

LITEMAX

DLF/DLH8500-N

Sunlight Readable 85" LED B/L LCD

User Manual

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Record of Revision

Version and Date	Page	Old Description	New Description	Remark
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1 General Description

The **DLF/DLH8500-N** is a 85 inch industrial grade sunlight readable LCD, with high brightness 2000 nits, 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 Key Features

- Sunlight readable
- High brightness 2000 nits
- Resolutions: 3840x2160
- Local Dimming 84zone
- LCD Blackening Defect Free (Hi-Tni 110°C)
- Aspect ratio of 16:9
- Wide temperature (-30°C~50°C)
- Low power consumption
- BL MTBF: 50,000 hours

1.2 General Specifications

Model Name	DLF/DLH8500-N
Description	85" TFT LCD, 2000nits LED Backlight, 3840x2160
Screen Size	85"
Display Area (mm)	1872 (H) x 1053(V) mm
Brightness	2000 cd/m ²
Resolution	3840 x 2160
Aspect Ratio	16:9
Contrast Ratio	91000 : 1
Pixel Pitch (mm)	0.4875(H) x 0.4875(V)
Pixel Pre Inch (PPI)	52
Viewing Angle	178°(H),178°(V)
Color Saturation (NTSC)	91%
Display Colors	1.07G
Response Time (Typical)	12ms
Panel Interface	V by One
Input Interface	DVI-D,HDMI,DP
Input Power	AC100~240V
Power Consumption	1086W (1089W with AD Board)
OSD Key	5 Keys (Power Switch, Menu, +, -,Exit)
OSD Control	Brightness, Color, Contrast, Auto Turing, H/V Position...etc
Dimensions (mm)	1910.8 x 1091.8 x 49
Bezel Size(U/B/L/R)	19.4/19.4/19.4/19.4 mm
Weight (Net)	35kg
Operating Temperature	-30°C ~ 50°C
Storage Temperature	-30°C ~ 70°C

DLF= Panel + LED Driving Board

DLH= Panel + LED Driving Board + AD Control Board +Thermal Control Board

1.3 Absolute Maximum Ratings

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

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-30	+50	°C	(1), (3), (4)
Operating Ambient Temperature	T _{OP}	-30	+50	°C	(1), (3), (4)
Panel Surface Temperature	P _{ST}	-	+80	°C	(2)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ($T_a \leq 40^\circ\text{C}$).

(b) Wet-bulb temperature should be 39°C Max.

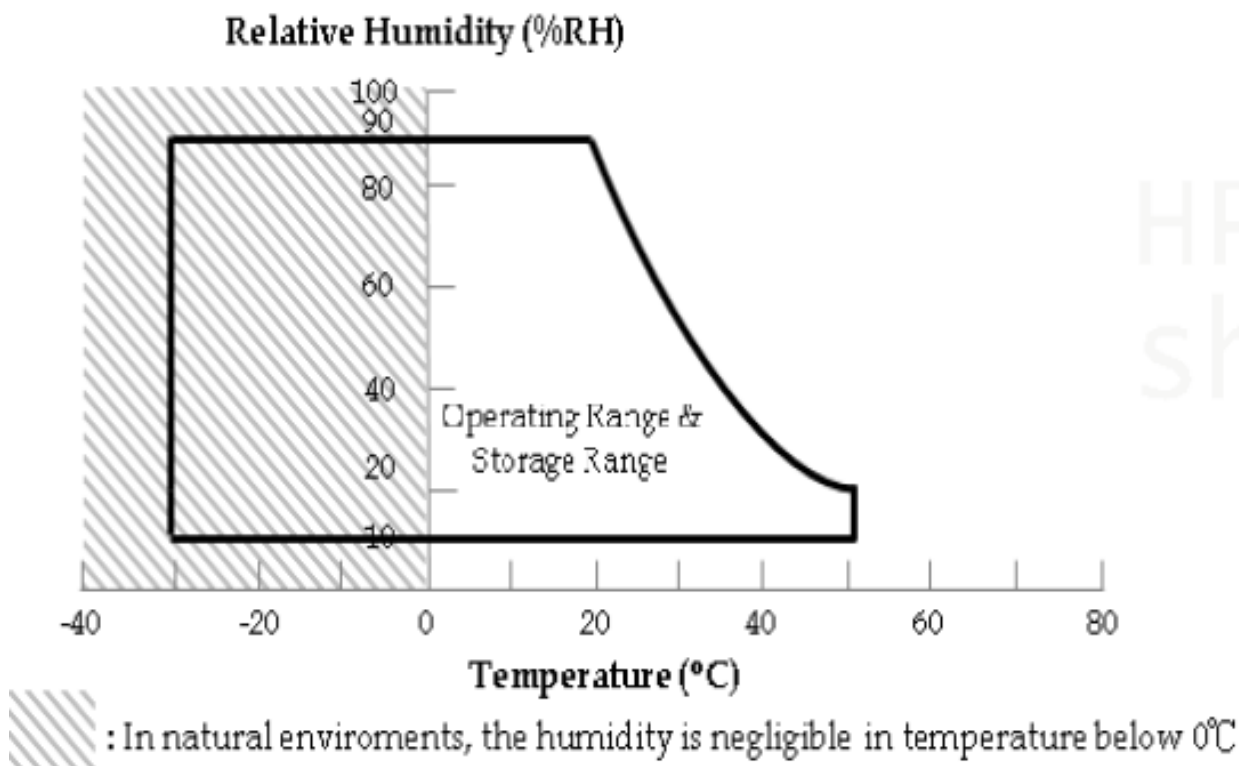
(c) No condensation.

Note (2) Surface temperature is measured at 50°C Dry condition.

Note (3) The specified temperature range is determined by the design of the product module. When integrated with the customer's system, it is imperative to control environmental conditions within this prescribed range; otherwise, the operational capability of the product cannot be guaranteed.

Note (4) Low temperature start can only be performed when the ambient temperature is greater than -20°C .

Response time depends on the temperature. (In lower temperature, it becomes longer.)



2 Electrical Characteristics

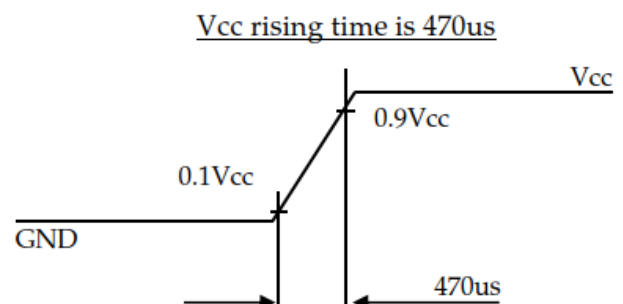
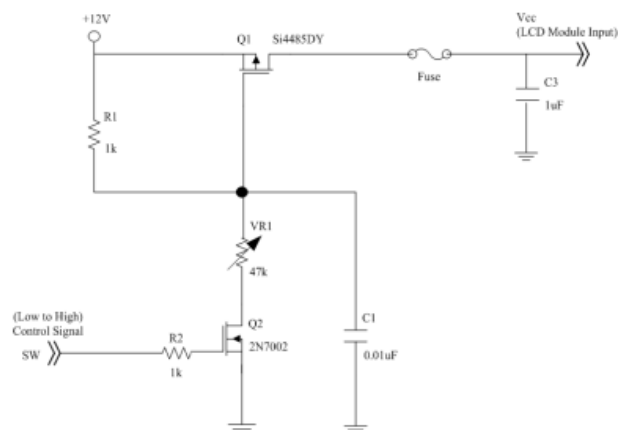
2.1 TFT LCD Module

(Ta = 25 ± 2 °C)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	10.8	12	13.2	V	(1)
Rush Current		I _{RUSH}	—	—	5.33	A	(2)
Power Consumption	White Pattern	P _T	—	37.95	41.745	W	(3)
	Black Pattern	P _T	—	15.787	17.367	W	
	Horizontal Stripe	P _T	—	37.536	41.29	W	
Power Supply Current	White Pattern	—	—	3.648	3.952	A	(3)
	Black Pattern	—	—	1.512	1.638	A	
	Horizontal Stripe	—	—	3.6	3.9	A	
VbyOne HS	Differential Input High Threshold Voltage	VLVTH			+50	mV	
	Differential Input Low Threshold Voltage	VLVTL	-50			mV	
	Differential Input Resistor	RRIN	80	100	120	ohm	
CMOS interface	Input High Threshold Voltage	VIH	2.7		3.6	V	
	Input Low Threshold Voltage	VIL	0		0.7	V	

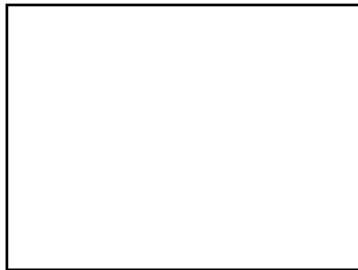
Note (1) The module should be always operated within the above ranges. The ripple voltage should be controlled under 10% of V_{CC} (Typ.)

Note (2) Measurement condition :



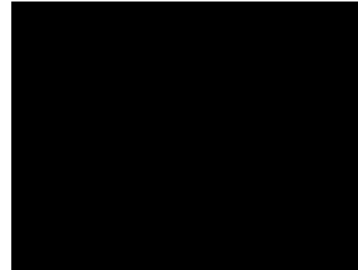
Note (3) The specified power supply current is under the conditions at $V_{cc} = 12\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



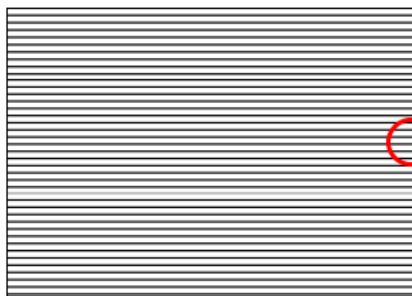
Active Area

b. Black Pattern



Active Area

c. Horizontal Stripe



3 Input Terminal PIN Assignment

3.1 TFT LCD Module

CNC08 Connector Pin Assignment: [5-05162216-1(XDYT),FF01-42T-5131(FCN)]

Pin	Name	Description	Note
1	N.C.	No Connection	(4)
2	N.C.	No Connection	
3	N.C.	No Connection	
4	N.C.	No Connection	
5	N.C.	No Connection	
6	N.C.	No Connection	
7	N.C.	No Connection	
8	N.C.	No Connection	
9	N.C.	No Connection	(4)
10	GND	Ground	
11	GND	Ground	
12	GND	Ground	
13	GND	Ground	
14	GND	Ground	
15	N.C.	No Connection	(4)
16	N.C.	No Connection	(4)
17	N.C.	No Connection	(4)
18	N.C.	No Connection	(4)
19	N.C.	No Connection	(4)
20	N.C.	No Connection	(4)
21	N.C.	No Connection	(4)
22	LD_EN	Local Dimming Mode Enable.	
23	N.C.	No Connection	(4)
24	N.C.	No Connection	(4)
25	HTPDN	No Connection or ground	(6)
26	LOCKN	Lock detect output, Open drain.	
27	GND	Ground	
28	RX0N	1 ST Pixel Negative VbyOne differential data input in area A. Lan 0	(1)

