



LITEMAX

DLF/DLH7501-LNU (V1) Sunlight Readable 75" LED B/L LCD

User Manual

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Record of Revision

Version and Date	Page	Old Description	New Description	Remark
Nov/8/2018	all		Initial release	

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1 General Description

The **DLF/DLH7501** is a **75** inch industrial grade sunlight readable LCD, with high brightness **3000** nits and high color saturation, it produce sharp images, crisp text and lifelike colors. The Durapixel LED backlight technology ensures high reliability and low power consumption, suitable for outdoor application, kiosk, factory automation, military, transportation and gaming application..

1.1 Features

- High Brightness 3000 nits
- Resolution 3840x2160
- Sunlight Readable
- LED Backlight
- Local Dimming
- Low Power Consumption
- LCD Blacking Defect Free(H-Tni 110°C)
- BL MTBF: 50,000 hours

1.2 General Specifications

Model Name	DLF/DLH7501-LNU V1
Description	75" TFT LCD, 3000 nits LED backlight, UHD (3840x2160)
Screen Size	75"
Display Area (mm)	1649.6(H) x 927.9(V)
Brightness	3000 cd/m ²
Resolution	3840x2160
Aspect Ratio	16 : 9
Contrast Ratio	1200 : 1
Pixel Pitch (mm)	0.429(H) x 0.429(V)
Pixel Per Inch (PPI)	59
Viewing Angle	178°(H),178°(V)
Color Saturation (NTSC)	68%
Display Colors	1.07G
Response Time (Typical)	8ms
Panel Interface	V-by-One
AD Board Input Interface	DVI-D, HDMI, DP
Input Power	DC24V
Power Consumption	607W (611W with AD Board)
OSD Key	5 Keys (Power Switch, Menu, +, Exit, -)
OSD Control	Brightness, Color, Contrast, Auto Turing, H/V Position...etc
Dimensions (mm)	1675.2 x 953.6 x 81.2
Bezel Size(U/B/L/R)	11.8/11.8/11.8/11.8 mm
Weight (Net)	27.6 kg
Operating Temperature	0 °C ~ 50 °C
Storage Temperature	-20 °C ~ 60 °C

DLF= Panel+ LED Driving Board

DLH= Panel+ LED Driving Board + AD Control Board

2 Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or permanent damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	Note
		Min	Max		
Power Input Voltage	LCD Circuit	VLCD	-0.3	+14.0	VDC
	Driver	VBL	-0.3	+27.0	VDC
Driver Control Voltage	ON/OFF	V _{OFF} / V _{ON}	-0.3	+3.9	VDC
	Brightness	EXTVBR-B	0.0	+3.9	VDC
T-Con Option Selection Voltage		VLOGIC	-0.3	+4.0	VDC
Operating Temperature		T _{OP}	0	+50	°C
Storage Temperature		T _{ST}	-20	+60	°C
Panel Front Temperature		T _{SUR}	-	+68	°C
Operating Ambient Humidity		H _{OP}	10	90	%RH
Storage Humidity		H _{ST}	5	90	%RH

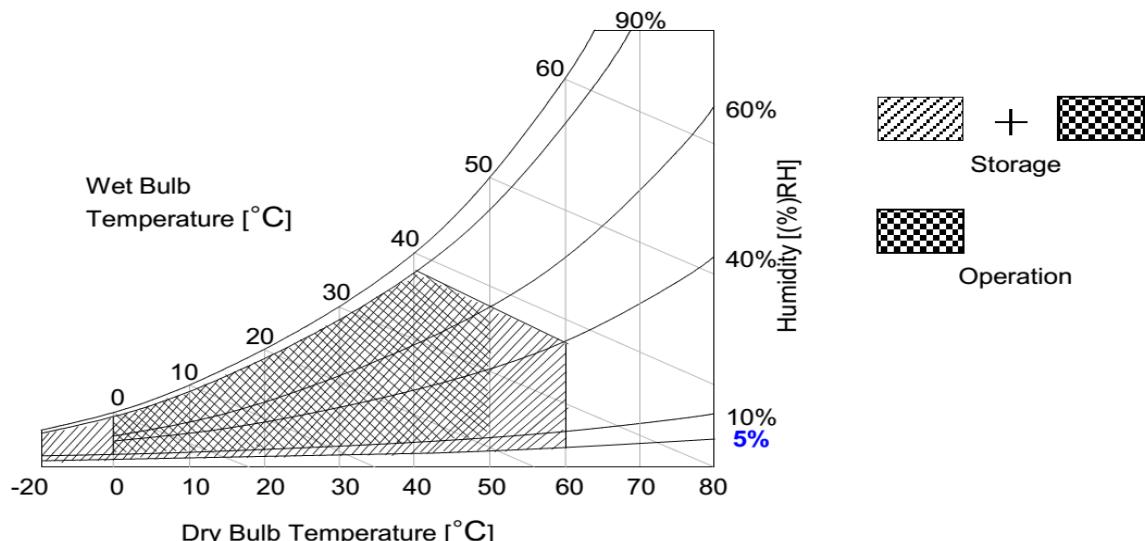
Note 1. Ambient temperature condition (Ta = 25±2°C)

2. Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be Max 39°C, and no condensation of water.

3. Gravity mura can be guaranteed below 40°C condition.

4. The maximum operating temperatures is based on the test condition that the surface temperature of display area is less than or equal to 68°C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 68°C. The range of operating temperature may be degraded in case of improper thermal management in final product design.



3 Electrical Specifications

3.1 Electrical Characteristics

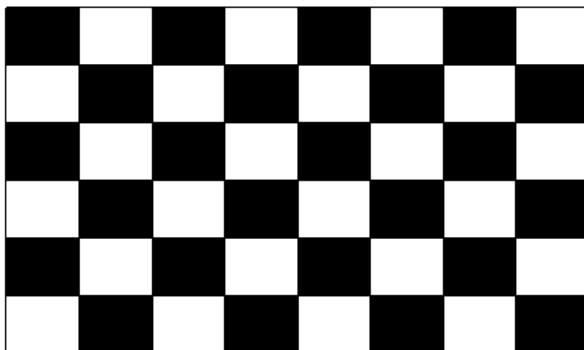
Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	notes
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V _{LCD}	10.8	12.0	13.2	V _{DC}	
Power Input Current	I _{LCD}	-	1490	1930	mA	1
		-	2350	3050	mA	2
T-CON Option Selection Voltage	Input High Voltage	V _{IH}	2.7	-	V _{DC}	
	Input Low Voltage	V _{IL}	0	-	V _{DC}	
Power Consumption	P _{LCD}	-	17.9	23.2	Watt	1
Rush current	I _{RUSH}	-	-	10	A	3

Note 1. The specified current and power consumption are under the $V_{LCD}=12.0V$, $T_a=25\pm2^{\circ}C$, $f_v=60Hz$ condition, and mosaic pattern(8×6) is displayed and f_v is the frame frequency.

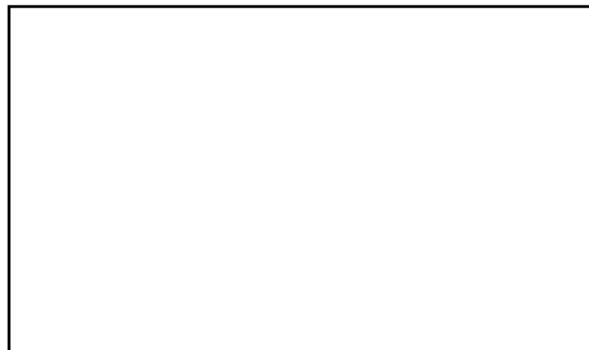
2. The current is specified at the maximum current pattern.
3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).
4. Ripple voltage level is recommended under $\pm 5\%$ of typical voltage

White : 1023 Gray
Black : 0 Gray



Mosaic Pattern(8×6)

Full White
R : 1023 Gray, G : 1023 Gray, B : 1023 Gray



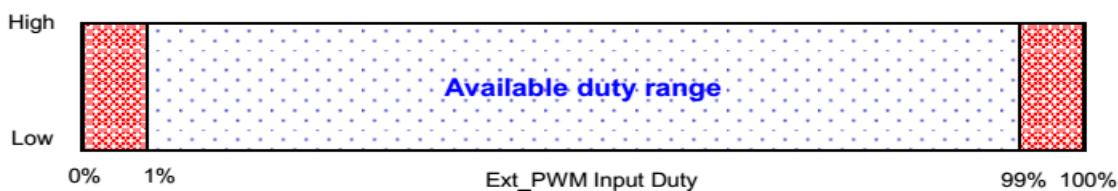
Max Current Pattern

Table 3. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit	Notes	
		Min	Typ	Max			
LED Driver :							
Power Supply Input Voltage	VBL	21.6	24.0	26.4	Vdc	1	
Power Supply Input Current	IBL	-	24.5	26.8	A	1	
Power Supply Input Current (In-Rush)	In-rush	-	-	35.8	A	VBL = 21.6V ExtVBR-B=100% 4	
Power Consumption (Total)	PBL	-	589.1	643.5	W	1	
Input Voltage for Control System Signals	On/Off	On	V on	2.5	-	3.6	Vdc
		Off	V off	-0.3	0.0	0.7	Vdc
	Brightness Adjust		ExtVBR-B	1	-	100	%
	PWM Frequency for NTSC & PAL		PAL		100	Hz	3
			NTSC		120	Hz	3
	Pulse Duty Level (PWM)		HighLevel	2.5	-	3.6	Vdc
			Low Level	0.0	-	0.7	Vdc
LED :							
Life Time			50,000		Hrs	6	

Notes :

1. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 60 minutes at $25\pm2^{\circ}\text{C}$. The specified current and power consumption are under the typical supply Input voltage 24V and VBR (ExtV_{BR-B} : 100%), it is total power consumption.
2. LGD recommend that the PWM freq. is synchronized with One time harmonic of V_{sync} signal of system. Though PWM frequency is over 120Hz (max 252Hz), function of LED Driver is not affected.
3. The duration of rush current is about 200ms. This duration is applied to LED on time
4. Even though inrush current is over the specified value, there is no problem if I^2T spec of fuse is satisfied.
5. Ext_PWM Signal have to input available duty range. Between 99% and 100% ExtV_{BR-B} duty have to be avoided. ($99\% < \text{ExtV}_{\text{BR-B}} < 100\%$) But ExtV_{BR-B} 0% and 100% is possible.
6. The life time is determined as the time at which brightness of the LED is 50% compared to that of initial value at the typical LED current on condition of continuous operating at $25\pm2^{\circ}\text{C}$, based on duty 100%.



3.2 Interface Connection

This LCD module employs three kinds of interface connection, 5-pin connector and 51-pin connector are used for the module electronics and 14-pin,12-pin connector is used for the integral backlight system..

