BOE

TITLE : XK493L6D-WH1-5700 Product Specification

Rev. A

BOE Technology Group Co.,Ltd

	Prepared By	Reviewed By	Approved By
Signature/Date			

REVISION HISTORY

(√)preliminary specification

(   )Final specification

Revision No.	Page	Description of changes	Date	Prepared
Rev.A	32	Initial Release	2022.12.06	-

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1.0 GENERAL DESCRIPTION

1.1 Introduction

The XK493L6D-WH1-5700 is a Color Active Matrix Organic Light Emitting Diode Display (OLED).It is a Top emission display type. It has a 49.3 inch diagonally measured active display area with half FHD resolution (540 vertical by 1920 horizontal pixel array).

Each pixel is divided into Red, Green, Blue and White sub-pixels or dots which are arrayed in squares. Gray scale or the luminance of the sub-pixel color is determined with a 10-bit gray scale signal for each dot. Therefore, it can present a palette of more than 1.07B(true) colors.

It has been designed to apply the 10-bit 4-lane V by One interface.

It is intended to support TV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.
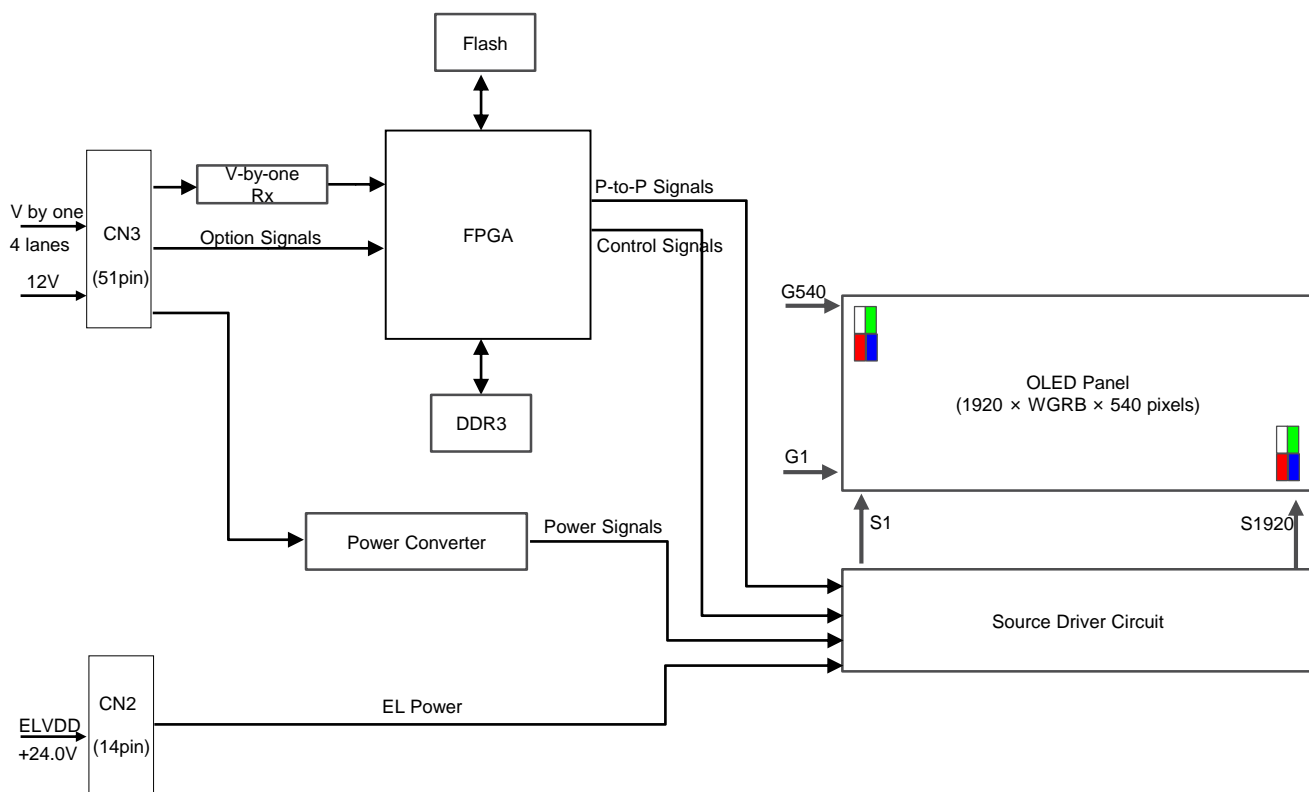
1.2 General Specification

< Table 1. General Specifications >

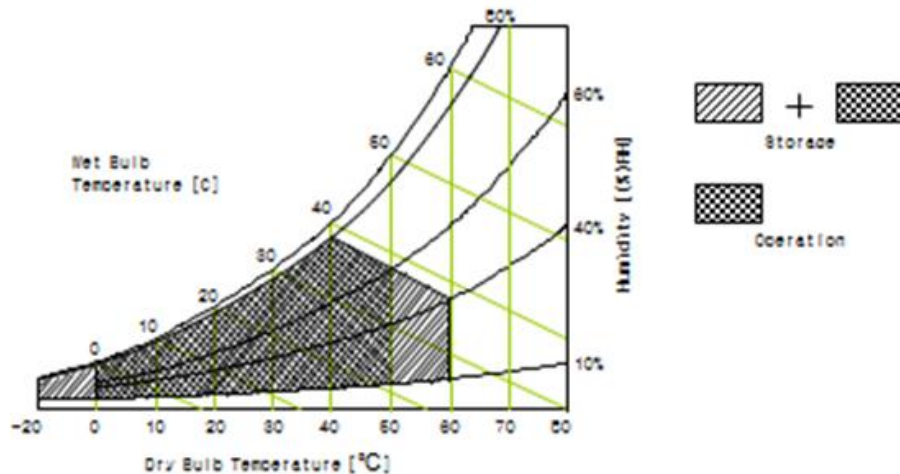| Parameter	Specification
Active Screen Size	1206.53mm(H) × 339.34mm(V)
Outline Dimension (Typ.)	1218.33mm(H) × 357.74mm(V) × 1.4mm(B) (Typ.)
Pixel Format	1920 horiz. by 540 vert. Pixels, BWGR Quad arrangement
Pixel pitch	628.4μm(H) × 628.4μm(V)
Color Depth	10bit(R), 1.07Billon colors
Luminance, White	400/150 cd/m2 (Center 1point ,Typ.)
Color Viewing Angle	R/L 120 (min.), (Δu'v' = ±0.02)
Power Consumption	Total 89W@W255 Pattern [Logic = 28W, ELVDD = 61W] （Typ.）
Weight	1.55Kg (Typ.)
Display Mode	Normally Transparent
Total transmittance	40%

2.0 ABSOLUTE MAXIMUM RATINGS

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Open Cell Electrical Specifications >

[VSS=ELVSS=0V]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	VSS-0.3	13.5	V	Ta = 25 ℃
	ELVDD	ELVSS-0.3	26.0	V	
TCON Option Voltage	V_{LOGIC}	VSS-0.3	3.8	V	
Operating Temperature	T_{OP}	0	+45	℃	Note 1
Panel Front Temperature	T_{SUR}	-	+60	℃	Note 2
Storage Temperature	T_{SUR}	-20	+60	℃	Note 1
	T_{ST}	-20	+60	℃	
Operating Ambient Humidity	Hop	10	90	%RH	
Storage Humidity	Hst	10	90	%RH	

Note 1 : Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39 ℃ max. and no condensation of water.
Note 2 : 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 OLED 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℃. The range of operating temperature may be degraded in case of improper thermal management in final product design.

