□Tentative Specification
□Preliminary Specification
■Approval Specification

MODEL NO.: S485AJ1

SUFFIX: A01

Revision : C1
Customer :

APPROVED BY SIGNATURE

Name / Title _____ _____
Note

_____
Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By
ChihFan Ting	John.Hsieh	Shoi Wu

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REVISION HISTORY

Version	Date	Page(New)	Section	Description
Ver. 1.0	May.03, 2023	ALL	ALL	Approval Specification was first issued.
Ver. 1.1	May.26, 2023	P.9	3.1	ELECTRICAL CHARACTERISTICS-TFT LCD MODULE: Rush Current, Power Consumption, Power Supply Current
		P.15	4.1	INTERFACE PIN CONNECTION-TFT LCD MODULE: Item21
		P.17	4.1	Note3 & photo
		P.23	5.1.1	Note5
		P.40~44	10.	MECHANICAL CHARACTERISTIC
Ver. 1.2	Sep.21, 2023	P.7	2.1	ABSOLUTE RATINGS OF ENVIRONMENT
Ver. 1.3	Oct.25, 2023	P.29	6.2	Color Chromaticity: White x.y & Correlated color temperature (modified typing error)
Ver. 2.0	Dec.05, 2023	P.8	2.3.2	Light Bar Voltage, Control Signal Level (modified typing error)
		P11	3.2.1	CONVERTER CHARACTERISTICS (modified typing error)
		P12	3.2.1	Note6 : photo
		P.38~39	9.2	PACKAGING METHOD (AL bag or anti bag)

1. GENERAL DESCRIPTION

1.1 OVERVIEW

S485AJ1-A01 is a 48.5" inch TFT Liquid Crystal Display PID module with LED Backlight unit and 8 lane V-by-one interface method. This module supports 3840 x 720 Quad Full HDTV format and can display true 1.07G colors (8-bit+FRC).

Liquid crystal : Advanced wide temperature LC (-40℃~110℃)

1.2 FEATURES

- High brightness 1000 nits
- High contrast ratio 5000:1
- Fast response time Gray to gray average 12 ms
- High color saturation NTSC 72%
- Half Quad Full HDTV (3840 x 720 pixels) resolution, true HDTV format
- DE (Data Enable) only mode
- V-by-One HS interface
- Optimized response time for 50Hz/60Hz frame rate
- Ultra wide viewing angle : Super MVA technology
- Viewing Angle : 178(H)/178(V) (CR ≥ 10) VA Technology
- RoHs compliance
- T-con input frame rate : QFHD 45~63Hz,
  Output frame rate: QFHD 45~63Hz

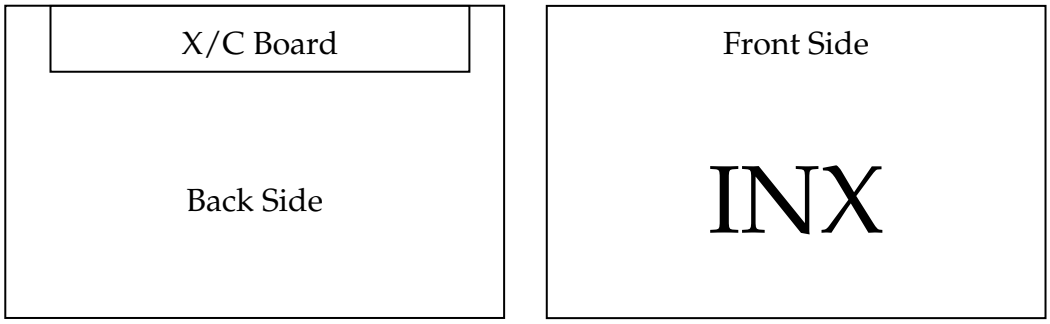
1.3 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	1209.6 (H) x 226.8 (V) (48.5" diagonal)	mm	(1)
Bezel Opening Area	1212.6 (H) x 229.8 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	3840 x R.G.B. x 720	pixel	-
Pixel Pitch (Sub Pixel)	0.315 (H) x 0.315 (W)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	1.07G colors (8-bit+FRC)	color	-
Display Operation Mode	Transmissive mode / Normally black	-	-
Surface Treatment	Anti-Glare coating(Haze 1%) , Hardness 3H	-	(2)
Rotation Function	Unachievable		(3)
Display Orientation	Signal input with "INX"		(3)

Note (1) Please refer to the attached drawings in chapter 9 for more information about the front and back outlines.

Note (2) The spec. of the surface treatment is temporarily for this phase. INX reserves the rights to change this feature.

Note (3)



1.4 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	1230.9	1232.4	1233.9	mm	(1)
	Vertical (V)	248.6	249.6	250.6	mm	(1)
	Depth (D)	13.7	14.7	15.7	mm	(2)
		24.4	25.4	26.4		(3)
Weight		5100	5400	5700	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

Note (2) Module Depth is between bezel to Rear.

Note (3) Module Depth is between bezel to Converter cover

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1), (3), (4)
Operating Ambient Temperature	T_{OP}	-20	+60	ºC	(1), (2), (3), (4)
Panel Surface Temperature	P_{ST}		+70	ºC	(2)

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

(a) 90 %RH Max. (Ta ≦ 40 ºC).

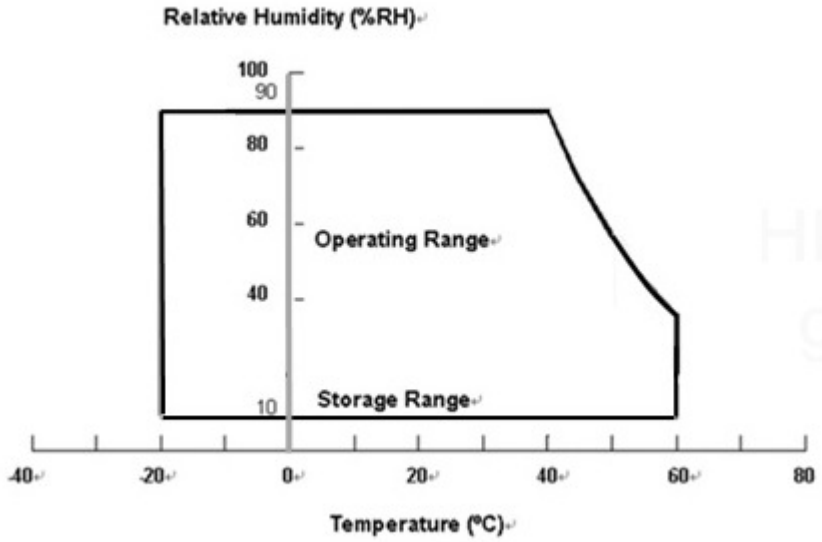
(b) Wet-bulb temperature should be 39 ºC Max.