3.2.1 LCD Module

- LCD Connector(CN1): 20037WR-H05 (manufactured by YEONHO)

Table 4-1. MODULE CONNECTOR(CN1) PIN CONFIGURATION

No	Symbol	Description
1	GND	Ground
2	GND	Ground
3	VLCD	Power Supply +12.0V
4	VLCD	Power Supply +12.0V
5	VLCD	Power Supply +12.0V

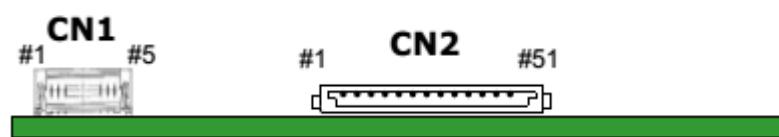
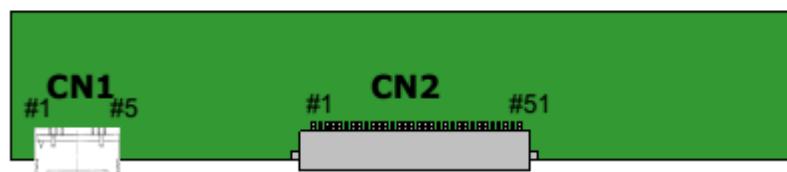
- LCD Connector (CN2): FI-RXE51S-HF (manufactured by JAE) or compatible or GT05S-51S-H38
 (Manufactured by LSM) or IS050-C51B-C39-C (manufactured by UJU)

Table 4-2. MODULE CONNECTOR(CN2) PIN CONFIGURATION

No	Symbol	Description	No	Symbol	Description
1	NC	No Connection(notes 2)	27	GND	Ground
2	NC	No Connection(notes 2)	28	Rx0n	V-by-One HS Data Lane 0
3	NC	No Connection(notes 2)	29	Rx0p	V-by-One HS Data Lane 0
4	NC	No Connection(notes 2)	30	GND	Ground
5	NC	No Connection(notes 2)	31	Rx1n	V-by-One HS Data Lane 1
6	NC	No Connection(notes 2)	32	Rx1p	V-by-One HS Data Lane 1
7	NC	No Connection(notes 2)	33	GND	Ground
8	NC	No Connection(notes 2)	34	Rx2n	V-by-One HS Data Lane 2
9	NC	No Connection	35	Rx2p	V-by-One HS Data Lane 2
10	GND	Ground	36	GND	Ground
11	GND	Ground	37	Rx3n	V-by-One HS Data Lane 3
12	GND	Ground	38	Rx3p	V-by-One HS Data Lane 3
13	GND	Ground	39	GND	Ground
14	NC	NO CONNECTION	40	Rx4n	V-by-One HS Data Lane 4
15	Input Mode	Vx1 Input Data Format 'L'=Non-Division , 'H'=2-Division	41	Rx4p	V-by-One HS Data Lane 4
16	NC	No Connection	42	GND	Ground
17	NC	No Connection	43	Rx5n	V-by-One HS Data Lane 5
18	NC	No Connection	44	Rx5p	V-by-One HS Data Lane 5
19	NC	No Connection	45	GND	Ground
20	NC	No Connection	46	Rx6n	V-by-One HS Data Lane 6
21	Bit_SEL	'H' = 10bit , 'L' = 8bit	47	Rx6p	V-by-One HS Data Lane 6
22	LOCAL_ON	'H' = Enable	48	GND	Ground
23	M+ Bypass	'H' = RGB, 'L' = M+	49	Rx7n	V-by-One HS Data Lane 7
24	GND	Ground	50	Rx7p	V-by-One HS Data Lane 7
25	HTPDN	Hot plug detect	51	GND	Ground
26	LOCKN	Lock detect	-	-	-

Note:

1. All GND (ground) pins should be connected together to the LCD module's metal frame.
2. #1~#8 NC (No connection) : These pins are used for back up power source, VLCD (power input) .
 These pins are should be connected together.
3. All Input levels of V-by-One signals are based on the V-by-One HS Standard Version 1.4.
4. #9 & #14 & #16 ~#20 NC(No Connection) : These pins are used only for LGD (Do not connect)
5. Specific pin (#22) is used for Local Dimming function of the LCD module.
 If not used, these pins are no connection. (Please see the Appendix IV-2 for more information.)
6. About specific pin (#15) , Please see the Appendix VI.



Rear view of LCM

3.2.2 Backlight Module

Master

-LED Driver Connector

: 20022WR - H14B2(Yeonho), 20022WR-H12B2(Yeonho)

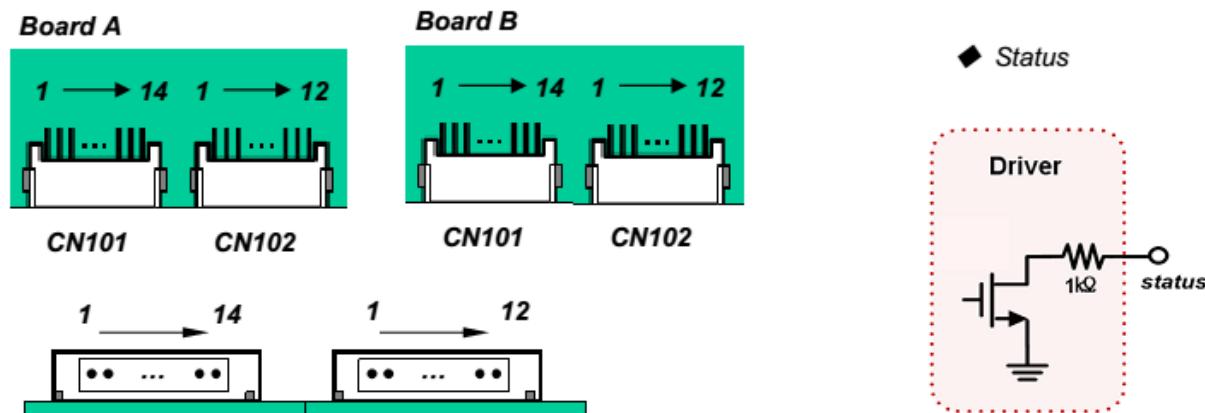
Table 5-1. LED DRIVER CONNECTOR PIN CONFIGURATION

Pin No	Symbol	Description (CN101)	Description (CN102)	Note
1	VBL	Power Supply +24.0V	Power Supply +24.0V	
2	VBL	Power Supply +24.0V	Power Supply +24.0V	
3	VBL	Power Supply +24.0V	Power Supply +24.0V	
4	VBL	Power Supply +24.0V	Power Supply +24.0V	
5	VBL	Power Supply +24.0V	Power Supply +24.0V	
6	GND	Backlight Ground	Backlight Ground	
7	GND	Backlight Ground	Backlight Ground	
8	GND	Backlight Ground	Backlight Ground	1
9	GND	Backlight Ground	Backlight Ground	
10	GND	Backlight Ground	Backlight Ground	
11	Status	Backlight Status	Don't care	2
12	VON/OFF	Backlight ON/OFF control	Don't care	
13	NC	Don't care		
14	EXTVBR_B	External PWM		3

Notes :

1. GND should be connected to the LCD module's metal frame.
2. Normal : Low (under 0.7V) / Abnormal : Open
3. High : on duty / Low : off duty, Pin#14 can be opened. (if Pin #14 is open , EXTVBR-B is 100%)
4. Each impedance of pin #12 and 14 is over 50 [KΩ] .

◆ Rear view of LCM



3.3 Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Table 6. TIMING TABLE (DE Only Mode)

ITEM		Symbol	Min	Typ	Max	Unit	Note
Horizontal	Display Period	t_{HV}	480	480	480	t_{CLK}	3840/8
	Blank	t_{HB}	60	70	120	t_{CLK}	1
	Total	t_{HP}	540	550	600	t_{CLK}	
Vertical	Display Period	t_{VV}	2160	2160	2160	Lines	
	Blank	t_{VB}	40	90	600	Lines	1
	Total	t_{VP}	2200	2250	2760	Lines	

ITEM		Symbol	Min	Typ	Max	Unit	Note
Frequency	DCLK	f_{CLK}	67	74.25	78.00	MHz	594/8
	Horizontal	f_H	121.8	135	140	KHz	2
	Vertical	f_V	47	60	63	Hz	2, 4

notes: 1. The input of HSYNC & VSYNC signal does not have an effect on normal operation (DE Only Mode). If you use spread spectrum of EMI, add some additional clock to minimum value for clock margin.

2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency

3. Spread Spectrum Rate (SSR) is limited to $\pm 0.5\%$ center spread at 30KHz
※ Timing should be set based on clock frequency.

4. The performance of the electro-optical characteristics may be influenced by Harmonic of vertical refresh rate and Ext_PWM Input Duty.

3.4 V by One input signal Characteristics

3.4.1 V by one Input Signal Timing Diagram

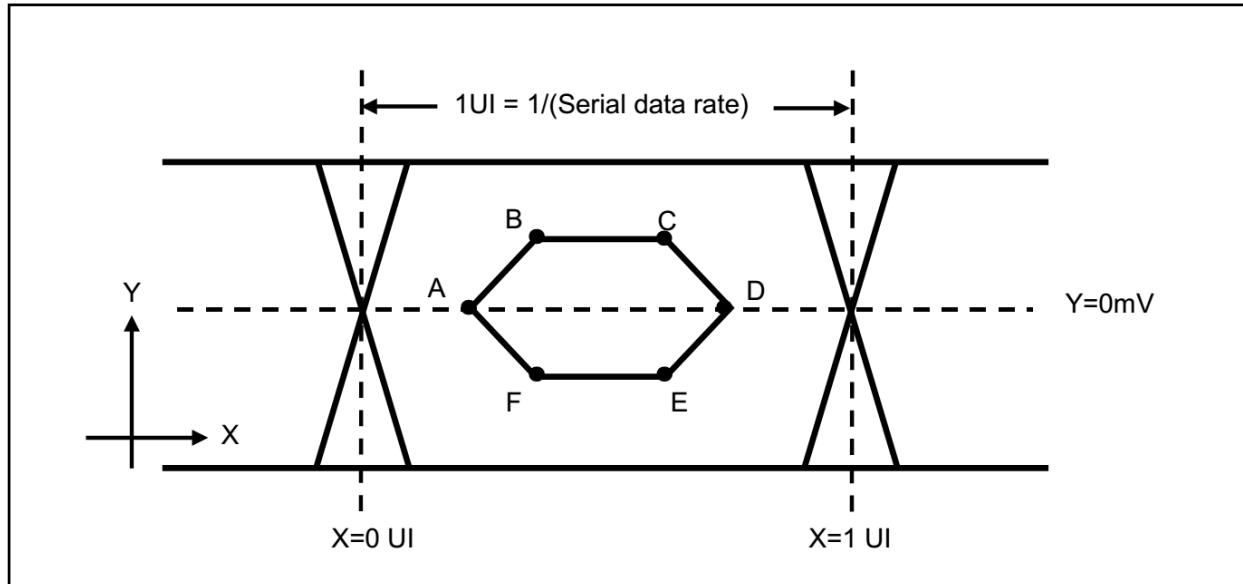


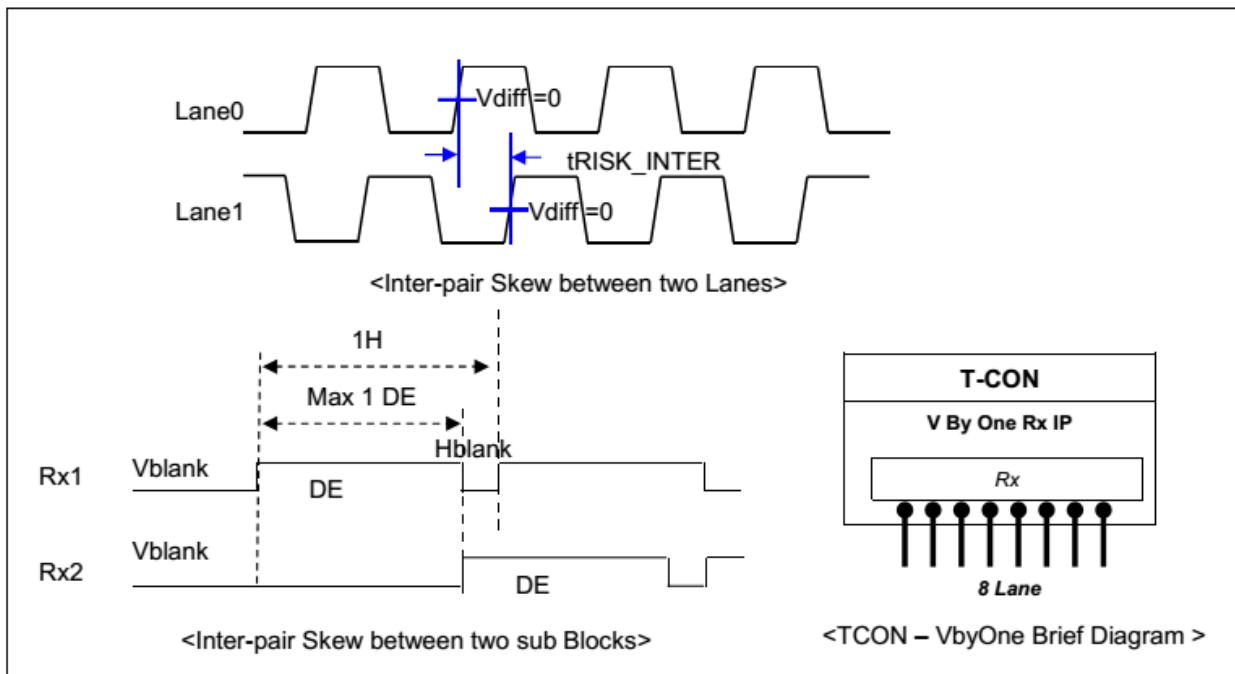
Table7. Eye Mask Specification

	X[UI]	Note	Y[mV]	Note
A	0.25 (max)	2	0	-
B	0.3 (max)	2	50	3
C	0.7(min)	3	50	3
D	0.75(min)	3	0	-
E	0.7(min)	3	-50	3
F	0.3(max)	2	-50	3