29	RX0P	1 ST Pixel Positive VbyOne differential data input in area A. Lan 0	(1)
30	GND	Ground	
31	RX1N	2 ND Pixel Negative VbyOne differential data input in area A. Lan 1	(1)
32	RX1P	2 ND Pixel Positive VbyOne differential data input in area A. Lan 1	
33	GND	Ground	
34	RX2N	3 RD Pixel Negative VbyOne differential data input in area A. Lan 2	(1)
35	RX2P	3 RD Pixel Positive VbyOne differential data input in area A. Lan 2	
36	GND	Ground	
37	RX3N	4 TH Pixel Negative VbyOne differential data input in area A. Lan 3	(1)
38	RX3P	4 TH Pixel Positive VbyOne differential data input in area A. Lan 3	
39	GND	Ground	
40	RX4N	5 TH Pixel Negative VbyOne differential data input in area A. Lan 4	(1)
41	RX4P	5 TH Pixel Positive VbyOne differential data input in area A. Lan 4	
42	GND	Ground	
43	RX5N	6 TH Pixel Negative VbyOne differential data input in area A. Lan 5	(1)
44	RX5P	6 TH Pixel Positive VbyOne differential data input in area A. Lan 5	
45	GND	Ground	
46	RX6N	7 TH Pixel Negative VbyOne differential data input in area A. Lan 6	(1)
47	RX6P	7 TH Pixel Positive VbyOne differential data input in area A. Lan 6	
48	GND	Ground	
49	RX7N	8 TH Pixel Negative VbyOne differential data input in area A. Lan 7	(1)
50	RX7P	8 TH Pixel Positive VbyOne differential data input in area A. Lan 7	
51	GND	Ground	

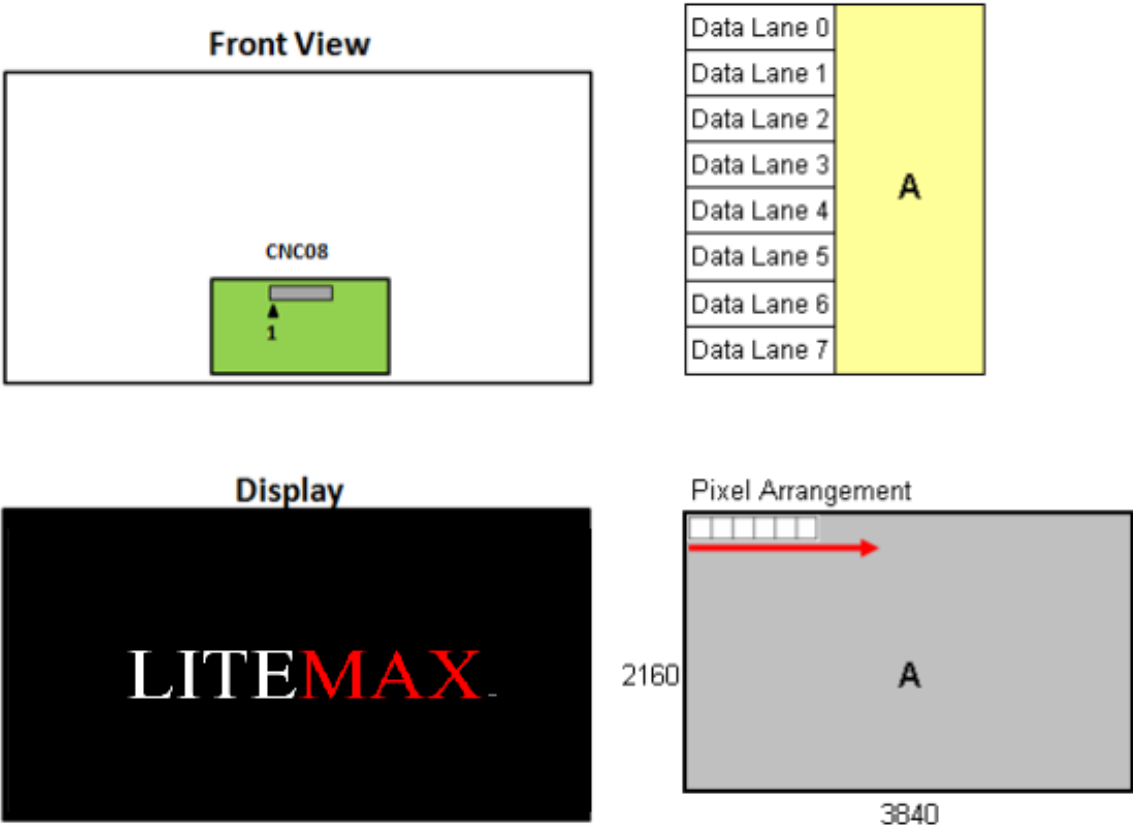
CNC07 Connector Pin Assignment: (CI0105M1HR0-LA-NH, JH2-D4-053N)

Matting connector: [PHR5(JST)]

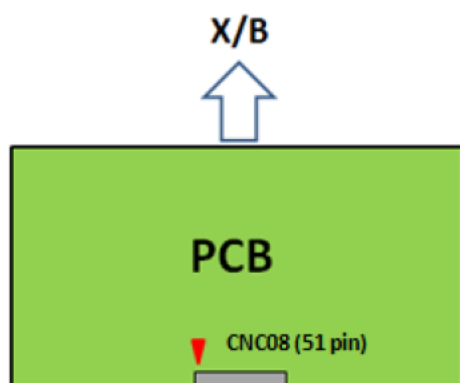
1	GND	Ground	
2	GND	Ground	
3	Vin	Power input (+12V)	(5)
4	Vin	Power input (+12V)	
5	Vin	Power input (+12V)	

Note (1) V-by-One HS Data Mapping

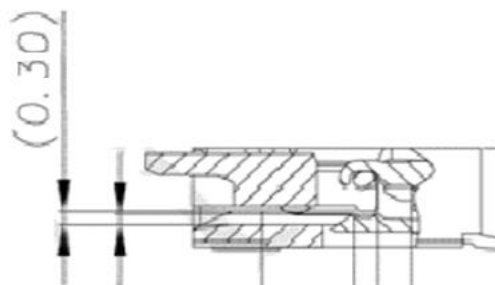
Area	Lane	Data Stream
A	Lane 0	1, 9, 17,, 3825, 3833
	Lane 1	2, 10, 18,, 3826, 3834
	Lane 2	3, 11, 19,, 3827, 3835
	Lane 3	4, 12, 20,, 3828, 3836
	Lane 4	5, 13, 21,, 3829, 3837
	Lane 5	6, 14, 22,, 3830, 3838
	Lane 6	7, 15, 23,, 3831, 3839
	Lane7	8, 16, 24,, 3832, 3840



Note (2) V-by-One HS connector pin order defined as follows



Note (3) V-by-One connector mating dimension range request is 0.27mm~0.33mm as below

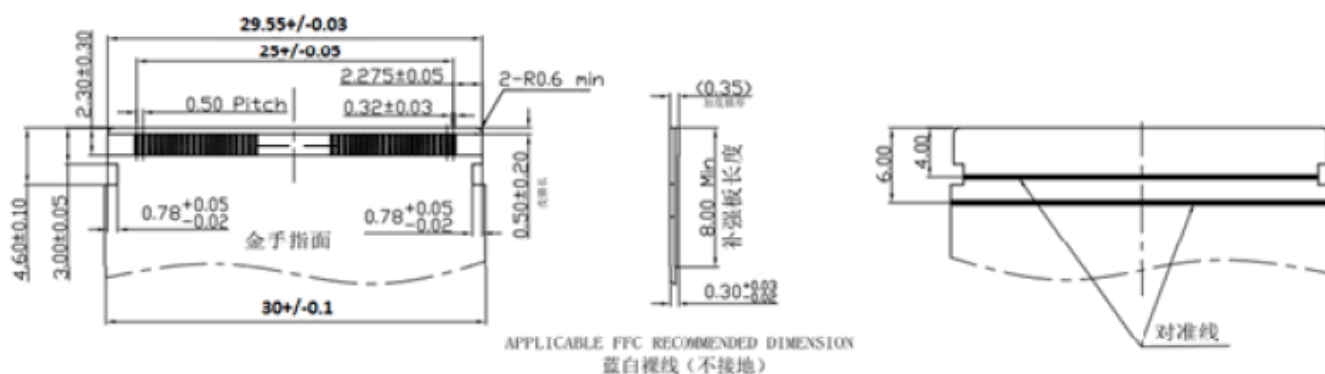


Note (4) Reserved for internal use. Please leave it open.

Note (5) Power input (+12V), Please check the current rating of FFC cable to meet the power consumption requirement.

Note (6) This pin connect to ground internal, but it could be open

Note (7) V-by-One connector Recommend Mating FFC drawing as below.



3.2 Color Data Input Assignment

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																													
		Red										Green										Blue									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
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	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red (0) / Dark	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
	Red (1)	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
	Red (2)	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
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	Red (1021)	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Red (1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green (0) / Dark	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
	Green (1)	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
	Green (2)	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
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	Green (1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0
	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Green (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Blue	Blue (0) / Dark	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
	Blue (1)	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
	Blue (2)	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
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	Blue (1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1
	Blue (1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
Blue (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage · 1: High Level Voltage

3.3 Input Signal Timing Specifications

The input signal timing specifications are shown as the following table and timing diagram.

(Ta = 25± 2°C)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
VbyOne Receiver	Intra-Pair skew		-0.3		0.3	UI	(2)
	Inter-Pair skew		- 5		5	UI	(3)
	Spread spectrum modulation range	Felkin_mod	1/Tc-0.5%	—	1/Tc+0.5%	MHz	(4)
	Spread spectrum modulation frequency	F _{SSM}	—	—	30	KHz	

Input Timing Spec For UHD, Frame Rate =50Hz

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame rate	2D mode		Fr5	47	50	53	Hz	(5),(6)
Horizontal Frequency			Fh	122.8	135	140	KHz	
Vertical Active Display Term (8 Lan,3840X2160 Active Area)	2D Mode	Total	Tv	2200	2700	2790	Th	Tv=Tvd+Tvb
		Display	Tvd	2160	2160	2160	Th	
		Blank	Tvb	40	540	630	Th	
Horizontal Active Display Term (8 Lan,3840X2160 Active Area)	2D Mode	Total	Th	530	550	570	Tc	Th=Thd+Thb
		Display	Thd	480	480	480	Tc	
		Blank	Thb	50	70	90	Tc	

