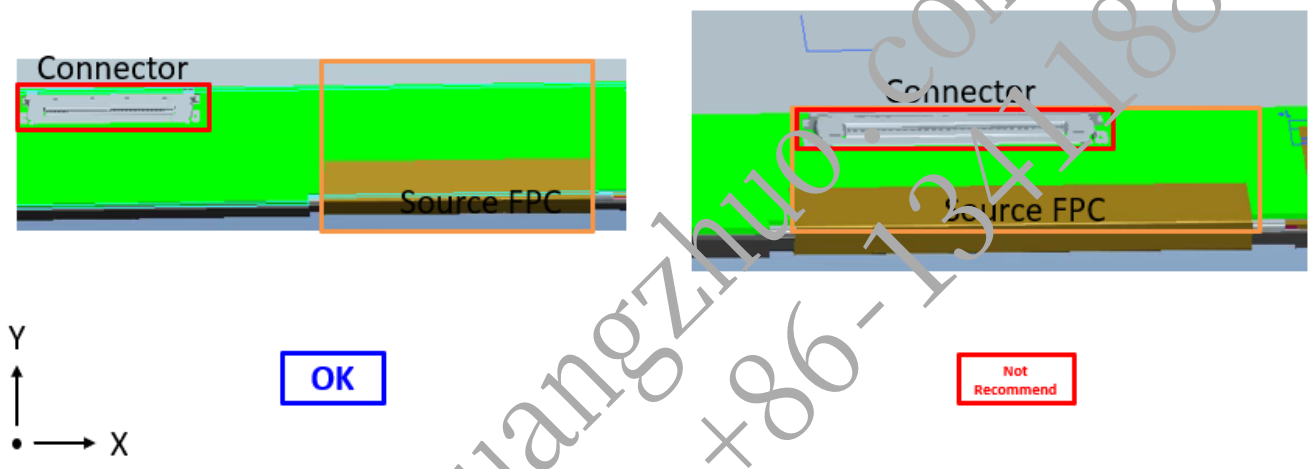
Appendix B

LCM to A-Cover / sponges z-gap



Purpose	Bent type product: The System Connector should not overlap with LCM FPC in X-direction, it may cause FPC lead broken during system connector plug and un-plug process (Panel FPC Bonding location is related to Mask and can not be changed easily)

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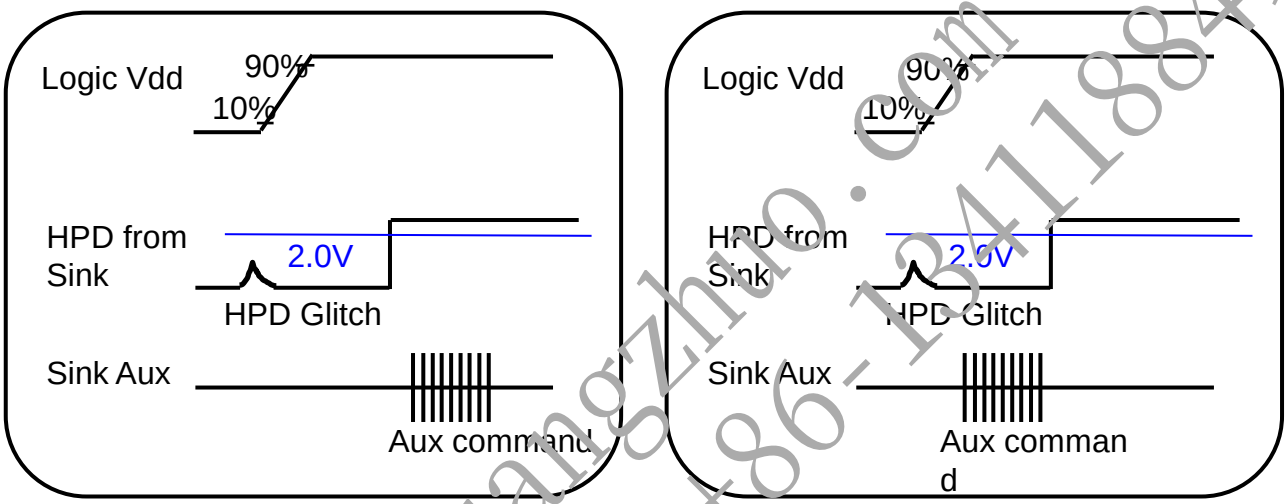
Appendix C

HPD Signal recognition



Normal Signal (Ignore HPD Glitch)

Abnormal Signal

Purpose	When HPD glitch voltage less than 2.0(V), system signal can't output AUX command data.