Note 1. All Input levels of V by One signals are based on the V by One HS Standard Ver. 1.4

2. This is allowable maximum value.
3. This is allowable minimum value.
4. The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated.
 - PLL bandwidth : 15 Mhz
 - Damping Factor : 1

3.4.2 V by one Input Signal Timing Diagram



Description	Symbol	Min	Max	Unit	notes
Allowable inter-pair skew between lanes	tRISK_INTER	-	5	UI	1,3
Allowable inter-pair skew between sub-blocks	tRISK_BLOCK	-	1	DE	1,4

Notes 1.1UI = 1/serial data rate

2. it is the time difference between the true and complementary single-ended signals.
3. it is the time difference of the differential voltage between any two lanes in one sub block.
4. it is the time difference of the differential voltage between any two blocks in one IP.

3.5 Color Data Reference

The brightness of each primary color (red, green, blue) is based on the 10bit or 8bit gray scale data input for the color. The higher binary input, the brighter the color. Table 8 provides a reference for color versus data input

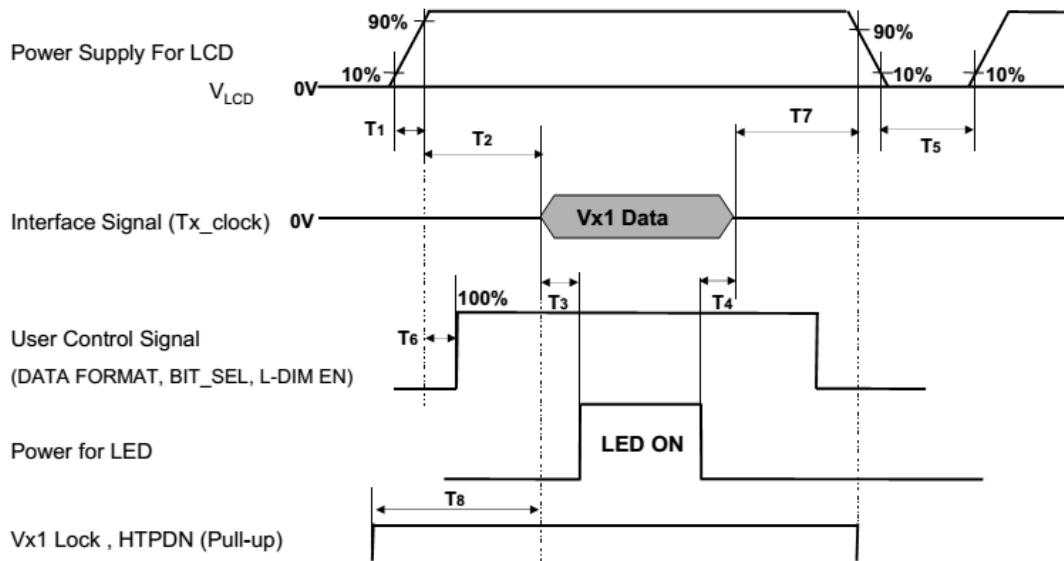
. Table 8. COLOR DATA REFERENCE

Packer input & Unpacker output		30bpp RGB (10bit)	24bpp RGB (8bit)
Byte0	D[0]	R[2]	R[0]
	D[1]	R[3]	R[1]
	D[2]	R[4]	R[2]
	D[3]	R[5]	R[3]
	D[4]	R[6]	R[4]
	D[5]	R[7]	R[5]
	D[6]	R[8]	R[6]
	D[7]	R[9]	R[7]
Byte1	D[8]	G[2]	G[0]
	D[9]	G[3]	G[1]
	D[10]	G[4]	G[2]
	D[11]	G[5]	G[3]
	D[12]	G[6]	G[4]
	D[13]	G[7]	G[5]
	D[14]	G[8]	G[6]
	D[15]	G[9]	G[7]
Byte2	D[16]	B[2]	B[0]
	D[17]	B[3]	B[1]
	D[18]	B[4]	B[2]
	D[19]	B[5]	B[3]
	D[20]	B[6]	B[4]
	D[21]	B[7]	B[5]
	D[22]	B[8]	B[6]
	D[23]	B[9]	B[7]
Byte3	D[24]	Don't care	
	D[25]	Don't care	
	D[26]	B[0]	
	D[27]	B[1]	
	D[28]	G[0]	
	D[29]	G[1]	
	D[30]	R[0]	
	D[31]	R[1]	

Notes 1. 30bpp RGB (10bit) is 4 byte mode, otherwise (24bpp RGB) 3byte mode

3.6 Power Sequence

3.6.1 LCD Driving circuit



Parameter	Value			Unit	Note
	Min	Typ	Max		
T1	0.5	-	20	ms	1
T2	0	-	-	ms	2
T3	400	-	-	ms	3
T4	100	-	-	ms	3
T5	3.0	-	-	s	4
T6	0	-	T2	ms	5
T7	0	-	-	ms	6
T8	0	-	-	ms	

Note :

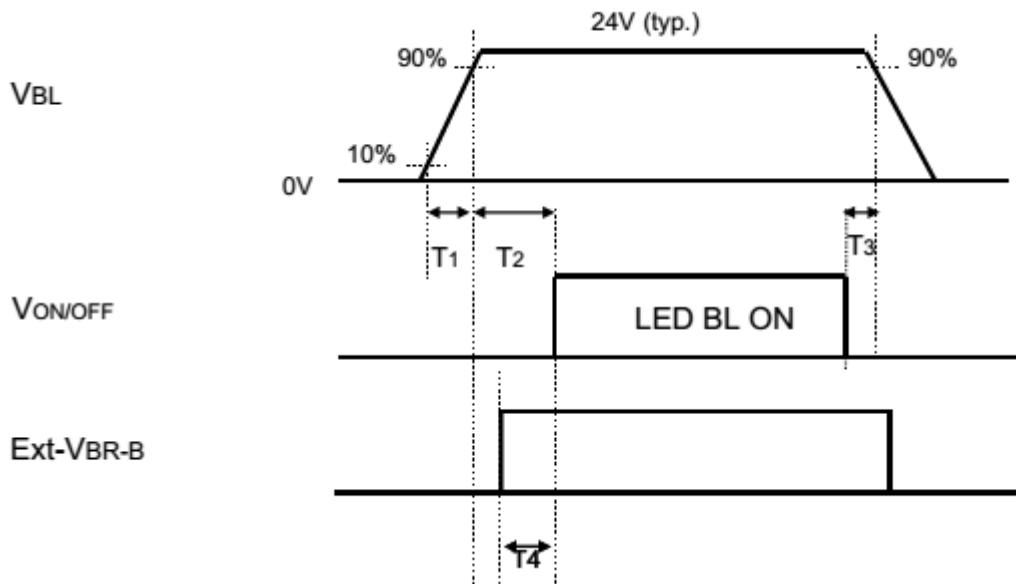
1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
2. If T2 is satisfied with specification after removing LVDS Cable, there is no problem.
3. The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
4. T5 should be measured after the Module has been fully discharged between power off and on period.
5. If the on time of signals (Interface signal and user control signals) precedes the on time of Power (V_{LCD}), it will be happened abnormal display. When T6 is NC status, T6 doesn't need to be measured.
6. It is recommendation specification that T7 has to be 0ms as a minimum value.

※ Please avoid floating state of interface signal at invalid period.

※ When the power supply for LCD (V_{LCD}) is off, be sure to pull down the valid and invalid data to 0V.

3.6.2 Sequence for LED Driver

Power Supply For LED Driver



3.6.3 Dip condition for LED Driver

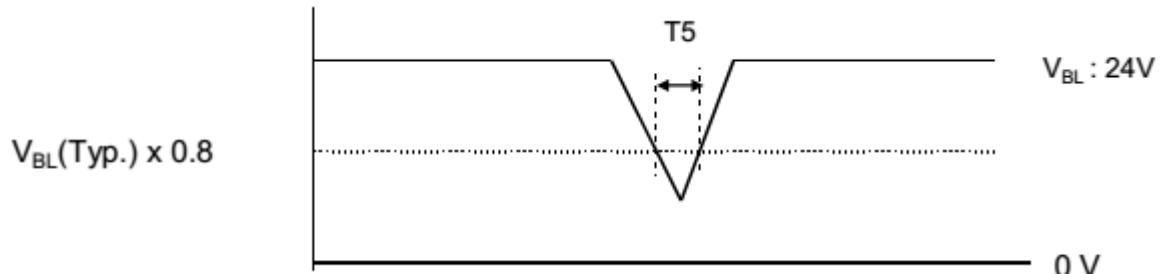


Table 11. Power Sequence for LED Driver

Parameter	Values			Units	Note
	Min	Typ	Max		
T1	20	-	-	ms	1
T2	500	-	-	ms	
T3	10		-	ms	
T4	0	-	-	ms	
T5	-	-	10	ms	$V_{BL}(\text{Typ.}) \times 0.8$

Note

1. T1 describes rising time of 0V to 24V and this parameter does not apply at restarting time. Even though T1 is over the specified value, there is no problem if I^2T spec of fuse is satisfied.

4 Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25\pm2^{\circ}\text{C}$.

The values are specified at distance 50cm from the LCD surface at a viewing angle of Φ and Θ equal to 0° .

FIG. 1 shows additional information concerning the measurement equipment and method.