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3.0 ELECTRICAL SPECIFICATIONS

3.1 Electrical Characteristics

It requires two power inputs. One is employed to power for the circuit. The other is used for the ELVDD.

< Table 3. Electrical Specifications >

[Ta =25 $\pm$ 2 ℃]

Parameter		Symbol	Values			Unit	Remark
			Min	Typ	Max		
Power Supply Input Voltage		VDD	10.8	12	13.2	V	
		ELVDD	22.5	24	25.5		
Power Supply Current		I_{VDD}	-	-	2.5	A	Note2
			-	-	4.1		Note3
		I_{ELVDD}	-	-	2.5		Note4
					5		Note5
Power Consumption		P_{VDD}	-	-	30.0	Watt	Note2
			-	-	49.2		Note3
		P_{ELVDD}	-	-	61		Note4
			-	-	120		Note5
Rush current		I_{RUSH_VDD}	-	-	8	A	Note6
		I_{RUSH_ELVDD}	-	-	7		
TTL Interface	Input High Threshold Voltage	VIH	2.7	3.3	3.4	V	
	Input Low Threshold Voltage	VIL	0	-	0.8		
	Output High Threshold Voltage	VOH	2.7	3.3	3.4		
	Output Low Threshold Voltage	VOL	0	-	0.8		

Note1. The specified current and power consumption are under the VIN=12.0V, ELVDD=24.0V Ta=25 $\pm$ 2℃, f_V =60Hz condition.

Note2. The current (I_{VDD}) is specified at the standard moving picture(IEC62087).

Note3. The current (I_{VDD}) is specified at the maximum current pattern (1by1 Horizontal Pattern).

Note4. The current (I_{ELVDD}) is specified at the white pattern (W255).

Note5. The current (I_{ELVDD}) is specified at the maximum current pattern (Secondary Color Pattern).

Note6. The Power Supply Input Voltage(ELVDD) ripple must be in 60mV.

Note7. The duration of rush current is about 2 ms and rising time of power input is 1ms (min).

4.0 OPTICAL SPECIFICATION

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25\pm2℃$. The values are specified at distance 50cm from the OLED surface at a viewing angle of Φ and θ equal to 0 ° .

< Table 4. Optical Table >

Ta= $25\pm2°C$, VDD=12V , ELVDD=24.0V, f_V =60Hz,

Parameter		Symbol	Min	Typ	Max	Unit	Remark
Contrast Ratio		CR		100,000			1
Surface Luminance, white	Normal		120	150	-	cd/m^2	2
	Peak		320	400	-		
Luminance Uniformity		δ_{WHITE}	70	80	-	%	3
Response Time		G to G	-	1	3	ms	4
Color Coordinates [CIE1931]	White	W_x		0.285			5
		W_y		0.294			
	Red	R_x	TYP. - 0.02	-	TYP. + 0.02		
		R_y		-			
	Green	G_x		-			
		G_y		-			
	Blue	B_x		-			
		B_y		-			
Color Temperature			-	9200	-	K	
Color Gamut (DCIP3)			-	90	-	%	
Color Viewing Angle (CR > 10)	Horizontal	Θ_3	60	-	-	Deg.	6
		Θ_9	60	-	-		
	Vertical	Θ_{12}	60	-	-		
		Θ_6	60	-	-		
Life Time (B10)		Hrs		40000			7
Gray Scale				2.2			8

Note :

1. Contrast measurements shall be made at viewing angle of θ= 0˚ and at the center of the OLE D surface (See Figure 1). Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. Luminance Contrast Ratio (CR) is defined mathematically.

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$
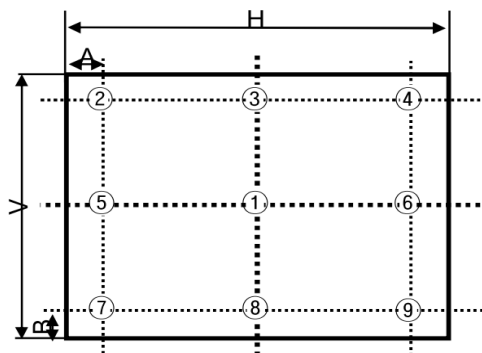
It is measured at center 1-point.

2. Normal full white luminance is determined with 100% APL after 30 minutes 'ON' with WRGB rolling pattern in a dark environment at $25\pm2˚C$. It is the luminance value at center 1-point across the OLED surface 50cm from the surface with all pixels displaying white. Peak luminance is determined with 25% APL after 60 seconds at least 'ON' with 25% white window box. Peak luminance measurement is proceeded after measuring normal luminance. For more information see the Fig. 2.

3. The variation in surface luminance , δ WHITE is defined as :

δ WHITE(9P) = Minimum(L on1,, …. L on9) / Maximum(L on1 ….. L on9)

Where L on1 to L on9 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). Response time depends on the temperature.(In lower temperature, it becomes longer.)
For additional information see the FIG. 3. (N<M).

5. The color chromaticity coordinates specified in Table 4.shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. We refer to $\theta_{\varnothing=0}$ (=θ_3) as the 3 o'clock direction (the "right"), $\theta_{\varnothing=90}$ (= θ_{12}) as the 12 o'clock direction ("upward"), $\theta_{\varnothing=180}$ (= θ_9) as the 9 o'clock direction ("left") and $\theta_{\varnothing=270}$ (= θ_6) as the 6 o'clock direction ("bottom"). While scanning θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V +/-10% at 25℃. Optimum viewing angle direction is 6 'clock.
Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the OLED surface.

7. IEC62087 standard video with ECD every 4 hours at room temperature 25℃ (If the cumulativ e time of usage is over 4 hours, ECD compensation should be performed.)

8. Gray scale specification.
Gamma Value is approximately 2.2.

< Figure 1. Measurement Set Up >
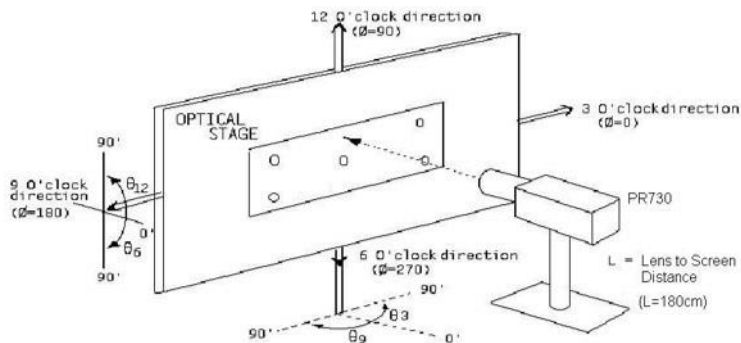
< Figure 2-1. 9 Points for Luminance Measure with 100% APL>