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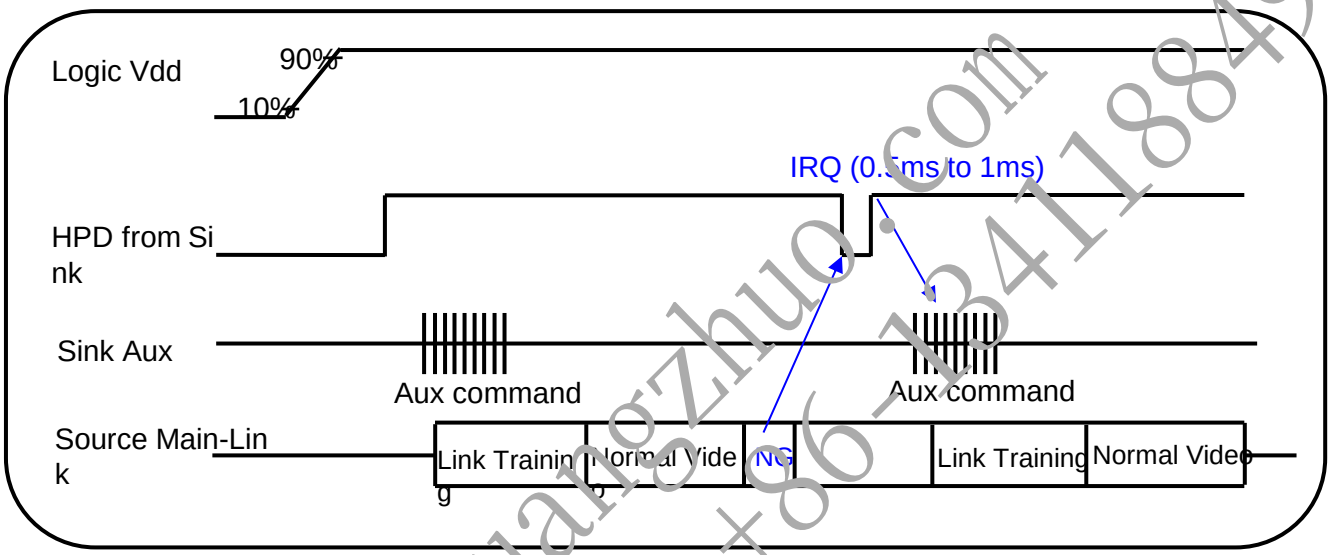
Appendix C

HPD Signal Definition IRQ (Interrupt Request)



Purpose	When HPD signal low than 0.5ms to 1ms, the source device should check sink status field from the DPCD and take link training again.

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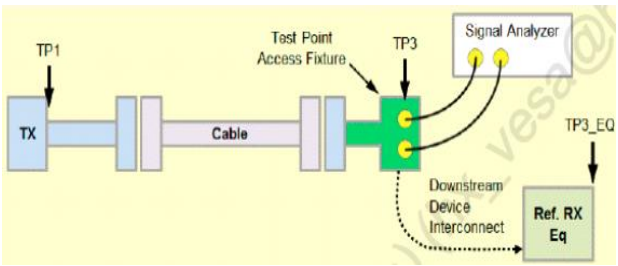
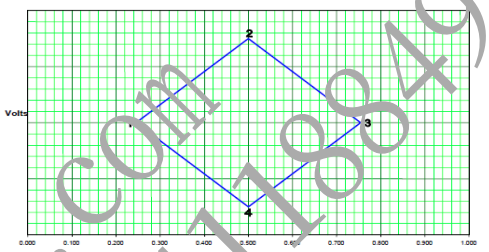
Appendix C

Main link eye diagram of TP3



Measured TP3 on LCM connector.