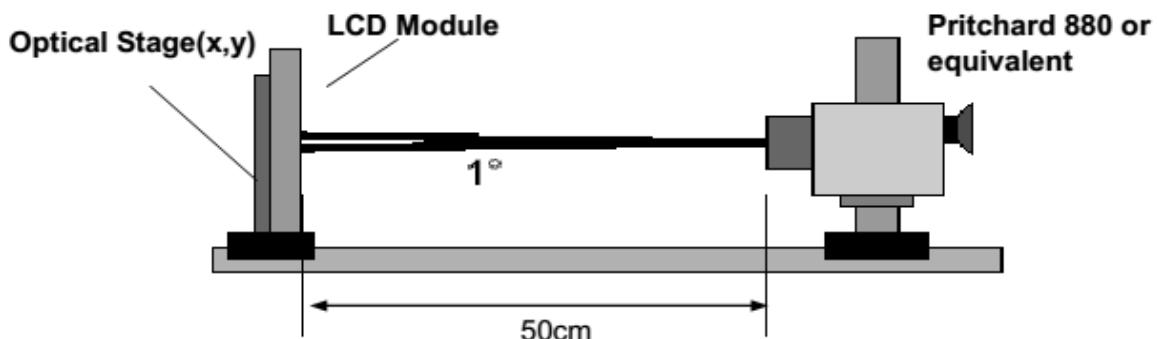


FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 10. OPTICAL CHARACTERISTICS

$T_a=25\pm2^{\circ}\text{C}$, $V_{LCD}=12.0\text{V}$, $f_V=60\text{Hz}$, $Dclk=74.25\text{MHz}$,

$EXTV_{BR-B}=100\%$

Parameter	Symbol	Value			Unit	notes
		Min	Typ	Max		
Contrast Ratio	CR	900	1200	-		1
Surface Luminance, white	L_{WH}	-	2400	3000		cd/m ²
Luminance Variation	δ_{WHITE}	9P	80	-		%
Response Time	Gray-to-Gray	G to G	-	8	ms	4
	Uniformity	$\delta_{G TO G}$	-	-		4
Color Coordinates [CIE1931]	RED	Rx		0.642		
		Ry		0.335		
	GREEN	Gx		0.311		
		Gy	Typ	0.596	Typ	
	BLUE	Bx	-0.03	0.152		+0.03
		By		0.062		
	WHITE	Wx		0.279		
		Wy		0.292		
Color Temperature				10,000		K
Color Gamut				68		%
Viewing Angle (CR>10)						
x axis, right($\phi=0^{\circ}$)	θ_r (x axis)	89	-	-		
x axis, left ($\phi=180^{\circ}$)	θ_l (x axis)	89	-	-		
y axis, up ($\phi=90^{\circ}$)	θ_u (y axis)	89	-	-	degree	5
y axis, down ($\phi=270^{\circ}$)	θ_d (y axis)	89	-	-		
Gray Scale		-	2.2	-		6

Notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

It is measured at center 1-point

2. Surface luminance is determined after the unit has been 'ON' and 1 Hour after lighting the backlight in a dark environment at $25 \pm 2^\circ\text{C}$. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2
3. The variation in surface luminance , WHITE is defined as :WHITE(9P) = Minimum (Lon1,Lon2~ Lon8, Lon9) / Maximum (Lon1,Lon2~ Lon8, Lon9)*100 Where Lon1 to Lon9 are the luminance with all pixels displaying white at 9 locations For more information, see the FIG. 2.
4. Response time is the time required for the display to transit from G(N) to G(M) (Rise Time, Tr_R) and from G(M) to G(N) (Decay Time, Tr_D). For additional information see the FIG. 3. ($\text{N} < \text{M}$)

※ G to G Spec stands for average value of all measured points. Photo Detector : RD-80S / Field : 2°

※ Gray to Gray Response time uniformity is Reference data. Appendix V

5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.
6. Gray scale specification Gamma Value is approximately 2.2. For more information, see the Table 11.

Table 11. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ)
L0	0.83
L63	0.27
L127	1.04
L191	2.49
L255	4.68
L319	7.66
L383	11.5
L447	16.1
L511	21.6
L575	28.1
L639	35.4
L703	43.7
L767	53.0
L831	63.2
L895	74.5
L959	86.7
L1023	100

Measuring point for surface luminance & measuring point for luminance variation.

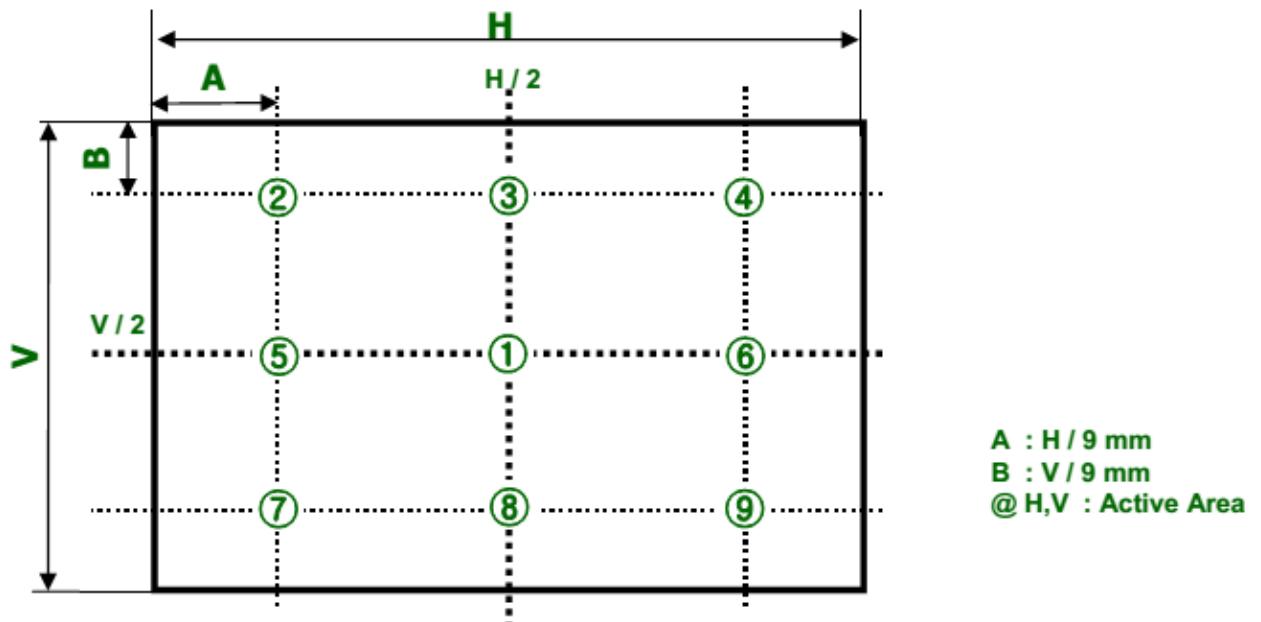


FIG . 2

Response time is defined as the following figure and shall be measured by switching the input signal for “Gray(N)” and “Gray(M)”.

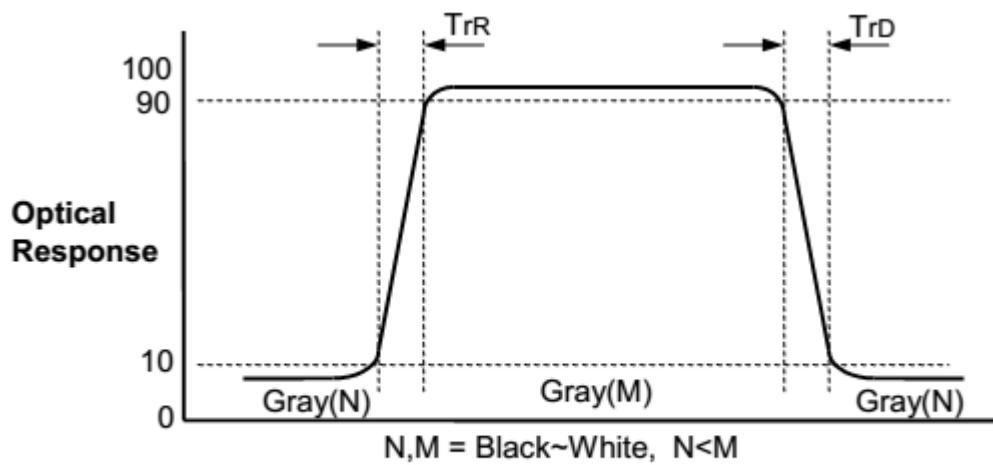


FIG. 3 Response Time

Dimension of viewing angle range

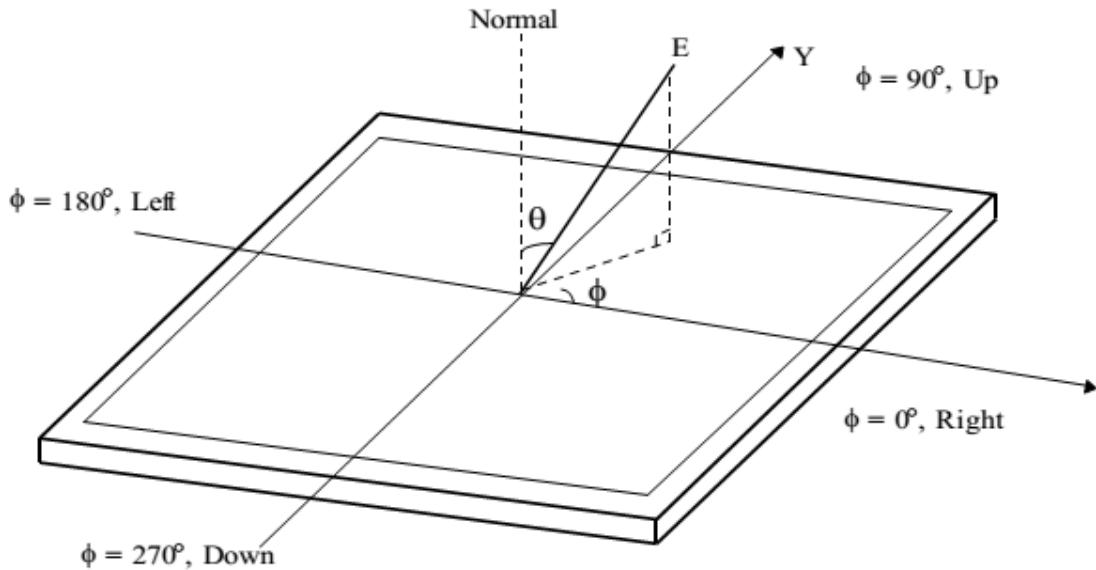
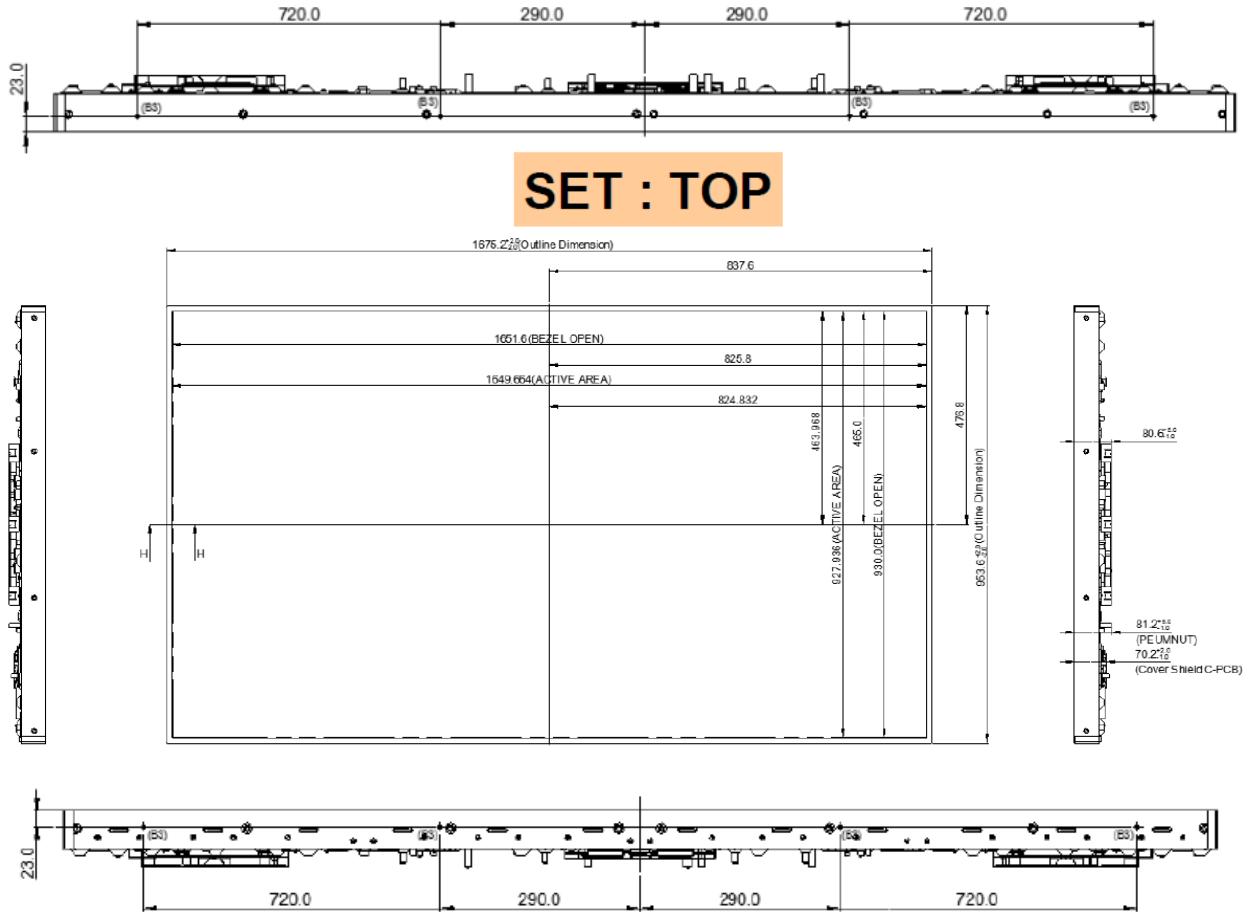


