

LITEMAX

SSD3565-I

Sunlight Readable 35.6" LED B/L LCD

User Manual

Approved by	Checked by	Prepared by

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Record of Revision

Version and Date	Page	Old Description	New Description	Remark
Nov./21/2022	all		Initial release	

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1 General Description

The **SSD3565-I** is a 35.6 inch color TFT-LCD display with special aspect ratio 8:9 and wide resolution 1900 x 2160. It is Litemax's Spanpixel series product which designed for high brightness 1000 nits with power efficiency LED backlight. It provides LCD panel with specific aspect ratios and sunlight readable for digital signage, public transportation, exhibition hall, department store, and vending machine.

1.1 Features

- Resizing LCD
- Square Screen (8 : 9)
- High Brightness 1000 nits
- Sunlight Readable
- LED Backlight
- Slim Bezel
- BL MTBF: 100,000 hours

1.2 General Specifications

Model Name	SSD3565-I
Description	35.6" Resizing LCD, 1000 nits LED backlight, 1900x2160
Screen Size	35.6"
Display Area (mm)	598.5(H) x 680.4(V)
Brightness	1000 cd/m2
Resolution	1900x2160
Aspect Ratio	8 : 9
Contrast Ratio	7000 : 1
Pixel Pitch (mm)	0.315(H) x 0.315(V)
Pixel Pre Inch (PPI)	80
Viewing Angle	178°(H),178°(V)
Color Saturation (NTSC)	83%
Display Colors	1.07G
Response Time (Typical)	9.5ms
Panel Interface	V-by-One
Input Interface	HDMIx2, DP
Input Power	DC24V
Power Consumption	73W
OSD Key	5 Keys (Power Switch, Menu, +, Exit, -)
OSD Control	Brightness, Color, Contrast, Auto Turing, H/V Position...etc
Dimensions (mm)	629 x 710.4 x 73.5
Bezel Size(U/B/L/R)	13.7/16.4/15.2/15.2 mm
Weight (Net)	15kg
Mounting	400x200, 400x300
Operating Temperature	0 °C ~ 50 °C
Storage Temperature	-20 °C ~ 60 °C

SSD= Panel + LED Driving Board + AD Control Board + Housing

1.3 Absolute Maximum Ratings

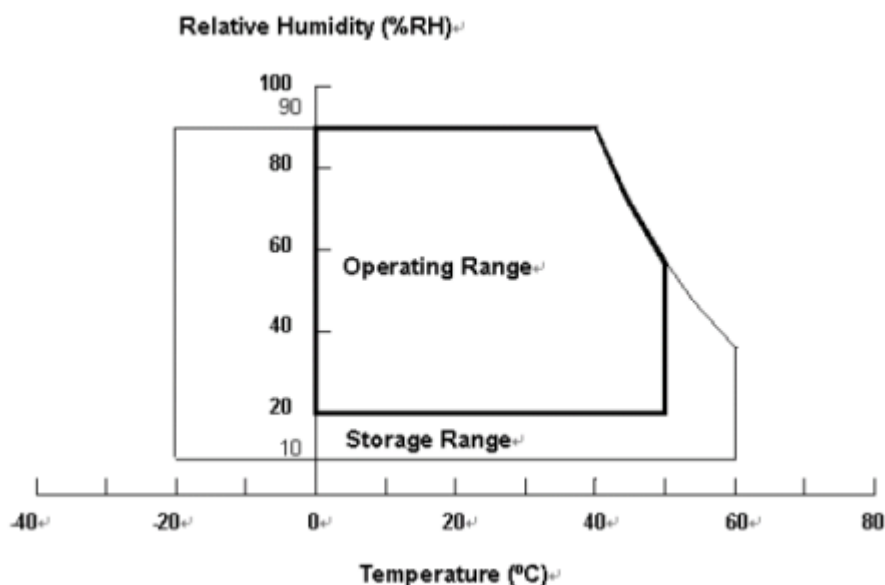
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1), (3)
Operating Ambient Temperature	T _{OP}	0	50	°C	(1), (2), (3)

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

- (a) 90 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).
- (b) Wet-bulb temperature should be 39 °C Max.
- (c) No condensation.

Note (2) Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) The rating of environment is base on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.



2 Electrical Specification

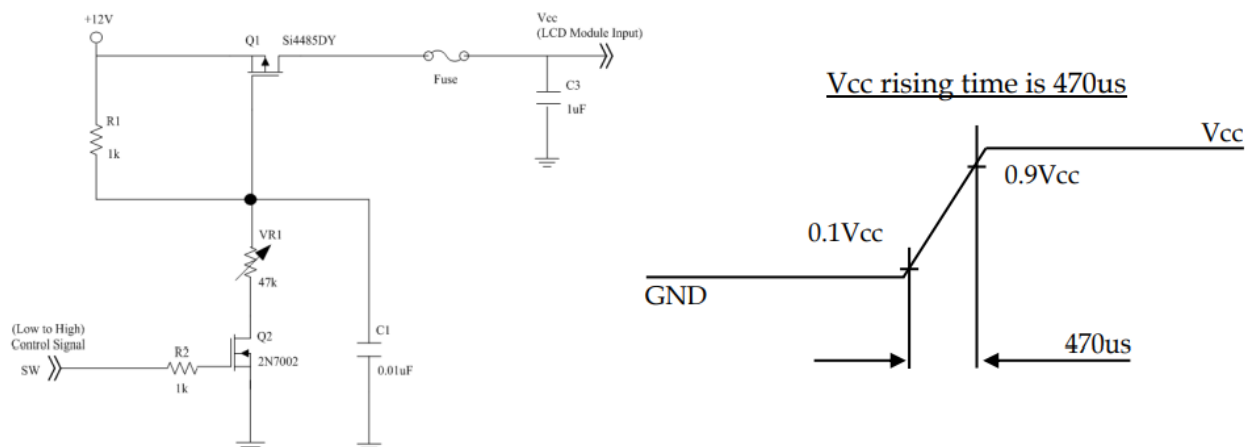
2.1 TFT LCD

(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}	—	—	2.91	A	(2)
Power Consumption	White Pattern	P _T	—	21.56	23.72	W	(3)
	Horizontal Stripe	P _T	—	19.28	21.21	W	
	Black Pattern	P _T	—	9.57	10.52	W	
Power Supply Current	White Pattern	—	—	1.86	2.25	A	(3)
	Horizontal Stripe	—	—	1.66	2.01	A	
	Black Pattern	—	—	0.82	0.97	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(HeavyLoading Pattern)



Active Area

b. Black Pattern



Active Area

c. Horizontal Stripe pattern



2.2 Input Terminal Pin Assignment

TFT LCD Open Cell Input

CNC06 Connector Pin Assignment: [FF01-42T-5131 (FCN), 5-05162216-1 (Xin Da Yi Tong)]

Pin	Name	Description	Note
1	Vin	Power input (+12V)	(5)
2	Vin	Power input (+12V)	
3	Vin	Power input (+12V)	
4	Vin	Power input (+12V)	
5	Vin	Power input (+12V)	
6	Vin	Power input (+12V)	
7	Vin	Power input (+12V)	
8	Vin	Power input (+12V)	
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	SDA	I2C Data signal,(open drain)	(7)
19	SCL	I2C Clock signal,(open drain)	(7)
20	N.C.	No Connection	(4)
21	VSYNC	VSYNC (for Converter)	
22	N.C.	No Connection	(4)
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	1ST Pixel Negative V-by-One differential data input in area A. Lane 0	(1)
29	RX0P	1ST Pixel Positive V-by-One differential data input in area A. Lane 0	
30	GND	Ground	
31	RX1N	2ND Pixel Negative V-by-One differential data input in area A. Lane 1	(1)
32	RX1P	2ND Pixel Positive V-by-One differential data input in area A. Lane 1	
33	GND	Ground	
34	RX2N	3RD Pixel Negative V-by-One differential data input in area A. Lane 2	(1)
35	RX2P	3RD Pixel Positive V-by-One differential data input in area A. Lane 2	
36	GND	Ground	
37	RX3N	4TH Pixel Negative V-by-One differential data input in area A. Lane 3	(1)
38	RX3P	4TH Pixel Positive V-by-One differential data input in area A. Lane 3	
39	GND	Ground	
40	RX4N	5TH Pixel Negative V-by-One differential data input in area A. Lane 4	(1)
41	RX4P	5TH Pixel Positive V-by-One differential data input in area A. Lane 4	
42	GND	Ground	
43	RX5N	6TH Pixel Negative V-by-One differential data input in area A. Lane 5	(1)
44	RX5P	6TH Pixel Positive V-by-One differential data input in area A. Lane 5	

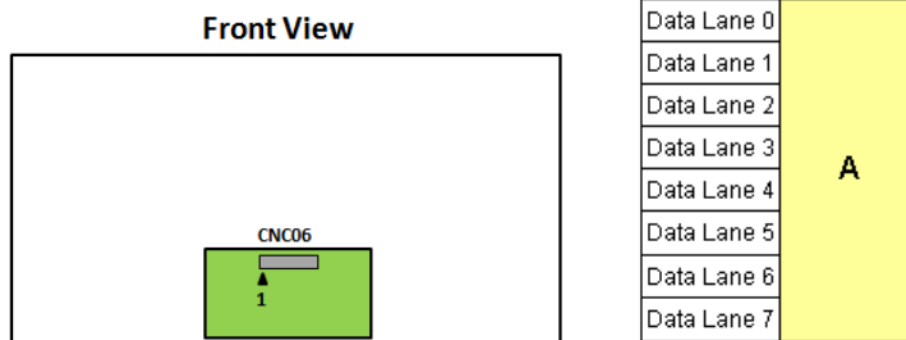
45	GND	Ground	
46	RX6N	7TH Pixel Negative V-by-One differential data input in area A. Lane 6	(1)
47	RX6P	7TH Pixel Positive V-by-One differential data input in area A. Lane 6	
48	GND	Ground	
49	RX7N	8TH Pixel Negative V-by-One differential data input in area A. Lane 7	(1)
50	RX7P	8TH Pixel Positive V-by-One differential data input in area A. Lane 7	
51	GND	Ground	