Input Timing Spec For UHD, Frame Rate =60Hz

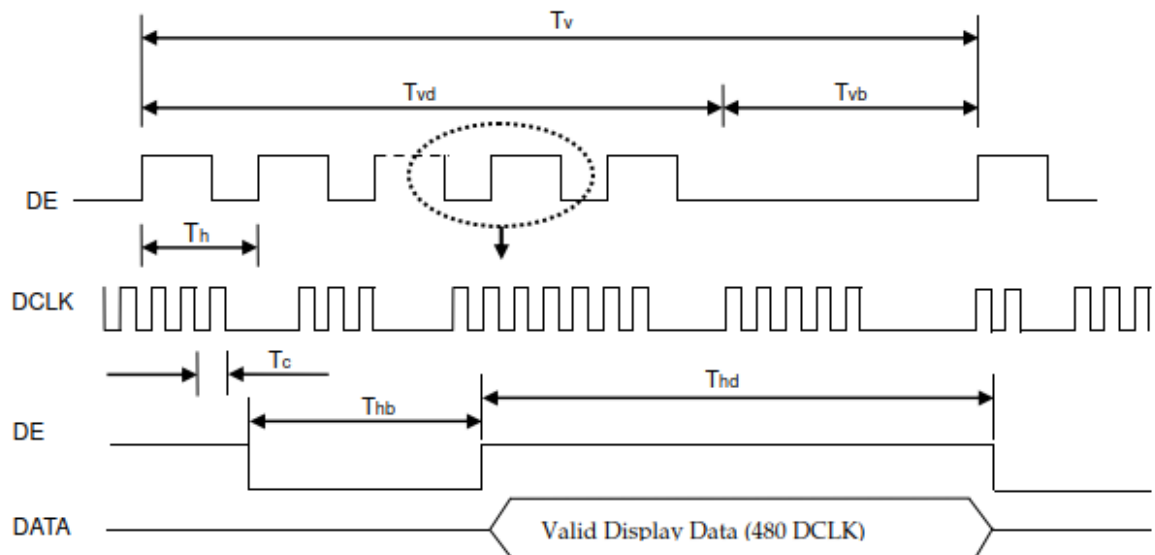
Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame rate	2D mode		Fr6	57	60	63	Hz	(5),(6)
Horizontal Frequency			Fh	122.8	135	140	KHz	
Vertical Active Display Term (8 Lan, 3840X2160 Active Area)	2D Mode	Total	Tv	2200	2250	2790	Th	Tv=Tvd+Tvb
		Display	Tvd	2160	2160	2160	Th	—
		Blank	Tvb	40	90	630	Th	—
Horizontal Active Display Term (8 Lan, 3840X2160 Active Area)	2D Mode	Total	Th	530	550	570	Tc	Th=Thd+Thb
		Display	Thd	480	480	480	Tc	—
		Blank	Thb	50	70	90	Tc	—

Note (1) Please make sure the range of pixel clock has follow the below equation :

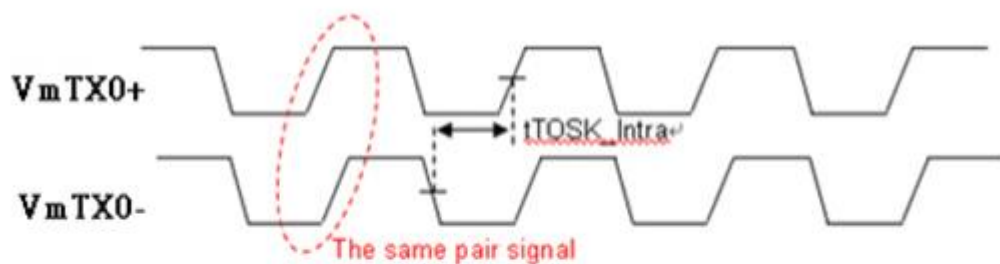
$$F_{clk}(max) \geq Fr \times Tv \times Th$$

$$Fr \times Tv \times Th \geq F_{clk}(min)$$

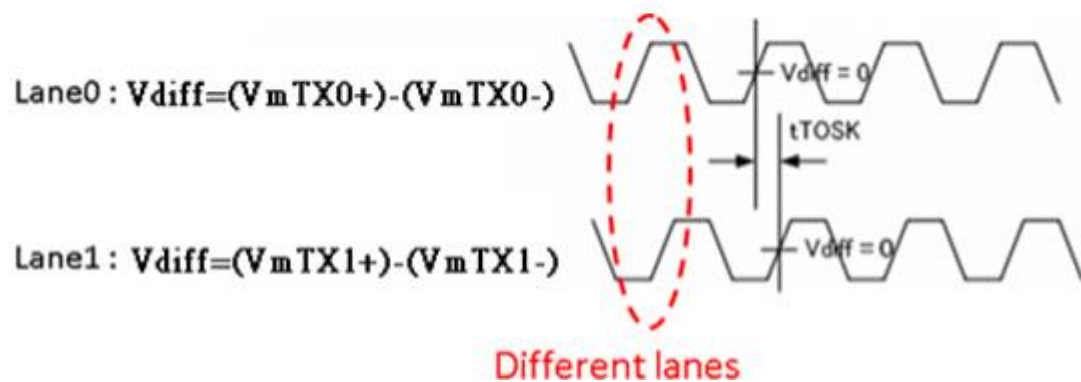
INPUT SIGNAL TIMING DIAGRAM



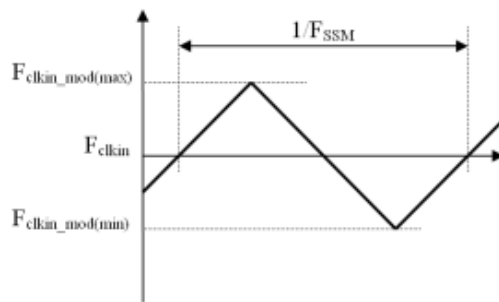
Note (2) VbyOne HS Intra-pair skew



Note (3) VbyOne HS Inter-pair skew

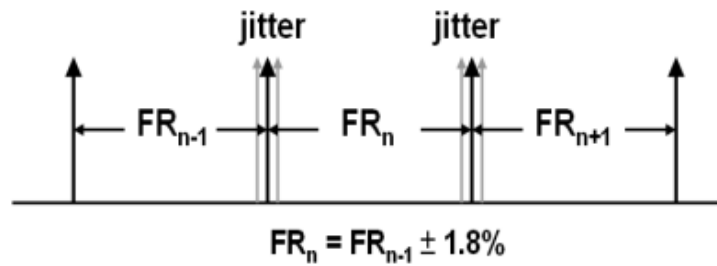


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) For converter reference signals, The frame-to-frame jitter of the input frame rate is defined as the above figures. $FR_n = FR_{n-1} \pm 1.8\%$.

Note (6) For converter reference signals, The setup of the frame rate jitter $> 1.8\%$ may result in the cosmetic LED backlight symptom.



3.4 Timing Diagram

V by One Input Signal Timing Diagram

The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated.

PLL bandwidth: 40MHz

Damping facto: 1.4

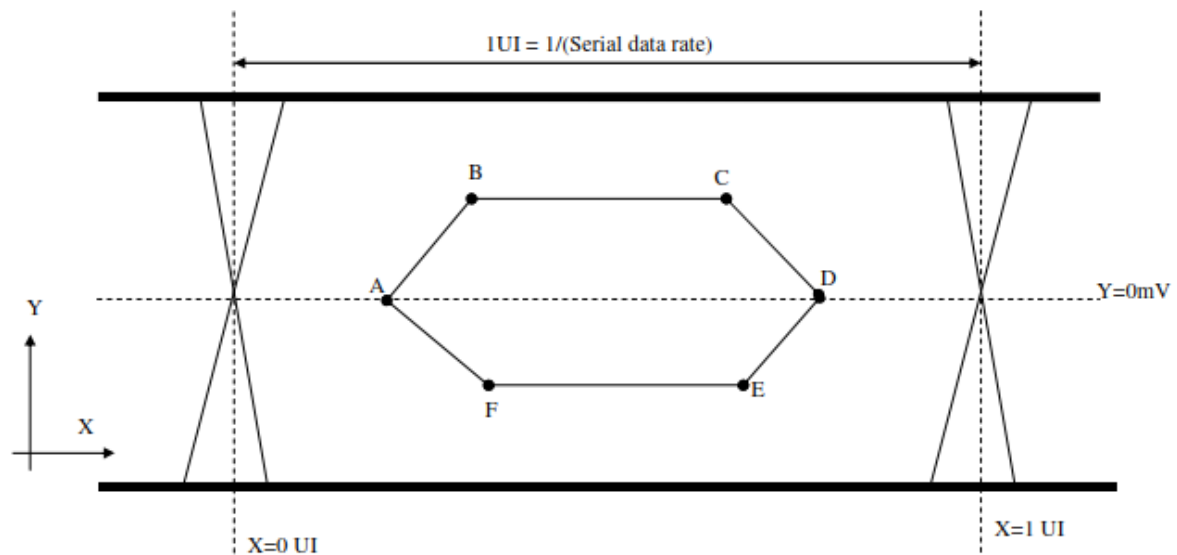


Table 1 Eye Mask Specification

	X [UI]	Y [mV]	Note
A	0.25	0	(1)
B	0.3	50	(1)
C	0.7	50	(1)
D	0.75	0	(1)
E	0.7	-50	(1)
F	0.3	-50	(1)

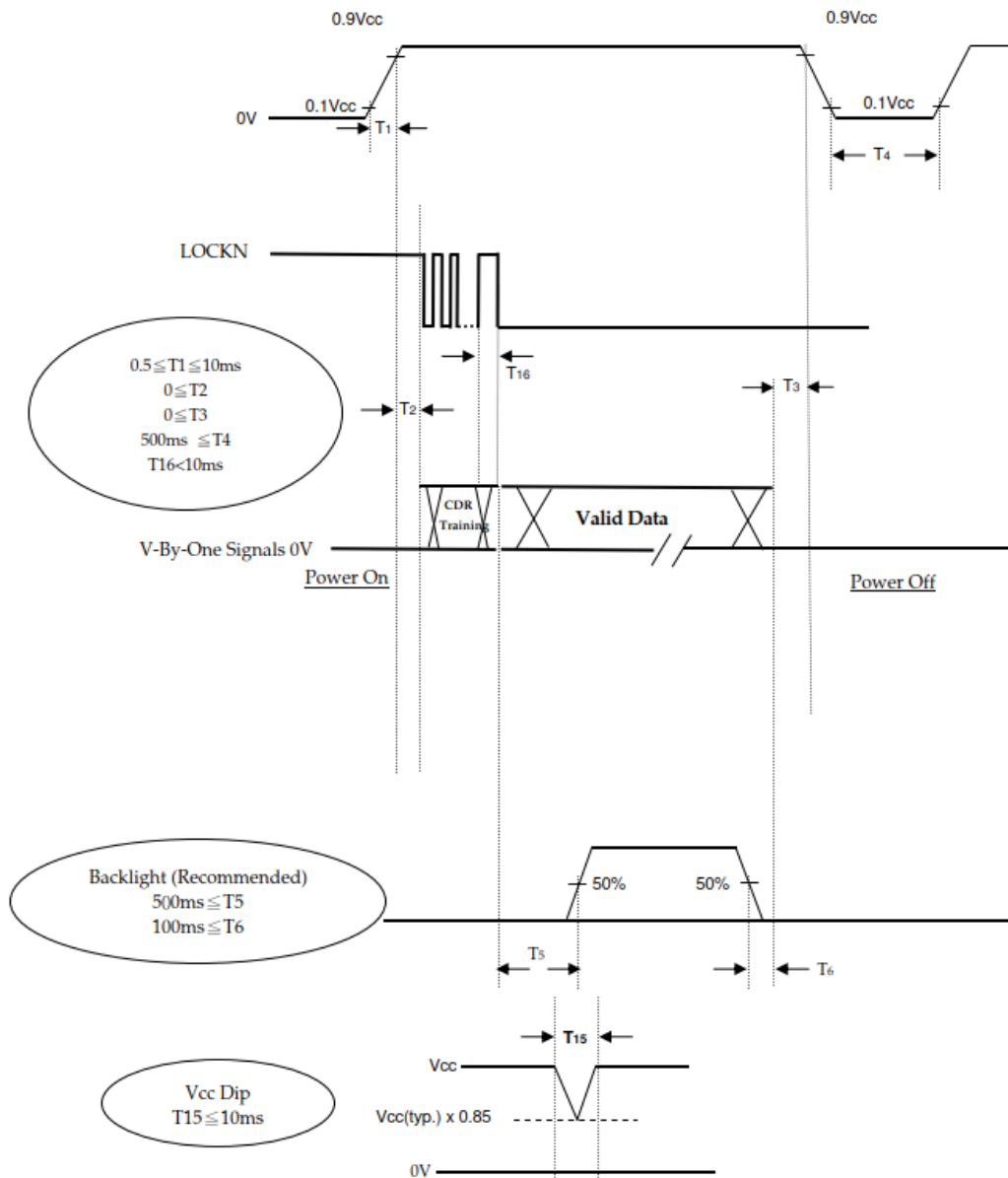
Note (1) Input levels of V-by-One HS signals are comes from “V-by-One HS Stander Ver.1.4”