(c) No condensation.

Note(2) Surface temperature is measured at 60 ºC Dry condition.

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.

Note (4) Response time depends on the temperature. (In lower temperature, it becomes longer.)



2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

(a) Do not leave the module in high temperature, and high humidity for a long time, It is highly recommended to store the module with temperature from 0 to 35 ℃ at normal humidity without condensation.

(b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent

light.

2.3 ELECTRICAL ABSOLUTE RATINGS

2.3.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	13.5	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions

2.3.2 BACKLIGHT CONVERTER UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Light Bar Voltage	VW	–	67.5	VRMS	
Converter Input Voltage	VBL	21.6	26.4	V	(1)
Control Signal Level	–	-0.3	6	V	(1), (3)

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under normal operating conditions.

Note (2) No moisture condensation or freezing.

Note (3) The control signals include On/Off Control and External PWM Control.

3. ELECTRICAL CHARACTERISTICS

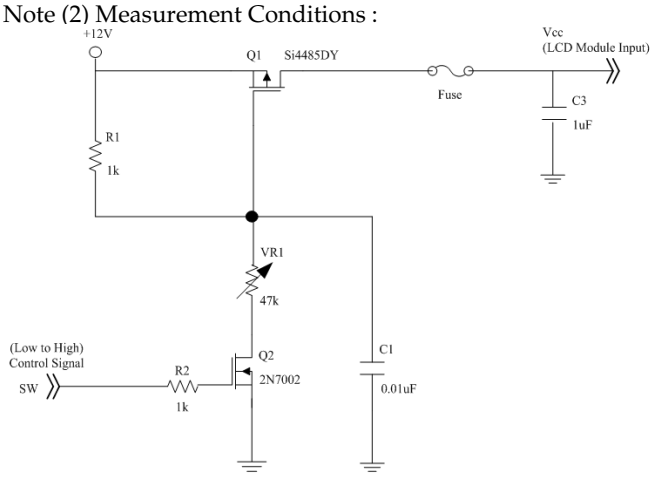
3.1 TFT LCD MODULE

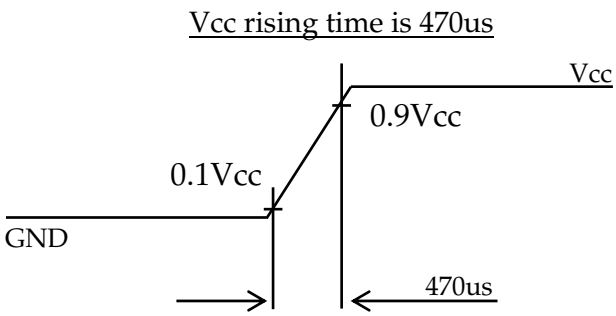
(Ta = 25 ± 2 ℃)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	10.8	12	13.2	V	(1)
Rush Current		I_{RUSH}	–	–	2.21	A	(2)
Power Consumption	White Pattern	P_T	–	10.	11.	W	(3)
	Black Pattern	P_T	–	6.16	6.77	W	
	Horizontal Stripe	P_T	–	9.71	10.68	W	
Power Supply Current	White Pattern	–	–	0.87	1	A	
	Black Pattern	–	–	0.54	0.61	A	
	Horizontal Stripe	–	–	0.84	0.99	A	
V-by-One 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	V_{IH}	2.7	–	3.6	V	
	Input Low Threshold Voltage	V_{IL}	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 Vcc (Typ.)

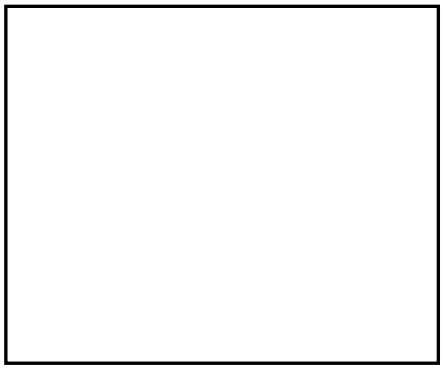
Note (2) Measurement Conditions :





Note (3) The specified power supply current is under the conditions at Vcc = 12 V, Ta = 25 ± 2 ℃, fv = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

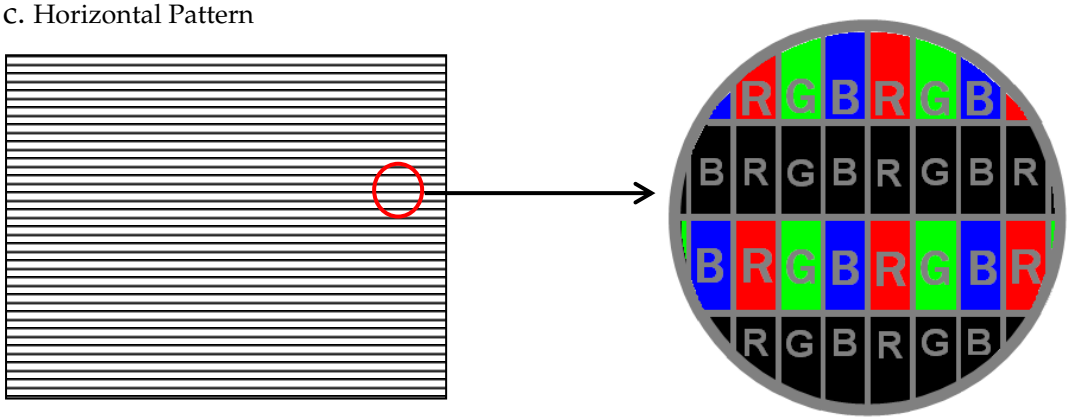


Active Area

b. Black Pattern

Active Area

c. Horizontal Pattern



3.2 BACKLIGHT CONVERTER UNIT

3.2.1 CONVERTER CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Consumption	P_{BL}	-	50	58	W	(1), (2)
Converter Input Voltage	VBL	22.8	24	25.2	VDC	
Converter Input Current	I_{BL}	-	2.1	2.42	A	Non Dimming
Input Inrush Current	I_R	-	-	6.9	Apeak	V_{BL}=22.8V, (3)
Dimming Frequency	FB	150	-	170	Hz	
Dimming Duty Ratio	DDR	5	-	100	%	(4)
Life Time	-	50,000	-	-	Hrs	(5)

Note (1) The power supply capacity should be higher than the total converter power consumption PBL. 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 48.5" backlight unit under input voltage 24V.