FIG. 4 Viewing Angle

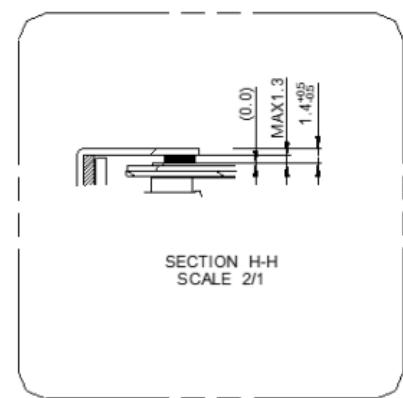
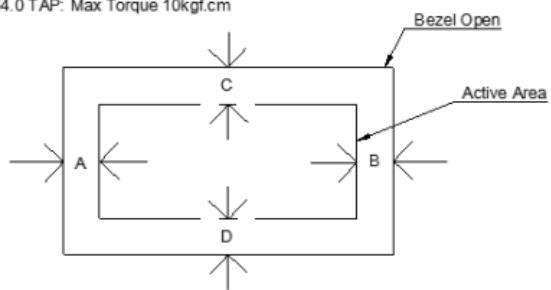
5 Mechanical Characteristics

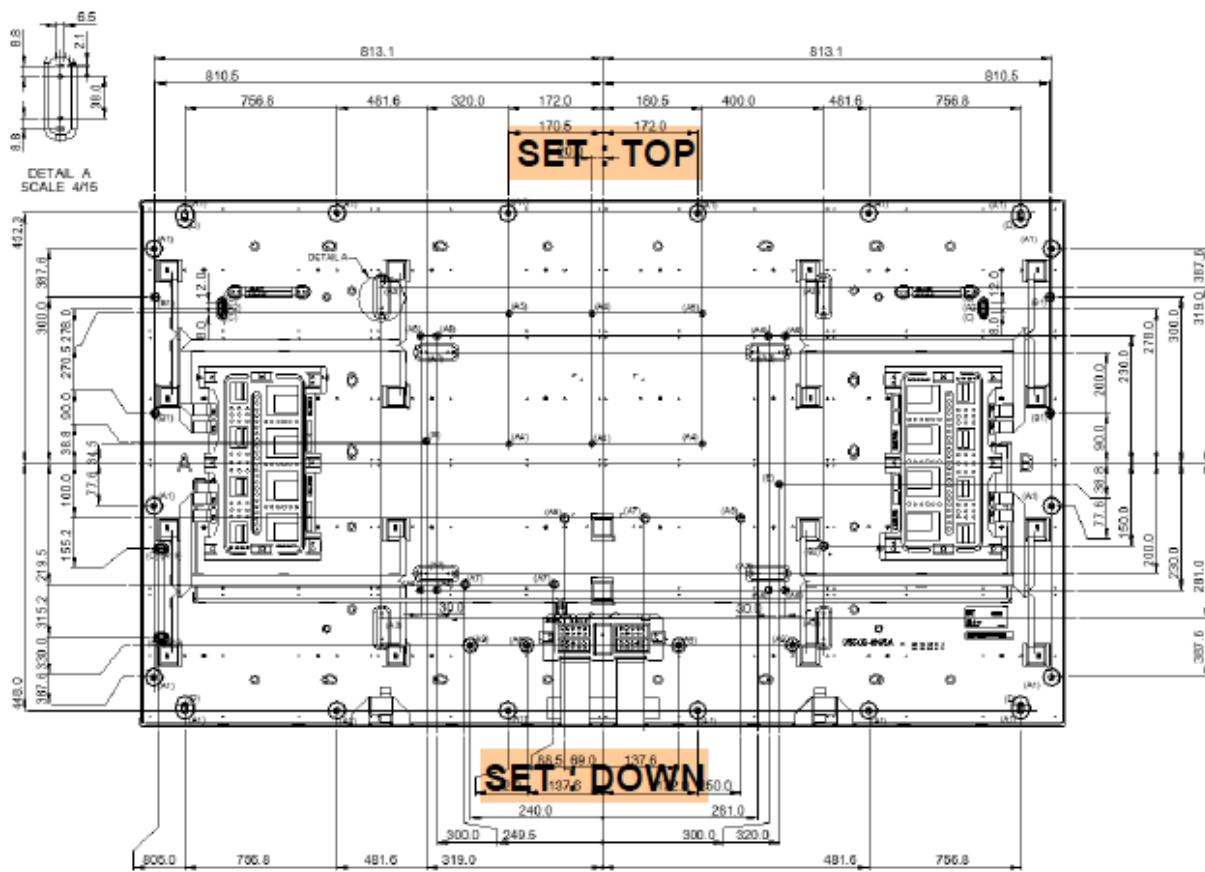


SET : DOWN

NOTES

1. UNSPECIFIED TOLERANCE IS ± 1.0MM
2. TILT AND PARTIAL DISPOSITION TOLERANCE OF DISPLAY AREA AS FOLLOWING.
- (1) Y-DIRECTION: |A-B| < 1.5
- (2) X-DIRECTION: |C-D| < 1.5
3. M3.0 TAP: Max Torque 5kgf.cm
- M4.0 TAP: Max Torque 10kgf.cm





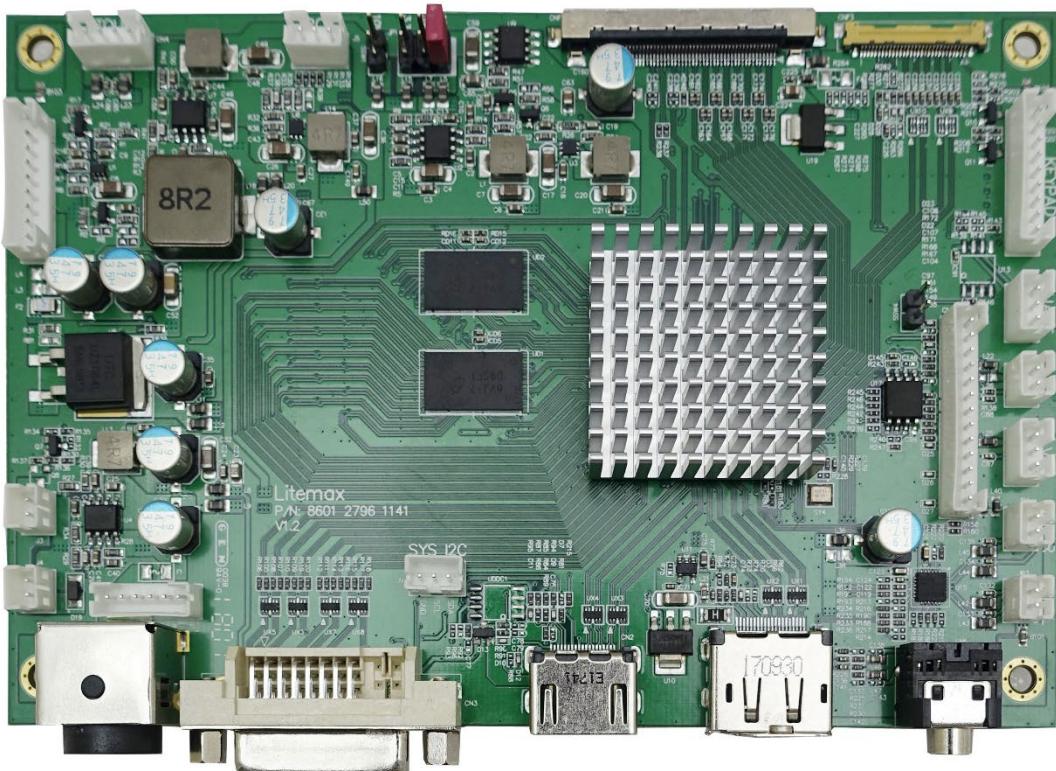
ITEM NO.	DESCRIPTION	TYPE	UDM Height (mm)	Max Depth (mm)	Torque (kgf.cm)
(A1)	M3	TAP	10.6	10.6	MAX 5.0
(A2)	M3	TAP	4.0	4.0	MAX 5.0
(A3)	M4	TAP	5.0	5.0	MAX 10.0
(A4)	M3	TAP	8.8	8.8	MAX 5.0
(A5)	M3	TAP	8.8	8.8	MAX 5.0
(A6)	M3	TAP	10.0	10.0	MAX 5.0
(A7)	M3	TAP	26.6	8.0	MAX 5.0
(A8)	M3	TAP	26.6	8.0	MAX 5.0
(A9)	M3	TAP	21.0	8.0	MAX 5.0
(A10)	M3	TAP	3.8	3.8	MAX 5.0
(B1)	M4	TAP	10.6	6.0	MAX 10.0
(B2)	M4	TAP	10.1	5.0	MAX 10.0
(B3)	M4	TAP	0.0	5.0	MAX 10.0
(C)	n 2.2	EMBO	Height 2.0mm		
(A5)	n 3.8	GUIDE PEMNUT	1st Height 8.0mm 2nd Height 1.2mm		
(A8)	n 3.6	GUIDE PEMNUT	1st Height 26.0mm 2nd Height 1.0mm		
(D)	n 5.0	EMBO	Height 2.0mm		
(E)	n 5.0	GUIDE PEMNUT	1st Height 10.0mm 2nd Height 2.0mm		