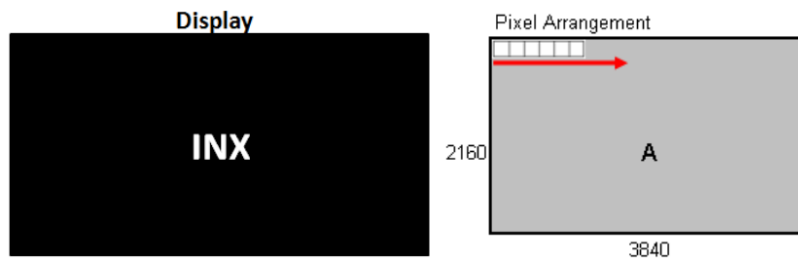
Note (1) V-by-One HS Data Mapping(QFHD mode):

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

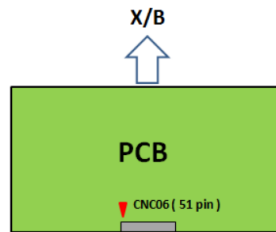
V-by-One HS Data Mapping (FHD VRR mode)

Area	Lane	Data Stream
A	Lane 0	1, 9, 17,, 1905, 1913
	Lane 1	2, 10, 18,, 1906, 1914
	Lane 2	3, 11, 19,, 1907, 1915
	Lane 3	4, 12, 20,, 1908, 1916
	Lane 4	5, 13, 21,,1909, 1917
	Lane 5	6, 14, 22,, 1910, 1918
	Lane 6	7, 15, 23,, 1911, 1919
	Lane7	8, 16, 24,, 1912, 1920

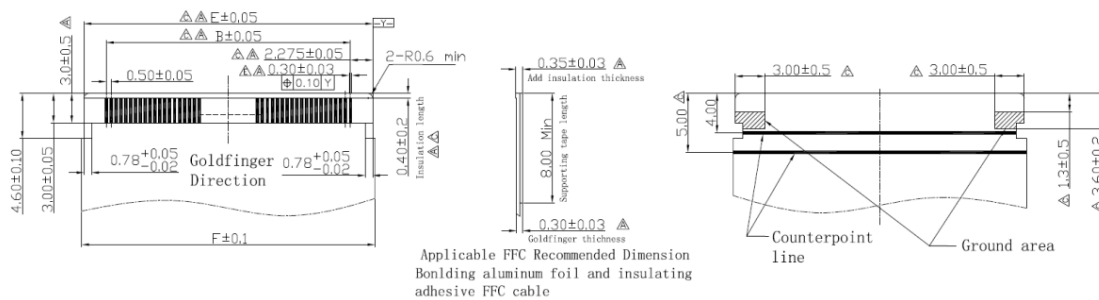




Note (2) VbyOne HS connector pin order defined as follows



Note (3) V-by-One connector Recommend Mating FFC drawing as below.



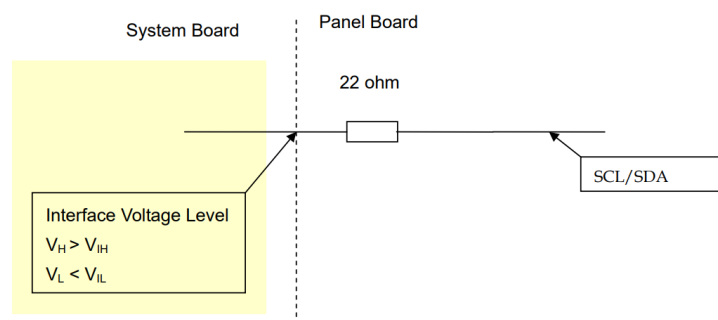
PIN	DIM:B	DIM:E	DIM:F
30	14.50	19.05	19.5
41	20.00	24.55	25.0
51	25.00	29.55	30.0

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 connects to ground internal, but it could be open.

Note (7) I2C pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including Panel board loading as below.



2.3 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 the color versus data input.

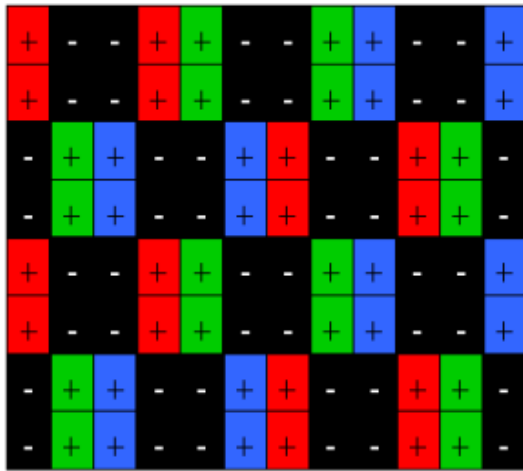
Color		Data Signal																			
		Red										Green									
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cyan	0	0	0	0	0	0	0	0	0	0	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
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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
	Red (1)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	Red (1021)	1	1	1	1	1	1	1	1	1	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
	Red (1023)																				
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
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (2)	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1
	Green (1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0
	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0
	Green (1023)																				
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
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (2)	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	Blue (1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	Blue (1022)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
	Blue (1023)																				

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

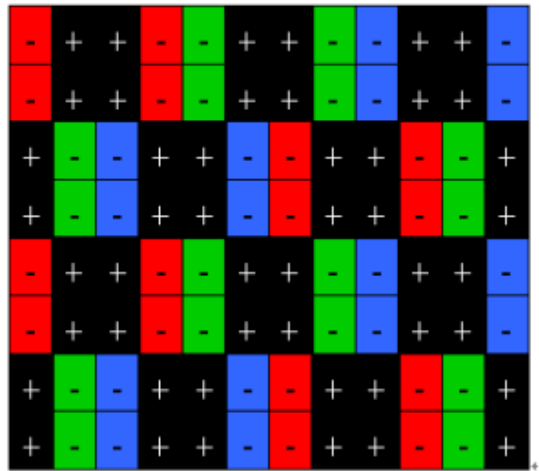
Flicker (Vcom) Adjustment

(1) Adjustment Pattern: Sub-pixel on/off pattern was shown as below.

Frame N



Frame N+1



(2) Adjustment method: (Digital V-com)

2.4 Interface Timing

Input Signal Timing Specifications

(Ta = 25 ± 2 °C)

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	F _{clk_in_mod}	1/Tc-0.5%	—	1/Tc+0.5%	MHz	(4)
	Spread spectrum modulation frequency	F _{SSM}	—	—	30	KHz	

Timing spec for QFHD Mode Frame Rate =45~ 63Hz and support HDMI 2.1 VRR

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frequency	Data Clock	1/Tc	70	74.25	80	MHz	(1)
Frame Rate	QFHD Mode	F _r	45	60	63	Hz	(5),(6)
Horizontal Frequency		F _h	122.8	135	140	KHz	
Vertical Active Display Term (8 Lane,3840X2160 Active Area)	Total	T _v	2200	2250	2790	Th	T _v =T _{vd} +T _{vb}
	Display	T _{vd}	2160			Th	
	Blank	T _{vb}	40	90	630	Th	
Horizontal Active Display Term (8 Lane,3840X2160 Active Area)	Total	T _h	530	550	570	Tc	T _h =T _{hd} +T _{hb}
	Display	T _{hd}	480			Tc	
	Blank	T _{hb}	50	70	90	Tc	

Timing spec for FHD VRR mode

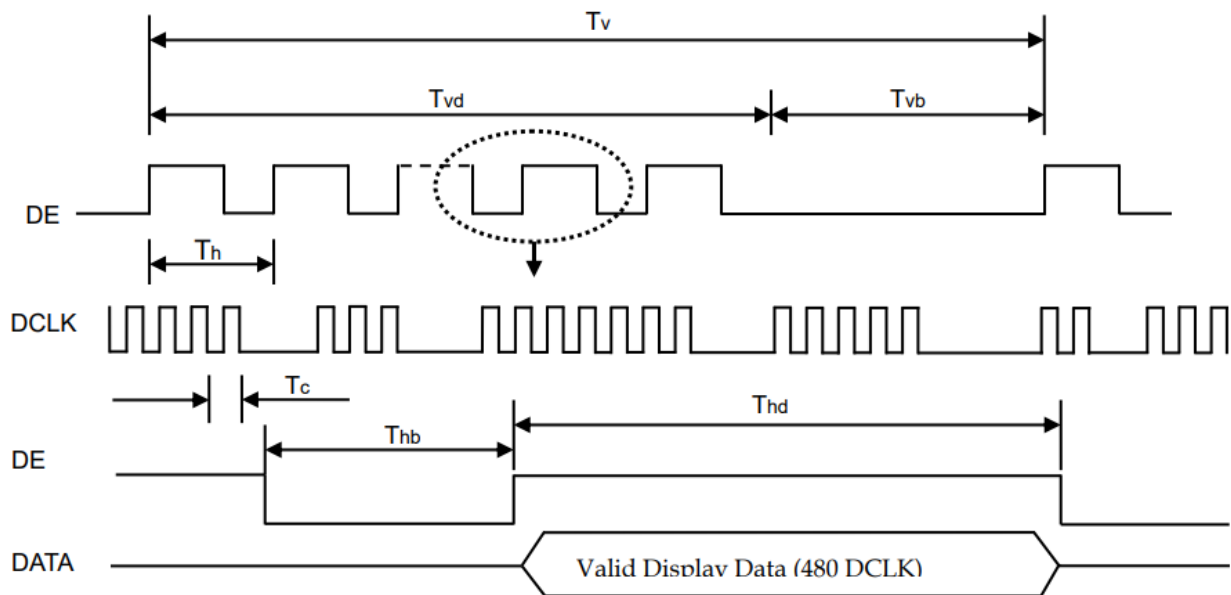
Note(7)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note	
Frequency	Data Clock	1/Tc	41.5	—	41.92	MHZ	CLK_in note(8)	for 48~144Hz
			37.1	—	41.92			for 48~120Hz
Frame rate	FHD VRR mode	Fr	48	—	144	Hz	for 48~144Hz	
			48	—	120	Hz	for 48~120Hz	
		Fh	150	—	159.5	KHz	for 48~144Hz	
			137	—	159.5	KHz	for 48~120Hz	
Vertical Active Display Term (8 Lan,1920X1080 Active Area)	Total	Tv	1102	—	3320	Th	Tv=Tvd+Tvb	
	Display	Tvd	1080			Th	—	
	Blank	Tvb	22	—	2253	Th	—	
Horizontal Active Display Term (8 Lan,1920X1080 Active Area)	Total	Th	263	—	264	Tc	Th=Thd+Thb for 48~144Hz	
			263	—	270		Th=Thd+Thb for 48~120Hz	
	Display	Thd	240			Tc	—	
	Blank	Thb	23	—	24	Tc	for 48~144Hz	
			23	—	30	Tc	for 48~120Hz	

