

TITLE : MD315QU1-M00

Product Specification

Rev.O

BOE Optoelectronics Technology Co.,Ltd

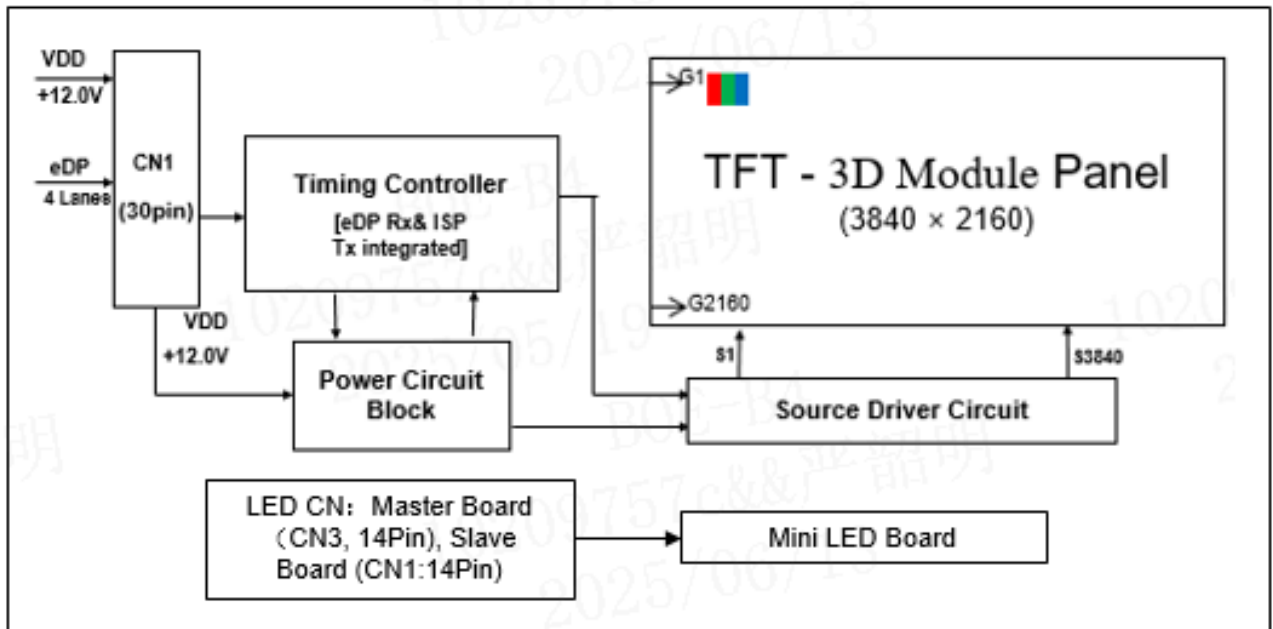
Contents

No.	Item	Page
1.0	GENERAL DESCRIPTION	4
2.0	ABSOLUTE MAXIMUM RATINGS	6
3.0	ELECTRICAL SPECIFICATIONS	7
4.0	OPTICAL SPECIFICATIONS	10
5.0	INTERFACE CONNECTION	14
6.0	SIGNAL TIMING SPECIFICATIONS	20
7.0	SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL	21
8.0	POWER SEQUENCE	22
9.0	MECHANICAL CHARACTERISTICS	23
10.0	RELIABILITY TEST	26
11.0	HANDLING & CAUTIONS	25
12.0	PRODUCT SERIAL NUMBER	27
13.0	PACKING	28
14.0	APPENDIX	30

1.0 GENERAL DESCRIPTION

1.1 Introduction

GPR 3D Module is composed of 2D LCM and GPR, 2D LCM is a color active matrix TFT module using IGZO TFT's (Thin Film Transistors) as an active switching devices. This module has a 31.5 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 Module panel used for this module is adapted for a higher color type.



1.2 Features

- 4 lane eDP Interface with 5.4Gbps Link Rates
- High-speed response
- Real 10bit color depth , display 1.07B colors
- Compatible with DCI-P3 99% Typ. @CIE 1976; Adobe RGB 99% Typ. @CIE 1931
- High luminance and contrast ratio, and wide viewing angle
- DE (Data Enable) only
- RoHS/Halogen Free
- Gamma Correction
- Reverse type

1.3 Application

- Medical surgical Monitor
- 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 MD315QU1-M00.

<Table 1. General Specifications>

Parameter	Specification	Unit	Remarks
Active area	697.306(H) × 392.234(V)	mm	
Number of pixels	3840(H) × 2160(V)	pixels	
Pixel pitch	0.18159(H) × 0.18159(V)	mm	
Pixel arrangement	RGB Vertical stripe		
Display colors	1.07B (10bit)	colors	
Brightness	Typ.900 Min.680	cd/m ²	
Display mode	Normally Black		
Dimensional outline	709.4 ±0.6(H) x 417.78±0.6(V) x15.54 ±0.5(Body) typ.	mm	Thickness 26.85mm (Max.) Refer to the drawing for detail
Weight	5000 (Typ.)±250	g	updated
Bezel width (L/R/U/D)	6.05/6.05/5.53/20	mm	
Surface Treatment	Clear		
Back-light	Mini LED direct back-light type with 1152 blocks		

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 >

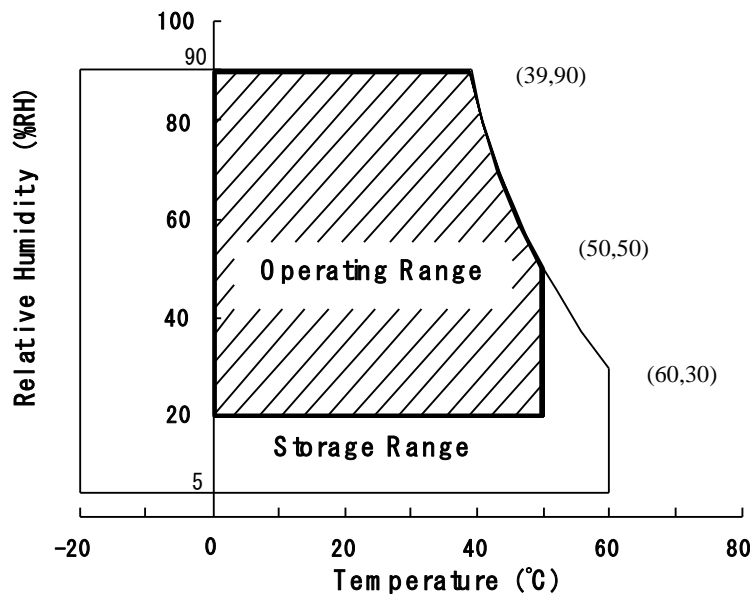
[VSS=GND=0V]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	VSS-0.3	13.5	V	Ta = 25 °C
Logic Supply Voltage	V _{IN}	VSS-0.3	V _{DD} +0.3	V	
Operating Temperature	T _{OP}	0	+50	°C	1)
Storage Temperature	T _{ST}	-20	+60	°C	1)
3D Module Surface Temperature (Operation)	T _{surface}	0	+65	°C	2)

Note : 1) Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39°Cmax. and no condensation of water.

2) Panel Surface Temperature should be Min. 0 °C and Max. +65 °C under the VDD = 12.0V, Frame rate = 60Hz, 25 °C ambient Temp. no humidity control and LED string current is typical value.