< Figure 2-1. 1 Points for peak luminance measure with 25% APL >

< Figure 3. Response Time Testing >

N,M = Black~White, N<M

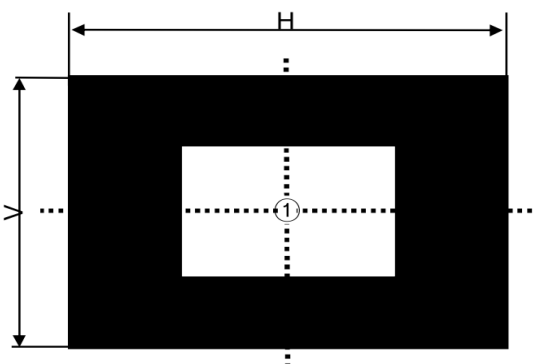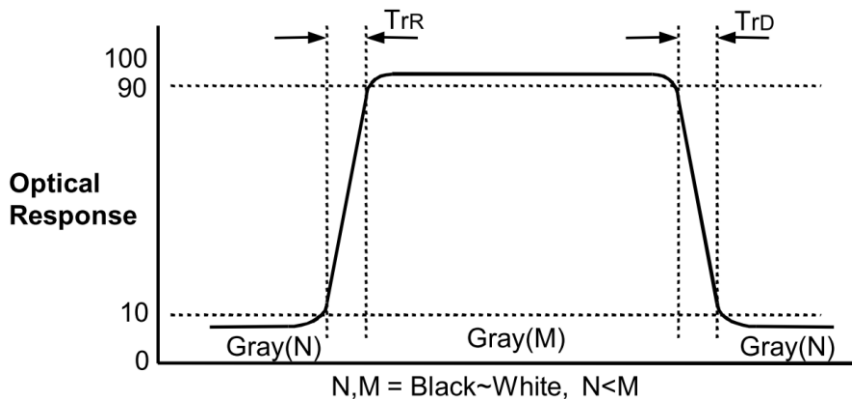| SPEC. NUMBER A	SPEC. TITLE	PAGE
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5.0 INTERFACE CONNECTION.

This OLED module employs two kinds of connectors, 14-pin connector is used for the EL power and 51-pin connector is used for the module electronics

5.1 OLED Module (Signals)

< Table 5.1. MODULE CONNECTOR(CN3) PIN CONFIGURATION>

No	Symbol	Description	No	Symbol	Description
1	VDD	Power Supply +12.0V	27	GND	Ground
2	VDD	Power Supply +12.0V	28	Rx0N	V-by-One HS Data Lane 0
3	VDD	Power Supply +12.0V	29	Rx0P	V-by-One HS Data Lane 0
4	VDD	Power Supply +12.0V	30	GND	Ground
5	NC	No Connection	31	Rx1N	V-by-One HS Data Lane 1
6	GND	Ground	32	Rx1P	V-by-One HS Data Lane 1
7	GND	Ground	34	GND	Ground
8	GND	Ground	34	Rx2N	V-by-One HS Data Lane 2
9	GND	Ground	35	Rx2P	V-by-One HS Data Lane 2
10	ECD	Compensation flag, Set ← Module	36	GND	Ground
11	AC_Det	AC_Det(H=On), Set → Module	37	Rx3N	V-by-One HS Data Lane 3
12	Error Detection	'H' =Error, 'L' =Normal, Set ← Module	38	Rx3P	V-by-One HS Data Lane 3
13	I2C-SDA1	I2C for Customer	39	GND	Ground
14	I2C-SCL1		40	NC	No Connection
15	NC	No Connection	41	NC	No Connection
16	NC		42	NC	No Connection
17	NC		43	NC	No Connection
18	NC		44	NC	No Connection
19	NC		45	NC	No Connection
20	ELVDD_DET	ELVDD reset , Set ← Module	46	NC	No Connection
21	NC	No Connection	47	NC	No Connection
22	NC	No Connection	48	NC	No Connection
23	NC	No Connection	49	NC	No Connection
24	GND	Ground	50	NC	No Connection
25	HTPDN	Hot plug detect	51	NC	No Connection
26	LOCKN	Lock detect	-	-	-

1. All GND pins should be connected together.
2. All Input levels of V-by-One signals are based on the V-by-One HS Standard.
3. Specific pin No. #10 is used for compensation when power turn off.
4. Specific pin No. #12 is used for "Power Error detection" of the OLED module.
5. Specific pin No. #13 and #14 are used for Customer Signal Input, the I2C definition refer to I2C register map.
6. Specific pin No. #20 is only used for ELVDD level monitoring of the OLED module.
7. V-by-One Connector(CON5): FI-RE51S-HF(manufactured by JAE) and Mating connector: FI-RE51HL(JAE) or compatible.

Rear view of OLED Module

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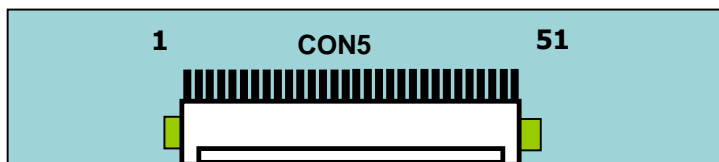
5.2 OLED Module (Powers)

- ELVDD Connector(CN2): CI0114M1HR0-NH(manufactured by CviLux) or compatible
-Mating Connector : CI0114S0000 (manufactured by CviLux) or compatible

< Table 6. ELVDD CONNECTOR (CN2) PIN CONFIGURATION>

CON2		
Pin NO	**Symbol**	**Description**
1	ELVSS	OLED Ground
2	ELVSS	OLED Ground
3	ELVSS	OLED Ground
4	ELVSS	OLED Ground
5	ELVSS	OLED Ground
6	ELVSS	OLED Ground
7	ELVSS	OLED Ground
8	ELVDD	OLED Power Supply +24V
9	ELVDD	OLED Power Supply +24V
10	ELVDD	OLED Power Supply +24V
11	ELVDD	OLED Power Supply +24V
12	ELVDD	OLED Power Supply +24V
13	ELVDD	OLED Power Supply +24V
14	ELVDD	OLED Power Supply +24V

Rear view of OLED Module

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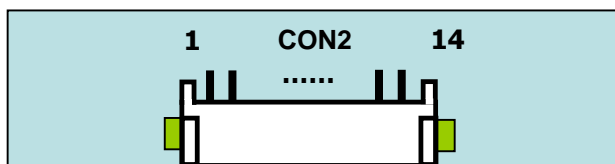
6.0 SIGNAL TIMING SPECIFICATION

Table 7 shows the signal timing required at the input of the V-by-One transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

< Table 7. Timing Table >

	Parameter	Symbol	Min	Typ.	Max.	Unit	Remarks
DCLK frequency		1/Tclk	74	74.25	75.5	MHz	
Horizontal section	Horizontal Total	HT	548	550	552	Tclk	Note1
	Horizontal Blank	HB	34	37	40	Tclk	
	Valid Data Width	HV	-	480	-	Tclk	
Vertical section	Frame Rate	fV	-	120	-	Hz	Note1
	Vertical Total	VT	-	564	-	HT	
	Vertical Sync	VS	2	3	4	HT	
	Vertical Back Porch	VBP	15	18	20	HT	
	Vertical Front Porch	VFP	2	3	4	HT	
	Valid Data Width	VV	540	540	540	HT	

Note1: Timing should be set based on clock(DCLK) frequency.
Note2: This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.
Note3: The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency.
Note4: HSync and VSync are High active.

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6.1 V by One Eye Mask Specification.