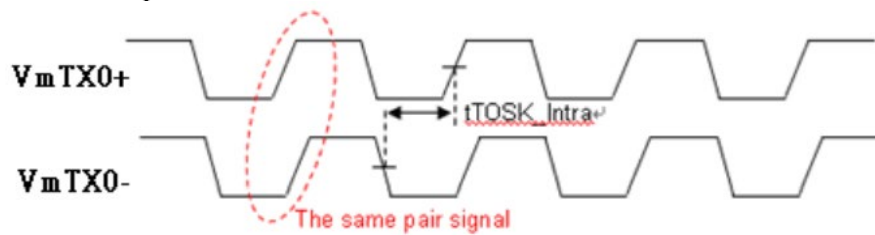
Note (1) Please make sure the range of pixel clock has follow the below equation:

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

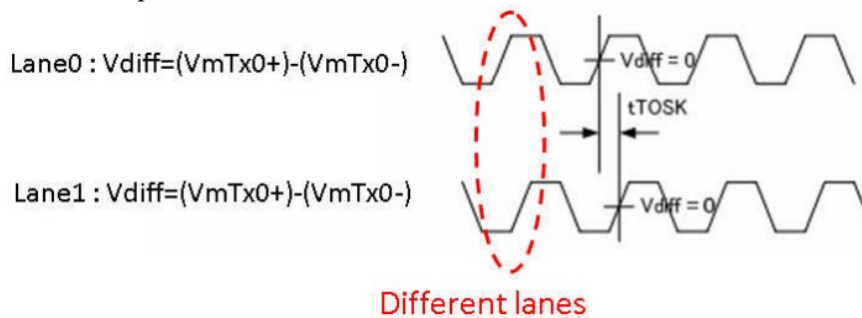
$$Fr \times Tv \times Th \geq F_{clk_{in}}(\min)$$



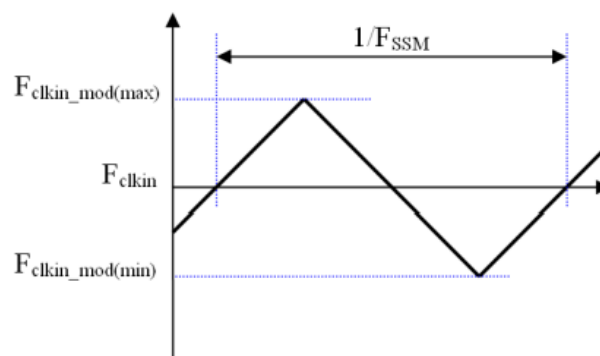
Note (2) VbyOne HS Intra-pair skew



Note (3) VbyOne HS Inter-pair skew.

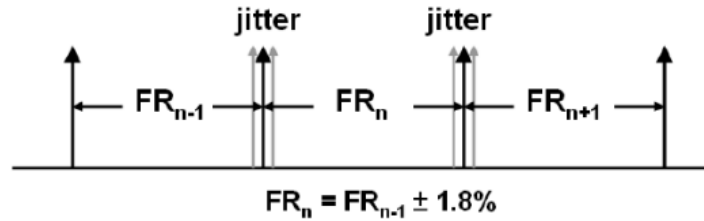


Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



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

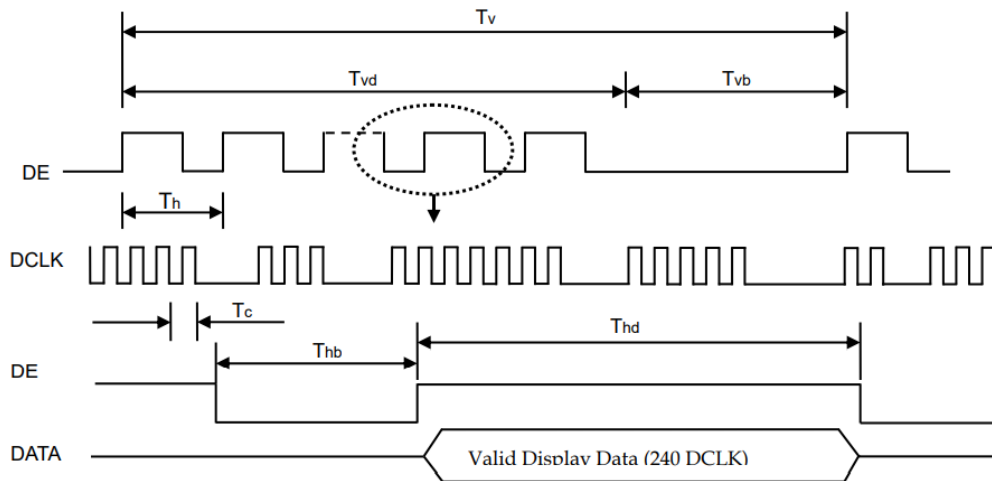
Note (6) For converter reference signals, The setup of the frame rate jitter $> 1.8\%$ may result in the cosmetic LED backlight symptom.



Note (7) FHD VRR mode is controlled by I2C command. It's important and necessary to follow the product SPEC, otherwise it may lead to abnormal or no display.

Note (8) Please make sure the range of pixel clock has follow the below equation :

$$CLK_{in} = Fr \times Tv \times Th$$



2.5 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 : 15MHz

Damping factor : 1.4

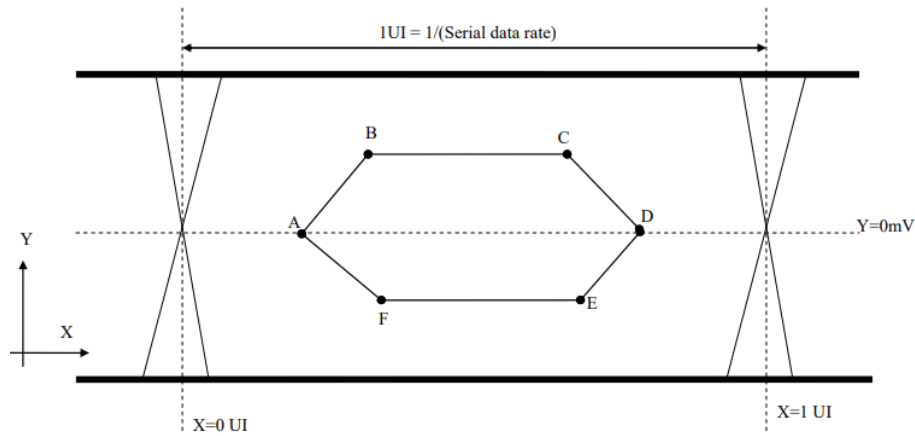


Table 1 Eye Mask Specification

	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”

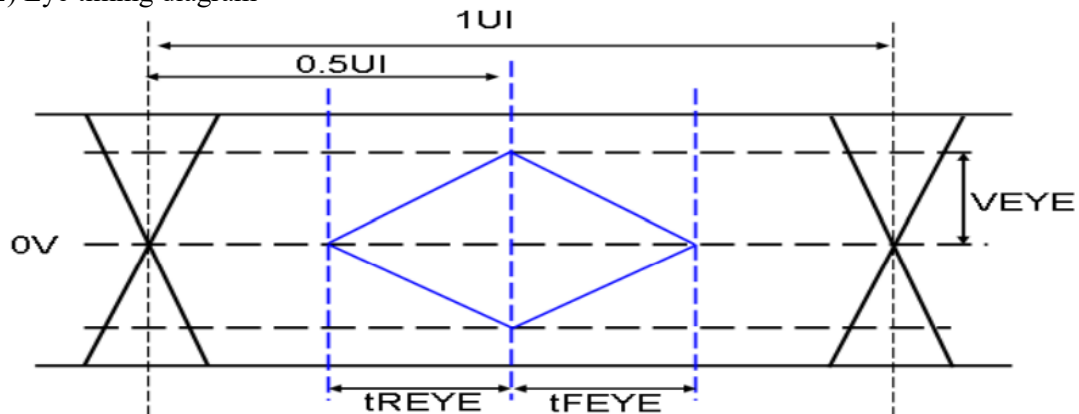
CMPI Signal Timing Diagram

(1) CMPI AC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Effective Veye Rising Time	tREYE	0.2	-	-	UI	
Effective Veye Falling Time	tFEYE	0.2	-	-	UI	
Effective Veye Level	VEYE	75	-	-	mV	
CMPI Clock	1UI		0.667		ns	

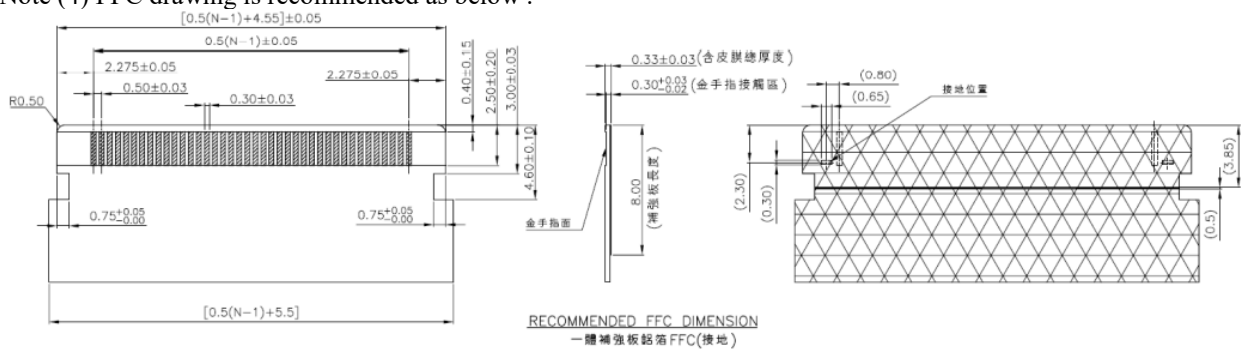
Note (1) CMPI EYE diagram must be in above spec. within any pattern If your application is not in our spec., INX can not guarantee Display and function normal.