3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Specifications

< Table 3. Electrical specifications >

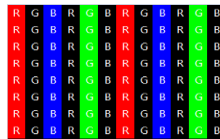
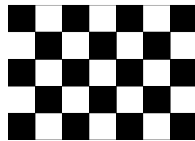
[Ta =25±2 °C]

Parameter		Min.	Typ.	Max.	Unit	Remarks
Power Supply Voltage	V _{DD}	10.8	12.0	13.2	V	Note1
Power Supply Current	I _{DD}	-	680	1500	mA	
In-Rush Current	I _{RUSH}	-	-	3	A	Note 2
Permissible Input Ripple Voltage	V _{RF}	-	-	300	mV	Note1,3
Differential input voltage	V _{ID}	100	-	600	mV	
Differential input common mode voltage	V _{cm}	0	-	2	V	V _{IH} =100mV, V _{IL} =-100mV
Power Consumption	P _D	-	8.2	18	W	
	P _{BL}	-	68.6	-	W	
	P _{total}	-	76.8	-	W	

Notes : 1. The supply voltage is measured and specified at the interface connector of 3D Module.
The current draw and power consumption specified is for VDD=12.0V, Frame rate=60Hz ,
Test Pattern :

a) Typ : Mosaic Pattern

b) Max : **Vertical Subline**



- Duration of rush current is about 2 ms and rising time of VDD is 1ms (min)
- Ripple Voltage should be covered by Input voltage Spec.
- Calculated value for reference (Input pins*VPIN ×IPIN) excluding inverter loss.

3.2 Back light Electrical Specification

<Table 4. Back light Electrical Specification >

Parameter		Min.	Typ.	Max.	Unit	Remarks
Driver Board Input Voltage	VLED	23.2	24.5	25.8	V	
Driver Board Input Current	ILED	2.66	2.8	2.94	A	
Input Supply Voltage	VCC_12V	10.8	12	13.2	V	Note 1
Input Supply Current	Ivcc_12v	140	163	190	mA	Note 1
In Rush Current	Irush_VLED	/	/	20	A	
In Rush Current	Irush_VCC_12V	/	/	2.0	A	Note 1
Power Consumption	PBL	61.7	68.6	75.9	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	SYS_CS: low level is enable
	Low	0	/	0.7	V	Others: high level is enable
SYS_VSYNC	Vsync	-	60	-	Hz	
LED Life-Time	-	30,000	-		Hrs	Note 2

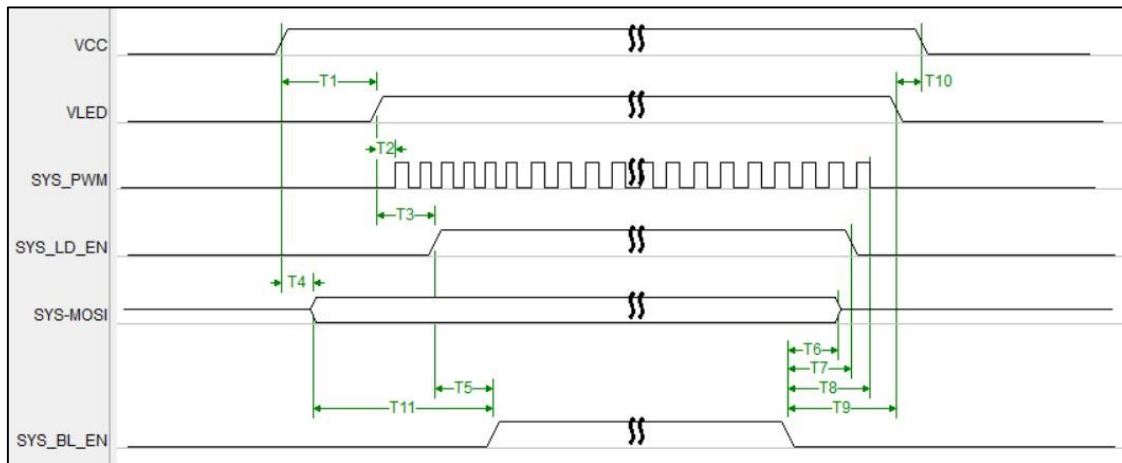
* Mini LED Board contains 1152 blocks, one block consists of 4 LEDs in serial.

Note:

1. Only the VCC part of the power connector on the Master Board is actually used (the VCC part of the Slave Board is NC designed) .
2. The life time of LED is determined as the time at which luminance of the LED depreciates 50% of its initial value at the typical LED current on condition of continuous operating at 25 ± 2°C

3.3 LED Driver Power sequence

<Figure 1. LED Driver Power sequence >



<Table 5. 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	
F-PWM	5000	--	10000	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 = $25 \pm 2^\circ\text{C}$) 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 3D Module surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta_{\phi=0}$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta_{\phi=90}$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta_{\phi=180}$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta_{\phi=270}$ ($=\theta_6$) 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 12.0V +/-4% at 25°C . Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications of 2D

[VDD = 12.0V, Frame rate = 60Hz, Clock = 533MHz, Ta = $25 \pm 2^\circ\text{C}$]

< Table 6. Optical Specifications _2D >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
2D 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.	
Static Luminance Contrast ratio		CR		1400	2000	-		Note 2
Dynamic Luminance Contrast ratio		DCR		-	1000000	-		Note 3
Luminance of White		Y_w		680	900		cd/m ²	Note 4
White luminance uniformity		ΔY		75	-		%	Note 5
Reproduction of color	White	W_x	$\Theta = 0^\circ$ (Center) Normal Viewing Angle	0.283	0.313	0.343	-	Note 6
		W_y		0.299	0.329	0.359	-	
	Red	R_x		-0.03	0.696	+0.03	-	
		R_y			0.303		-	
	Green	G_x		0.206	-			
		G_y		0.748	-			
	Blue	B_x		0.152	-			
		B_y		0.039	-			
Response Time	GTG	T_g		-	14	20	ms	Note 7
Color Gammut		-	DCI-P3		99%			@CIE 1976
			Adobe RGB		99%			@CIE 1931
Gamma		-		2.0	2.2	2.4	-	
2D Crosstalk		-		-	-	2	%	Note 8

4.0 OPTICAL SPECIFICATION

4.3 Optical Specifications of 3D

[VDD = 12.0V, Frame rate = 60Hz, Clock = 533MHz , Ta =25±2 °C]

< Table 7. Optical Specifications _3D >

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
3D Crosstalk		/	$\Theta = 0^\circ$ (Center)	-	1.5%	2%	/	Note 9
Viewing Angle range(3D)	Horizontal	Θ_3	Crossstalk $\leq 7\%$	65	75	-	Deg.	Note 10
		Θ_9		65	75	-	Deg.	
	Vertical	Θ_{12}		5.5	8.5	-	Deg.	
		Θ_6		5.5	8.5	-	Deg.	
3D Luminance		Y_w	$\Theta = 0^\circ$ (Center)	272	360	-	cd/m ²	Note 11
3D Viewing Distance		/		1.3	-	-	m	Note 12

Note :

- 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 3D Module surface.
- Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ and at the center of the 3D Module surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (refer to Figure 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

- Dynamic Contrast measurements shall be made at viewing angle of $\theta = 0^\circ$ and at the center of the active area. The white luminance shall be measured with 10% center patch set to white at black state. The dark luminance shall be measured with 2.5% screen area of each corner set to white at black state. Dyanmic CR is defined as follows.

$$DCR = \frac{\text{Luminance when displaying 10\% center white patch at black state}}{\text{Luminance when displaying a black raster with 2.5\% corner area set to white}}$$

- Test point is at the center of active area. 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.
- The White luminance uniformity on 3D Module surface is then expressed as : $\Delta Y = (\text{Minimum Luminance of 9points} / \text{Maximum Luminance of 9points}) * 100$ (refer to Figure 2 shown in Appendix).
- The color chromaticity coordinates specified in Table 4. 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.
- 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 the time table is defined as Figure 3and 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
0																	
15																	
31																	
47																	
63																	
79																	
95																	
111																	
127																	
143																	
159																	
175																	
191																	
207																	
223																	
239																	
255																	

- 2D Cross-Talk of one area of the 3D Module 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. (refer to Figure 4 shown in Appendix).