Downstream Device Mask at TP3

	UI	Voltage
1	0.246	0
2	0.5	0.075
3	0.755	0
4	0.5	-0.075

Eye for TP3 at HBR

	UI	Voltage
1	0.375	0
2	0.5	0.023
3	0.625	0
4	0.5	-0.023

Eye for TP3 at RBR

Purpose	1. Main Link EYE Diagram should meet TP3 point of VESA. 2. The measure method is through access fixture.

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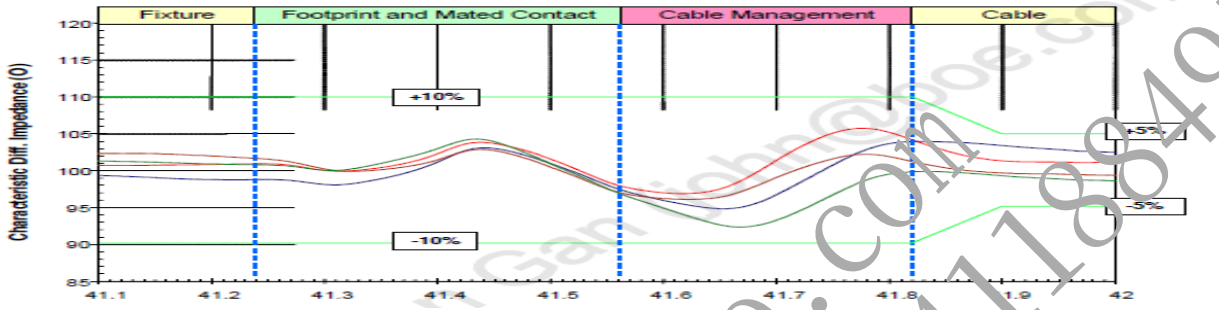
Appendix C

Impedance Profile through a DP Connector



Differential Impedance Profile Measurement Data Example

Segment	Differential Impedance Value	Maximum Tolerance
Fixture	100Ω/VESA	±10%
Connector	100Ω/VESA	±10%
Wire management	100Ω/VESA	±10%
Cable	100Ω/VESA	±5%