Note (2) Eye timing diagram



Note (3) Measure point : X –board CMPI0P/N_1 ~ CMPI0P/N_12

Note (4) FFC drawing is recommended as below :



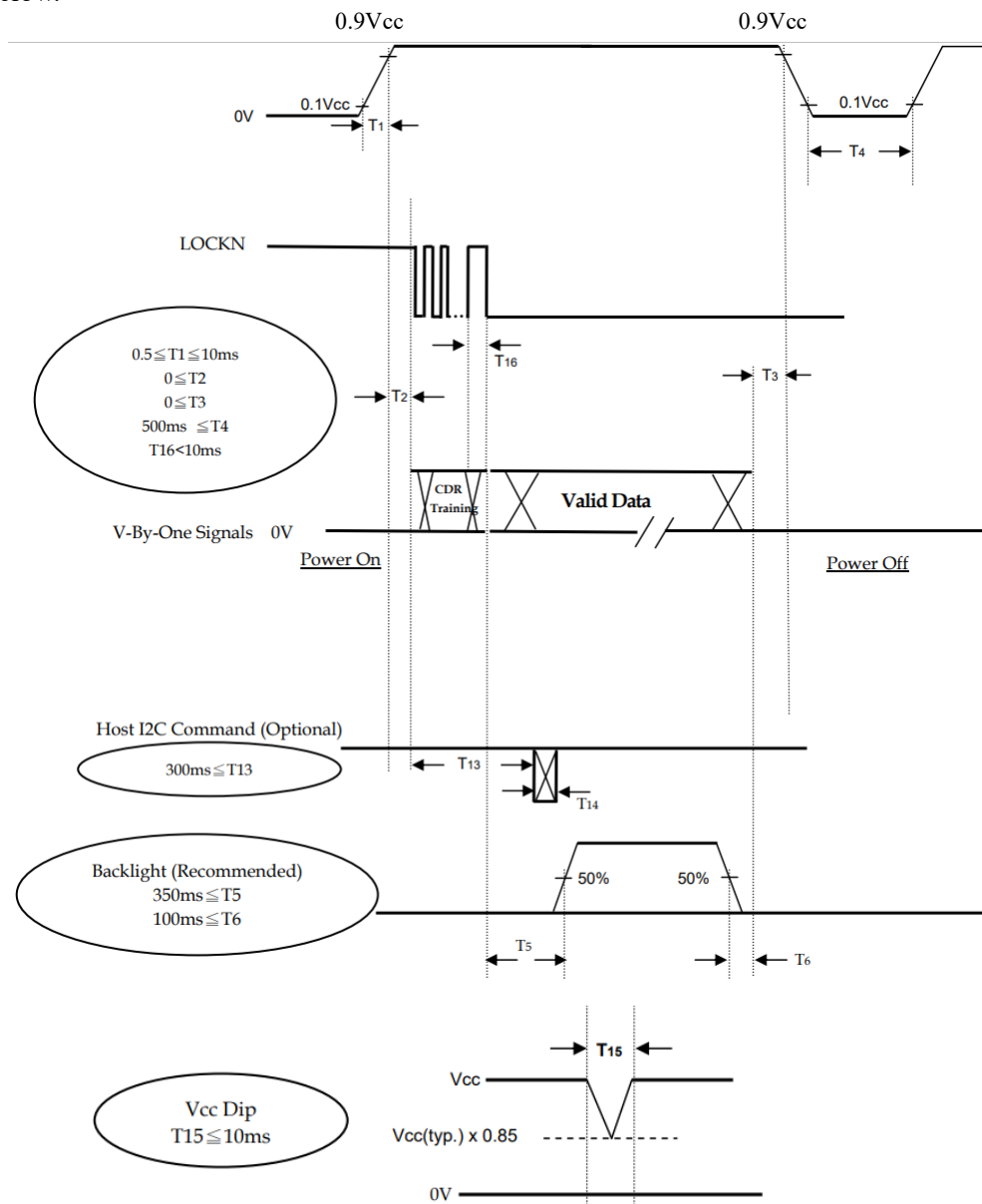
Byte Length and Color mapping of V-by-One HS

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]

2.6 Power ON/OFF Sequence

($T_a = 25 \pm 2^\circ\text{C}$)

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



Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

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 Vcc is in off level, please keep the level of input signals on the low or high impedance besides HTPDN and LOCKN. If $T2 < 0$, that maybe cause electrical overstress failure.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

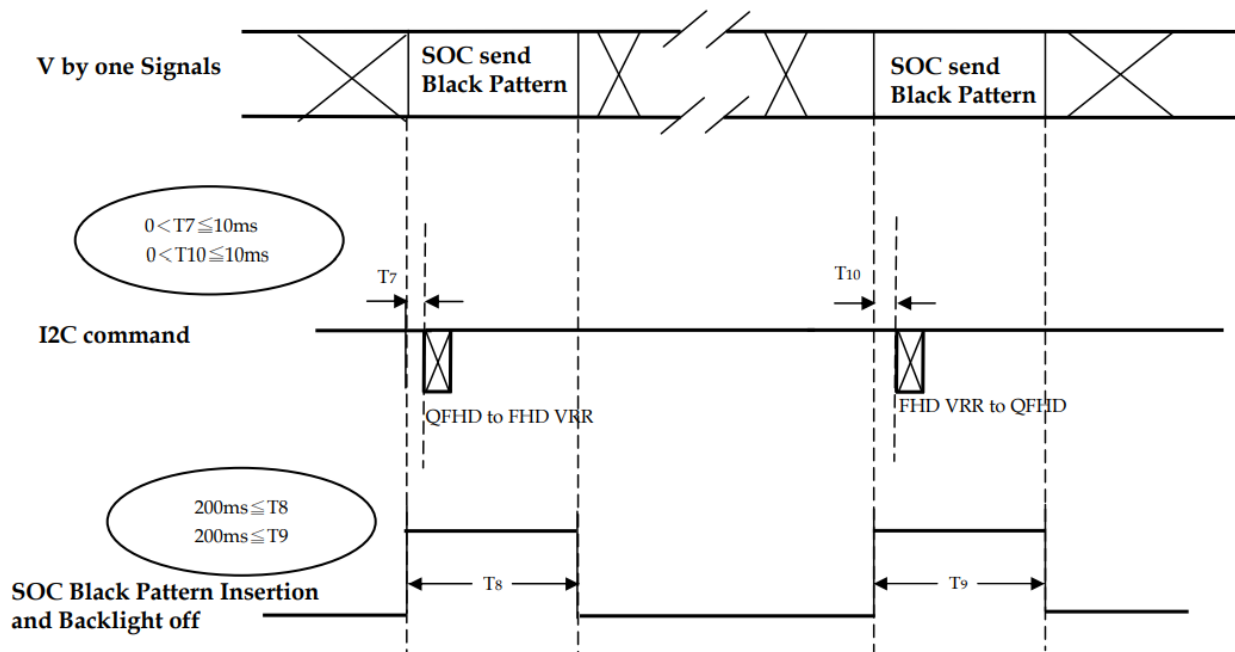
Note (5) Interface signal shall not be kept at high impedance when the power is on.

Note (6) Vcc must decay smoothly when power-off.

Note (7) When the I2C Command is after backlight turns on, the display may momentarily become abnormal screen.

Note (8) T16, V-by-One signals shall be stabilized and follows timing specification which defined by section 5.1&5.2

QFHD / FHD VRR Mode Change Signal Sequence



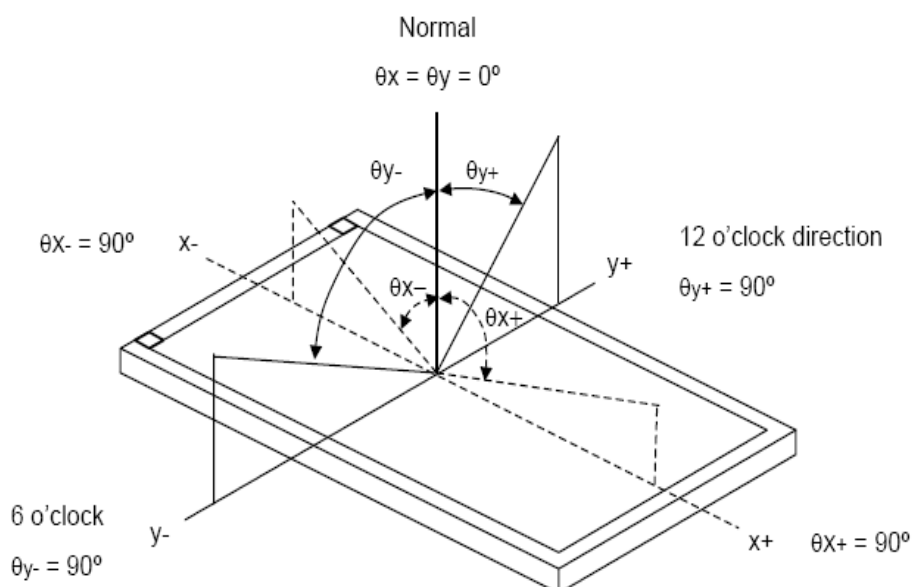
Note (1) When QFHD/FHD VRR mode is changed, TCON will insert black pattern internally. During black insertion, TCON would load required optical table and TCON parameter setting. The black insertion time should be longer than 200ms because TCON must recognize QFHD or FHD VRR format and set the correct parameter.