Note :

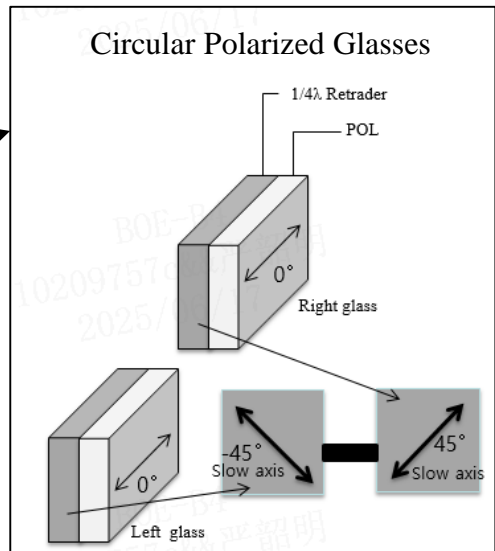
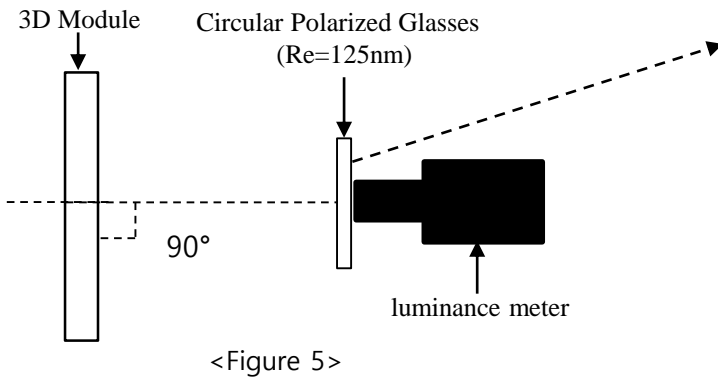
9. 3D Crosstalk : test at the center of the active area

- ① test pattern : left black / right white, refer to the Figure 2, luminance on the left、right glass is Llbw, Lrbw;
- ② test pattern :left white / right black, refer to the Figure 3, luminance on the left、right glass is Llwb, Lrbw;
- ③ test pattern : left black / right black, refer to the Figure 4, luminance on the left、right glass is Llbb, Lrbw;
- ④ test equipment and test methods : adjust the angle between the luminance meter and the screen, until the luminance is perpendicular to the screen, and measure the luminance transmitted through the Circular Polarized Glasses , at a distance approximately 1.5 meters. refer to the Figure 5.

$$\text{3D Crosstalk of left eye} = \frac{Llbw - Llbb}{Llwb - Llbb}$$



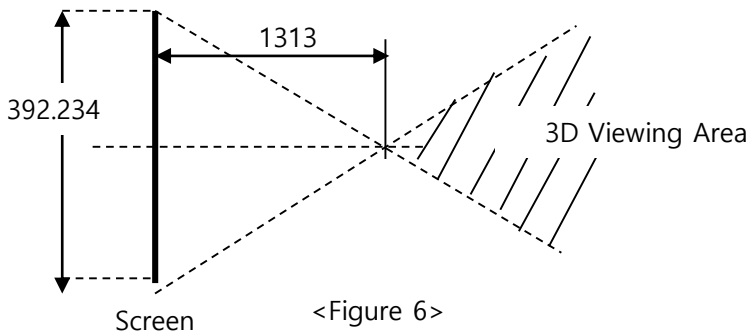
$$\text{3D Crosstalk of right eye} = \frac{Lrbw - Lrbw}{Lrbw - Lrbw}$$



10. Test point : center of the active area

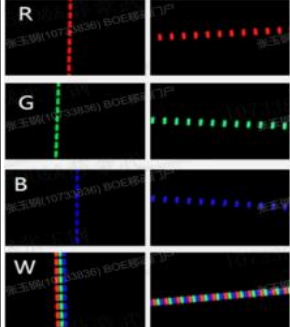
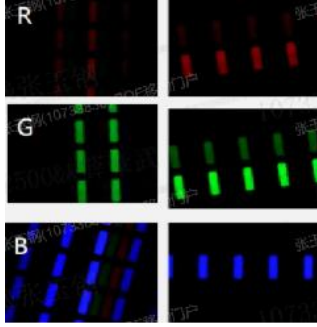
11. 3D luminance is the luminance transmitted through the Circular Polarized Glasses. Test at the center of the active area

12. 3D Viewing Distance is shown as Figure 6



4.3 3D Criitcal Optical Parts

< Table 8. 3D Critical Parts >

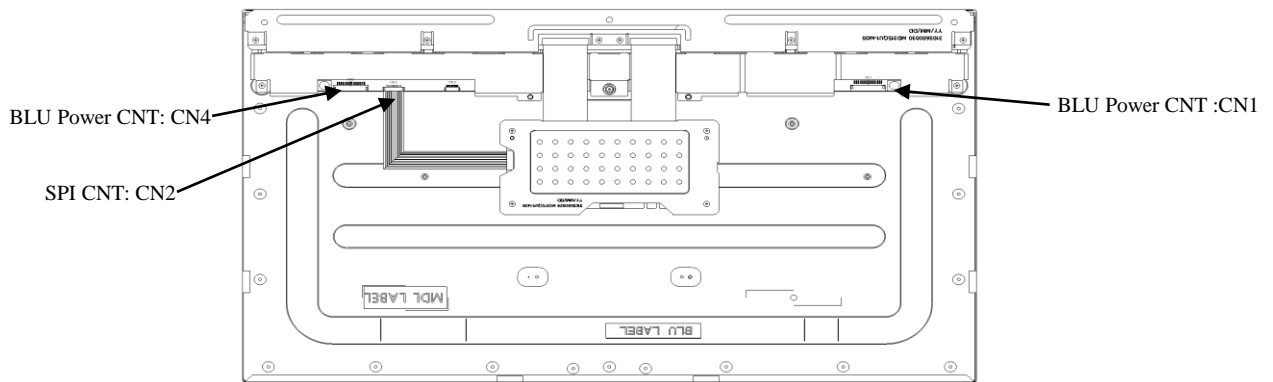
Item	Requirement	Note	
3D-glasses	Material: PC (recommend), Re=125nm	/	
Image Signal Pro - cessing and Display Board	Maintain unbroken Pixel-to-Pixel mapping from singal source to display unit(end to end)	Pixel-to-Pixel integrity	Image enhancement (e.g.,sharpening/HDR compromise Pixel-to-Pixel integrity)
			
Cover Glass	Chemically tempered glass	Isotropic Cover Glass	
Surface film	Non PET, SRF and other anisotropic materials as substrates	/	
Touch	Suggest using infrared touch control	/	

5.0 INTERFACE CONNECTION.

5.1 BLU Electrical Interface Connection

5.1.1 BLU Driver Board & CNT

BLU Power CNT	CN1&CN4	Vendor: YEONHO, Pin Pitch: 2.0mm
SPI CNT	CN2	Vendor: CVILUX, Pin Pitch: 1.25mm



< Table 9 : BLU Power CNT Pinmap >

Pin No	Symbol	Description
1	VLED	Power supply
2	VLED	Power supply
3	VLED	Power supply
4	VLED	Power supply
5	VLED	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_12	Power supply 12V
13	SYS_BL_EN	Back Light_EN
14	SYS_BL_PWM	BL Global PWM Dimming

< Table 10 : SPI CNT Pinmap >

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

Note: Module Brightness can be controlled by varying the PWM Duty on the SYS_BL_PWM Pin