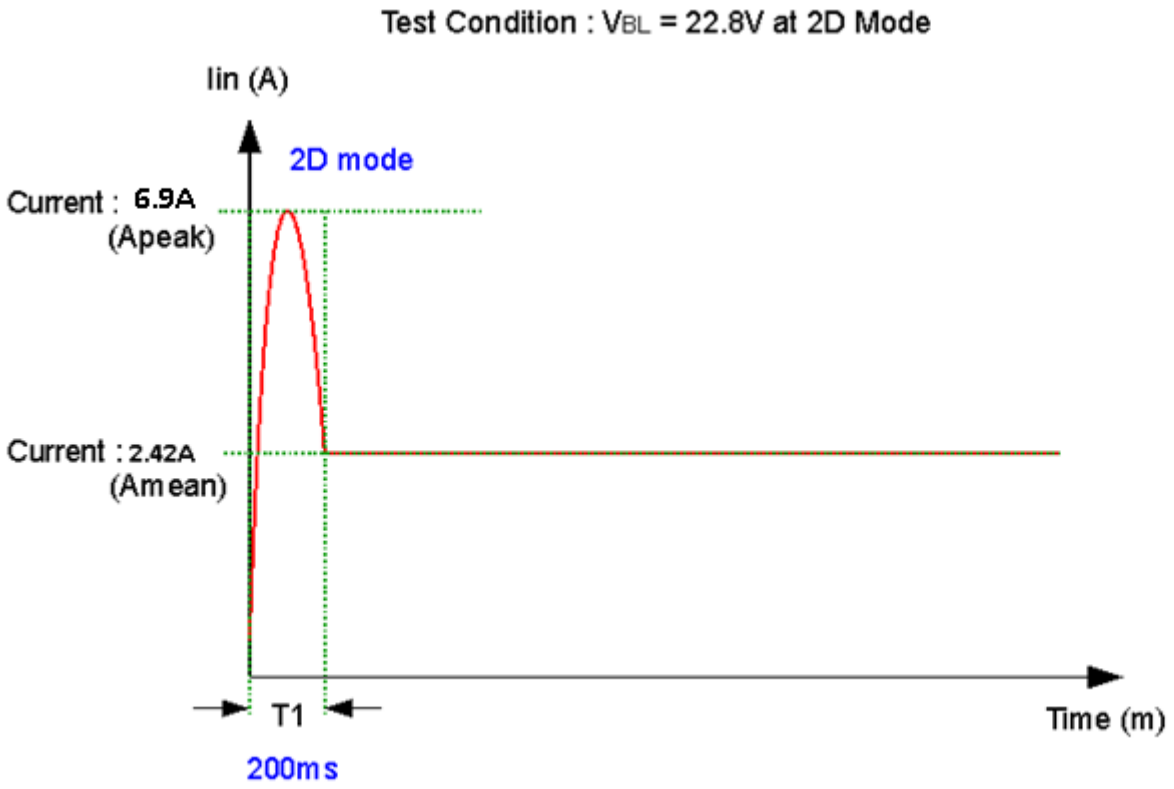
Note (3) For input inrush current measure, the VBL rising time from 10% to 90% is about 20ms.

Note (4) EPWM signal have to input available duty range. 5% minimum duty ratio is only valid for electrical operation.

Note (5) 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℃

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℃

3.2.2 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	—	5.0	V	Duty on	(5)
	LO		—	0	—	0.8	V	Duty off	
Error Signal		ERR	—	—	—	—	—	Abnormal: Open collector	
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		
PWM Signal Falling Time		TPWMF	—	—	—	50	us		
Input Impedance		Rin	—	1	—	—	MΩ		
PWM Delay Time		TPWM	—	100	—	—	ms		
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. (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 signal have to input available frequency range.