3 Optical Specification

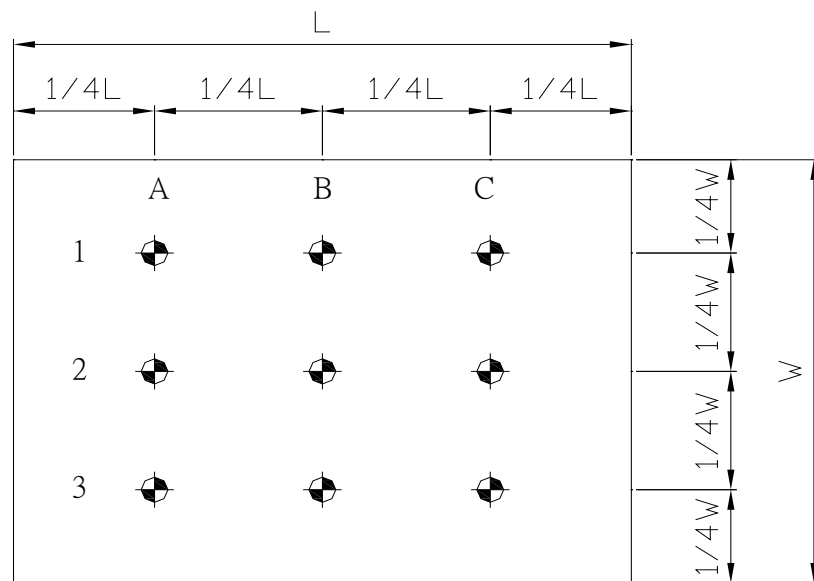
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color chromaticity	Red	Rx	$\theta_x=0$ $\theta_y=0$ Klein K-10	0.619	0.649	0.679	-	Test Mode: (1) (2) (3)
		Ry		0.304	0.334	0.364	-	
	Green	Gx		0.270	0.300	0.330	-	
		Gy		0.616	0.646	0.676	-	
	Blue	Bx		0.117	0.147	0.177	-	
		By		0.018	0.048	0.078	-	
	White	Wx		0.269	0.299	0.329	-	
		Wy		0.310	0.340	0.370	-	
Center Luminance of White		Lc	$\theta_x=0$	-	1000	-	cd/m ²	
Uniformity		Lu	$\theta_y=0$ BM-7	-	83	-	%	
Contrast Ratio		CR	$\theta_x=0$	-	7000:1	-	-	Test Mode: (1) (4)
Color Saturation		NTSC	$\theta_y=0$ Klein K-10	-	83	-	%	
Viewing Angle	Horizontal	θ_{x+}	$CR \geq 10$	-	89	-	Deg	Test Mode: (1) (3)
		θ_{x-}		-	89	-		
	Vertical	θ_{y+}		-	89	-		
		θ_{y-}		-	89	-		

Test Mode :

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

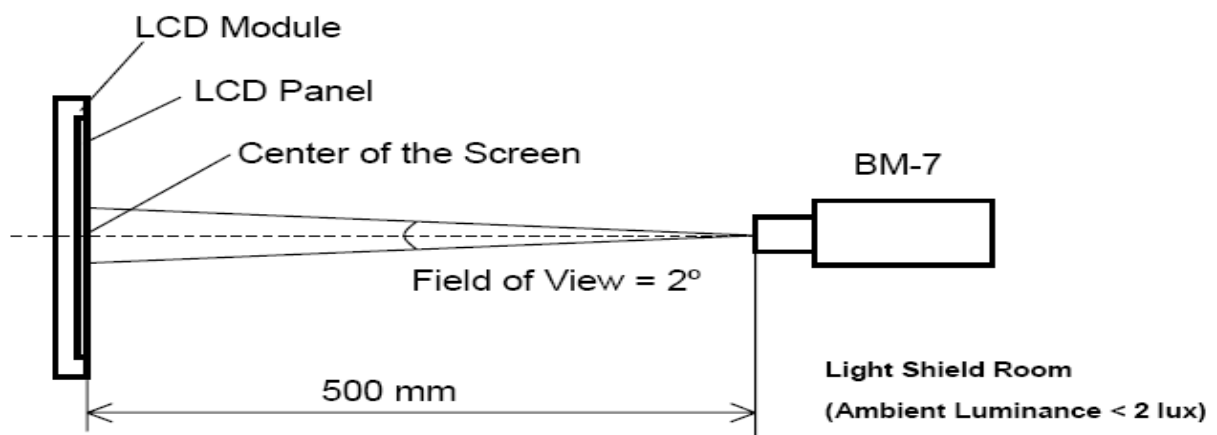


(2) Definition of Test Point:

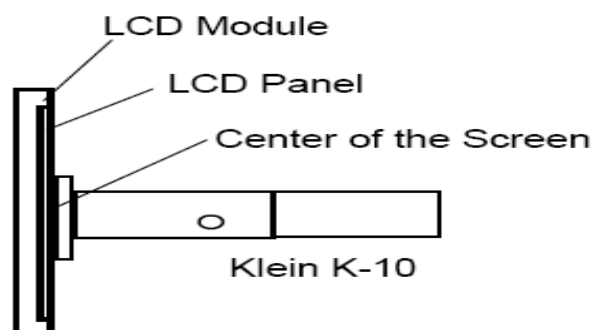


Active Area

(3) BM-7 Measurement Setup:



(4) Klein K-10 Measurement Setup:



4 LED Driving Board Specifications

This specification is applied to LED converter unit for SSF/SSH3565-I 1000nits LED backlight.

4.1 Operating Characteristics

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remark
Input Voltage	Vin		22.0	24.0	26.0	V	
Input Current (Low Brightness)	IinL	Brightness = 0%	0.0	-----	-----	mA	
Input Current (High Brightness)	IinH	Brightness = 100%	2.65	2.52	2.33	A	(1)
LED Current (Low Brightness)	IoutL	Brightness = 0%	0.0	-----	-----	Arms	
LED Current (High Brightness)	IoutH	Brightness = 100%	0.61	0.62	0.63	A	J3、J4
			0.61	0.62	0.63	A	J5、J6
Working Frequency	W_Freq	Brightness = 100%	350	400	450	KHZ	
Brightness Control	DC mode						
	Vadj	Connection of	0.2	-----	4.8	V	(2)
	PWM mode						
	PWM	Connect to PWM	0	-----	100	%	(3)
	Freq		-----	200	1000	Hz	(4)
ON/OFF Control	Von	Normal Operation	2	-----	5	V	
	Voff		0	-----	0.8	V	
Output Voltage	Vout	Brightness = 100%	44.75	45.23	45.82	V	J3、J4
			44.75	45.23	45.82	V	J5、J6
Efficiency	η	Brightness = 100%	93.5	94.2	95.1	%	(5)

Remark:

(1) this data is based on the testing result of practical input voltage, Iin is measured by related Vin.

(min, typ, max)

(2) Max brightness at Vadj=0.2V. Min brightness at Vadj=4.8V.

(3) Max dimming ratio = 1:100.

(4) Frequency can be adjusted in accordance with demand(120Hz minimum, or lights will be flickering)

(5) η max = $V_{out(max)} \cdot I_{outH(max)} / V_{in(max)} \cdot I_{inH(min)}$

η min = $V_{out(min)} \cdot I_{outH(min)} / V_{in(min)} \cdot I_{inH(max)}$

4.2 Input Pin Assignment

Input Connector: CN1(JST B10B-PH-K-S or Compatible)

PIN No	Symbol	Description
1	Vin	DC+
2	Vin	DC+
3	Vin	DC+
4	Vin	DC+
5	Vin	DC+
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	GND	Ground

DC or PWM Connector: CN2

PIN NO	Symbol	Description
1	DC	Close pin 1,2 LED driver is DC dimming
2	GND	
3	PWM	Close pin 2,3 LED driver is PWM dimming

Note: If you use CN2 to set DC/PWM, please NC the pin1 of CN3.

Input Connector: CN3(JST B4B-PH-K-S or Compatible)

PIN No	Symbol	Description
1	CL	PWM or DC selection
2	Control	ON/OFF Control
3	Brightness	Brightness Control
4	GND	Ground

Note: Pin1 is dimming method control pin, Low → DC dimming, High → PWM dimming.