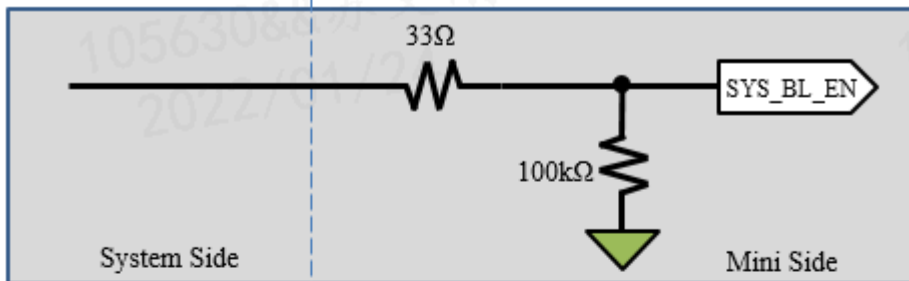
① Local Dimming On (SYS_LD_EN=H), Brightness = Luminance of White * PWM Duty * SPI Gray Level /255 ;

② Local Dimming Off (SYS_LD_EN=L), Brightness =Luminance of White * PWM Duty ;

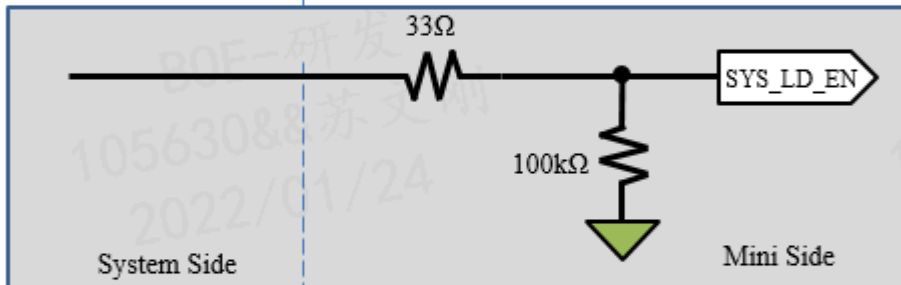
* Luminance of White: refer to 4.2 Optical Specification of 2D; SPI Gray Level : SPI data sent from TCON board to BLU

5.1.2 Logic Signal DEFAULT STATE

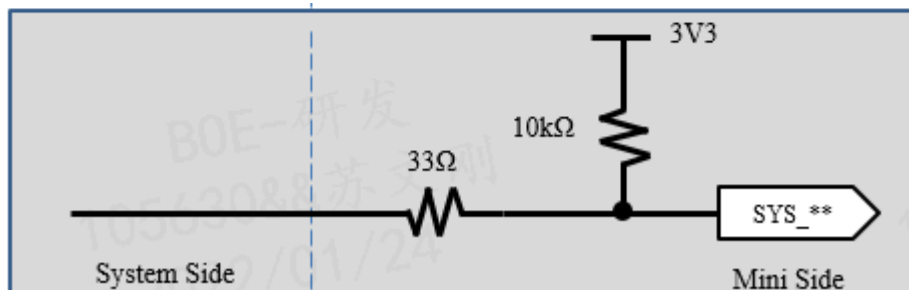
<Figure 7. The default state signals(SYS_BL_EN) controlled by system main board>



<Figure 8. The default state signals(SYS_LD_EN) controlled by system main board>



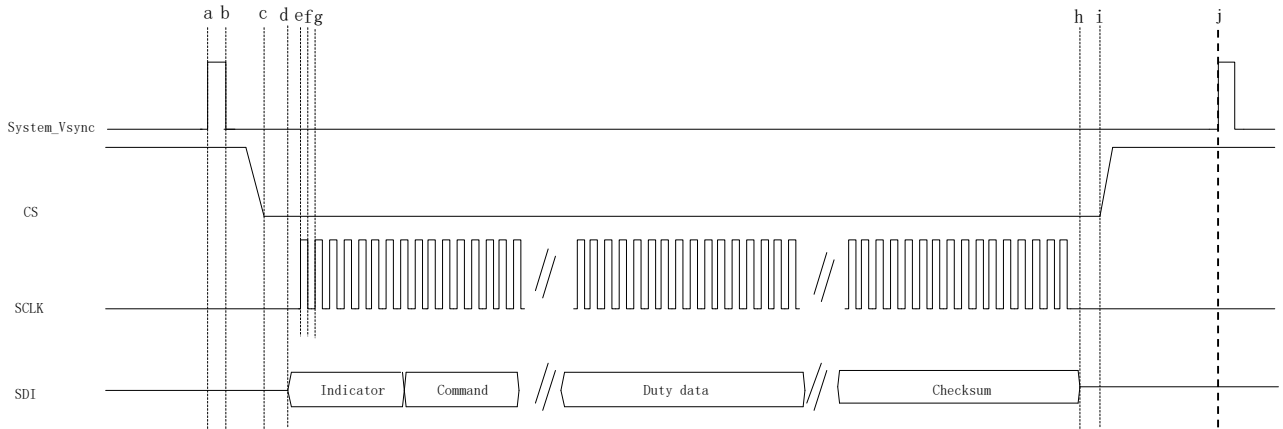
<Figure 9. The default state signals (SYS_VSYNC/ SYS_CS/ SYS_MOSI /SYS_MISO/SYS_SCK/SYS_BL_PWM) controlled by system main board>



5.1.3 SPI Interface Parameter

The specification of the LED Driver SPI parameter is shown in Table 9.

<Figure 10. LED Driver SPI parameter>



<Table 11. LED Driver SPI parameter Specification>

Parameter	Value			Units	Note
	Min	Typ	Max		
Tab	10	-	100	us	
Tbc	10	-	100	us	
Tcd	3	-	100	us	
Tef	31.25	50	83.35	ns	
Teg	62.5	100	166.7	ns	
Thi	3	-	200	us	

5.1.3 SPI Interface Parameter

SPI Data Format:

Indicator	Command	Data1	Data2	...	DataN	Checksum	0x00
-----------	---------	-------	-------	-----	-------	----------	------

Definition:

1. Indicator (1Byte)

0xAA : 8bit

2. Command (1Byte)

0x81 : 8bit

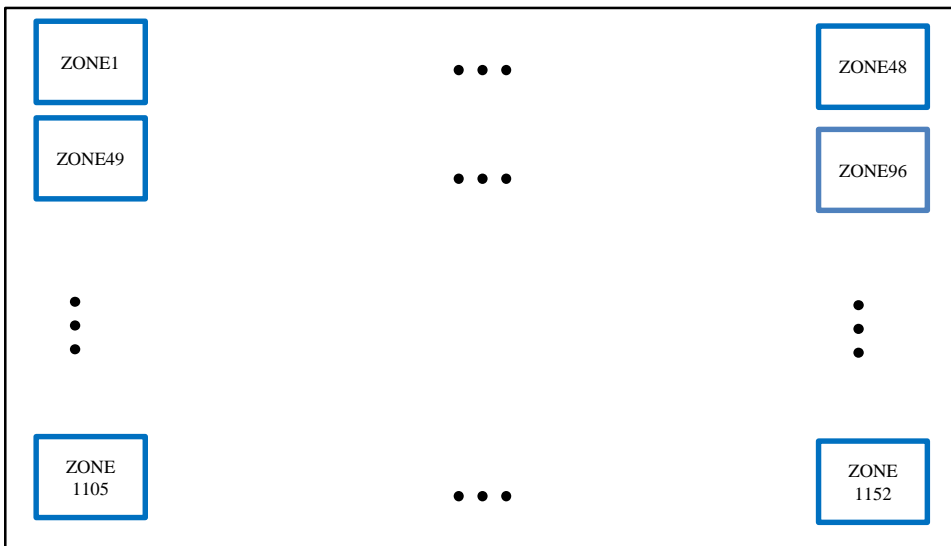
3. Data1~DataN: 1Byte per Rec_Data,

8bits local dimming Rec_Data

4. Checksum: 1Byte 8bits XOR

$ID \wedge Command \wedge Data1 \wedge Data2 \wedge \dots \wedge DataN$ (^:Exclusive XOR,N=1152)