< Table 8. Signal Timing Waveforms Table >

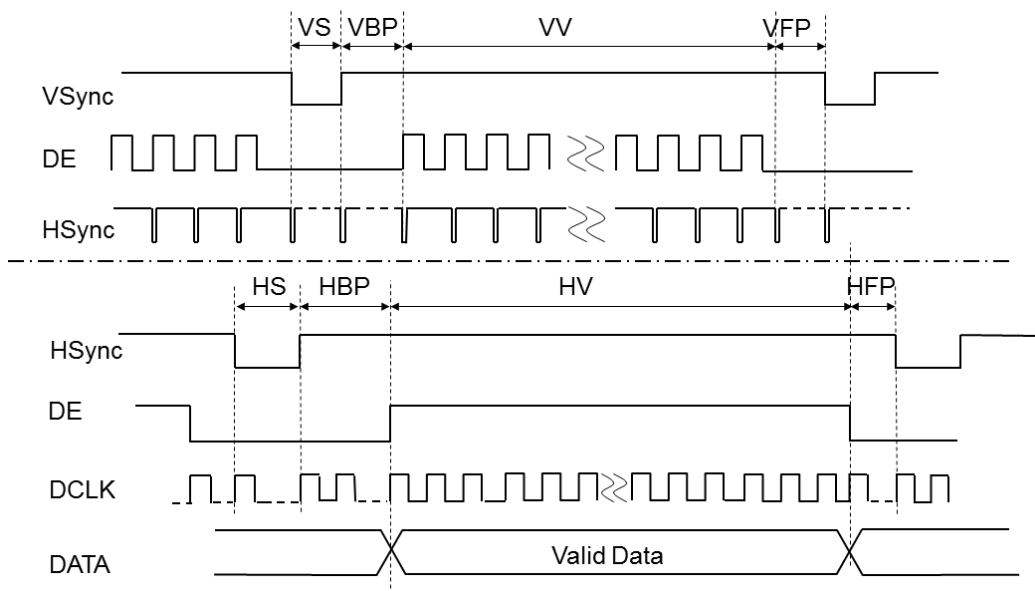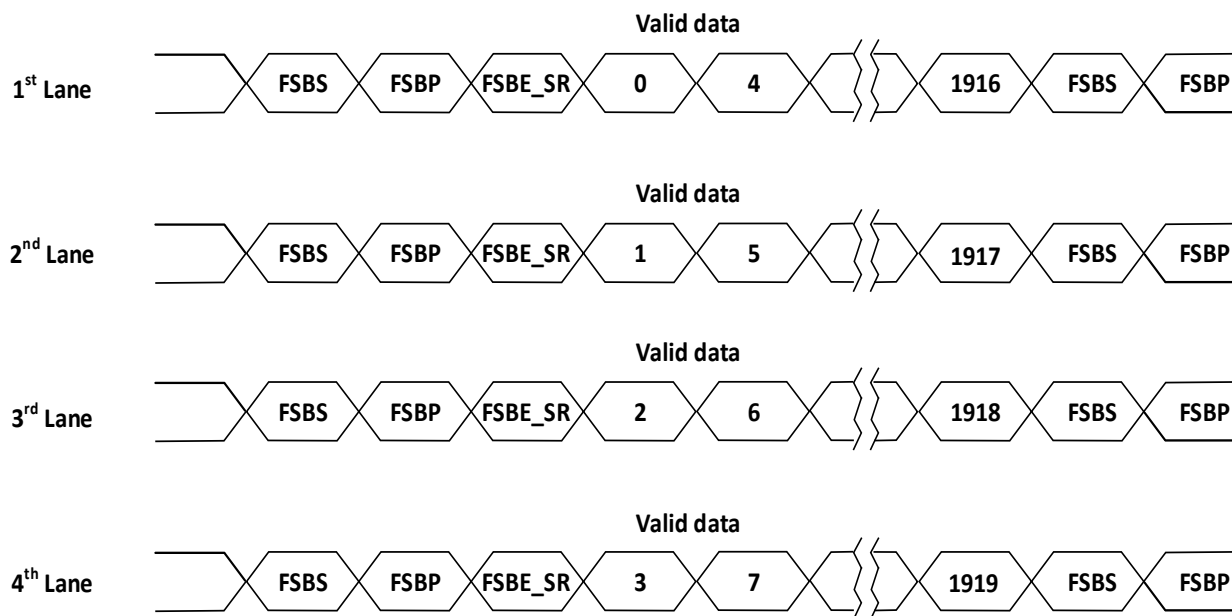| Parameter	Symbol	Condition	Min	Typ	Max	Unit
Unit Interval(VBO Operation Bit Rate)	tRBIT	3-byte	380	tTCIP/30	1667	PS
		4-byte	285	tTCIP/40	1250	PS
		5-byte	266	tTCIP/50	1000	PS
Eye Width at Package Pin	tREYE	-	-	0.5	-	UI
Eye Width Position A at Package Pin	tA	-	-	0.25	-	UI
Eye Width Position B at Package Pin	tB	-	-	0.3	-	UI
Eye Width Position Cat Package Pin	tC	-	-	0.7	-	UI
Eye Width Position D at Package Pin	tD	-	-	0.75	-	UI
Eye Width Position E at Package Pin	tE	-	-	0.7	-	UI
Eye Width Position F at Package Pin	tF	-	-	0.3	-	UI
Intra – pair Skew	TTOSK_intra	-	-0.3	-	0.3	UI
Intra – pair Skew	TTOSK_inter	-	-500	-	500	UI
SSCG	-	30KHz modulation	-0.5		0.5	%
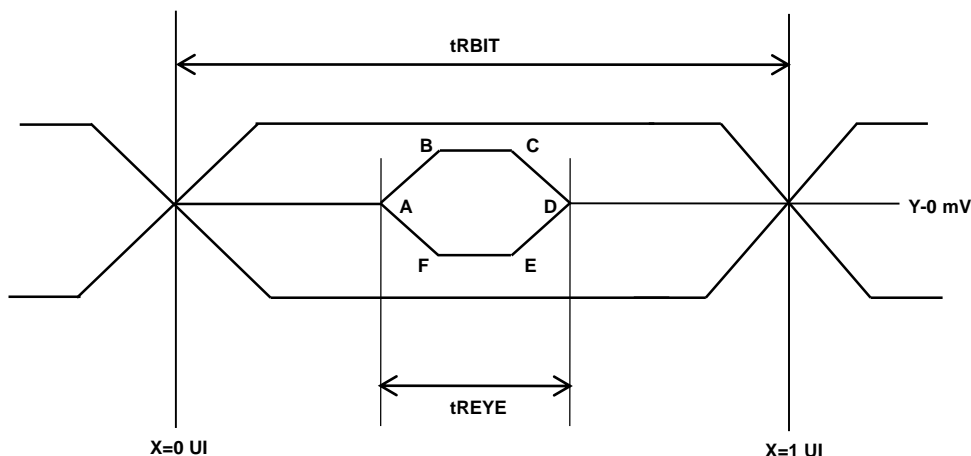
Note1：All Input levels of V by One signals are based on the V by One HS Standard.

Note2： The eye diagram is measured by the oscilloscope and receiver CDR characteristic must be emulated

Note3：System side have to put pull high resistor on LOCKN/HTPDN pins.