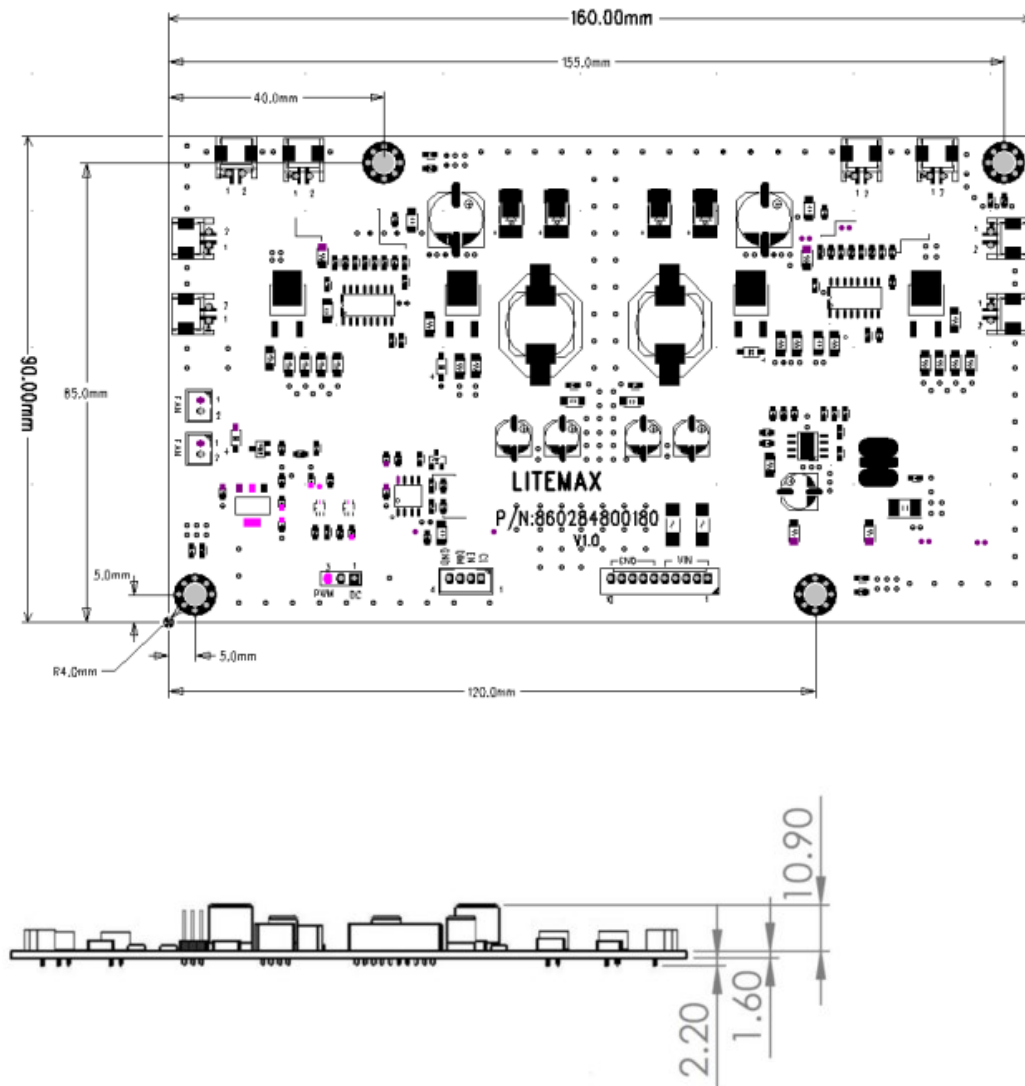
If pin1 is be used, please NC CN2.

Output Connector: J3, J4, J5, J6(JST S2B-EH or Compatible)

PIN NO	Symbol	Description
1	Output	LED High Voltage(+)
2	Output	LED Low Voltage (-)

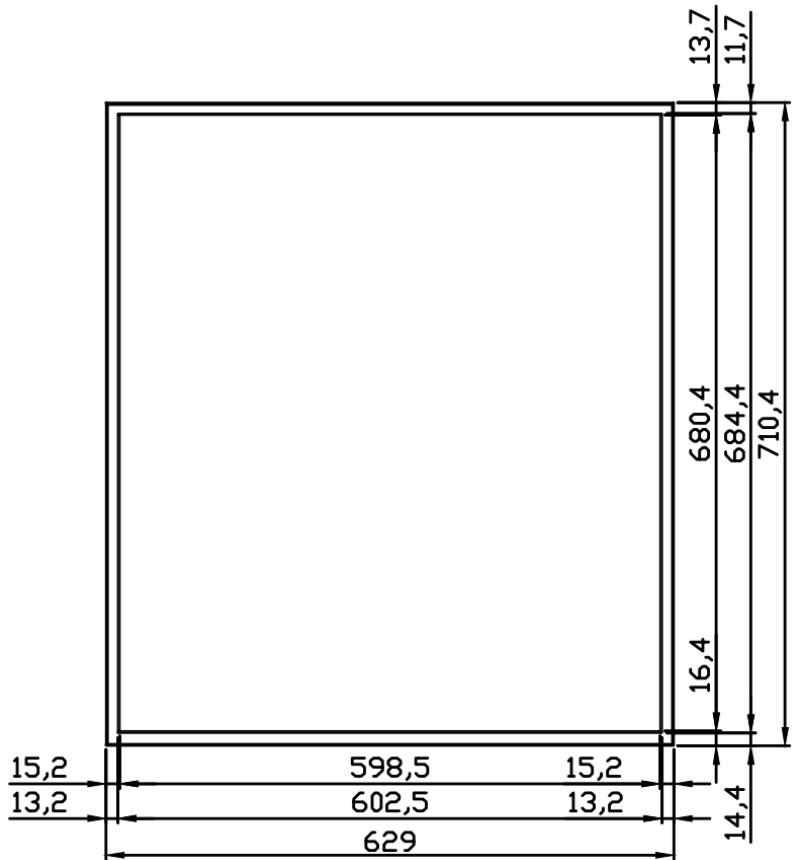
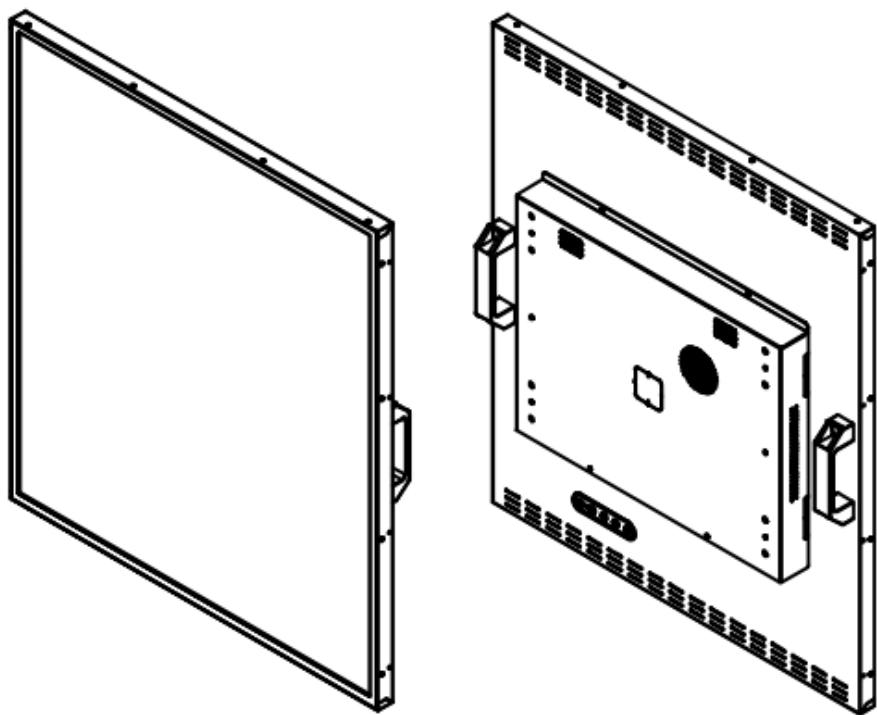
4.3 LED Driving Board Mechanical Characteristics

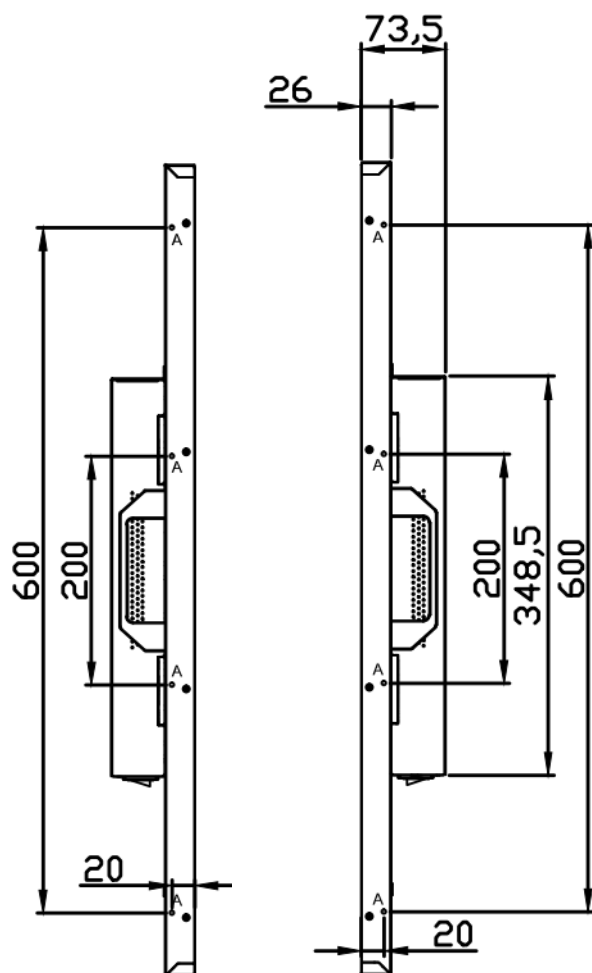
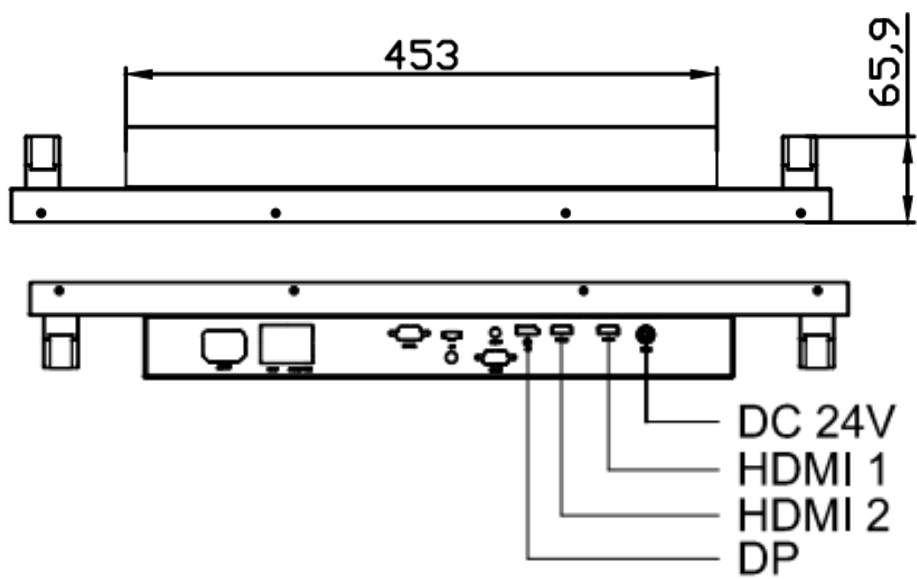
Dimension: 160 x 90 x 12.5mm