SPI Data Mapping:



5.4 eDP Interface Connection

- eDP Connector CN1 : STM MSAK24025P30 or Equivalent

< Table 12. eDP Connector Pin Map >

Pin No	Symbol	Function	Remark
1	VDD	Power Supply (12.0V)	
2	VDD	Power Supply (12.0V)	
3	VDD	Power Supply (12.0V)	
4	VDD	Power Supply (12.0V)	
5	VDD	Power Supply (12.0V)	
6	GND	Ground	
7	GND	Ground	
8	NC	SCL for BOE us only,please keep NC	
9	NC	SDA for BOE us only,please keep NC	
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	SYS_LD_EN	pull high : Local dimming ON(defaultt) pull low : Local dimming OFF	
30	NC	No connection	Reserved for BIST Function

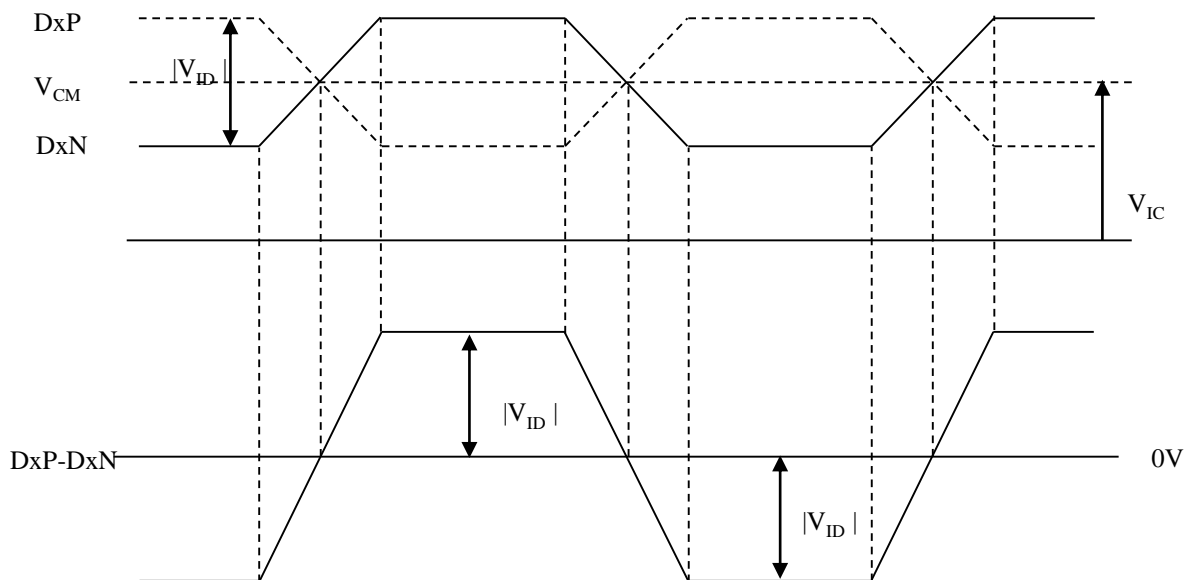
5.4 eDP Rx Interface Timing Parameter

5.4.1 Main link Signal

< Table 13. Main link Signal Parameter >

Item	Symbols	Min	Typ	Max	Unit	Remark
Spread spectrum clock	SSC	-0.3	-	-	%	
Main link swing voltage	$ V_{ID} $	100	-	600	mv	
Main link common mode voltage	V_{IC}	0	-	2.0	V	

<Figure 11. Edp Rx Wave form>



6.0 SIGNAL TIMING SPECIFICATION

6.1 This module is operated by the DE only.

< Table 14. Signal Timing >

Item	Symbols		Min	Typ	Max	Unit	Note
DCLK	Period	tCLK	1.8	1.87	2.5	ns	
	Frequency	-	400	533	543	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	135	KHz	
Vsync	Period	tVP	2213	2222	2900	tHP	
	Vertical Valid	tVV	2160			tHP	
	Vertical Blank	tVB	53	62	1318	tHP	
	Frequency	fV	47	60	61	Hz	

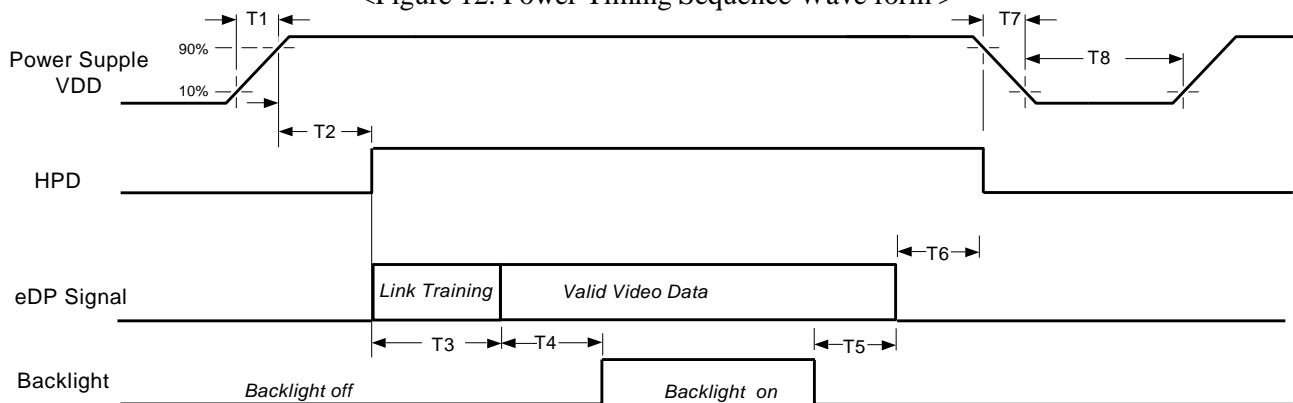
Note

1. DE Only Mode, While operation, DE signal should be have the same cycle. The input of HSYNC & VSYNC signal does not have an effect on normal operation.
2. Best operation clock frequency is 533Mhz.
3. Frequency] = [H Total] * [V Total] * [vertical Frame rate]
H Total, V Total and Frame rate should operate within the range between Frequency_Min and Frequency_Max
4. Except Best operation clock frequency, FOS(Flicker & Brightness & Crosstalk, Etc.) are not guaranteed.

8.0 POWER SEQUENCE

To prevent a latch-up or DC operation of the 3D Module module, the power on/off sequence shall be as shown in below.

<Figure 12. Power Timing Sequence Wave form >



< Table 16. Power Timing Sequence Parametre >

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.

9.0 MECHANICAL CHARACTERISTICS

9.1 Dimensional Requirements

Figure 5 (located in Appendix) shows mechanical outlines for the model ME315QUM-NM1. Other parameters are shown in Table 17.