6 AD2796GDHP Board & OSD Functions

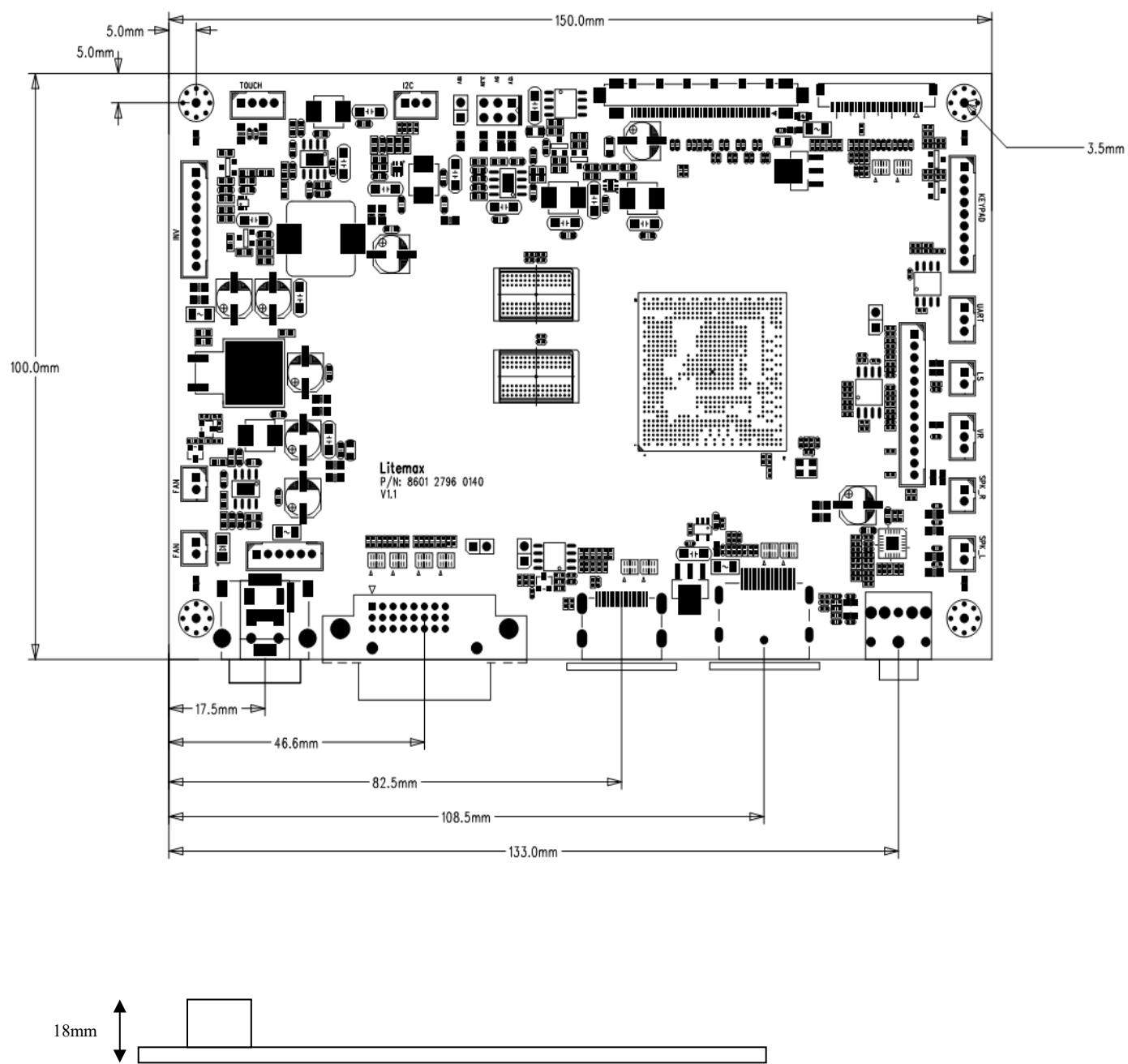
We developed this A/D board to support industrial high brightness and commercial applications. This A/D board has many functions. It has an external luminance sensor as an option to control brightness, fan rotation and RS232. Rev.1 is European RoHS compliant.

6.1 General Description

- Max resolution 4096x2160 60Hz
- One HDMI 2.0, supports 4096x2160 60Hz.
- One Display port 1.2, supports 4096x2160 60Hz.
- One DVI dual link, supports 4096x2160 30Hz.
- Support PIP
- OSD can be rotated 0deg/90deg/270deg
- Embedded MCU with ADC port for light sensor application.
- Support HDCP 1.4.
- Audio line in and speaker output.
- Embedded OSD.
- Support V-by-1, eDP panel.



6.2 Outline Dimension



6.3 AD2796DHP Board Pin Define

CNF1: Panel V-by-One connector

Pin	Function	Pin	Function
1	GND	27	HPD
2	X7P	28	8b/10b SEL
3	X7N	29	NC
4	GND	30	NC
5	X6P	31	NC
6	X6N	32	NC
7	GND	33	SCL
8	X5P	34	SDA
9	X5N	35	NC
10	GND	36	NC
11	X4P	37	NC
12	X4N	38	GND
13	GND	39	GND
14	X3P	40	GND
15	X3N	41	GND
16	GND	42	GND
17	X2P	43	NC
18	X2N	44	Panel power
19	GND	45	Panel power
20	X1P	46	Panel power
21	X1N	47	Panel power
22	GND	48	Panel power
23	X0P	49	Panel power
24	X0N	50	Panel power
25	GND	51	Panel power
26	LOCKN		

CN3: DVI-D Input Connector (24pin)

Pin	Function	Pin	Function	Pin	Function
1	TMDS Data2-	9	TMDS Data1-	17	TMDS Data0-
2	TMDS Data2+	10	TMDS Data1+	18	TMDS Data0+
3	Shield	11	Shield	19	Shield
4	TMDS Data4-	12	TMDS Data3-	20	TMDS Data5-
5	TMDS Data4+	13	TMDS Data3+	21	TMDS Data5+
6	DDC Clock	14	+5V Power	22	Shield
7	DDC Data	15	Power ground	23	TMDS Clock+
8	Vertical SYNC	16	Hot Plug Detect	24	TMDS Clock-

CN5: Analog RGB Input connector (13pin connector)

Pin	Function	Pin	Function
1	SDA	8	BLUE_RTN
2	SCL	9	BLUE
3	GND	10	GREEN_RTN
4	+5V	11	GREEN
5	GND	12	RED_RTN
6	VSYNC	13	RED
7	HSYNC		

CN2: HDMI Connector (19pin HDMI)

Pin	Function	Pin	Function	Pin	Function
1	TMDS Data2+	9	TMDS Data0-	17	GND
2	Shield	10	TMDS Clock+	18	HDMI +5V
3	TMDS Data2-	11	Shield	19	HPD
4	TMDS Data1+	12	TMDS Clock-		
5	Shield	13	CEC		
6	TMDS Data1-	14	NC		
7	TMDS Data0+	15	HDMI_SCL		
8	Shield	16	HDMI_SDA		

CN1: DISPLAY PORT Connector (20pin DP)

Pin No.	Function	Pin No.	Function
1	LAN_C_D3N	11	GND
2	GND	12	ML_LANE0_P
3	LAN_C_D3P	13	GND
4	ML_LANE2_N	14	GND
5	GND	15	AUX_CH_P
6	ML_LANE2_P	16	GND
7	ML_LANE1_N	17	AUX_CH_N
8	GND	18	Hot plug detect
9	ML_LANE1_P	19	GND
10	ML_LANE0_N	20	DP +5V

JS2: Power DIN(Power Din 4 Pin)

Pin	Function	Pin	Function
1	Power Input	3	GND
2	Power Input	4	GND

JS1: Power Jack

Pin No.	Function	Pin No.	Function
1	Power Input	2	GND
3	GND		

J2: Power input connector (Wafer 6 pin 2.0mm)

Pin	Function	Pin	Function
1	Power Input note1	4	GND
2	Power Input note1	5	GND
3	Power Input note1	6	GND

Not 1:Power input has tow different versions,12V power input version and 24V input version
don't mistake.

CN4: Reserved (5V/12V)(4PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	5Vdc	2	GND
3	12Vdc	4	GND

J1: Backlight Power and Control (Wafer 2.0mm pitch 9pin)

Pin	Function	Pin	Function
1	DC/PWM SEL	6	GND
2	Enable	7	12V (Note3)
3	Dimming	8	12V (Note3)
4	GND	9	12V (Note3)
5	GND		

Note3: Pin 7,8,9 are for 12V version only. If you choose 24V version, these 3 pin are NC.

J3,J4: FAN (Wafer 2.0mm pitch 2pin)

Pin No.	Function	Pin No.	Function
1	FAN(+)	2	GND

JP2: Key Pad (Wafer 2.0mm pitch 9pin)

Pin No.	Function	Pin No.	Function
1	POWER KEY	6	MENU KEY
2	GREEN LED	7	AUTO KEY
3	RED LED	8	GND
4	DOWN KEY	9	GND
5	UP KEY		

J6: Keypad (Wafer 2.0mm pitch 3pin)

Pin No.	Function	Pin No.	Function
1	3,3VDC	2	VR OUT
3	GND		

J7: Ambient Light sensor (Wafer 2.0mm pitch 2pin)

Pin No.	Function	Pin No.	Function
1	5VDC	2	Sensor Out

JP1: PANEL Power selection (2.54mm pitch 2x3 Jump) (Note4)

Pin No.	Function	Pin No.	Function
1-2	12V	5-6	3.3V
3-4	5V		

SSW1: Panel power selection (2.54mm pitch 2x1 jump) (Note4)

Pin No.	Function		
1-2 close	10V+		

Note4: Panel power selection can only be chosen one. If you short multi jump at the same time, it will damage product.

JP3, JP4: Speaker output (Wafer 2.0mm pitch 2pin)

Pin No.	Function	Pin No.	Function
1	SPK+	2	SPK-

J8: UART (Wafer 2.0mm pitch 3pin)

Pin No.	Function	Pin No.	Function
1	TX	3	GND
2	RX		

J5: I²C (Wafer 2.0mm pitch 3pin)

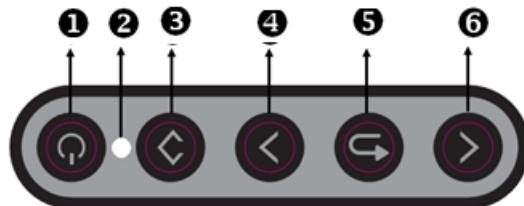
Pin No.	Function	Pin No.	Function
1	SDA SCL	3	GND

CNF3: eDP

Pin	Function	Pin	Function
1	GND	16	GND
2	NC	17	AUX_P
3	GND	18	AUX_N
4	GND	19	GND
5	L3N	20	HPD
6	L3P	21	GND
7	GND	22	NC
8	L2N	23	NC
9	L2P	24	GND
10	GND	25	NC
11	L1N	26	Panel power
12	L1P	27	Panel power
13	GND	28	Panel power
14	L0N	29	Panel power
15	L0P	30	Panel power

6.4 OSD Function

MEMBRANE CONTROL BUTTOM



① **Key:** (Power) function key

Press the power switch will turn the monitor on.

Press it again to turn the monitor off.



② **LED Status:** Power ON-Green / Power off-No./Power Saving-Orange



③ **Key:** (Menu / Enter) function key

When OSD is on. Press this button to the OSD “Main Menu”,

When OSD is off. Press this button to “Enter>Select”.



④ **Key:** Increase item number or value of the selected item.

When OSD is off, it is hot key for input switch between DVI, HDMI and DP.



⑤ **Key:** (Exit/Return) function key

It also used for return to previous menu for sub-menu.

Or exit OSD when in Main Menu



⑥ **Key:** Decrease item number or item value when OSD is on.

When OSD is off, it is Brightness hot key

Screen Adjustment Operation Procedure

1. Entering the screen adjustment

The setting switches are normally at stand-by. Push the **Menu Key** once to display the main menu of the screen adjustment. The adjustable items will be displayed in the main menu.

2. Entering the settings



Use the **Down Key**  and **Up Key**  buttons to select the desired setting icon and push the **SELECT** button to enter sub-menu.

3. Change the settings



After the sub-menu appears, use the **Down Key**  and **Up Key**  buttons to change the setting values.

4. Save



After finishing the adjustment, push the  button to memorize the setting.