5 Mechanical Drawing

Unit:mm





6 AD68415HHP 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 a display port and two HDMI input.

General Description

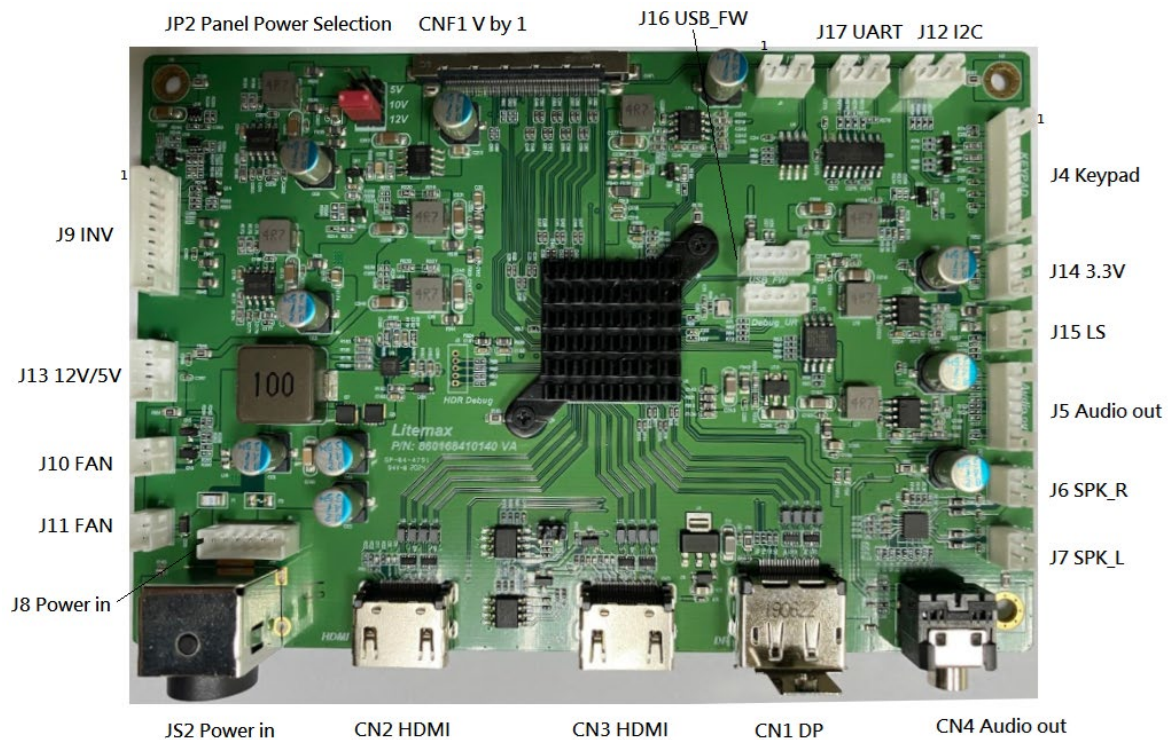
- Max resolution up to UHD (4096x2160)
- Support V-by-one or e-DP panel
- Two HDMI input (HDMI 2.0) support 4Kx2K@60Hz
- Display port input (DP 1.2a) support 4Kx2K@60Hz
- V-by-one or e-DP interface
- Support PIP (Optional ,1920x1080), PBP (Optional)
- Support panel DC 5V/10V/12V Output
- OSD control
- PWM/DC dimming control for backlight driver
- Input power DC 24V or DC 12V (Optional)
- Embedded MCU with ADC port for light sensor application (Optional)
- Auto detect digital light sensor
- External fan control by software
- EDID code protect control by software
- Audio line out and speaker output (Optional)
- External RS232 control (Optional)
- Audio in and 4Wx2(4Ω) Audio Out (Optional)

Characteristics

Power Input	12V/24V (Note1)
Power Consumption	15W Max. (Note2)
Input interface	HDMI 2.0, DP 1.2a
Output interface	V-by-1 8 lanes, eDP 8 lanes.
Resolution	Max 4096x2160
Support panel voltage	5 / 10 / 12 V
Speaker	4W speaker x 2
Backlight control	EN and PWM or DC dimming for backlight
Operation Temperature	-20 ~ 70 degree C
Storage Temperature	-20 ~ 70 degree C

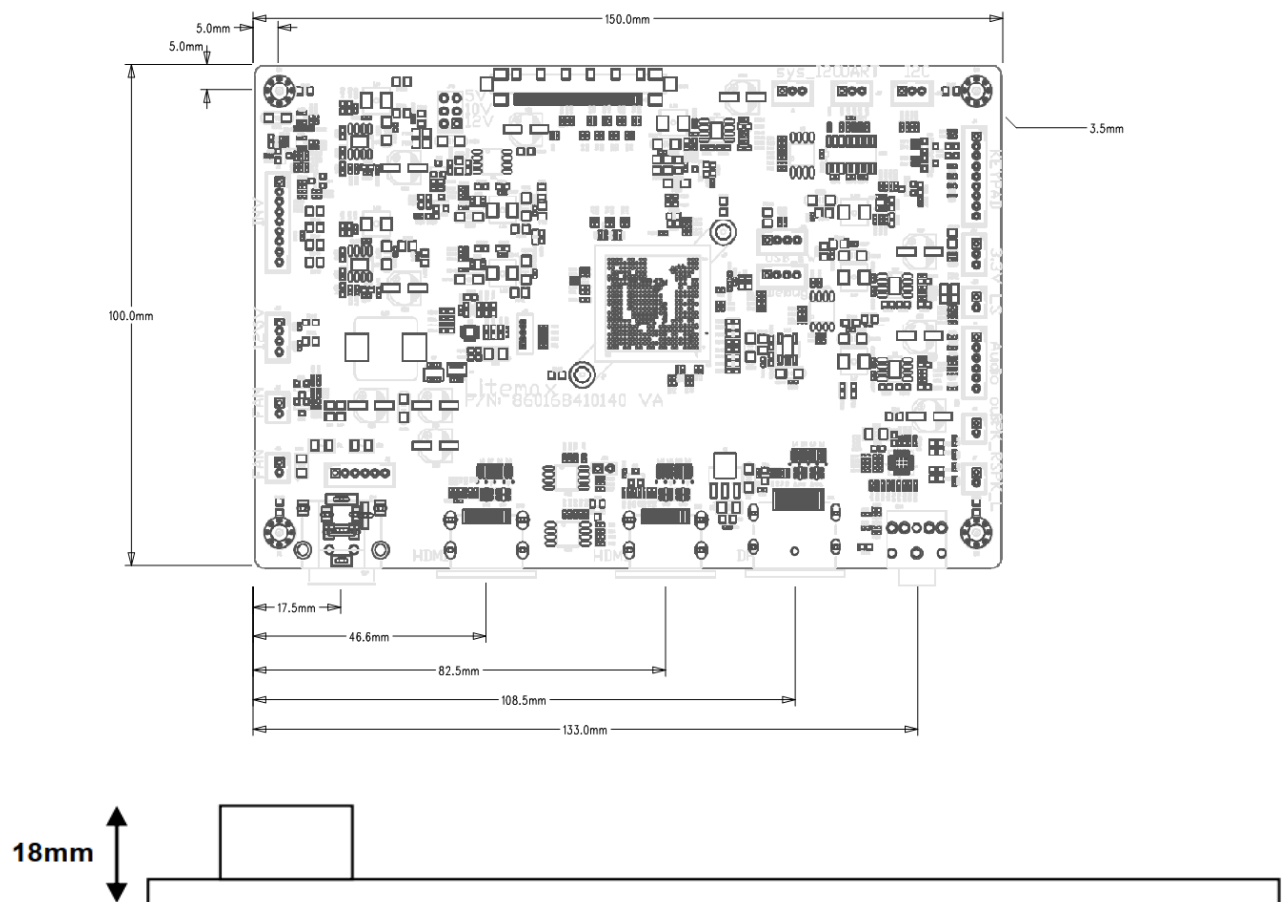
Note1: 12V or 24V are two different PCBA version, selection should be noted.

Note2: 15W means AD board own consumption, not include Backlight, LCD and T-con.