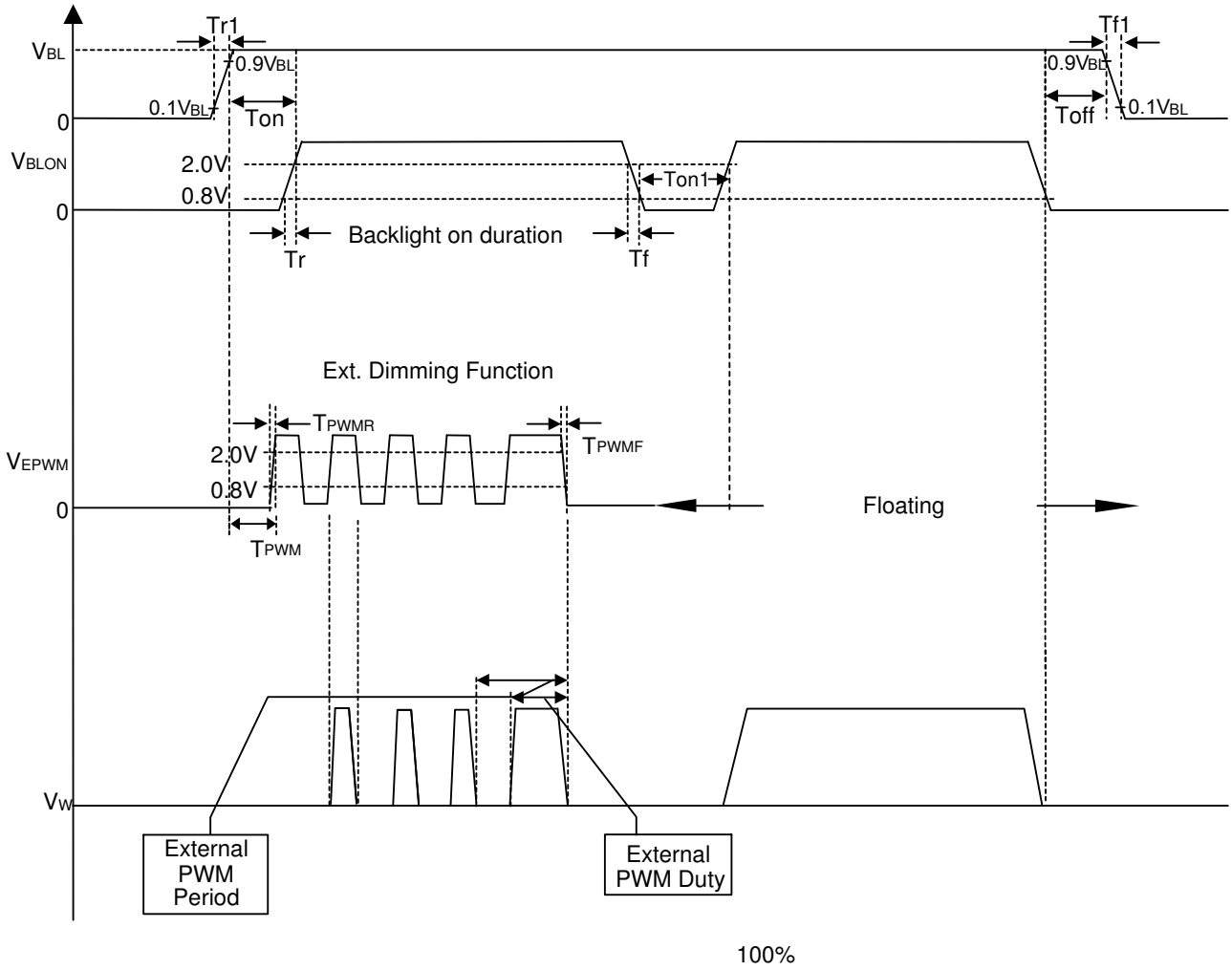


Fig. 1

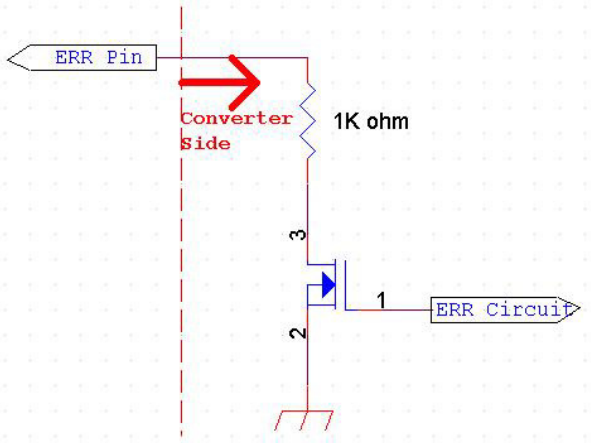


Fig. 2

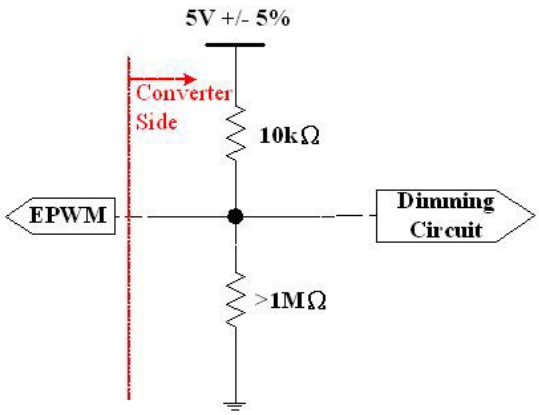


Fig. 3

4. INTERFACE PIN CONNECTION

4.1 TFT LCD MODULE

CNC03 Connector Pin Assignment: [WF23-402-5133 (FCN) , 187059-51221 (P-TWO)]

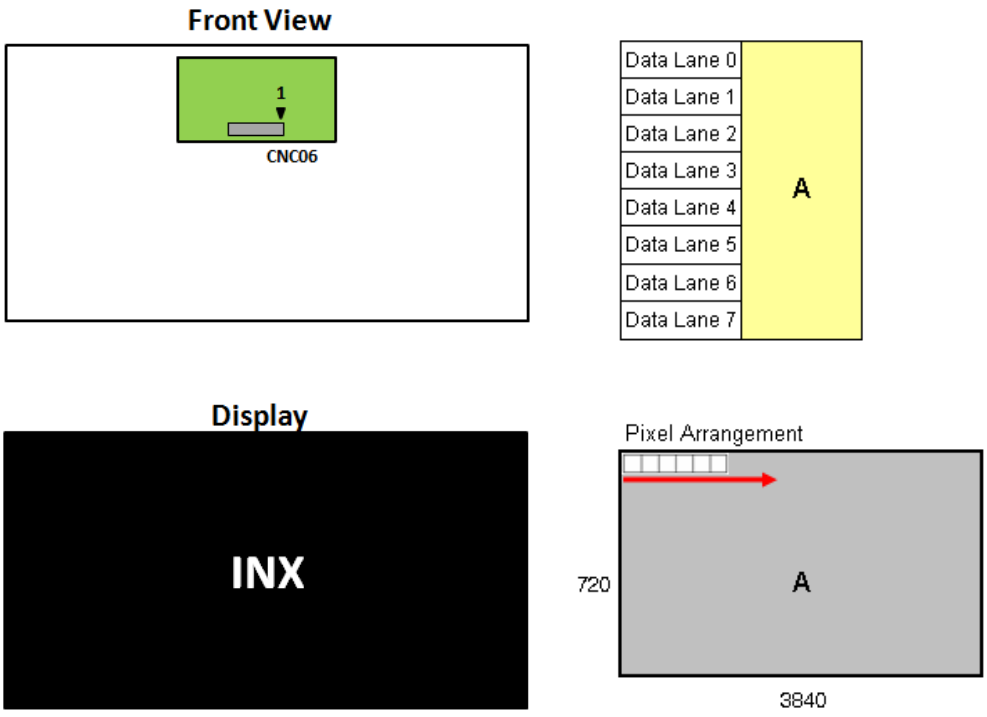
Matting connector suggestion : [FI-RE51HL(JAE)]

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	N.C.	No Connection	(4)
19	N.C.	No Connection	(4)
20	N.C.	No Connection	(4)
21	N.C.	No Connection	(4)
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	

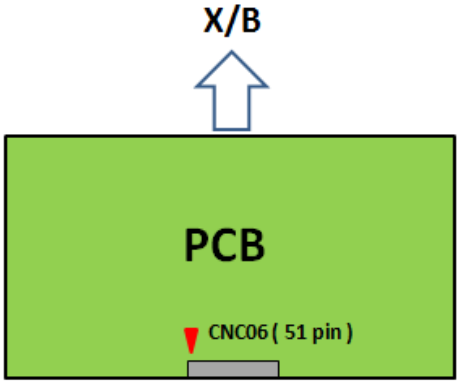
34	RX2N	3RD Pixel Negative V-by-One differential data input in area A. Lane 2	(1)
35	RX2P	3RD Pixel Positive V-by-One differential data input in area A. Lane 2	
36	GND	Ground	
37	RX3N	4TH Pixel Negative V-by-One differential data input in area A. Lane 3	(1)
38	RX3P	4TH Pixel Positive V-by-One differential 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)