5. Return & Exit the Main Menu

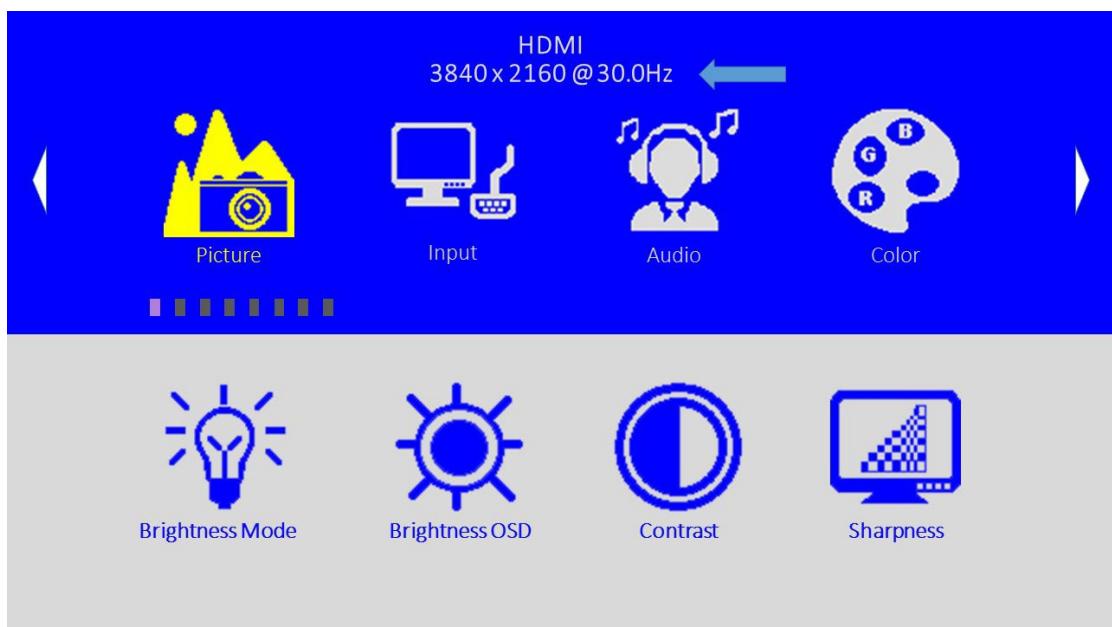
Exit the screen adjustment; push the “MENU” button. When no operation is done around 30 sec (default OSD timeout), it goes back to the stand-by mode and no more switching is accepted except MENU to restart the setting.

6.5 OSD Menu

OSD

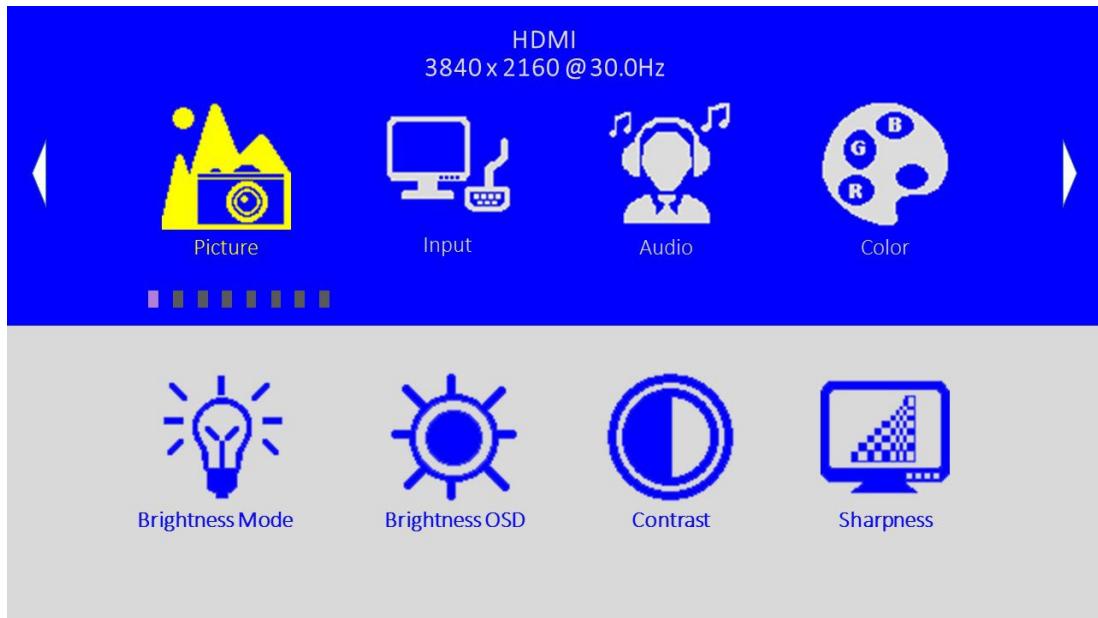
Here are some instructions for you to use the OSD (On Screen Display). By pressing the "Menu", you will see the below picture.

Timing shows resolution, H-frequency, and V-frequency of the panel. This 2 information is not changeable by user.



Picture Icon

There are 4 subpages inside the OSD manual, Brightness Mode, Brightness OSD, Contrast, and Sharpness.



Picture: press "Menu" into subpage



Brightness Mode: press "Menu" you will see 2 selections



Brightness OSD



Brightness LS(Ambient light sensor).



There are **Brightness OSD** and **Brightness Offset**



If is Brightness Mode, you can go into adjust the brightness. Press "left" you can dim down the brightness to "0", while press "right" you can increase the brightness to "100".



If is Brightness LS, you can adjust min. luminance to fit your application



Contrast: Press "Menu" you can adjust the contrast from "0" to "100" by pressing the "left" and "right".

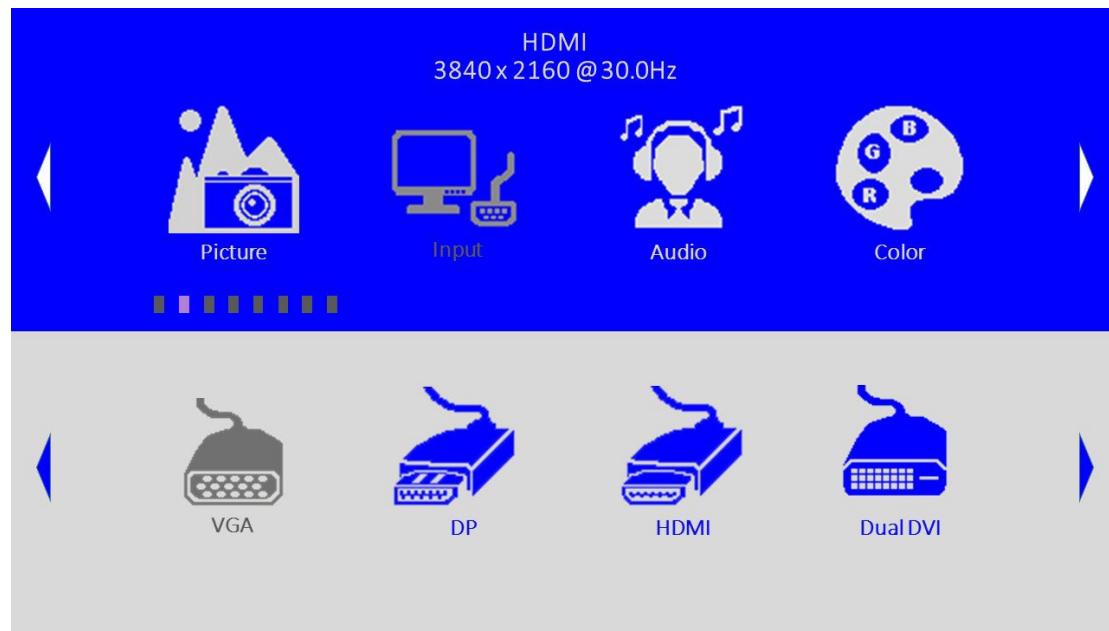


Sharpness: Press "Menu" you can adjust the contrast from "0" to "4" by Pressing the "left" and "right".

Input Icon



Subpage



There are 4 subpages inside the OSD manual, Auto, DP, HDMI Dual Link DVI-D, Contrast, and Sharpness.



Audio: press ''Menu'' you will see 4 selections



Auto



DP:

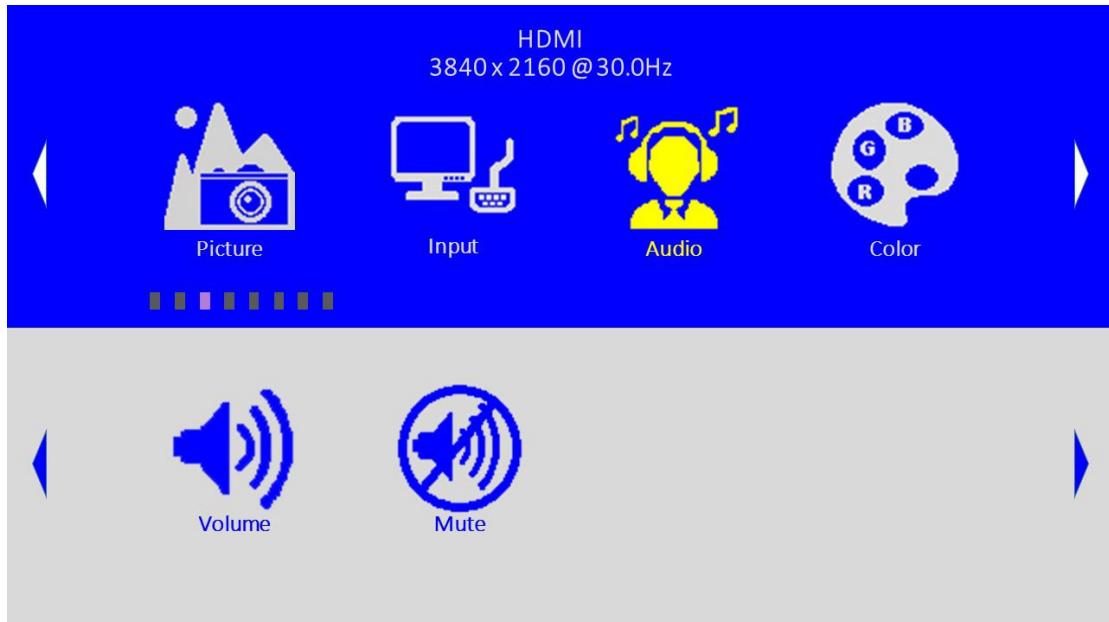


HDMI



Dual Link DVI-D

Audio Icon



There are 2 options for “Audio” subpage.



Audio: press “Menu” you will see 2 selections

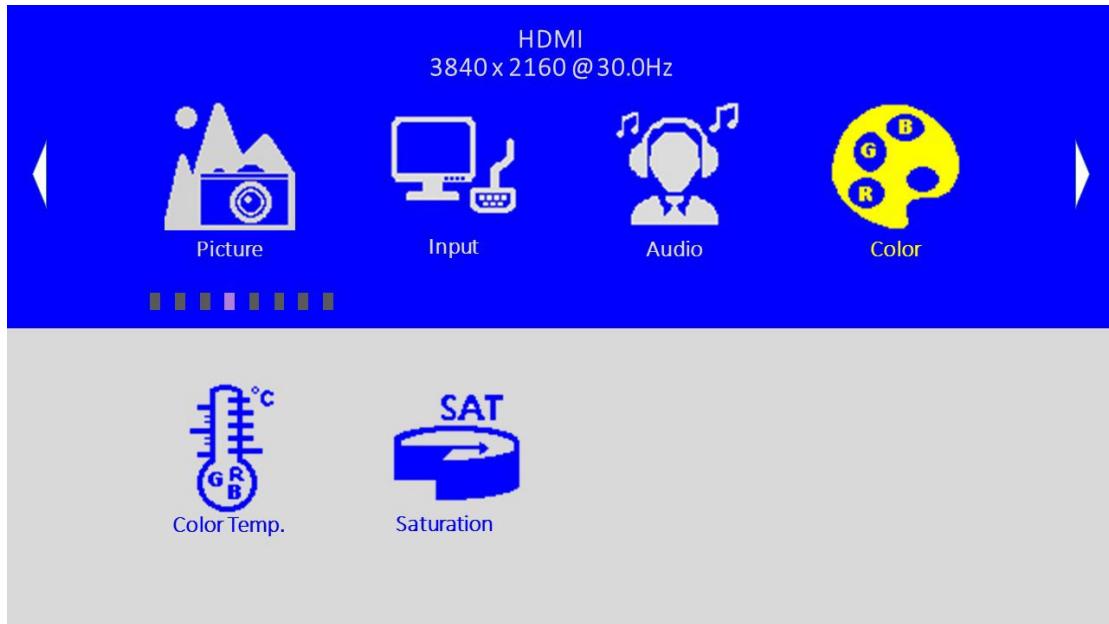


Audio Volume: Press “Menu” you can adjust the contrast from “0” to “100” by pressing the “left” and “right”.