Outline Dimensions

AD68415 150mm x 100mm x 18mm



AD68415HHP Board Pin Define**CNF1: V-by-one output (Wafer 0.5mm pitch 51 pin SMD 90°)**

Pin	Function	Pin	Function
1	GND	27	HPD
2	RX7P	28	8b/10b SEL
3	RX7N	29	NC
4	GND	30	NC
5	RX6P	31	NC
6	RX6N	32	NC
7	GND	33	SCL
8	RX5P	34	SDA
9	RX5N	35	NC
10	GND	36	NC
11	RX4P	37	NC
12	RX4N	38	GND
13	GND	39	GND
14	RX3P	40	GND
15	RX3N	41	GND
16	GND	42	GND
17	RX2P	43	NC
18	RX2N	44	Panel power
19	GND	45	Panel power
20	RX1P	46	Panel power
21	RX1N	47	Panel power
22	GND	48	Panel power
23	RX0P	49	Panel power
24	RX0N	50	Panel power
25	GND	51	Panel power
26	LOCKN		

J16: USB FW (Wafer 2.0mm pitch 4 pin)

Pin	Function	Pin	Function
1	+5V	3	D+
2	D-	4	GND

J17: UART (Wafer 2.0mm pitch 3 pin)

Pin	Function	Pin	Function
1	UART_TX	3	GND
2	UART_RX		

J12: I2C (Wafer 2.0mm pitch 3 pin)

Pin	Function	Pin	Function
1	SDA	3	GND
2	SCL		

J4: Keypad (Wafer 2.0mm pitch 9 pin)

Pin	Function	Pin	Function
1	POWER KEY	6	UP KEY
2	GREEN LED	7	DOWN KEY
3	RED LED	8	GND
4	AUTO KEY	9	NC
5	MENU KEY		

J14: 3.3V (Wafer 2.0mm pitch 3 pin)

Pin	Function	Pin	Function
1	3.3V	3	GND
2	VR(Optional)		

J15: Analog light sensor (Wafer 2.0mm pitch 2 pin)

Pin	Function	Pin	Function
1	5V	2	Sensor Out

J5: Audio out (Wafer 2.0mm pitch 6 pin) (Optional)

Pin	Function	Pin	Function
1	MUTE	4	Audio_Out_R
2	VOL	5	GND
3	Audio_Out_L	6	SPDIF

J6, J7: Speaker output (Wafer 2.0mm pitch 2 pin)

Pin	Function	Pin	Function
1	SPK+	2	SPK-

CN4: Audio line out (Phone.3.5φ 90° 5 pin)

Pin	Function	Pin	Function
1	GND	4	GND
2	Audio_Out_R	5	GND
3	Audio_Out_L		

CN1: Display port input (Display port 1.2a)

Pin	Function	Pin	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

CN2, CN3: HDMI input (HDMI 2.0)

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		

JS2: Power input (Power Din 4 pin)

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

JS1: Power input (Power Jack 3 pin) (Optional)

Pin	Function	Pin	Function
1	Power Input	3	GND
2	GND		

J8: Power input (Wafer 2.0mm pitch 6 pin)

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

J10, J11: 12V for Fan power (Wafer 2.0mm pitch 2 pin)

Pin	Function	Pin	Function
1	Fan+ (12V)	2	Fan-

J13: Reserved 12/5V (Wafer 2.0mm pitch 4 pin)

Pin	Function	Pin	Function
1	5V	3	12V
2	GND	4	GND

J9: Backlight power and control (Wafer 2.0mm pitch 9 pin)

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		

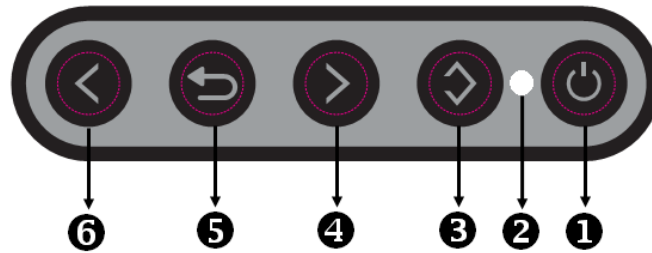
Note3: Pin 7,8,9 are for 12V version only. If you choose 24V version, these 3 pin are NC.

JP2: Panel power selection (2.54mm pitch 2x3 jump) (Note4)

Pin	Function	Pin	Function
1-2 close	12V	5-6 close	5V
3-4 close	10V		

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

OSD Function MEMBRANE CONTROL BUTTOM



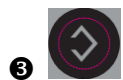
- ❶ **Key:** (Power) function key

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.

OSD Menu

- 1-  Picture



- 1-1.  Brightness mode

Choose the brightness mode by OSD. The function of light sensor and VR are optional.



- 1-2.  Brightness

Adjust the brightness range (0~100)



- 1-3.  Contrast

Adjust the contrast range (0~100)



1-4.



Sharpness

Adjust the sharpness range (0~4)



2-



Input source



3-



Audio



3-1. Volume

Adjust the volume range (0~100)



3-2. Mute

Turn on or turn off the mute



4- Color



4-1.  6500K

4-2.  9300K

4-3.  User Define



Red gain

Adjust the red gain range (0~100)

Green gain

Adjust the green gain range (0~100)

Blue gain

Adjust the blue gain range (0~100)

5- Other setting



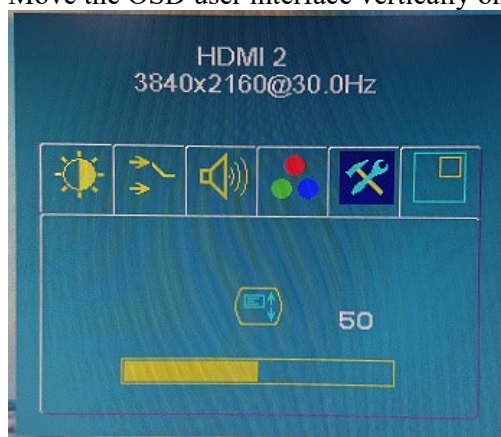
5-1. OSD_HPos

Move the OSD user interface horizontally on screen (0~100)



5-2. OSD_VPos

Move the OSD user interface vertically on screen (0~100)



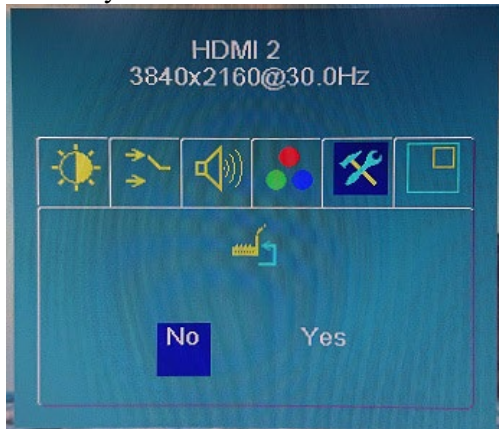
5-3. OSD Rotation

Rotate the degrees of OSD (0, 90, 180, 270 degrees)



5-4. Load Default

Recovery the value of OSD



6- PIP / PBP (Optional)



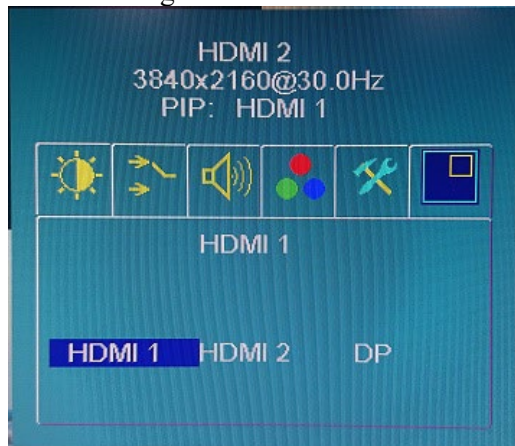
6-1. PIP / PBP Mode

Choose the Mode (OFF、PIP、PBP)



6-2. PIP / PBP Input

Switch the signal source of PIP/PBP



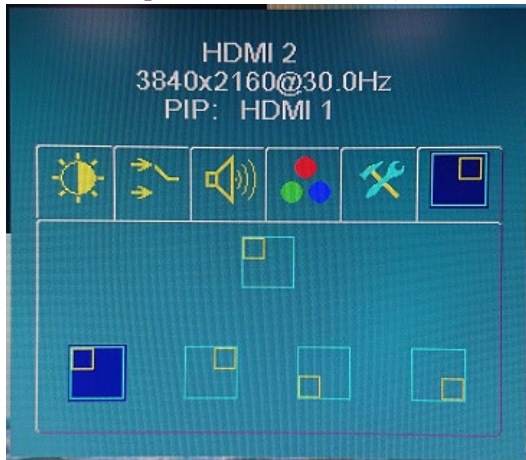
6-3. PIP / PBP Size

Choose the PIP/PBP size (1280x720, 1366x768, 1920x1080)



6-4. PIP / PBP Pos

Choose the position of PIP/PBP (LT、RT、LB、RB)

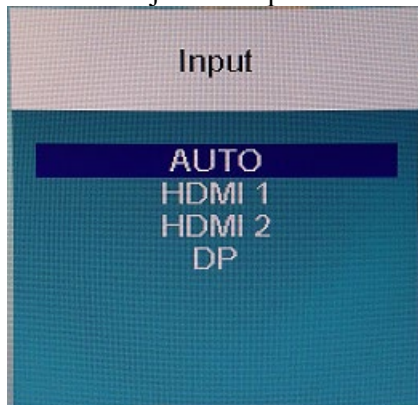


< Hot key >

Left key can adjust the brightness.

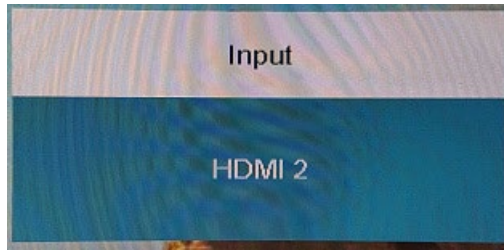


Right key can exhibit and adjust the input source.



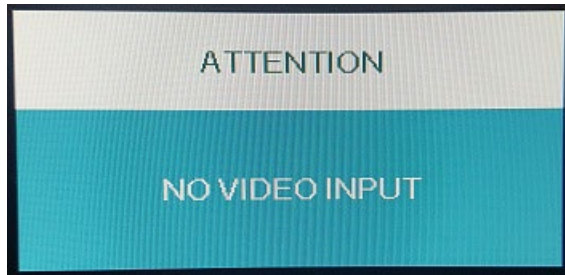
< Other >

Power on or switch the source can exhibit the information.



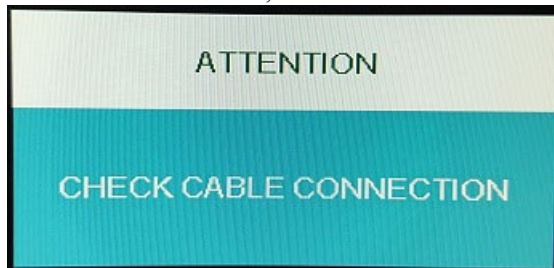
(Information)

No input source can exhibit NO VIDEO INPUT



(No Video Input)

If the cable doesn't connect the socket, the screen will exhibit CHECK CABLE CONNECTION



(Check Cable Connection)

7 Precautions

7.1 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.

7.2 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.

7.3 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.

8 Disclaimer

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