3.5 Byte Length and Color Mapping of V-by-One HS

Packer input & Unpacker output		30bpp RGB (10bit)
Byte 0	D[0]	R[2]
	D[1]	R[3]
	D[2]	R[4]
	D[3]	R[5]
	D[4]	R[6]
	D[5]	R[7]
	D[6]	R[8]
	D[7]	R[9]
Byte 1	D[8]	G[2]
	D[9]	G[3]
	D[10]	G[4]
	D[11]	G[5]
	D[12]	G[6]
	D[13]	G[7]
	D[14]	G[8]
	D[15]	G[9]
Byte 2	D[16]	B[2]
	D[17]	B[3]
	D[18]	B[4]
	D[19]	B[5]
	D[20]	B[6]
	D[21]	B[7]
	D[22]	B[8]
	D[23]	B[9]
Byte 3	D[24]	X
	D[25]	X
	D[26]	B[0]
	D[27]	B[1]
	D[28]	G[0]
	D[29]	G[1]
	D[30]	R[0]
	D[31]	R[1]

3.6 Power ON/OFF Sequence

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



Note (1) The supply voltage of the external system for the module input should follow the definition of V_{cc} .

Note (2) Apply the LED voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of V_{cc} is in off level, please keep the level of input signals on the low or high impedance besides HTPDN and $LOCKN$. If $T_2 < 0$, that maybe cause electrical overstress failure.

Note (4) T_4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) V_{cc} must decay smoothly when power-off.

Note (7) HTPDN(internal ground) : For customer reference signal. It can be ignored if customer not use.

Note (8) T_{16} , V -by-One signals shall be stabilized and follows timing specification which defined by section 5.1&5.2

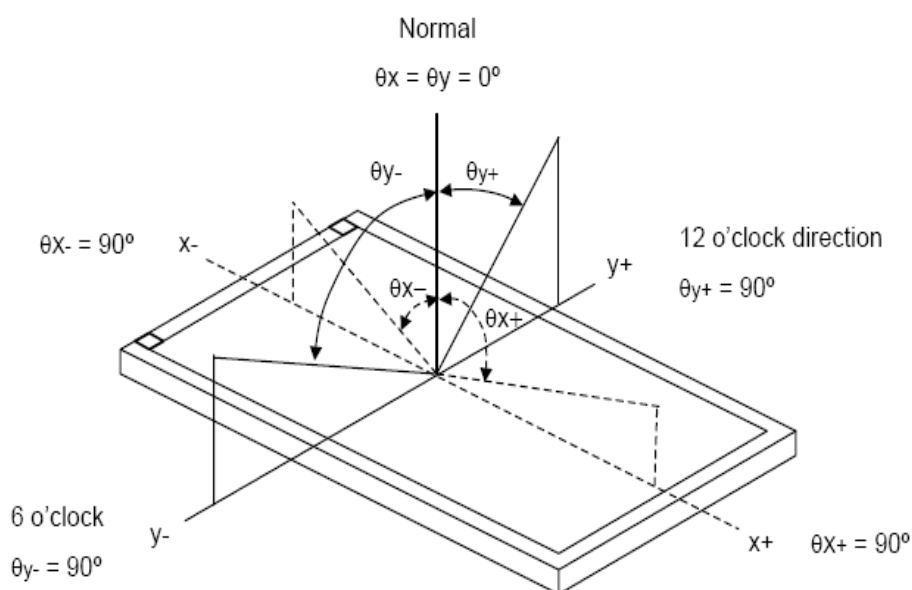
4 Optical Specification

OPTICAL SPECIFICATIONS

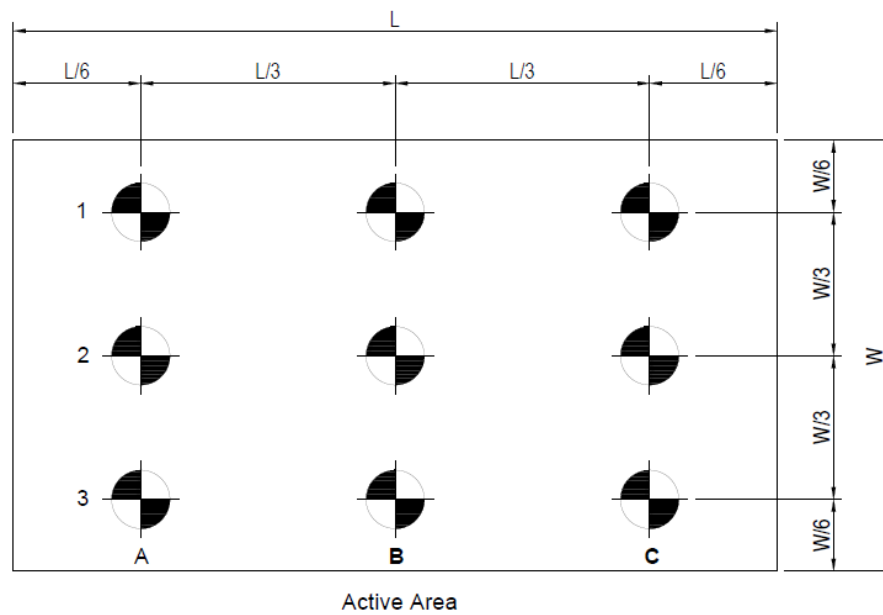
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color chromaticity	Red	Rx	$\theta_x=0$ $\theta_y=0$ CA-410	0.652	0.682	0.712	-	Test Mode: (2) (3)
		Ry		0.273	0.303	0.333	-	
	Green	Gx		0.211	0.241	0.271	-	
		Gy		0.655	0.685	0.715	-	
	Blue	Bx		0.117	0.147	0.177	-	
		By		0.019	0.049	0.079	-	
	White	Wx		0.242	0.272	0.302	-	
		Wy		0.251	0.281	0.311	-	
Center Luminance of White		Lc	$\theta_x=0$ $\theta_y=0$	1800	2000	2600	cd/m ²	
Uniform		Lu	CA-410	-	90	-	%	
Contrast Ratio		CR	$\theta_x=0$	81900:1	91000:1	-	-	Test Mode: (4)
Color Saturation		NTSC	$\theta_y=0$ Klein K-10	-	91		-	
Viewing Angle	Horizontal	θ_{x+}	-	-	89	-	Deg	Test Mode: (1)
		θ_{x-}		-	89	-		
	Vertical	θ_{y+}	-	-	89	-		
		θ_{y-}	-	-	89	-		

Test Mode :

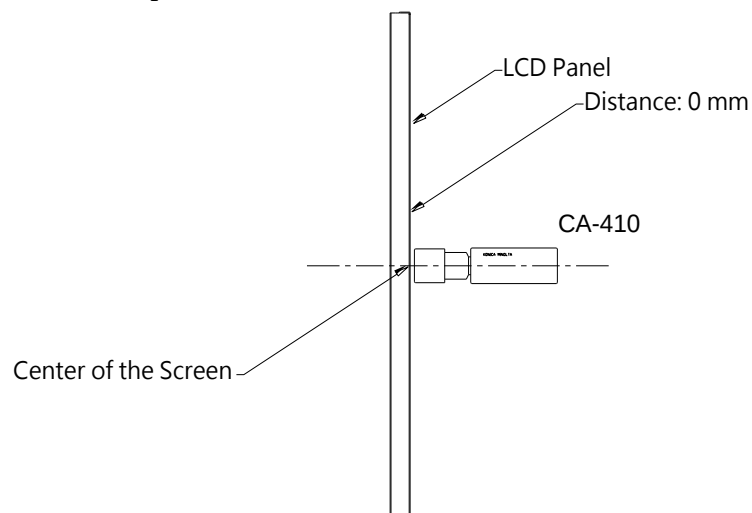
(1) Definition of Viewing Angle (θ_x , θ_y):



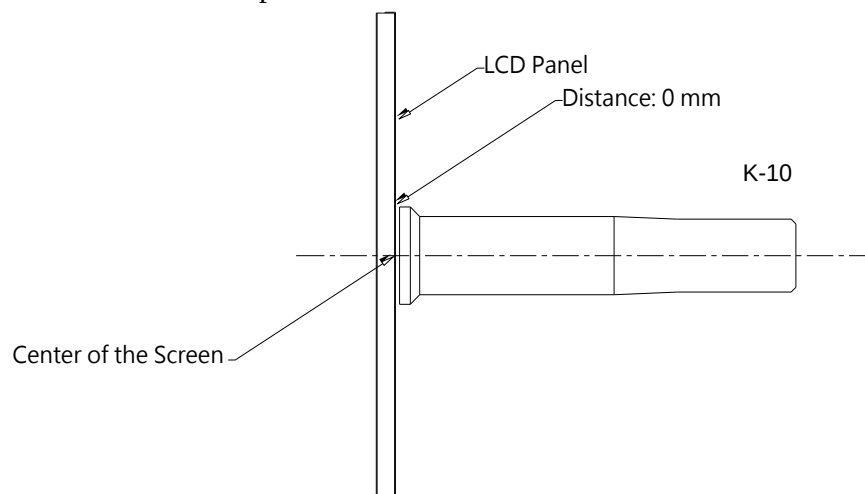
(2) Definition of Test Point:



(3) CA-410 Measurement Setup:



(4) Klein K-10 Measurement Setup:



5 Electrical Specification

5.1 Converttiter Characteristics

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Total Power Consumption	P _{CNV}	-	725	795	W	(1), (2)
Each converter spec, This module uses 3 converters						
Power Consumption	P _{BL}		241	265		(1)
Converter Input Voltage	V _{BL}	22.8	24.0	25.2	VDC	
Converter Input Current	I _{BL}	-	10.1	-	A	Non Dimming
Input Inrush Current	I _R	-	-	12	A _{peak}	V _{BL} =22.8V; (3) (6)
Dimming Frequency	FB	150	160	170	Hz	(5)
Dimming Duty Ratio	DDR	5	-	100	%	(4) (5)
Life Time	-	30,000	50,000	-	Hrs	(7)

Note (1) The power supply capacity should be higher than the total converter power consumption P_{BL}. Since the pulse width modulation (PWM) mode was applied for backlight dimming, the driving current changed as PWM duty on and off. The transient response of power supply should be considered for the changing loading when converter dimming.