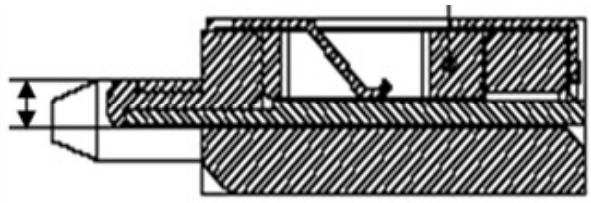
Area	Lane	Data Stream
A	Lane 0	1, 9, 17, ..., 3825, 3833
	Lane 1	2, 10, 18, ..., 3826, 3834
	Lane 2	3, 11, 19, ..., 3827, 3835
	Lane 3	4, 12, 20, ..., 3828, 3836
	Lane 4	5, 13, 21, ...,3829, 3837
	Lane 5	6, 14, 22, ..., 3830, 3838
	Lane 6	7, 15, 23, ..., 3831, 3839
	Lane7	8, 16, 24, ..., 3832, 3840



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



Note (3) V-by-One connector mating dimension range request is 0.93mm~1.0mm 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.

4.2 BACKLIGHT UNIT

4.2.1 LIGHT BAR UNIT

The pin configuration for the housing and lead wire is shown in the table below.

CNL01 Connector Pin Assignment: [WTB,CI1408M1VL0-NH (CviLux)]

L-side

Pin №	Symbol	Feature
1	N1	Negative of LED String
2	N2	
3	N3	
4	N4	
5	VLED+	Positive of LED String
6	VLED+	
7	VLED+	
8	VLED+	

R-side

Pin №	Symbol	Feature
1	VLED+	Positive of LED String
2	VLED+	
3	VLED+	
4	VLED+	
5	N1	Negative of LED String
6	N2	
7	N3	
8	N4	

4.2.2 CONVERTER UNIT

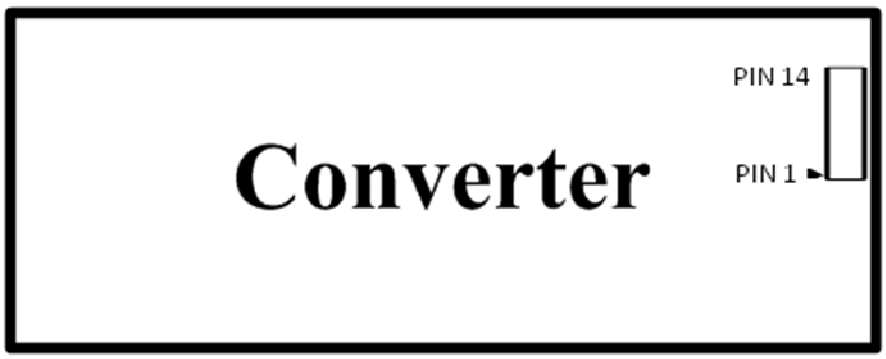
CNV04 Connector Pin Assignment: [CI0114M1HR0-LA-NH (CvilLux) , JH2-D4-143N (FCN)]
Matting connector : [PHR-14(JST)]

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) The pin14 must be connected to EPWM simultaneously.

Note (2) If Pin14 is open, E_PWM is 100% duty.

Note (3) Input connector pin order defined as follows



Input Connector

4.3 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 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	1	0	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	1	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green (1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	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
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
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (1021)	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	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

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

5. INTERFACE TIMING

5.1 INPUT SIGNAL TIMING SPECIFICATIONS

(Ta = 25 ± 2 ºC)

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
V-by-One Receiver	Intra-Pair skew		-0.3	—	0.3	UI	(2)
	Inter-pair skew		-5	—	5	UI	(3)
	Spread spectrum modulation range	F_{clkin_mod}	1/Tc-0.5%	—	1/Tc+0.5%	MHz	(4)
	Spread spectrum modulation	F_{SSM}	—	—	30	KHz	

5.1.1 Timing spec for QFHD Mode Frame Rate =45~ 63Hz

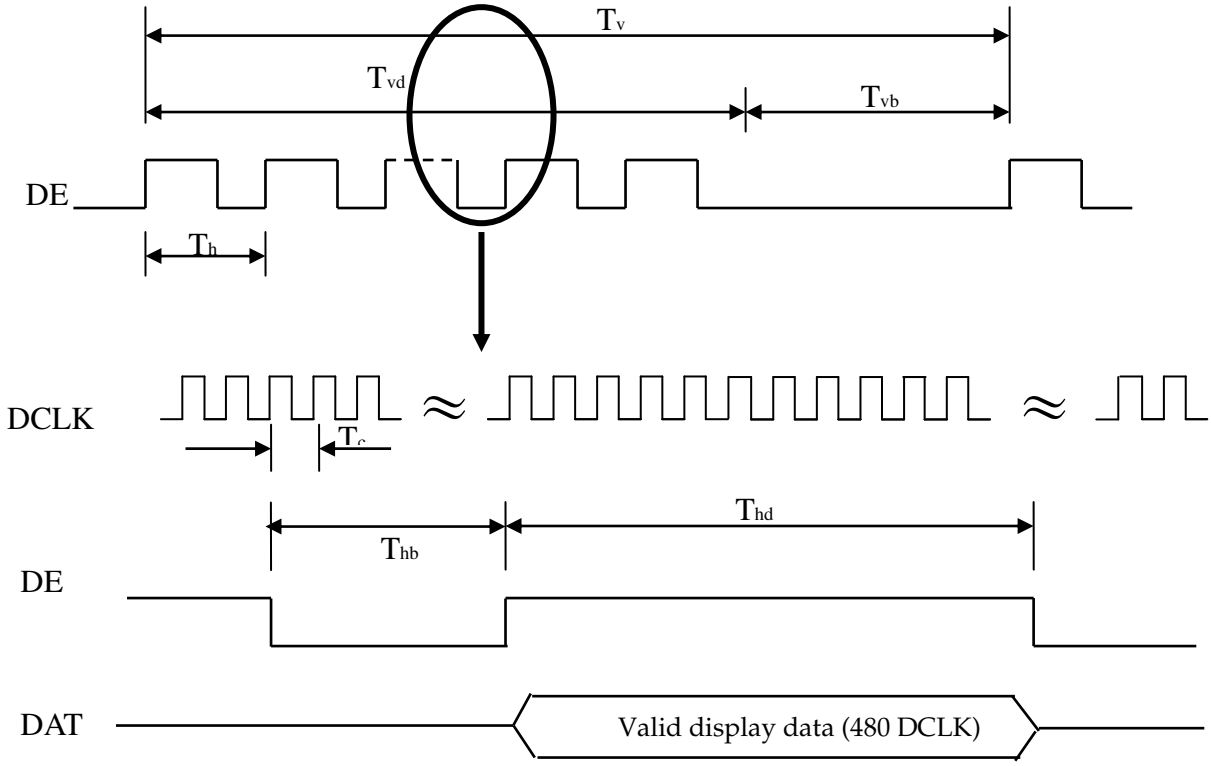
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frequency	Data Clock	1/Tc	70	74.25	80	MHZ	(1)
Frame Rate	QFHD Mode	F_r	45	60	63	Hz	(5),(6)
Horizontal Frequency		Fh	122.8	135	140	KHz	
Vertical Active Display Term (8 Lane,3840X2160 Active Area)	Total	Tv	2200	2250	2790	Th	Tv=Tvd+Tvb
	Display	Tvd	2160			Th	
	Blank	Tvb	40	90	630	Th	
Horizontal Active Display Term (8 Lane,3840X2160 Active Area)	Total	Th	530	550	570	Tc	Th=Thd+Thb
	Display	Thd	480			Tc	
	Blank	Thb	50	70	90	Tc	