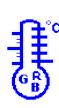
Mute: You can mute the speaker by pressing this option to ON or OFF

Color Icon



There are 2 options for “Color” subpage.

 **Color:** press “Menu” you will see 2 selections

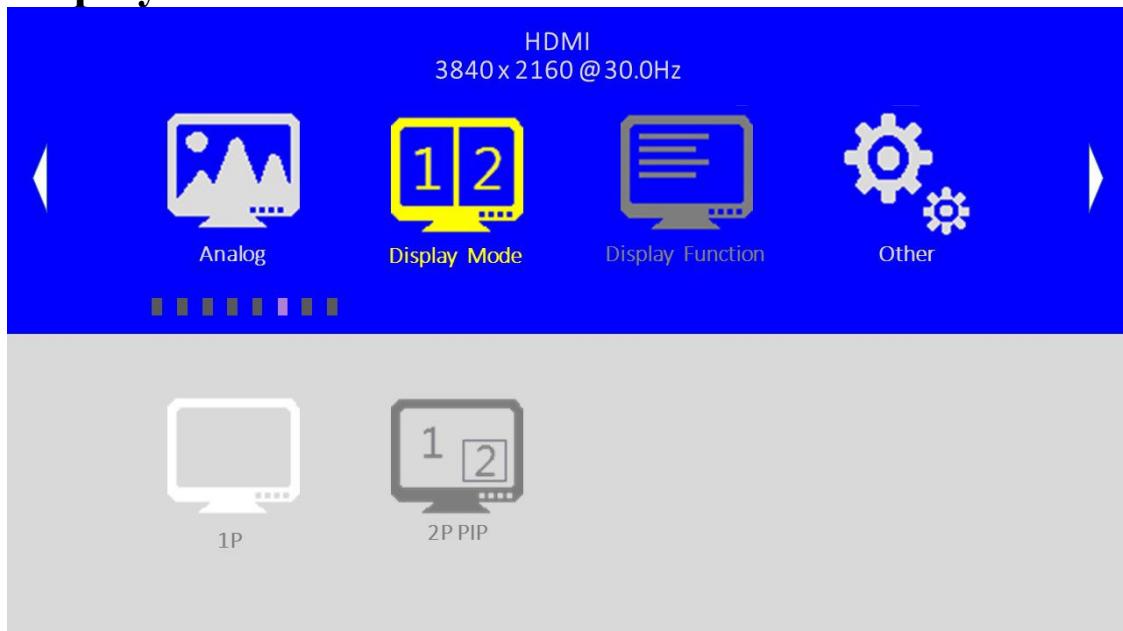


Temperature: You can have 3 options in this selection.



Saturation: you can go into adjust the saturation. Press “Left” you can dim down the saturation to “0”, while press “Right” you can increase the brightness to “100”.

Display Mode Icon

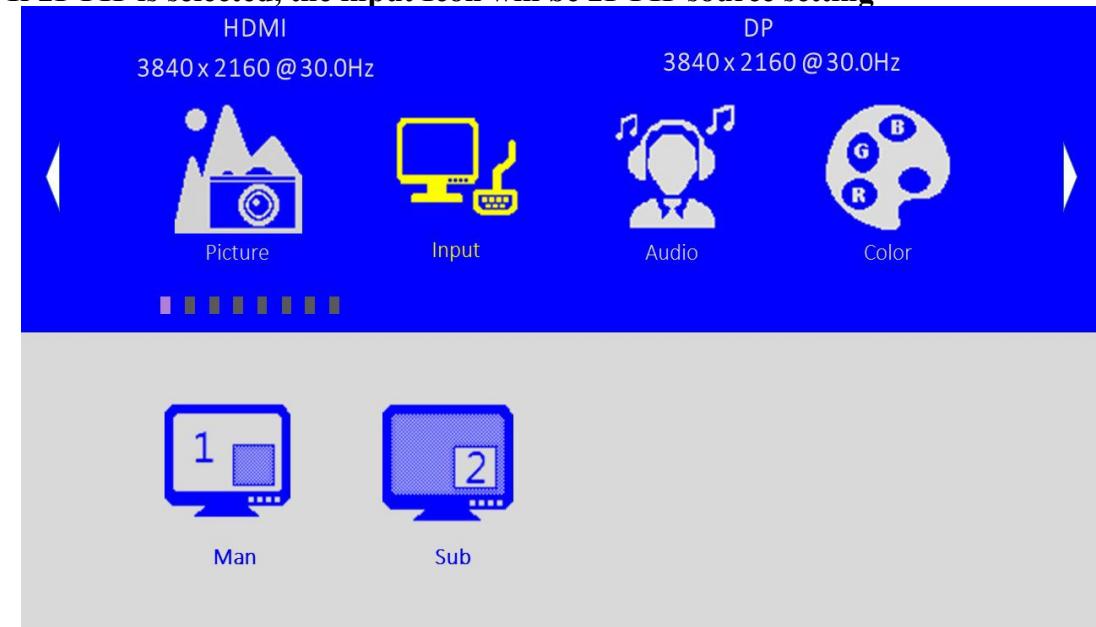


There are 2 options for “Display Mode” subpage.

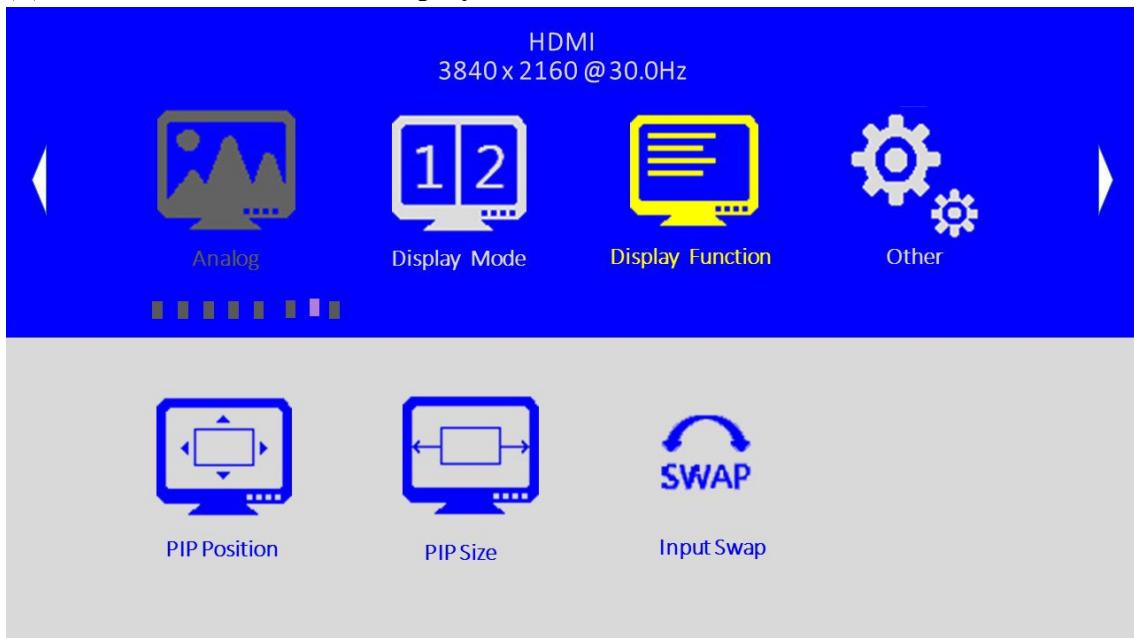
Display Mode: press “Menu” you will see 2 selections

- 1P**: Only Main Image
- 2P PIP**: Main Image & Sub Image

If 2P PIP is selected, the input Icon will be 2P PIP source setting



★If 2P PIP is selected, the Display Function Icom will enable.



Display Function Mode: press "Menu" you will see 3 selections



PIP Position: You can have 5 options in this selection.



PIP Size: Sub-picture zoom in/out

you can adjust the Sub-picture from "0" to "10" by pressing the "left" and "right".

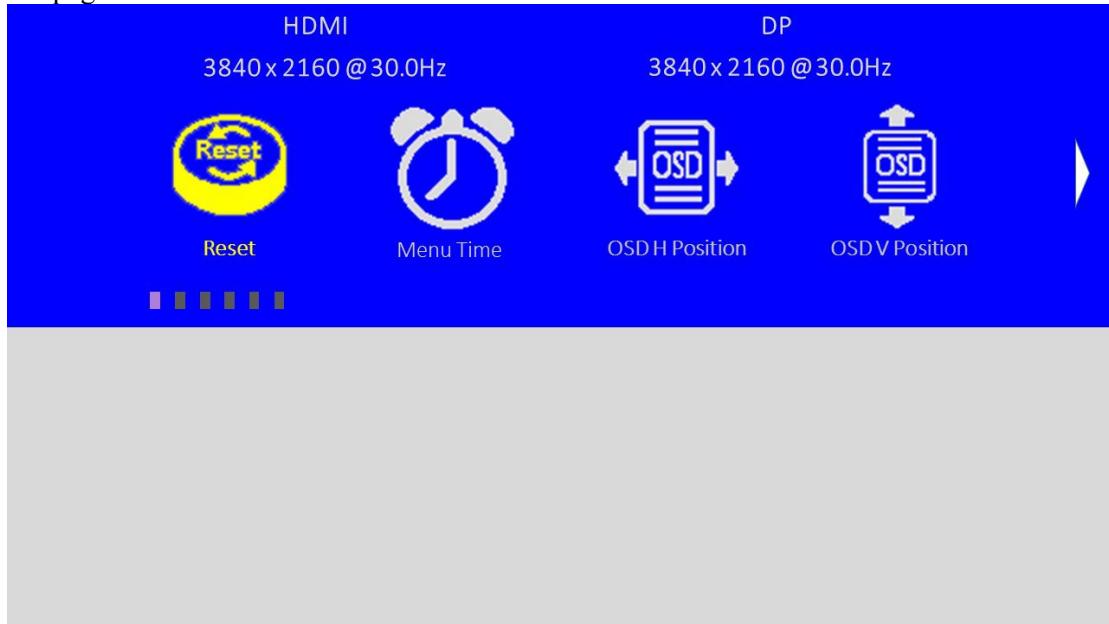


SWAP: Switch Main or Sub-picture

Other Icon



Subpage Icon





There are 6 options for “Other” subpage.



Other Mode: press “Menu” you will see 6 selections



Reset: By pressing this, the screen will be back to the default settings.



Menu Time: You can selection the time of OSD from 10 sec. to 60 sec.



OSD H Position: You can move the OSD horizontally.



OSD V Position: You can move the OSD Vertically.



Transparency: You can selection the transparency of OSD from 0 to 255.



Rotate: You can rotate the OSD to 0deg/90deg/270deg for panel installation

7 Precautions

7.1 Handling Precautions

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel
- (5) because the polarizer is very soft and easily scratched.
- (6) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (7) Wipe off water droplets or oil immediately. Staining and discoloration may occur if
- (8) they left on panel for a long time.
- (9) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (10) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (11) Do not disassemble the module.
- (12) Do not pull or fold the lamp wire.
- (13) Pins of I/F connector should not be touched directly with bare hands.

7.2 Storage Precautions

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

7.3 Operation Precautions

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

8 Disclaimer

All information in this document are subject to change, please constant LiteMax for any new design.