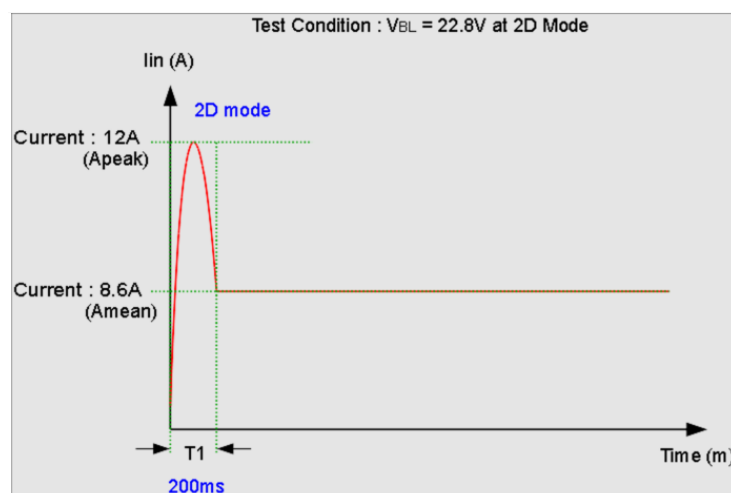
Note (2) The measurement condition of Max. value is based on 85" backlight unit under input voltage 24V.

Note (3) For input inrush current measure, the V_{BL} rising time from 10% to 90% is about 20ms.

Note (4) EPWM signal have to input available duty range. Between 97% and 100% duty (DDR) have to be avoided.
(97% < DDR < 100%) But 100% duty (DDR) is possible. 5% duty (DDR) is only valid for electrical operation.

Note (5) FB and DDR are available only at 0D Mode.

Note (6) Below diagram is only for power supply design reference.



Note (7) The lifetime is defined as the time which luminance of the LED decays to 50% compared to the initial value,
Operating condition: Continuous operating at Ta = 25±2°C

5.2 Converter Interface Characteristics

Parameter		Symbol	Test Condition	Value			Unit	Note	
				Min.	Typ.	Max.			
On/Off Control Voltage	ON	VBLON	—	2.0	—	5.0	V		
	OFF		—	0	—	0.8	V		
External PWM Control Voltage	HI	VEPWM	—	2.0	—	5.25	V	Duty on	(5), (6)
	LO		—	0	—	0.8	V	Duty off	
Error Signal		ERR	—	—	—	—	—	Abnormal: Open	
VBL Rising Time		Tr1	—	20	—	—	ms	10%-90% V _{BL}	
Control Signal Rising Time		Tr	—	—	—	100	ms		
Control Signal Falling Time		Tf	—	—	—	100	ms		
PWM Signal Rising Time		TPWMR	—	—	—	50	us	(6)	
PWM Signal Falling Time		TPWMF	—	—	—	50	us		
Input Impedance		Rin	—	1	—	—	MΩ	EPWM, BLON	
PWM Delay Time		TPWM	—	100	—	—	ms	(6)	
BLON Delay Time		T _{on}	—	300	—	—	ms		
		T _{on1}	—	300	—	—	ms		
BLON Off Time		Toff	—	300	—	—	ms		

Note (1) The Dimming signal should be valid before backlight turns on by BLON signal. It is inhibited to change the external PWM signal during backlight turn on period.

Note (2) The power sequence and control signal timing are shown in the Fig.1. For a certain reason, the converter has a possibility to be damaged with wrong power sequence and control signal timing.

Note (3) While system is turned ON or OFF, the power sequences must follow as below descriptions:

Turn ON sequence: VBL → PWM signal → BLON

Turn OFF sequence: BLOFF → PWM signal → VBL

Note (4) When converter protective function is triggered, ERR will output open collector status. Please refers to Fig.2.

Note (5) The EPWM interface that inserts a pull up resistor to 5V in Max Duty (100%), please refers to Fig.3.

Note (6) EPWM is available only at 2D Mode.

Note (7) EPWM signal have to input available frequency range.

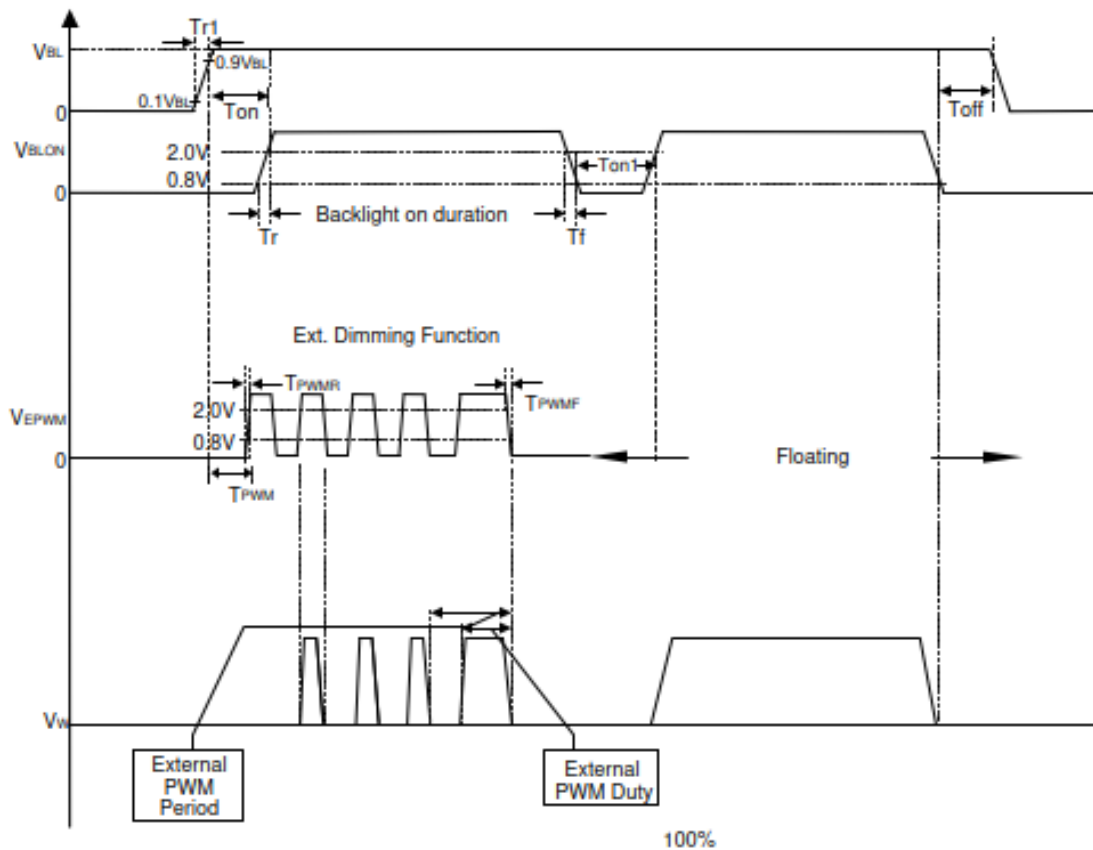


Fig. 1

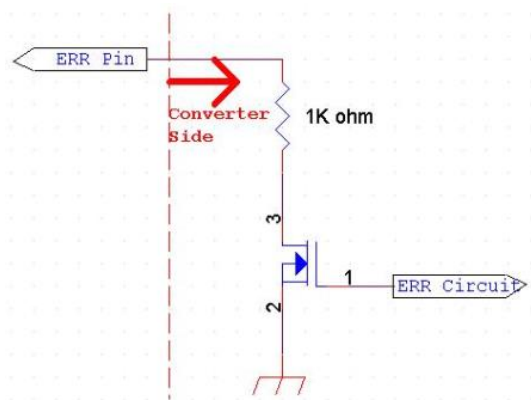


Fig. 2

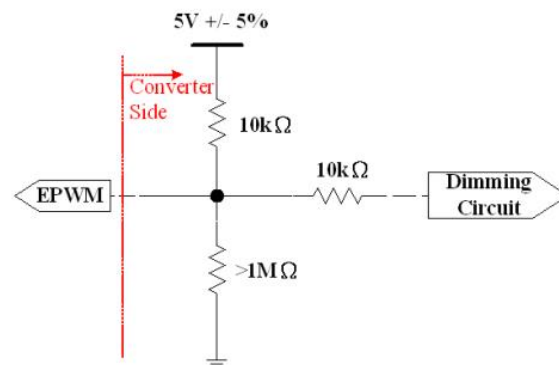


Fig. 3

5.3 Light Bar Unit

The pin configuration for the housing and lead wire is shown in the table below.
CNL01 Connector Pin Assignment: [a1001rs1b-04(XURUI)]

Pin No	Symbol	Feature
1	VLED+1	Positive of LED String
2	VLED+2	Positive of LED String
3	N2	Negative of LED String
4	N1	Negative of LED String

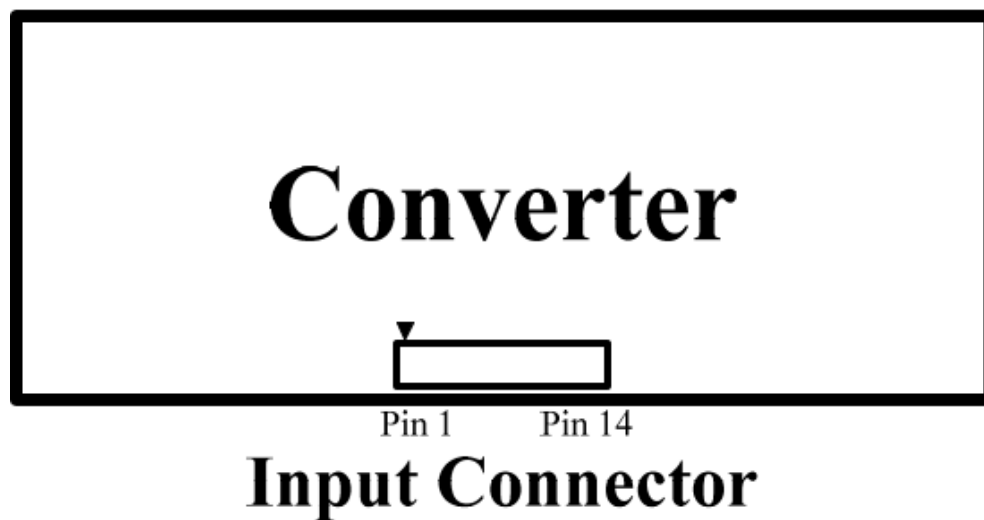
5.4 Converter Unit

CNV01 Connector Pin Assignment : [CI0114M1HR0-LA (CvilLux) , JH2-D4-143N (FCN)]
Matting connector : [JST PHR-14]

Pin No.	Symbol	Feature
1	VBL	+24V
2		
3		
4		
5		
6	GND	GND
7		
8		
9		
10		
11	ERR	Normal (GND) ; Abnormal (Open collector)
12	BLON	BL ON/OFF
13	NC	NC
14	E_PWM	External PWM Control