Note (1) Please make sure the range of frame rate has follow the below equation：

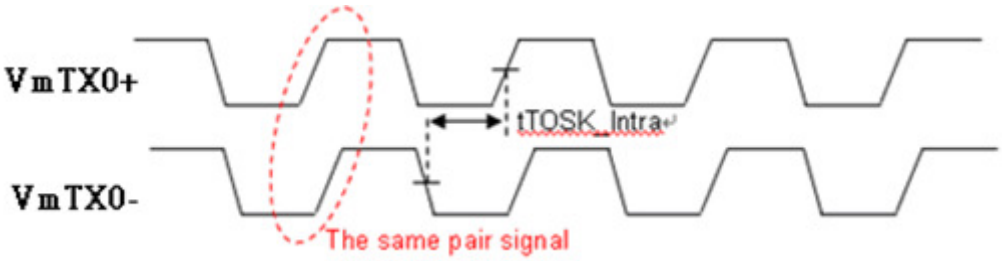
Fclkin(max) ≧ Fr ╳ Tv ╳ Th

Fr ╳ Tv ╳ Th ≧ Fclkin (min)

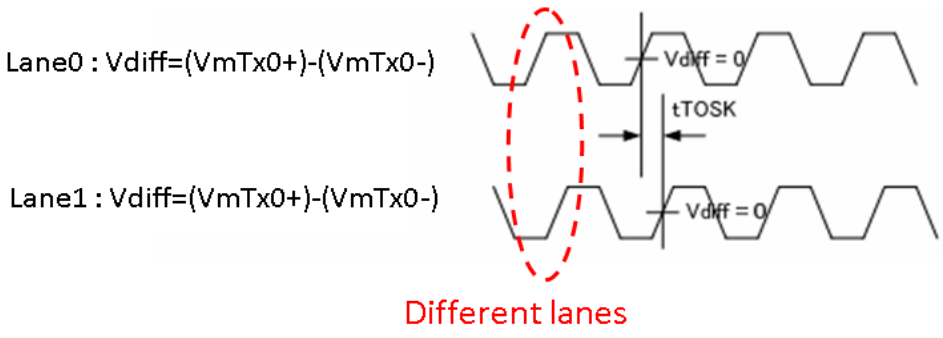
INPUT SIGNAL TIMING DIAGRAM



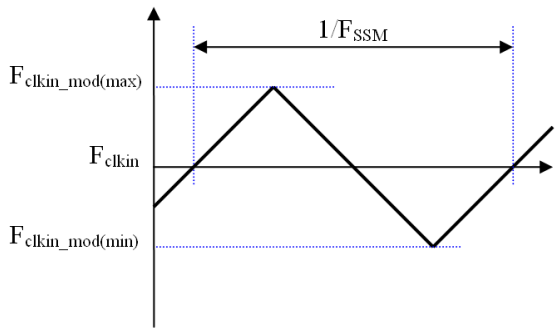
Note (2) V-by-One HS Intra-pair Data skew



Note (3) V-by-One HS Inter-pair skew.



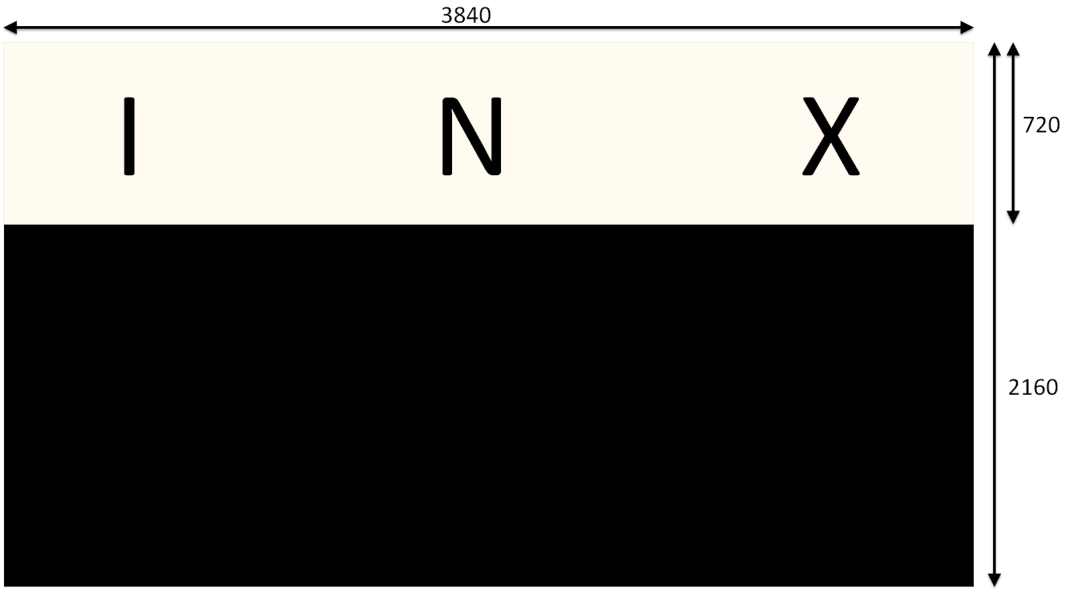
Note (4) The SSCG (Spread spectrum clock generator) is defined as below figures.