<Table 17. Dimensional Parameters>

Parameter	Specification	Unit
Dimensional outline	709.4 ±0.6(H) x 417.78±0.6(V) x15.54±0.5(Body) /26.85(Max.)	mm
Weight	5000±250	gram
Active area	697.306(H) × 392.234(V)	mm
Pixel pitch	0.18159(H) ×0.18159(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	

9.2 Mounting

Refer to Figure 6. (shown in Appendix)

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 RELIABILITY TEST

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

<Table 18. Reliability Test Parameters >

No	Test Items	Conditions	
1	High temperature storage test	Ta = 60 °C, 240 hrs	
2	Low temperature storage test	Ta = -20 °C, 240 hrs	
3	High temperature & high humidity operation test	Ta = 50 °C, 80%RH, 240hrs	
4	High temperature operation test	Ta = 50 °C, 240hrs	
5	Low temperature operation test	Ta = 0°C, 240hrs	
6	Thermal shock	Ta = -20 °C ↔ 60 °C (0.5 hr), 100 cycle	
7	Vibration test (non-operating)	Frequency	Random, 10 ~ 300 Hz, 30 min/Axis
		Gravity\ AMP	1.0 Grms
		Period	X, Y, Z 30 min
8	Shock test (non-operating)	Gravity	50G
		Pulse width	11msec, Half wave
		Direction	±X, ±Y, ±Z Once for each
9	Electro-static discharge test	Air : 150 pF, 330Ω, ±15 KV Contact : 150 pF, 330Ω, ±8 KV	

11.0 HANDLING & CAUTIONS

(1) Cautions when taking out the module

- Pick the pouch only, when taking out module from a shipping package.

(2) Cautions for handling the module

- As the electrostatic discharges may break the 3D Module module, handle the 3D Module module with care. Peel a protection sheet off from the 3D Module panel surface as slowly as possible.
- As the 3D Module panel and back - light element are made from fragile glass material, impulse and pressure to the 3D Module 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 3D Module 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 3D Module panel would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- Ultra-violet ray filter is necessary for outdoor operation
- If the product will be used in extreme conditions such as high temperature, humidity, display patterns, operation time, etc., it is strongly recommended to contact BOE for application engineering device. Otherwise, the reliability and function of the module may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stocks, markets, and controlling systems.

(4) Cautions for the storage

- When storing product as spares for a long time 3D Module panels should be kept from direct light, moisture, and prevent water condensing.
- Ventilate the warehouse with effectively with proper ventilation system. Temperature should between 5°C and 35°C at normal humidity($\leq 75\%$).
- Product should be kept in storage no more than 6months. If products has been stored over 3 months, it is recommended to return to temperature of 20°C and humidity of 50% for 24hours.

11.0 HANDLING & CAUTIONS

(5) Cautions for the atmosphere

- Dew drop atmosphere should be avoided.
- Do not store and/or operate the 3D Module 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.

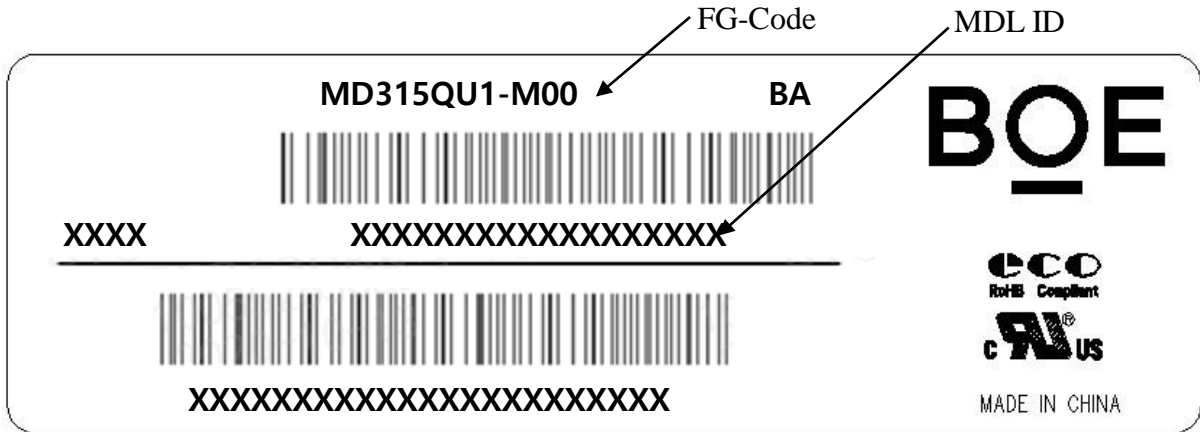
(6) Cautions for the module characteristics

- Do not apply fixed pattern data signal to the 3D Module module at product aging.
- Applying fixed pattern for a long time may cause image sticking.

(7) Other cautions

- Do not disassemble and/or re-assemble 3D Module 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.
- When this reverse model is used as a forward-type model (PCB on top side), BOE can not guarantee any defects of 3D Module.
- If 3D Module containing system is out of BOE 's operating or storing condition, BOE can not guarantee 3D Module operating properly.

12.0 PRODUCT SERIAL NUMBER

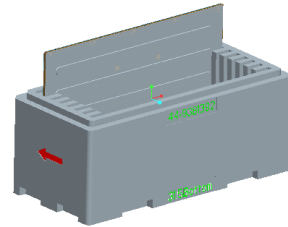


MDL ID Naming Rule:

Digit	1		2	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																

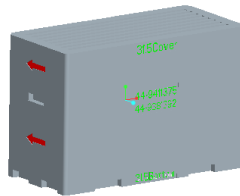
13.0 PACKING

13.1 Packing Order

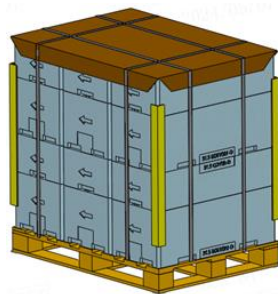


1. Put one MDL in the PE bag (PCB ↓) .

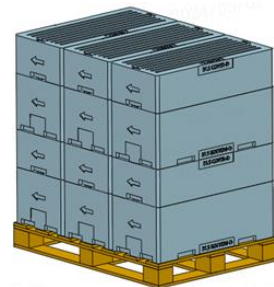
2. Put 6pcs MDL in the EPS Box.



3. Put one EPS Cover. Total: 6pcs MDL/Box



5. Put the Top-Cover on the Box (36ea MDLs per pallet) and Pack with 4 packing belts.



4. Put 6 EPS Box on the pallet.

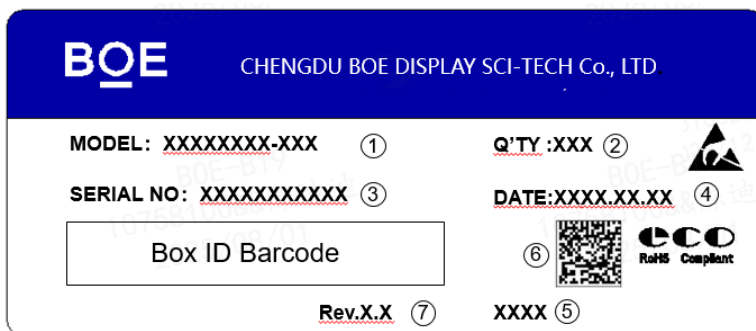


13.2 Packing Note

- Box Dimension : 810mm(L) × 376mm(W) × 504mm(H)
- Package Quantity in one Box : 6pcs

13.3 Box label

- ① FG-CODE Number
 - ② Quantity in one box
 - ③ Box ID
 - ④ Packing Date
 - ⑤ FG-Code Last Four Number
 - ⑥ QR Code(The scan content : FG-CODE Number)
 - ⑦ Fixed value of version information unique to some models (Rev.x.x : Rev.1.0~ Rev.Y.0 (Without I/O/U/Q/Z))
- Label Size : 70 mm (L) × 30 mm (W)



BOX ID编码原则:

Digit Code	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	S	L	S	T	2	1	2	D	0	0	0	0	1
Description	Products GBN (绑定FG-Code)		Grade 大等级	Line B19:T	Year 年份后两位		Month ≥10 用XYZ	Revision Code 小等级	Serial No. 00000-YYYYY 36进制 (去掉字母I/O/U/Q/Z)				