Impedance Profile Values for Cable Assembly

Purpose	Cable Impedance Profile 100ohm for Cable Assembly

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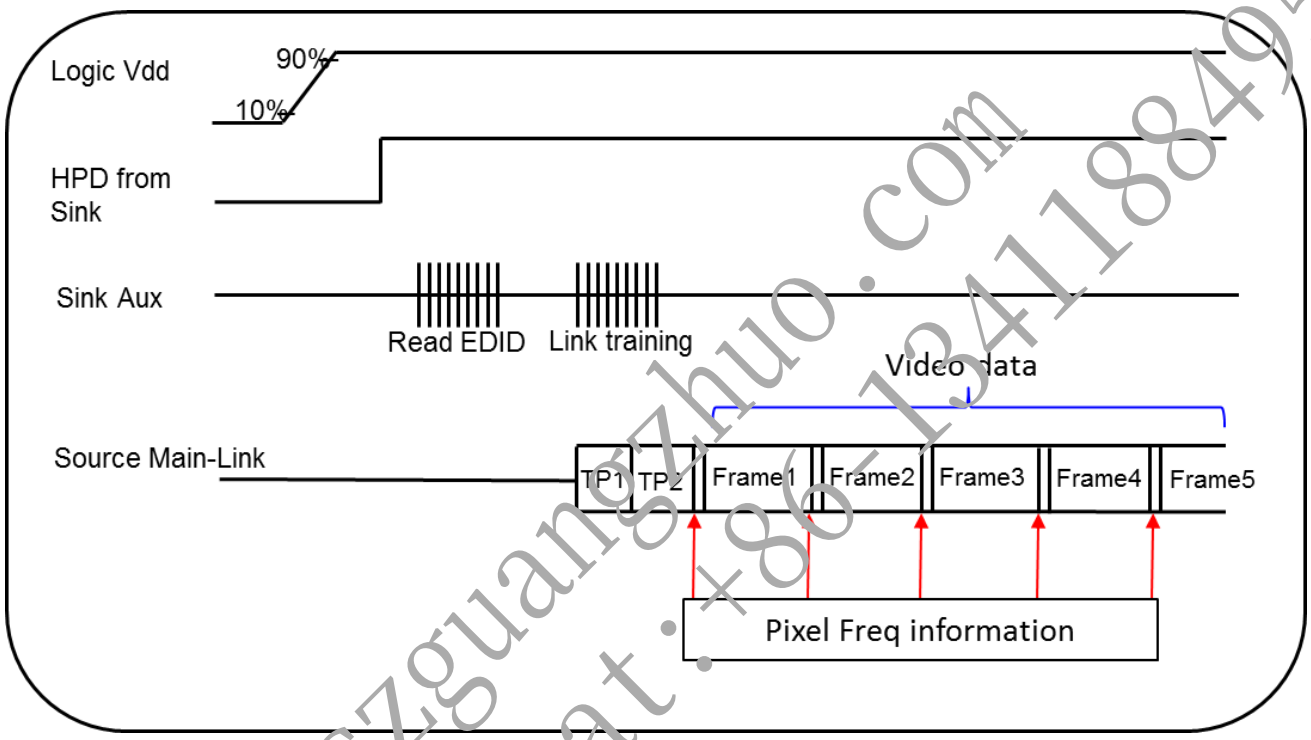
Appendix C

Main Link Pixel Freq information value of MSA data



Purpose	1. It need to fix pixel freq information value of MSA data output to prevent the initial abnormal pixel freq information value from incoming after power on. 2. BOE can read DPCD to check this value. Ex: BIOS is 1.62G , but into windows is 2.7G.

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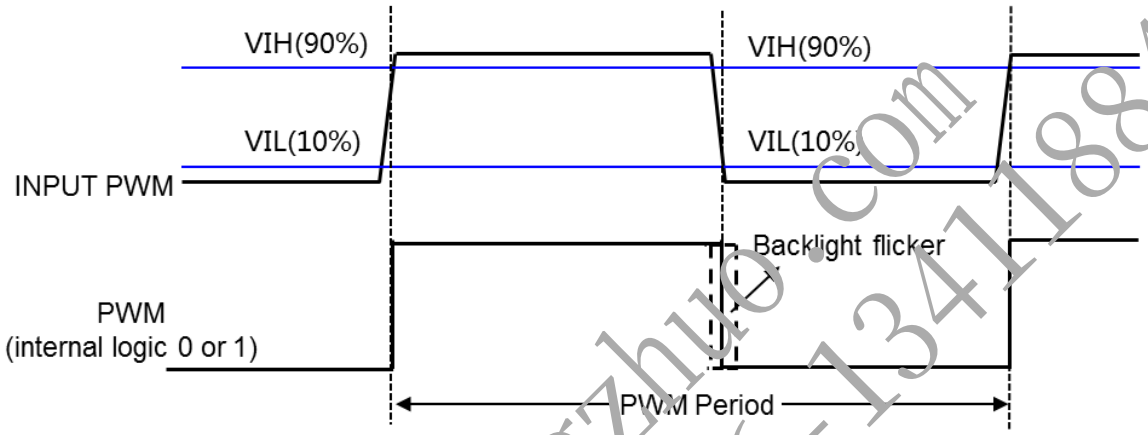
Appendix C

System Input PWM Rising/Falling time



Example:

Freq	Cycle Time	PWM Rising Time	PWM Falling Time
200Hz	5ms	≤1us	≤1us
1KHz	1ms	≤200ns	≤200ns

Purpose	1. LED driver need to calculate the duty cycle of input PWM signal. 2. To avoid backlight flicker visible on LCD, system input PWM suggest : PWM rising ≤ 200ppm*cycle time ; PWM falling ≤ 200ppm*cycle time.

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