Note (5) For primitive resolution 3840*720, typical Tvd should be 720 TH , image display at Tvd 721 to 2160 lines is invalid.

Hactive_AA_TCON Receive=3840

Vactive_AA=720
Vactive_TCON Receive=2160 (suggestion: insert the black data form 721th to 2160th)



5.2 Timing Dragram

5.2.1 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 facto : 1.4

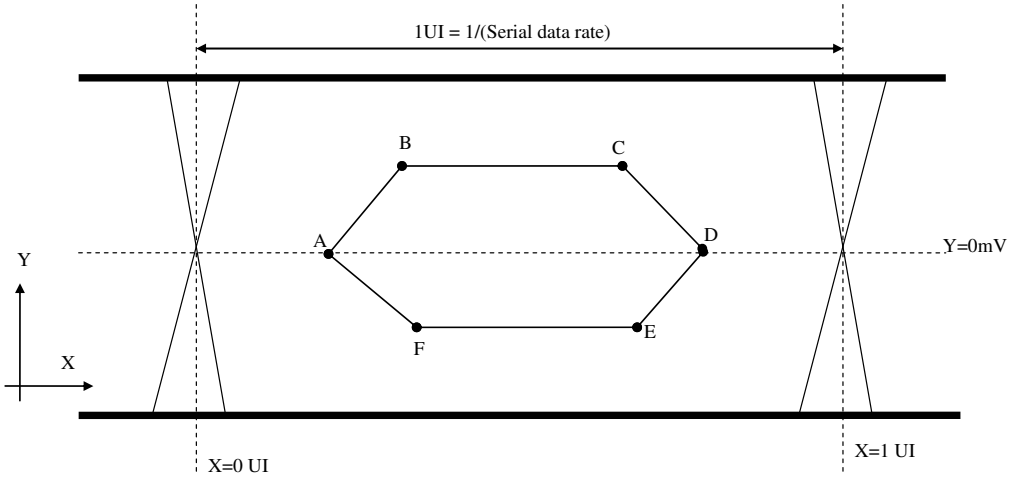


Table 1 Eye Mask Specification

	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"

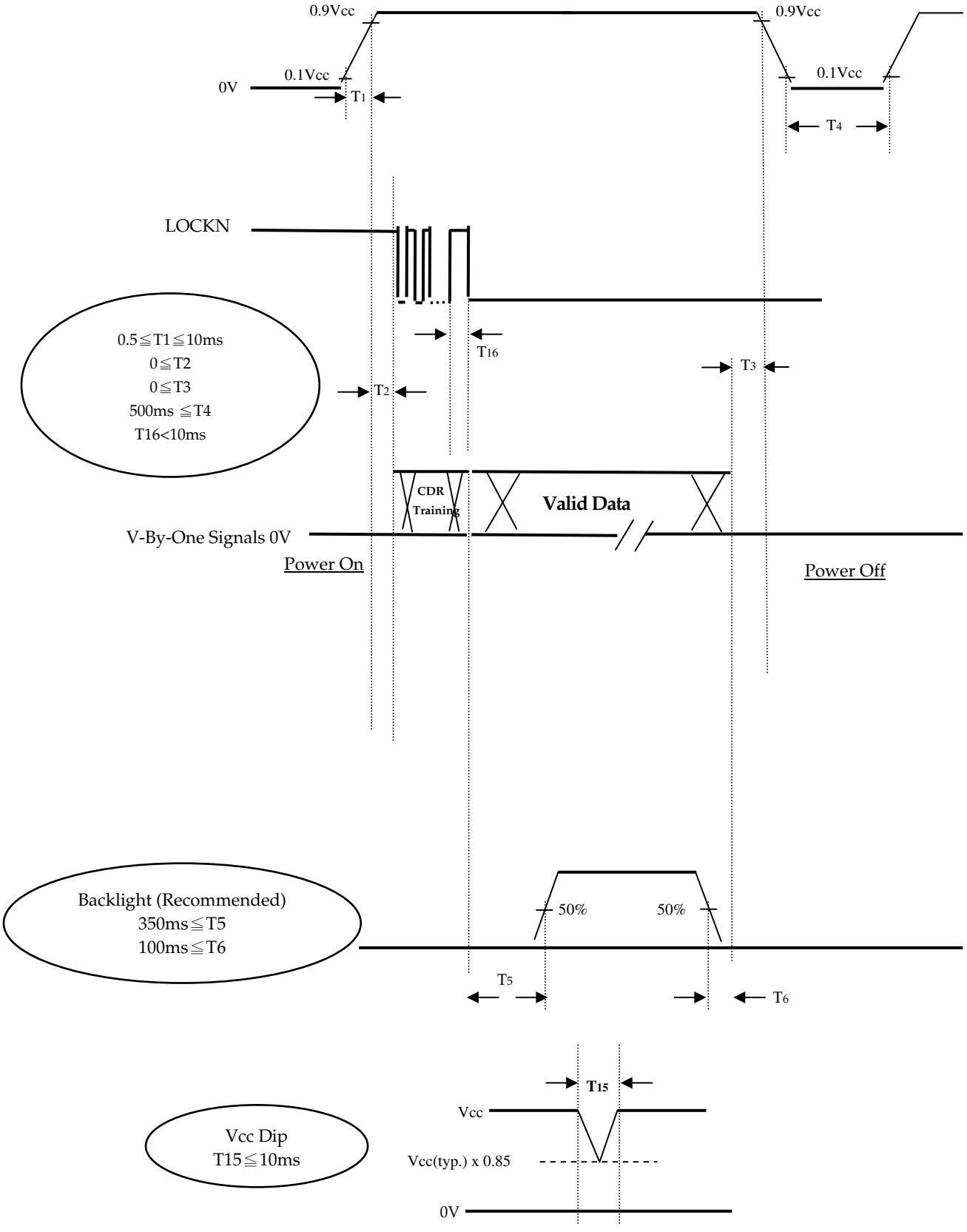
5.3 Byte Length and Color mapping of V-by-One HS

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]

5.4 POWER ON/OFF SEQUENCE

(Ta = 25 ± 2 ºC)