Note (1) If Pin14 is open, E_PWM is 100%

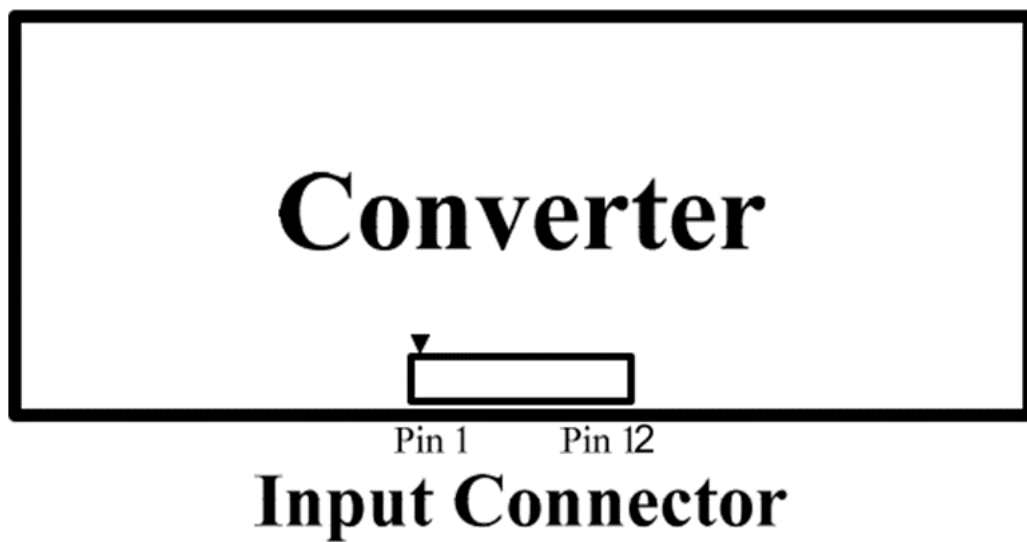
Note (2) Input connector pin order defined as follows



CNV02 connector Pin Assignment: [CI0112M1HR0-LA (CvilLux) or JH2-D4-123N (FCN)]
 Matting connector : [JST PHR-12]

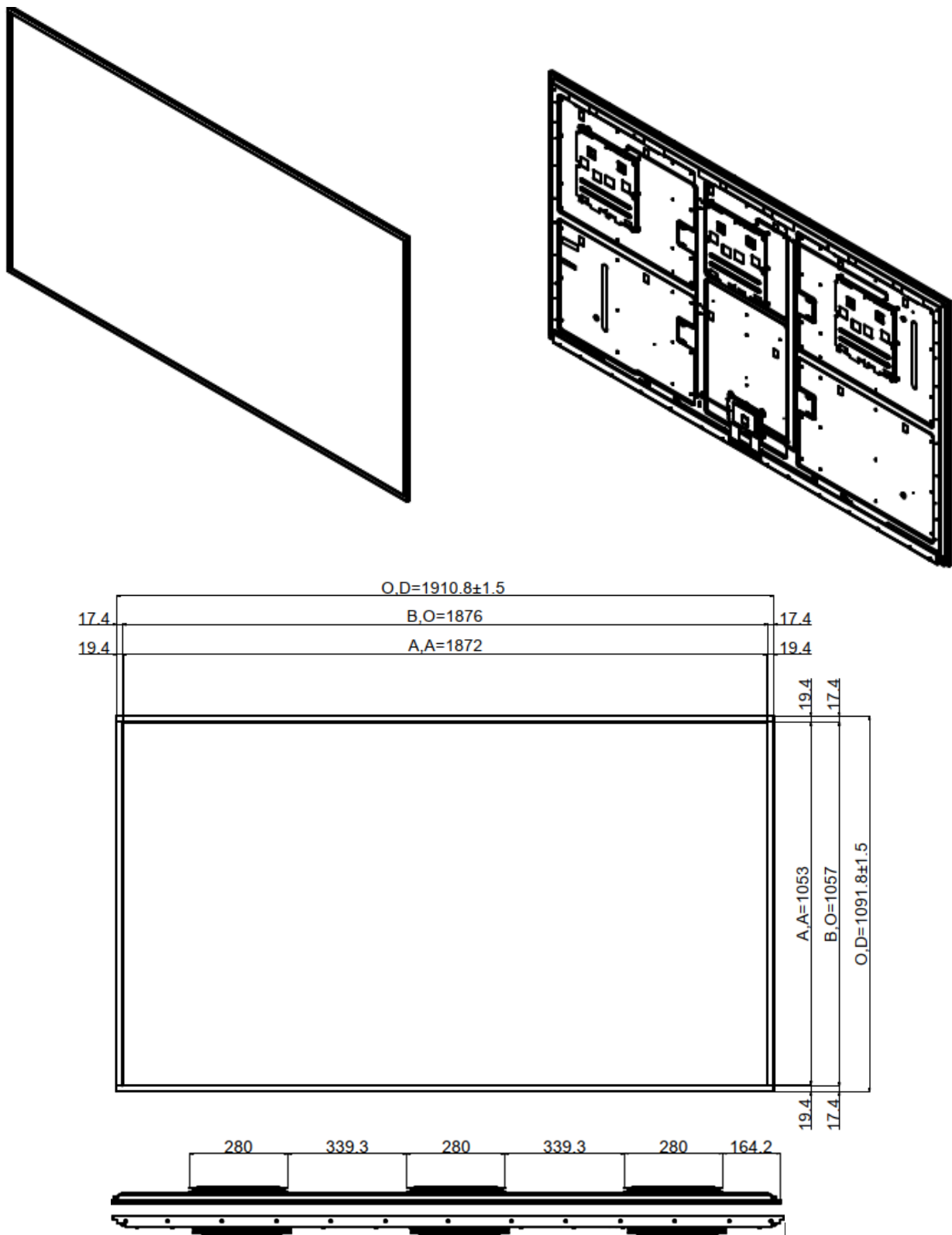
Pin No.	Symbol	Feature
1	VBL	+24V
2		
3		
4		
5		
6	GND	GND
7		
8		
9		
10		
11	NC	NC
12	NC	NC

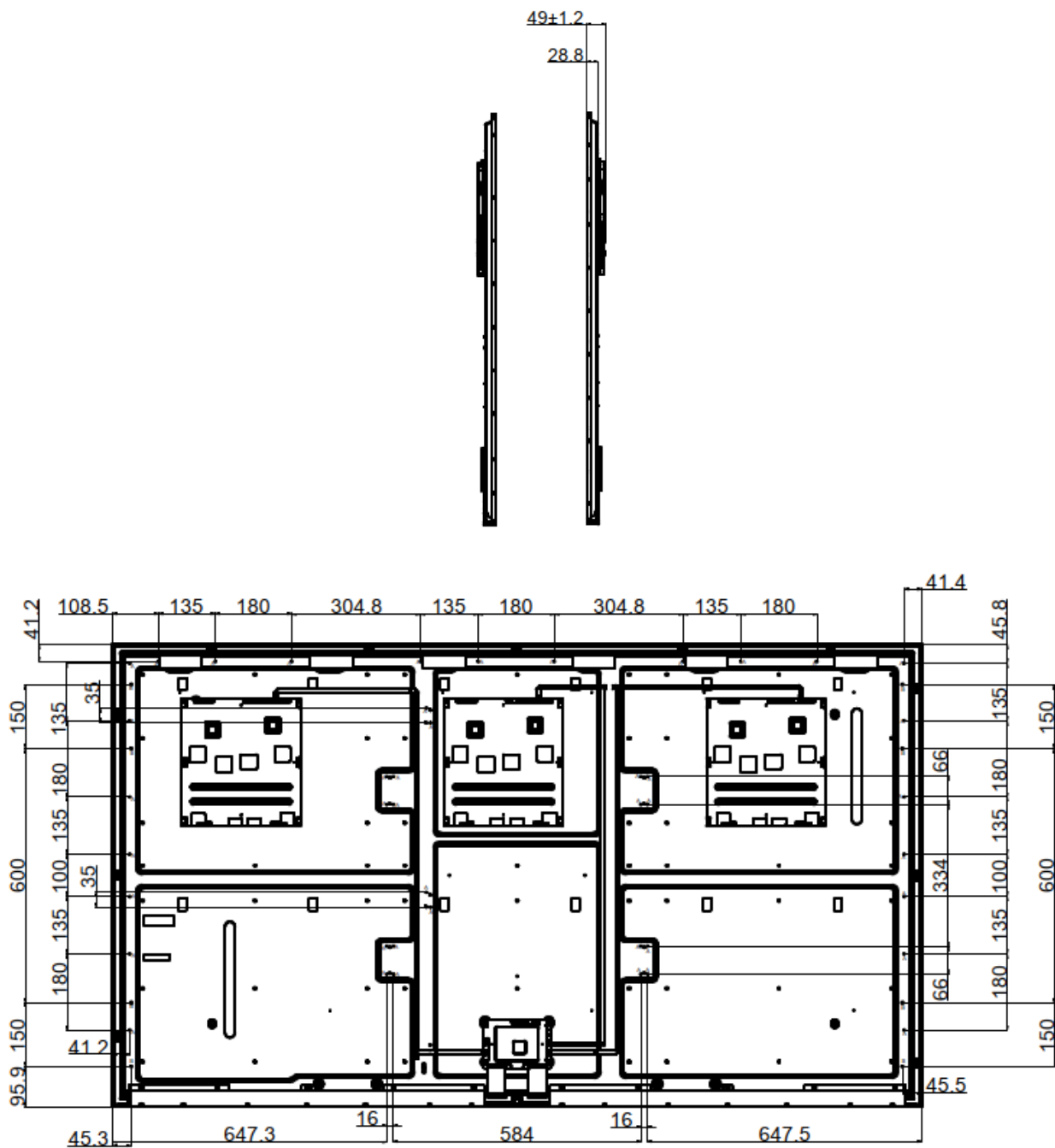
Note (1) Input connector pin order defined as follows



6 Mechanical Drawing

Unit:mm





Note:

O.D : Outline Dimension

B.O : Bezel Opening

A.A : LCD Active Area

A : 43-M3_USER HOLE_MAX Depth=6mm

B : 8-M4_USER HOLE_MAX Depth=6mm

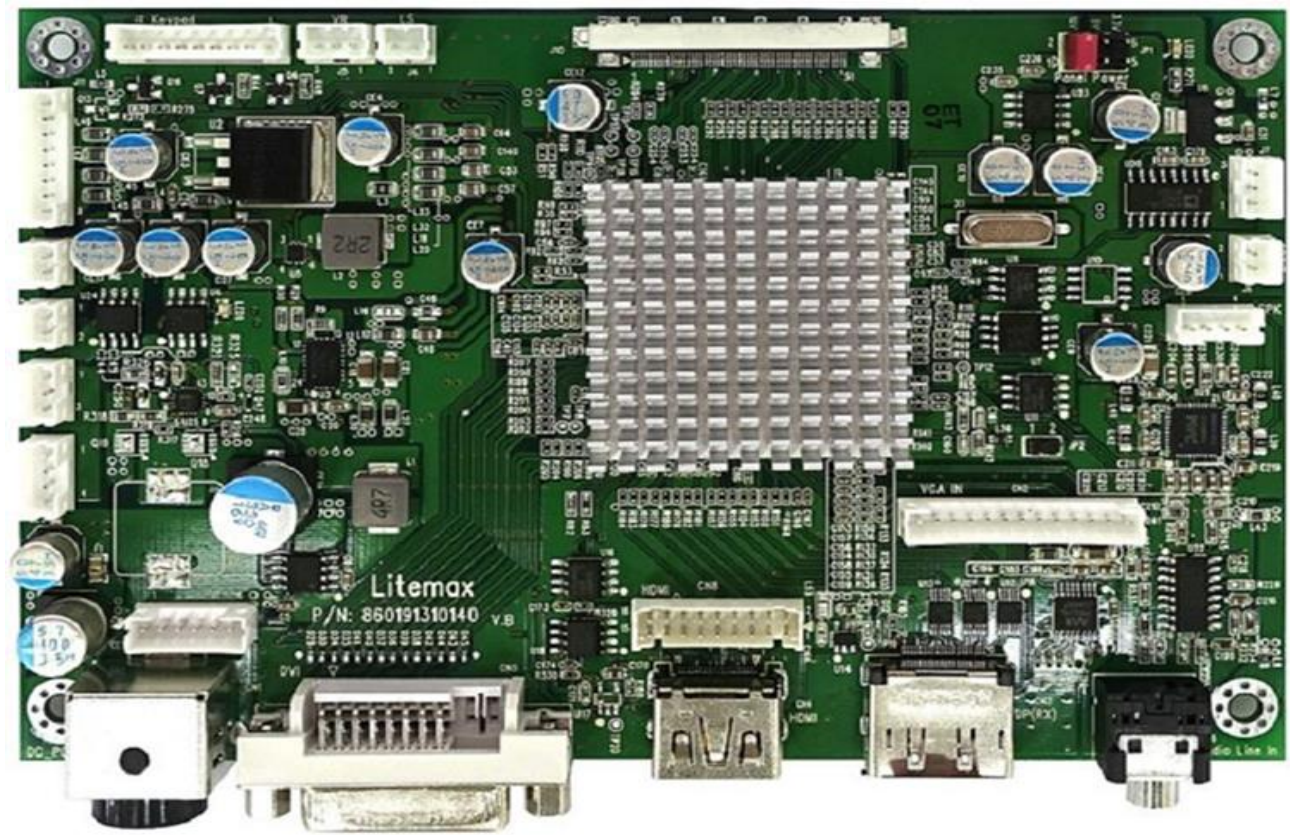
7 AD9131DHP Board & OSD Functions

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, or optional VR button to control brightness, fan rotation and RS232.

Rev.2 is European RoHS compliant.

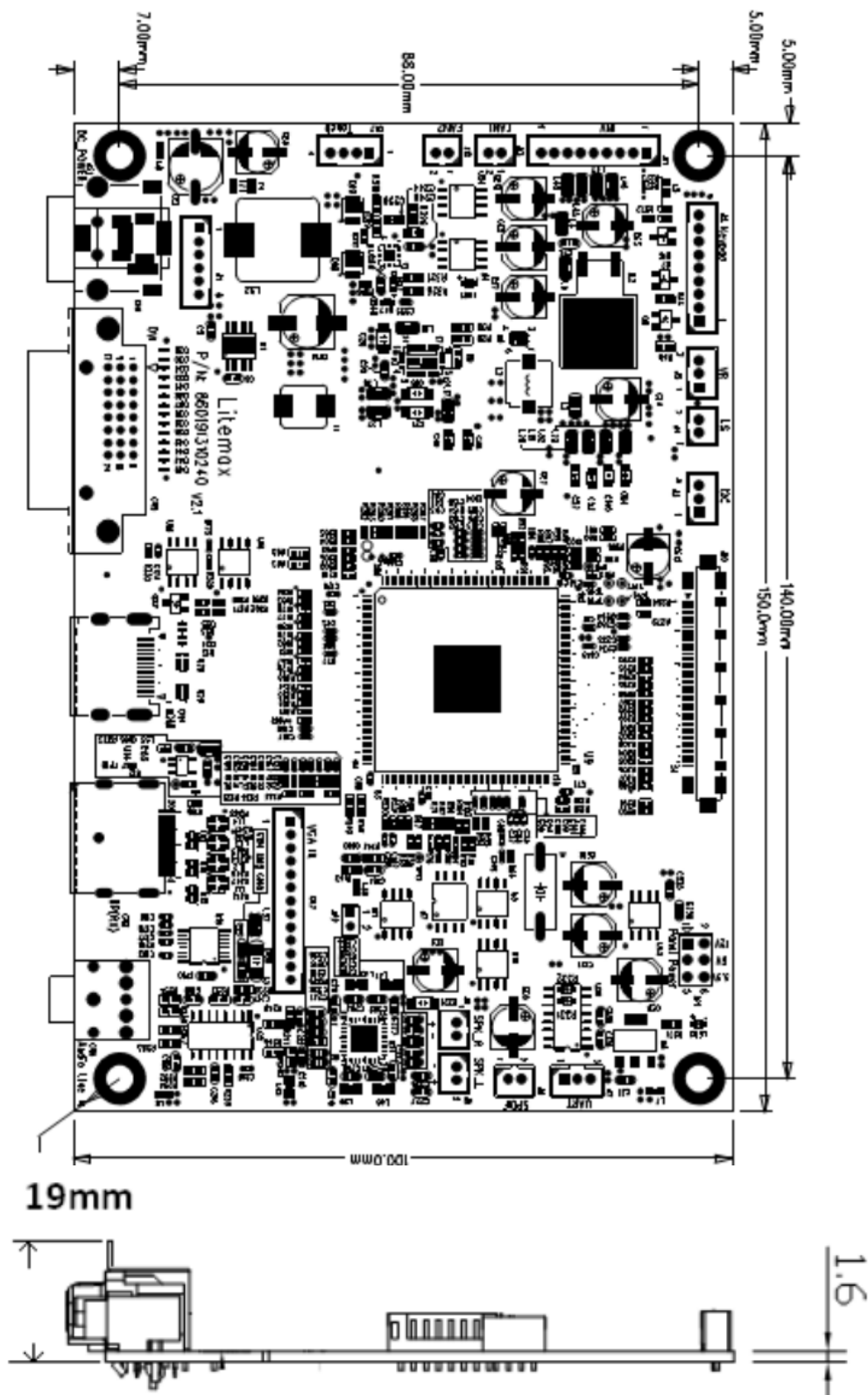
7.1 General Description

- Max resolution up to UHD (4096x2160)
- Support V-By-one panel
- DVI-D operates up to 165M Hz
- One ultra-reliable dual-link DVI input (4K2K@30Hz)
- One HDMI (HDMI 2.0) input (4K2K@60Hz)
- One display port input (DP 1.2a) (4K2K@60Hz)
- V-by-One interface
- Support panel DC5V or 3.3V, 12V output
- External fan control by software
- OSD control
- Inverter analog or PWM dimming control
- External V.R. brightness control (Optional)
- External light sensor brightness control (Optional)
- External RS232 control (Optional)
- Input power 24V DC or 12V DC (24V DC power input is optional)

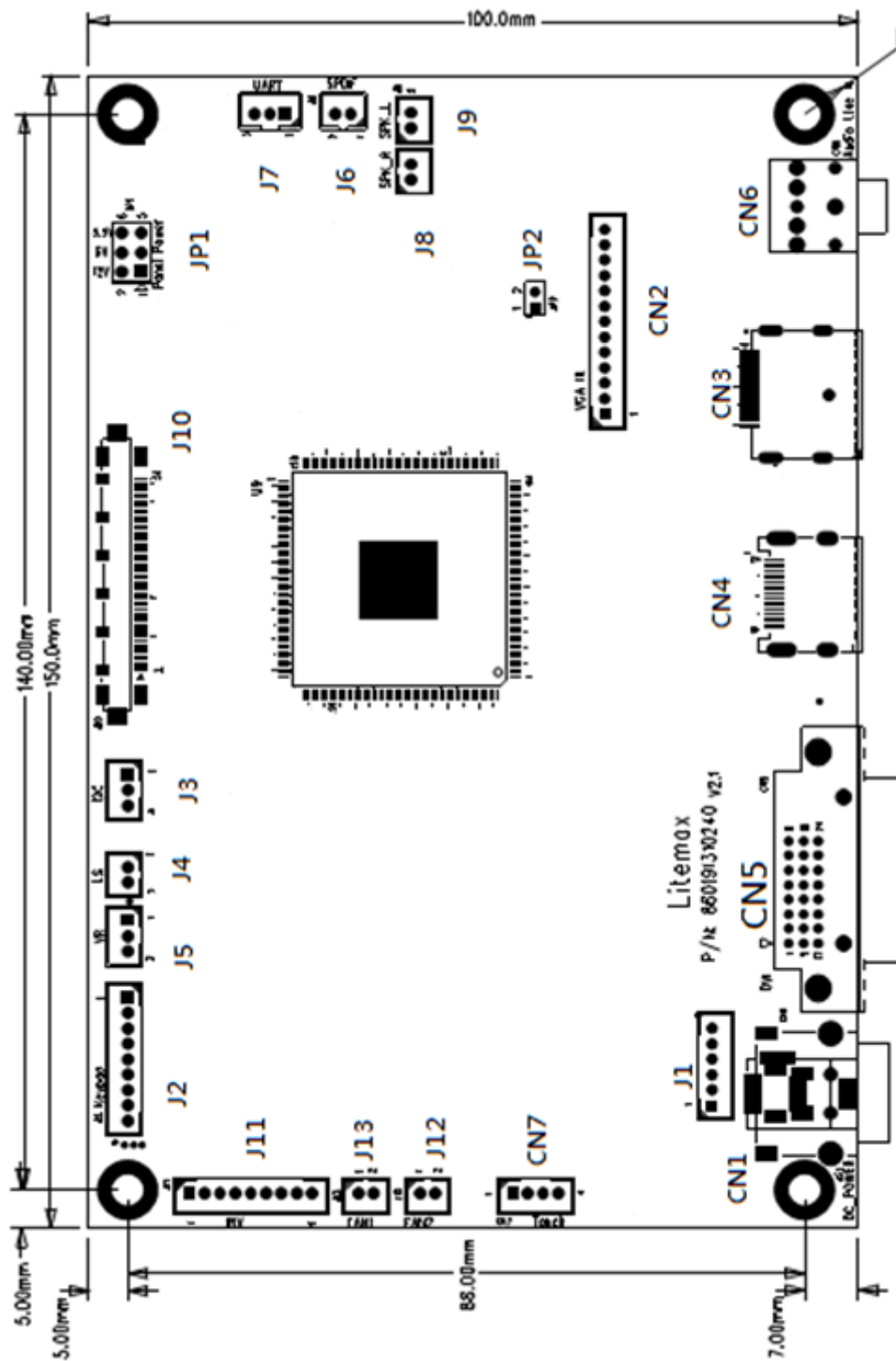


7.2 Outline Dimensions

AD9131 150 x 100mm



7.3 AD9131DHP Board Pin Define



J10: Panel (V-By-one or e-DP) connector

Pin No.	Function	Pin No.	Function
1	PANEL-VCC	27	GND
2	PANEL-VCC	28	RX0N
3	PANEL-VCC	29	RX0P
4	PANEL-VCC	30	GND
5	PANEL-VCC	31	RX1N
6	PANEL-VCC	32	RX1P
7	PANEL-VCC	33	GND
8	PANEL-VCC	34	RX2N
9	NC	35	RX2P
10	GND	36	GND
11	GND	37	RX3N
12	GND	38	RX3P
13	GND	39	GND
14	GND	40	RX4N
15	eDP_HPD1	41	RX4P
16	AUXTX_P1	42	GND
17	AUXTX_N1	43	RX5N
18	P_SDA	44	RX5P
19	P_SCL	45	GND
20	NC	46	RX6N
21	eDP_HPD0	47	RX6P
22	LD_EN	48	GND
23	AUXTX_P0	49	RX7N
24	AUXTX_N0	50	RX7P
25	HTPDN	51	GND
26	LOCKN		