6.2 V by One Input Signal Timing Diagram.

1st Lane

Valid data

FSBS — FSBP — FSBE_SR — 0 — 4 — 1916 — FSBS — FSBP

2nd Lane

Valid data

FSBS — FSBP — FSBE_SR — 1 — 5 — 1917 — FSBS — FSBP

3rd Lane

Valid data

FSBS — FSBP — FSBE_SR — 2 — 6 — 1918 — FSBS — FSBP

4th Lane

Valid data

FSBS — FSBP — FSBE_SR — 3 — 7 — 1919 — FSBS — FSBP

VS | VBP | VV | VFP

VSync

DE

HSync

HS | HBP | HV | HFP

HSync

DE

DCLK

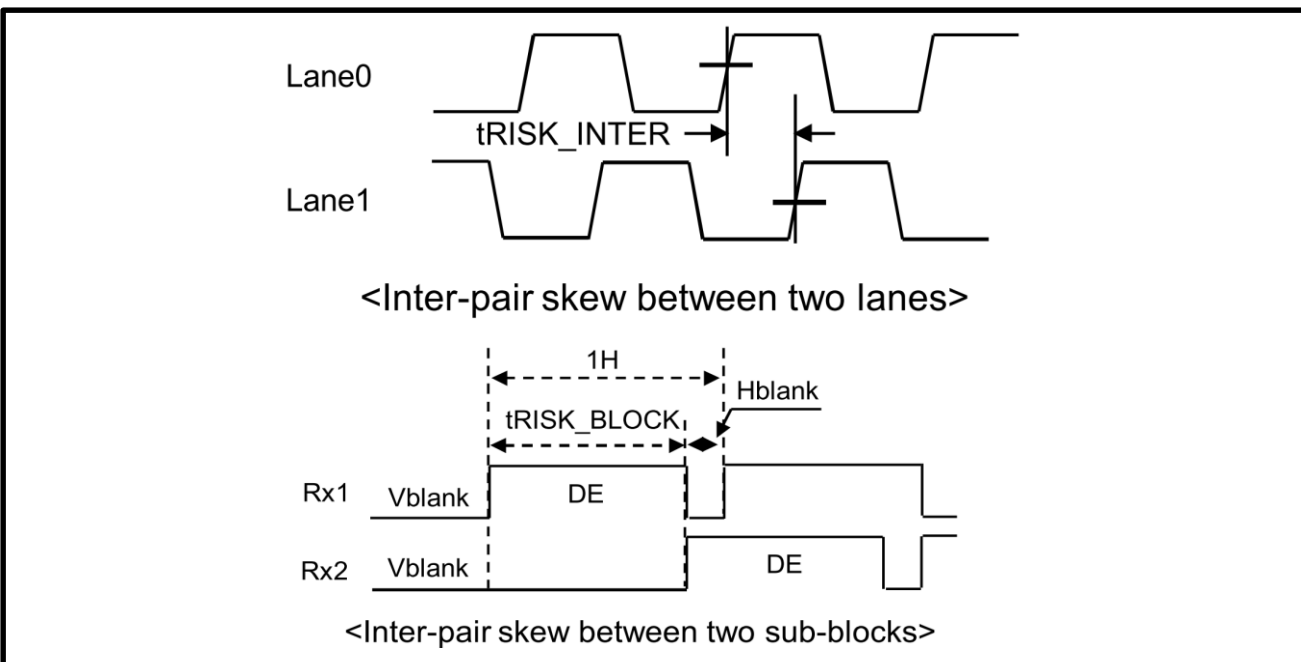DATA — Valid Data

Note1: HB=HS+HBP+HFP
Note2:Signal rising/falling edge should be aligned as the diagram.

6.3 V by One Input Signal Characteristics.
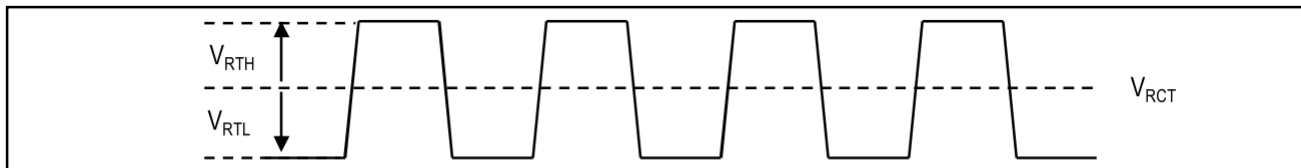
Description	Symbol	Min	Max	Unit	Note
CML Differential Input High Threshold	V_{RTH}	-	50	mV	-
CML Differential Input Low Threshold	V_{RTL}	-50	-	mV	-
CML Common Mode Bias Voltage	V_{RCT}	0.6	0.8	V	-

<Inter-pair skew between two lanes>

<Inter-pair skew between two sub-blocks>

Description	Symbol	Min	Max	Unit	Note
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.

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

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 9. Input Signal and Display Color Table >

Color		Input Color Data																															
		MSB			RED			LSB			MSB			GREEN				LSB			MSB			BLUE			LSB						
		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 Color	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(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
	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
	Blue(1023)	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
R	RED(000)	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(001)	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(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
G	Green (000)	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 (001)	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

	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
B	Blue(000)	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(001)	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(1022)	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	0
	Blue(1023)	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

8.0 POWER SEQUENCE

8.1 Power ON Sequence.

POS=1 Enable Signal
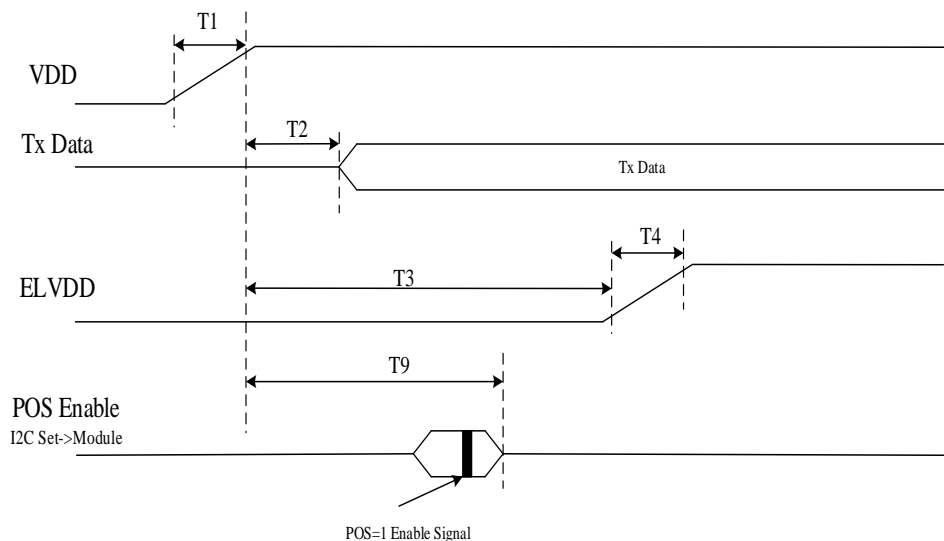
< Table 10. Sequence Table >

Parameter	Value			Unit	Notes
	Min	**Typ**	**Max**		
T1	1	-	35	ms	
T2	1	-	500	ms	
T3	5	-	-	sec	
T4	5	-	50	ms	
T9	1000	-	3000	ms	

Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
　　　 2. The T3 is recommended value, the case when failed to meet a minimum specification, abnormal
　　　　 display would be shown.
　　　 3. Even though T4 is over the specified value, there is no problem if I2T spec of fuse is satisfied.
　　　 4. Outside the T9 sequence，POS=1 signal is invalid.