14.0 APPENDIX

Figure 1. Measurement Set Up

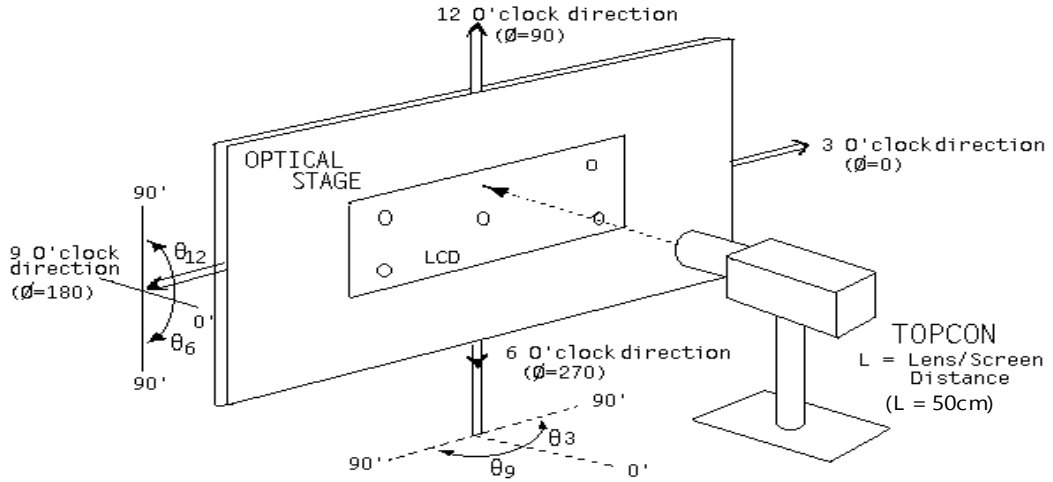


Figure 2. White Luminance and Uniformity Measurement Locations (9 points)

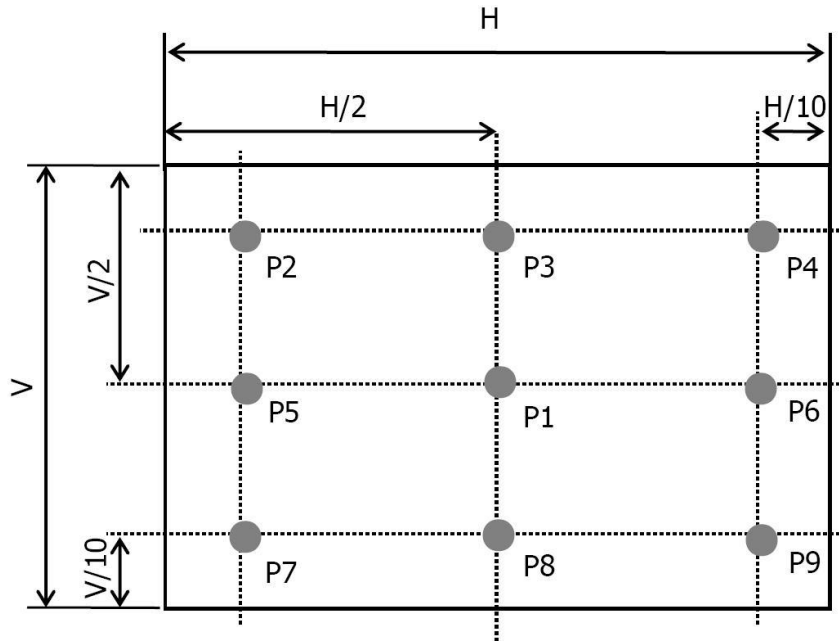


Figure 3. Response Time Testing

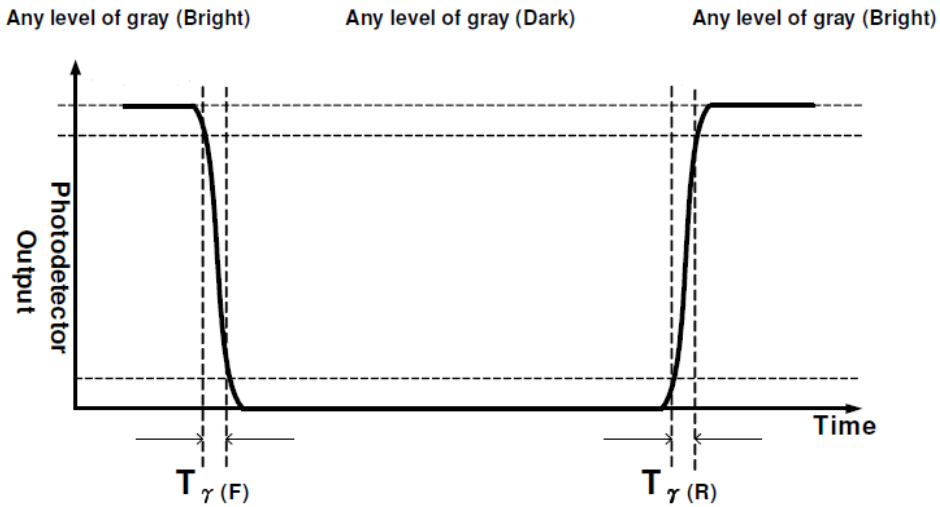
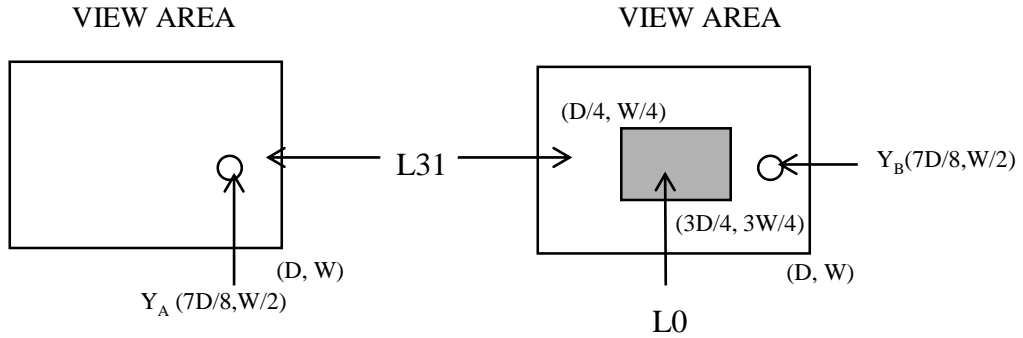


Figure 4. Cross Modulation Test Description



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

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-3D Module Outline Dimensions (Front view)