CN5: DVI-D Input Connector (24pin)

Pin No.	Function	Pin No.	Function	Pin No.	Function
1	T.M.D.S. Data2-	9	T.M.D.S. Data1-	17	T.M.D.S. Data0-
2	T.M.D.S. Data2+	10	T.M.D.S. Data1+	18	T.M.D.S. Data0+
3	T.M.D.S. Data2/4 Shield	11	T.M.D.S. Data1/3 Shield	19	T.M.D.S. Data0/5 Shield
4	T.M.D.S. Data4-	12	T.M.D.S. Data3-	20	T.M.D.S. Data5-
5	T.M.D.S. Data4+	13	T.M.D.S. Data3+	21	T.M.D.S. Data5+
6	DDC Clock	14	+5V Power	22	T.M.D.S. Clock Shield
7	DDC Data	15	Ground (for +5V)	23	T.M.D.S. Clock+
8	Vertical SYNC.	16	Hot Plug Detect	24	T.M.D.S. Clock-

CN4: HDMI Connector (19pin HDMI)

Pin No.	Function	Pin No.	Function	Pin No.	Function
1	T.M.D.S. Data2+	9	T.M.D.S. Data0-	17	GND
2	Shield	10	T.M.D.S. Clock+	18	HDMI 5V
3	T.M.D.S. Data2-	11	Shield	19	Hot Plug Detect
4	T.M.D.S. Data1+	12	T.M.D.S. Clock-		-
5	Shield	13	CEC		
6	T.M.D.S. Data1-	14	NC		
7	T.M.D.S. Data0+	15	HDMI_SCL		
8	Shield	16	HDMI_SDA		

CN3: 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

CN6: Audio Jack in

Pin No.	Function	Pin No.	Function
1	GND	2	LINE IN R
3	GND	4	GND
5	LINE IN L		

CN1: Power DIN(24V or 12V)

Pin No.	Function	Pin No.	Function
1	24VDC or 12VDC (Note 1)	2	24VDC or 12VDC (Note 1)
3	GND	4	GND

CN1: Power Jack (24V or 12V)

Pin No.	Function	Pin No.	Function
1	24VDC or 12VDC (Note 1)	2	GND
3	GND		

J1: Power input connector (6 pin 2.0mm)

Pin No.	Function	Pin No.	Function
1	24VDC or 12VDC (Note 1)	2	24VDC or 12VDC (Note 1)
3	24VDC or 12VDC (Note 1)	4	GND
5	GND	6	GND

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

CN7: Power out connector (5V/12V)(4PIN 2.0mm)

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

J11: Inverter Connector (8PIN 2.0mm)

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	DC/PWM	DC/PWM SEL	5	GND	GND
2	ON/OFF	Backlight ON/OFF	6	GND	GND
3	BRIGHT	Dimming adjust	7	12VDC	Input 12VDC
4	GND	GND	8	12VDC	Input 12VDC

J13,J12: FAN (2PIN 2.0mm)

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

J2: Key Pad (9PIN 2.0mm)

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		

J5: VR connector (3PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	3.3VDC	2	VR OUT
3	GND		

J4: Ambient (2PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	3.3VDC/5VDC	2	Sensor Out

JP1: PANEL VCC (3PIN 2.54mm)

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

J8& J9: Speaker Connector (2PIN 2.0mm)

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

J7 UART Connector (RS232 IN) (3PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	TXD	2	RXD
3	GND		

J3 I2C Connector (3PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	SDA	2	SCL
3	GND		

J6: SPDIF (2PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	SPDIF_OUT	2	GND

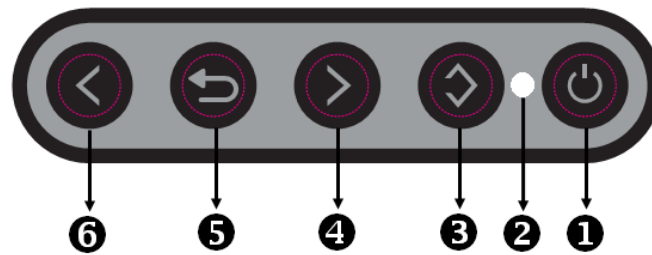
JP2: EDID (2PIN 2.0mm)

Pin No.	Function	Pin No.	Function
1	EEROM Write protect	2	GND

When need to rewrite EEROM EDID , short two pin .

7.4 OSD Function

MEMBRANE CONTROL BUTTOM



- ❶ **Key:** (Power) function key

Press the power switch will turn the monitor on.

Press it again to turn the monitor off.



- ❷ **LED Status:** Power ON-Green / Power off-No.



- ❸ **Key:** (Menu + Selection Right + Enter) function key

Press this button to the OSD “main menu”. And then press this button go to the “Selection Right” function, and press again this button to “Enter”.



- ❹ **Key:** (Menu + Selection Up + Increase) function key

Press this button to the OSD “main menu”. And then press this button go to the “Selection Up” function, and press again this button to adjustment value “Increase”.



- ❺ **Key:** (Menu + Exit) function key

Enter to the OSD adjustment menu. It also used for go back to previous menu for sub-menu.



- ❻ **Key:** (Menu + Selection Down + Decrease) function key

Press this button to the OSD “main menu”. And then press this button go to the “Selection Down” function, and press again this button to adjustment value “Decrease”.

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

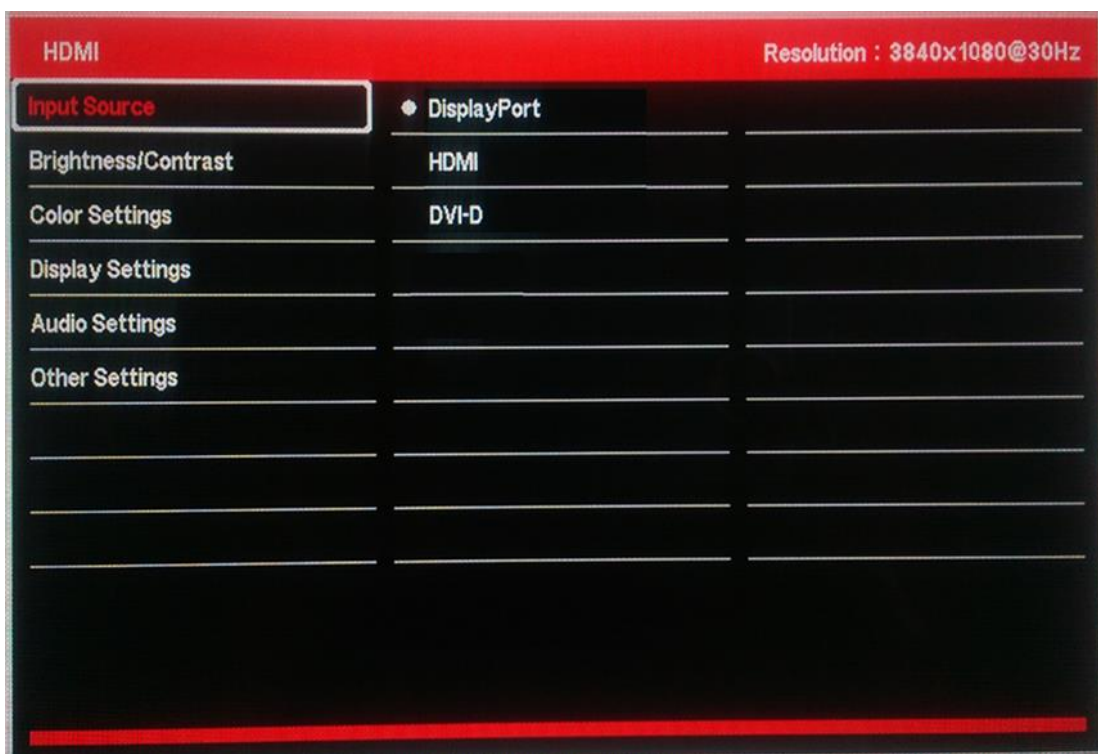
After finishing the adjustment, push the  button to memorize the setting.

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.

7.5 OSD Menu

By pressing the “menu” button, you will see the below picture. Across from timing you will see resolution, frequency, and V-frequency of the panel. These cannot be altered by the user.



8 Precautions

8.1 Handling and Mounting Precautions

- (1) The module should be assembled into the system firmly by using every mounting hole. Do not apply rough force such as bending or twisting to the LCD during assembly.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress, Concentrated stress) is not applied to the module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the LCD module.
- (3) While assembling or installing LCD modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (4) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (5) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily be scratched.
- (6) Please attach the surface transparent protection film to the surface in order to protect the polarizer. Transparent protection film should have sufficient strength in order to resist external force.
- (7) When the transparent protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (8) 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.
- (9) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (10) 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.
- (11) Protect the LCD module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (12) Do not disassemble the module.
- (13) Do not pull or fold the lamp wire.
- (14) Pins of I/F connector should not be touched directly with bare hands.

8.2 Storage Precautions

- (1) High temperature or humidity may reduce the performance of LCD module. Please store LCD module within the specified storage conditions.
- (2) If possible store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (3) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (4) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

8.3 Operation Precautions

- (1) Do not pull the I/F connector in or out while the LCD 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.
- (3) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (4) Brightness depends on the temperature. (In lower temperature, it becomes lower.)
- (5) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods are very important to minimize the interference.
- (7) Please do not give any mechanical and/or acoustical impact to module. Otherwise, module can't be operated its full characteristics perfectly.
- (8) Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.
- (9) Do not display the fixed pattern for a long time because it may cause image sticking.
- (10) In order to prevent image sticking, periodical power-off or screen save is needed after fixed pattern long time display.
- (11) Black image or moving image is strongly recommended as a screen save.
- (12) Static information display recommended to use with moving image. Cycling display between 10 minutes' information (static) display and 10 seconds' moving image.
- (13) Background and character (image) color change is recommended. Use different colors for background and character, respectively. And change colors themselves periodically.
- (14) LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly recommended.
- (15) Product reliability and functions are only guaranteed when the product is used under right operation usages.
- (16) If product will be used in extreme conditions, such as high temperature/ humidity, shock and vibration it is strongly recommended to contact Litemax for filed application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, taxi-top, in vehicle and controlling systems.

9 Disclaimer

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