8.2 Power Off Sequence1
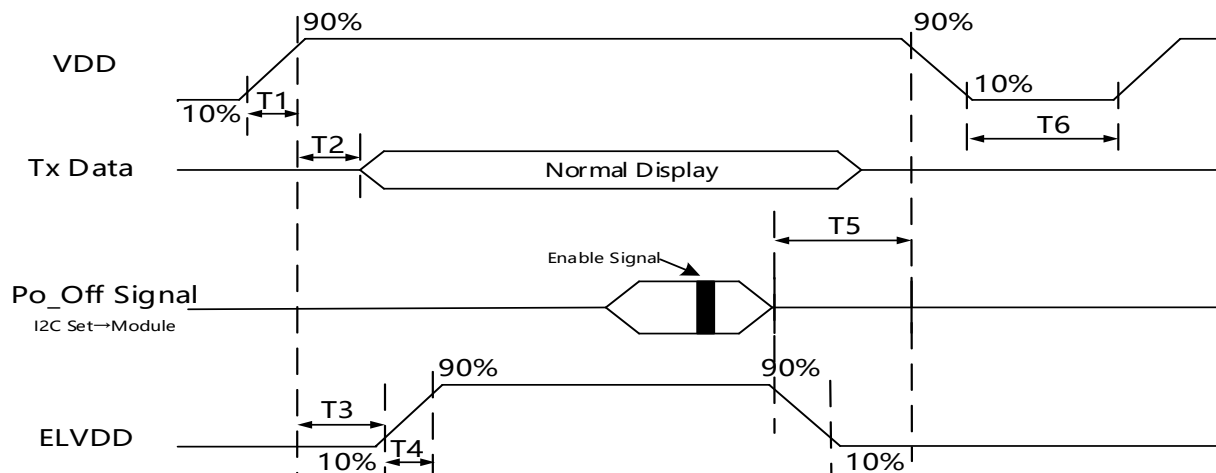
< Table 11. Sequence Table >

Parameter	Value			Unit	Notes
	Min	**Typ**	**Max**		
T1	1	-	35	ms	1
T2	1	-	500	ms	
T3	5	-	-	sec	2
T4	5	-	50	ms	3
T5	1500	2000	-	ms	
T6	1	-	-	sec	

Notes: 1. Even though T1 is over the specified value, there is no problem if I2T spec of fuse is satisfied.

2.The T3 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown.

3 .Even though T4 is over the specified value, there is no problem if I2T spec of fuse is satisfied.

8.3 Power Off Sequence2
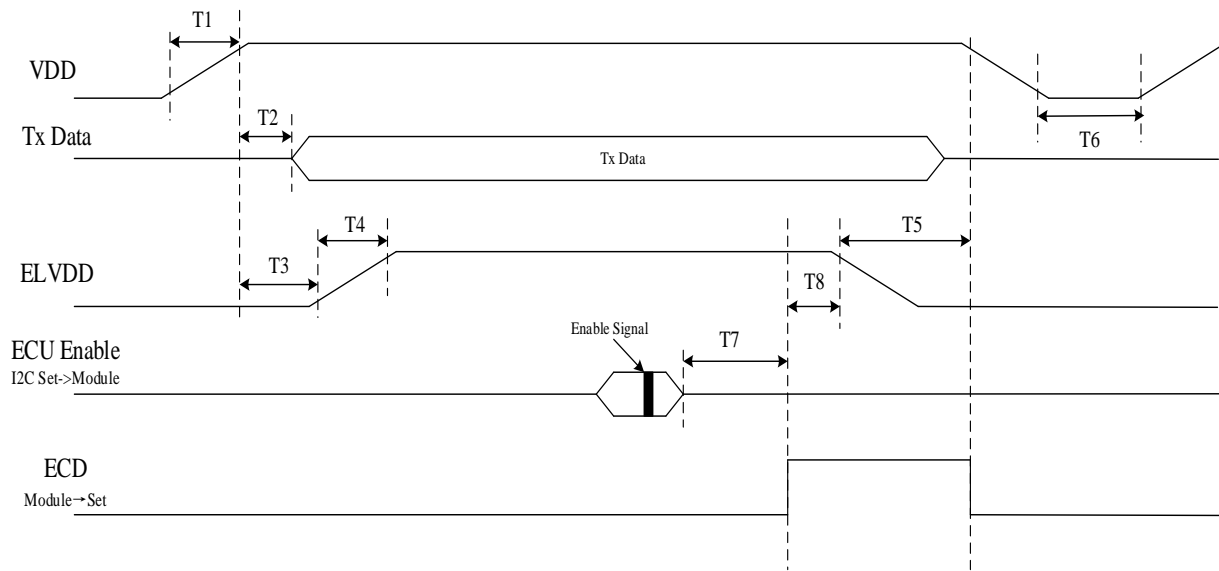
< Table 12. Sequence Table >

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	1	-	35	ms	
T2	1	-	500	ms	
T3	5	-	-	sec	
T4	5	-	50	ms	
T5	50	-	-	ms	
T6	1	-	-	sec	
T7	315	-	300	sec	Compensation Period
T8	0	-	7	sec	

Notes: 1.The maximum 335sec corresponds to the compensation mode after power off.

2.When there is power on action before completing ECU operation, don't change ECU enable signal (1→0).Just do power off and power on.

9.0 MECHANICAL CHARACTERISTICS

< Table 12. Mechanical Characteristics>

Item	Value	
Outline Dimension (Base On Board Ass'y)	Horizontal	1218.33mm
	Vertical	357.74mm
	Thickness	1.4mm(B)
Active Display Area (Base On Board Ass'y)	Horizontal	1206.53mm
	Vertical	339.34mm
Open Cell (Active Area ~ Edge Of Panel)	Horizontal	5.9mm(Left) / 5.9mm(Right)
	Vertical	5.9mm(Top) / 12.5mm(Bottom)
Weight	1.55Kg (Typ.)	

Notes: Please refer to a mechanical drawing in terms of tolerance at the next page.

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9.0 MECHANICAL CHARACTERISTICS