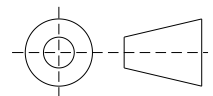
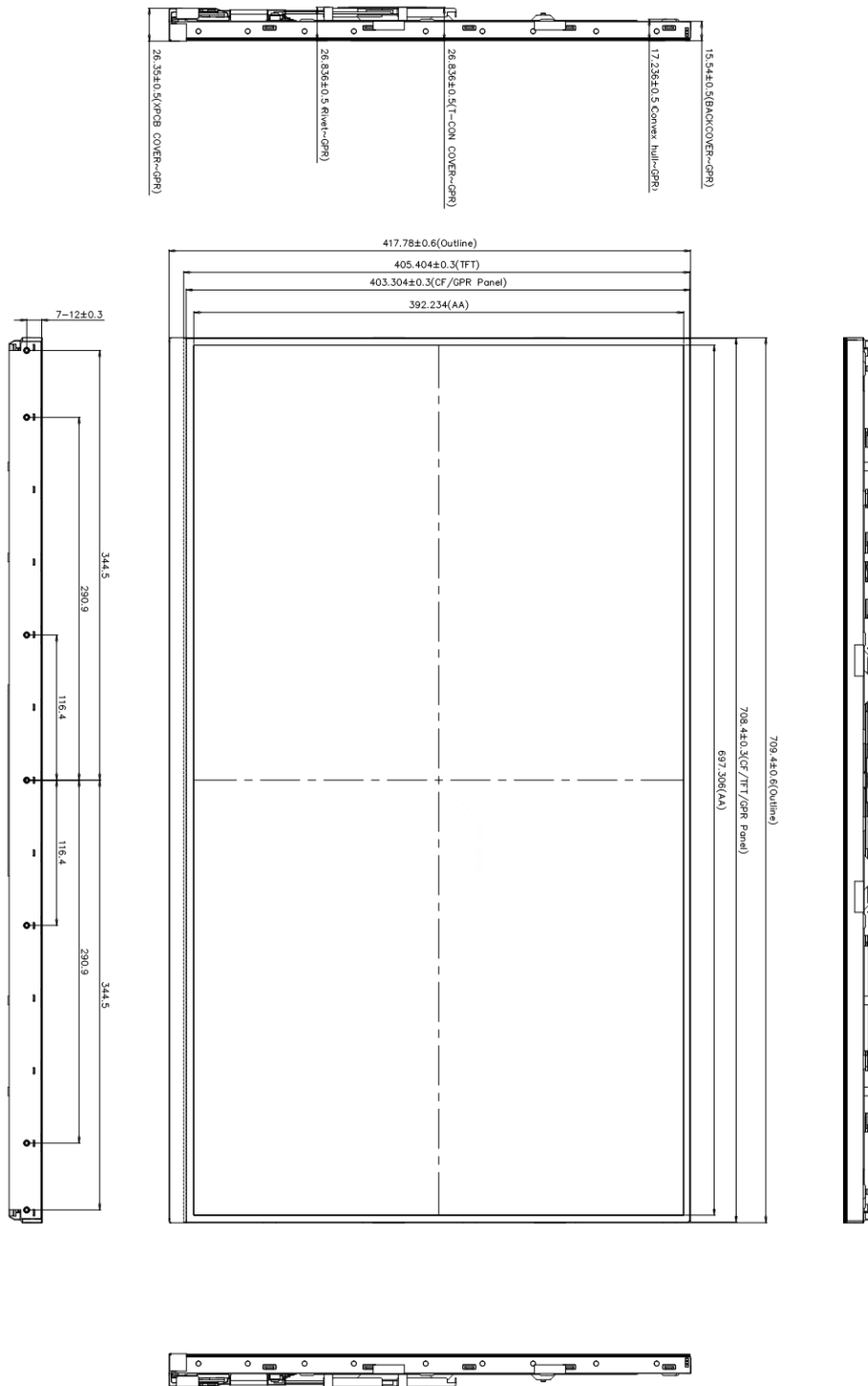
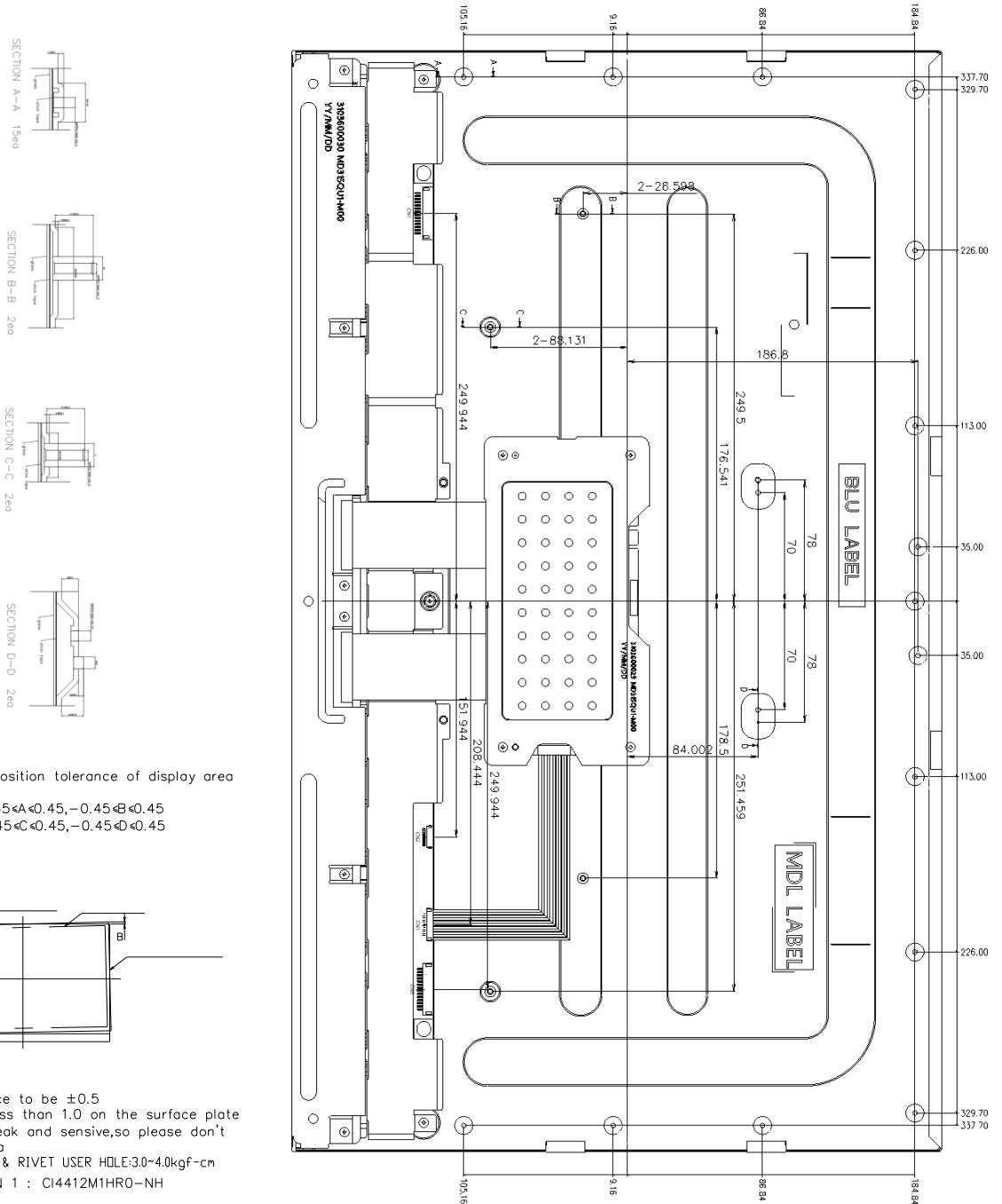
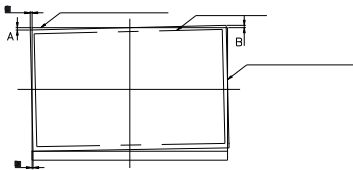


Figure 6. TFT-3D Module Outline Dimensions (Rear view)



NOTE:

1. Tilt and partial disposition tolerance of display area as following
 - (1) Y-direction: $-0.45 < A < 0.45, -0.45 < B < 0.45$
 - (2) X-direction: $-0.45 < C < 0.45, -0.45 < D < 0.45$



2. Unspecified tolerance to be ± 0.5
3. The LCM warp is less than 1.0 on the surface plate
4. The COF area is weak and sensitive, so please don't press the COF area
5. TORQUE of M3 SCREW & RIVET USER HOLE: $3.0 \sim 4.0 \text{ kgf-cm}$
6. MASTER-BOARD-CN 1 : C14412M1HR0-NH
 MASTER-BOARD-CN 2 : C1112M1HR0-NH
 MASTER-BOARD-CN 3 : 20022WR-H14B2
 SLAVE-BOARD-CN 1 : 20022WR-H14B2
 CN 4 : MSAK24025P30