9.1 Front View of Board Assembly

280.00

ELVDD   监测系统   VBO/12V

80.00

GOA/CEDS   CEDS/GMA   GMA/CEDS   CEDS/GOA
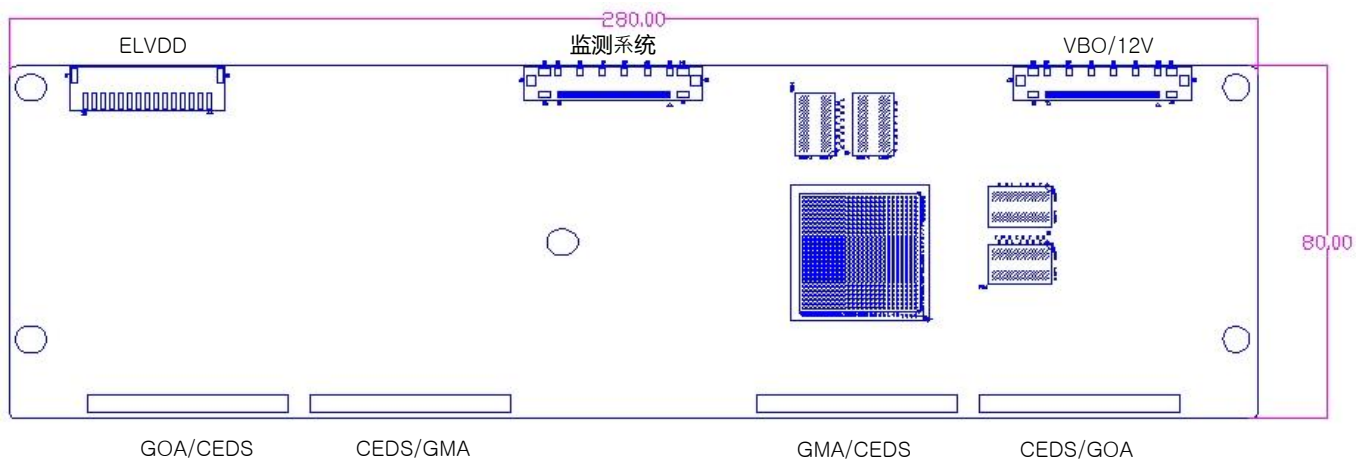
9.2 Front View of Board Assembly
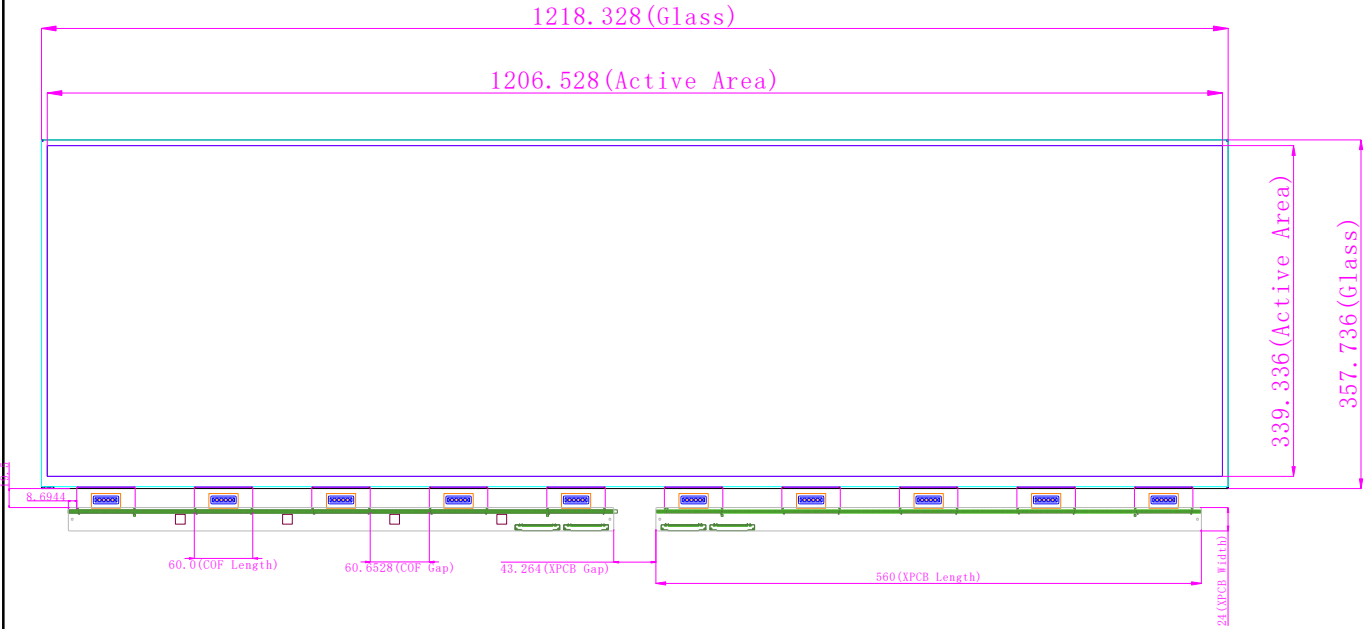

Figure 9.1. Front View of Board Assembly(mm)

10.0 RELIABLITY TEST

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

< Table 14. Reliability Test Parameters >

No	Test Items	Conditions
1	High Temperature Storage test	Ta = 60 ℃, 240hrs
2	Low temperature storage test	Ta = -20 ℃, 240 hrs
3	High temperature & high humidity operation test	Ta = 50 ℃, 80%RH, 500hrs
4	High temperature operation test	Ta = 50 ℃, 240hrs
5	Pallet packing vibration test (non-operating)	Wave form : random Vibration level : 1.2Grms Bandwidth : 1-200Hz Duration : Z, 60 min
6	Low temperature operation test	Ta = -5 ℃, 240hrs

Before and after Reliability test, OLED Module should be operated with normal function.

11.0 HANDLING & CAUTIONS

Please pay attention to the followings when you use this OLED module.

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

(2) Cautions for handling the Module
- As the electrostatic discharges may break the OLED Module, handle the OLED Module with care. Peel a protection sheet off from the OLED Module surface as slowly as possible.
- Be careful not to place any extra mechanical stress to the OLED module when designing the set .
- Be cautious not to any extra strong force (mechanical shock, strong tapping etc.) to the module. It may cause abnormal operating or a malfunction in the OLED Module.
- OLED Panel are made from fragile glass material, impulse and pressure to the OLED Module should be avoided.
- As the surface of the polarizer is very soft and easily scratched, use a soft dry cloth without chemicals for cleaning.
- Do not pull the interface connector in or out while the OLED Module is operating.
- Put the panel display side down on a flat horizontal plane.
- Handle connectors and cables with care.

(3) Cautions for the operation
- When fixed patterns are displayed for a long time, remnant image is likely to occur.
- When the panel is operating, do not lose Data and CLK signals. If any one of these signals is lost, the OLED Module would be damaged.
- Obey the supply voltage sequence. If wrong sequence is applied, the panel would be damaged.

(4) Cautions for the atmosphere
- The spike noise causes the mis-operation of circuits. It should be lower than following voltage :$V=\pm200mV$(Over and under shoot voltage).
- Dew drop atmosphere should be avoided.
- Do not store and/or operate the OLED Module in a high temperature and/or humidity atmosphere. Storage in an electro-conductive polymer packing pouch and under relatively low temperature atmosphere is recommended.
- 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.
- The polarizer surface should not come in contact with any other object. It is recommended that they are stored in the container in which they were shipped.

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11.0 HANDLING & CAUTIONS

(5) Display Condition

To extend the lifetime and optimize a function of module, the below-mentioned operating conditions are required.

• Normal operating condition
- a. Temperature: 20 $\pm$ 15 ℃
- b. Operating Ambient Humidity : 55 $\pm$ 25 %
- c. Only for indoor operation.
- d. Display pattern: dynamic pattern (Moving picture)
- e. TFT Compensation should need at least one time in a day.
- Refer to the 8.2. TFT compensation operation.
- f. Lifetime in this spec. is guaranteed only when Display is used according to operating usages.

• Operating usages under abnormal condition.
- a. Ambient condition: Well-ventilated place is recommended to set up Commercial system.

• Operating usages to reduce the risk of image sticking due to static image.
- a. Suitable operating time: under 18 hours a day.
- b. Information display recommended to use with moving picture.
- c. Logo image recommended not to use. If needed, recommend that its position needs to be periodically shifted. Change colors themselves periodically.
- d. The below-mentioned conditions are not recommended .
- Combination of Logo and background with largely different luminance.
- Using single moving picture. (Recommend to use different moving pictures.)
- The masked image with aspect ratio other than 16:9
- The division of screen

Note1) Abnormal condition just means conditions except normal condition.

Note2) Black image or moving image is strongly recommended as a screen saver.

• If the module will be used under severe conditions such as high temperature, high humidity, display patterns or operation time etc., it is strongly recommended to contact BOE for the advice about usage and applications. Otherwise, its reliability and function may not be guaranteed..

11.0 HANDLING & CAUTIONS

(6) Cautions for the panel characteristics
- Do not apply fixed pattern data signal to the OLED Module at product aging.
- Applying fixed pattern for a long time may cause image sticking.
- Strong light exposure causes degradation of polarizer and color filter.

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

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12.0 PRODUCT SERIAL NUMBER

FG-CODE   MDL ID

XK493L6D−WH1−5700   XXXXXXXXXXXXX   **BOE**

MADE IN CHINA

MDL ID Naming Rule:

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Code	S	L	S	5	1	2	3	5	9	0	0	0	0
Description	Model Code / GBN		Grade	Line	Year		Month	Mode Extension Code		Serial No 0000-ZZZZ			

13.0 Packing

BOE provides the standard shipping container for customers, unless customer specifies their packing information. The standard packing method and Barcode information are shown in below.

13.1 Packing Order

- B/Ass'y Qty + PE Sheet / Box: 12pcs + 13pcs
- B/Ass'y Qty / Pallet : 72pcs
- Box Qty / Pallet: 6Box
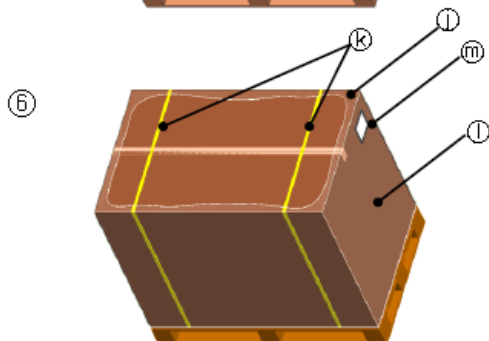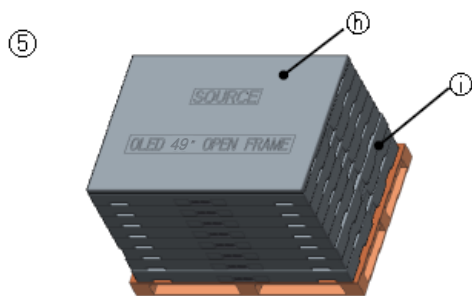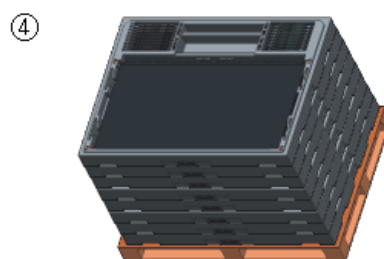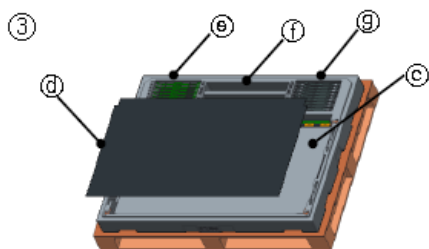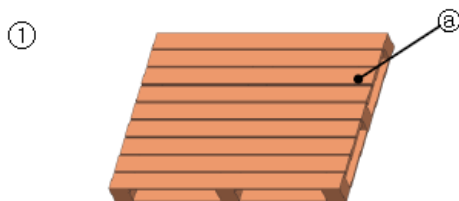
No.	Description	Material
ⓐ	Pallet	Plywood
ⓑ	Carton Plate	Paper(SW)
ⓒ	Board Ass'y	-
ⓓ	PE Sheet	LDPE
ⓔ	Control PCB	PCB
ⓕ	FFC	CABLE
ⓖ	Cover Shield	AL
ⓗ	Top Packing	EPS
ⓘ	Bottom Packing	EPS
ⓙ	Angle Packing	Paper(SW)
ⓚ	Band	PP
ⓛ	Wrap	L-LDPE
ⓜ	Label	YUPO

13.2 Packing Note

- Box Dimension : 1640*1090*152mm
- Package Quantity in one Box : 12pcs

13.3 Box Label
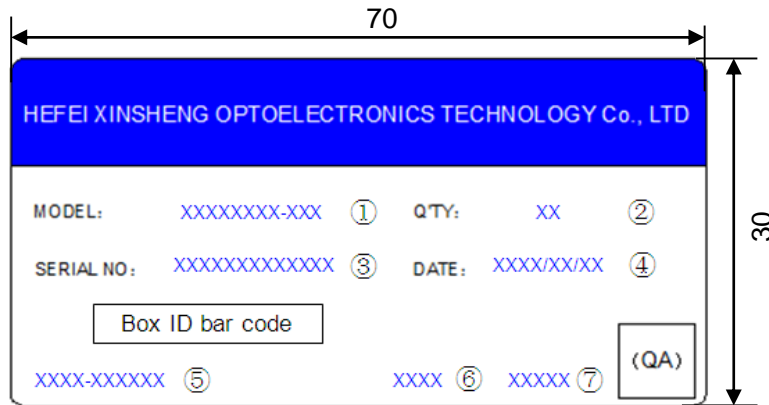
- Label Size : 70 mm (L) × 30 mm (W)
- Contents

    Model : XK493L6D-WH1

    Q`ty : **12** OLED Module in one box.

    Serial No. : Box Serial No. See next page for detail description.

    Date : Packing Date

    FG Code : FG Code of Product

	1.	FG-CODE(前12位)
	2.	包装数量
	3.	Box ID
	4.	包装日期
	5.	客户端段物料号
	6.	FG-Code后四位
	7.	供应商代码

Box ID Naming Rule:

	1	2	3	4	5	6	7	8	9	10	11	12	13
Code	S	L	S	5	1	2	3	D	0	0	0	0	0
Description	Products GBN		Grade	Line	Year		Month	Revision Code	Serial No 00000-ZZZZZ				

14.0 APPENDIX

14.1 Input mode of pixel data
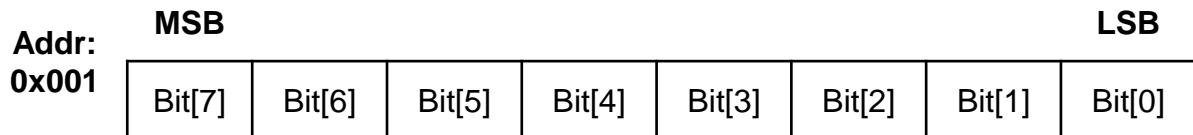
This OLED module only supports 1 division input mode.

Lane0–Lane3

Front View

4CH 1920*540@120Hz					
Lane0	1	5	......	1917	Pixel
Lane1	2	6	......	1918	Pixel
Lane2	3	7	......	1919	Pixel
Lane3	4	8	......	1920	Pixel

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14.1 I2C Register map

The following register is controlled by I2C Interface.

Addr: 0x001

	MSB							LSB
	Bit[7]	Bit[6]	Bit[5]	Bit[4]	Bit[3]	Bit[2]	Bit[1]	Bit[0]

Device Address：0xF0

Address	Register Name	Description	Remark
0x01	[7]:Power Off Enable	1: Power off, 0: Normal Display	
	[6]:POS Enable	1: Enable, 0: Disable	
	[5]:Reserved	-	-
	[4]:ECU Enable	1: Enable, 0: Disable	
	[3]:ECI Enable	1: Enable, 0: Disable	-
	[2]:Reserved	-	-
	[1]:Reserved	-	-
	[0]:Reserved	-	-
0x02	[7:0]:Reserved	-	