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

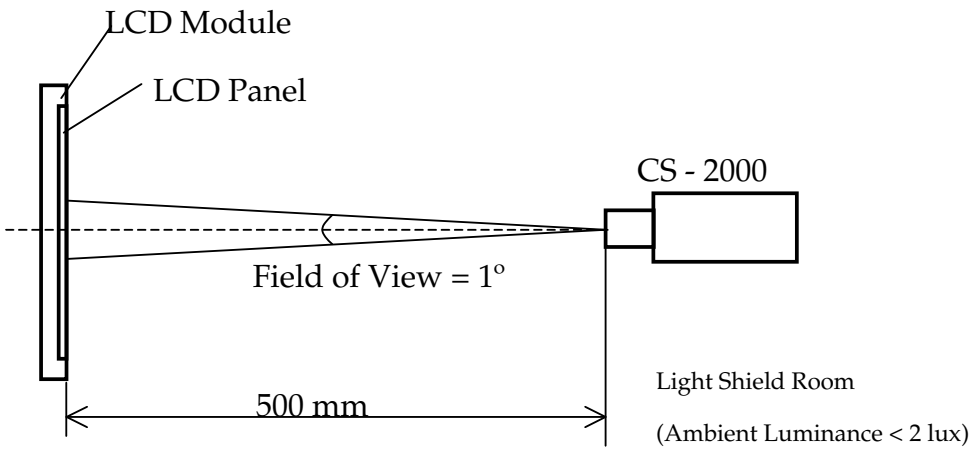
6. OPTICAL CHARACTERISTICS

6.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	12±1.2	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Vertical Frame Rate	Fr	60	Hz

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring in a windless room.

Local Dimming Function should be Disable before testing to get the steady optical characteristics (According to 5.1 CNF1 Connector Pin Assignment, Pin no. "22")



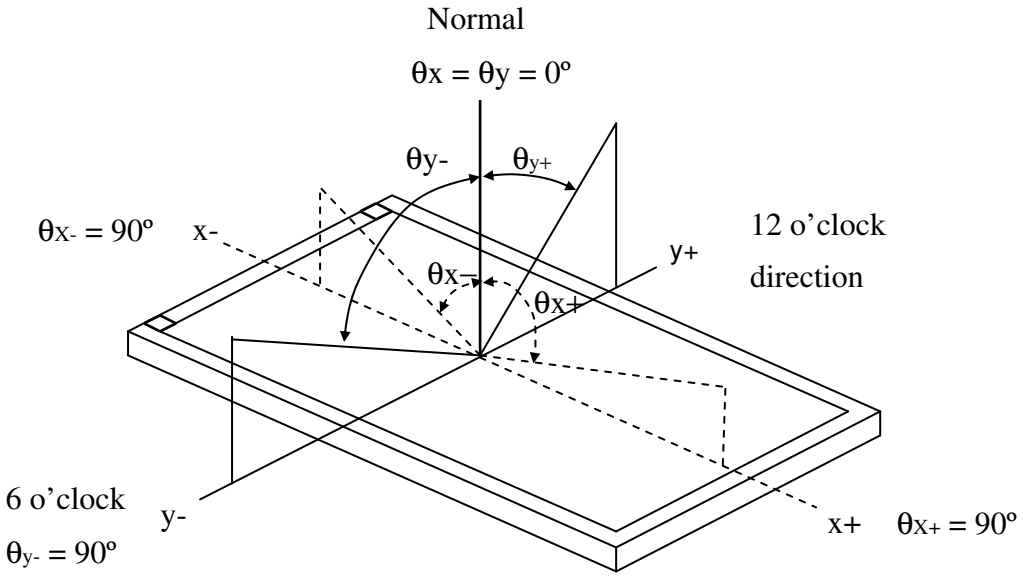
6.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 6.2. The following items should be measured under the test conditions described in 6.1 and stable environment shown in 6.1.

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing angle at normal direction	4000	5000	-	-	(2)
Response Time		Gray to gray			12	24	ms	(3)
Center Luminance of White		L_C		800	1000	-	cd/m²	(4)
White Variation		δW				1.3	-	(6)
Cross Talk		CT		-		4	%	(5)
Color Chromaticity	Red	Rx		Typ.-0.03	0.647	Typ.+0.03	-	
		Ry			0.335		-	
	Green	Gx			0.311		-	
		Gy			0.624		-	
	Blue	Bx			0.152		-	
		By			0.049		-	
	White	Wx			0.285		-	
		Wy			0.300		-	
	Correlated color temperature			-	9000	-	K	
	Color Gamut	C.G.		-	72	-	%	NTSC
Viewing Angle	Horizontal	θ_x+	CR≥10	80	89	-	Deg.	(1)
		θ_x-		80	89	-		
	Vertical	θ_Y+		80	89	-		
		θ_Y-		80	89	-		

Note (1) Definition of Viewing Angle (θx, θy) :

Viewing angles are measured by Autronic Conoscope Cono-80 (or Eldim EZ-Contrast 160R).



Note (2) Definition of Contrast Ratio (CR) :

The contrast ratio can be calculated by the following expression.

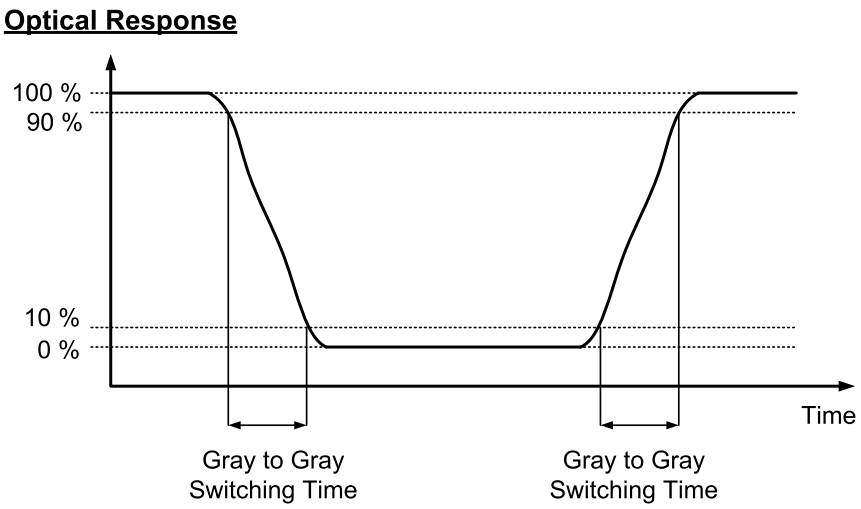
$$\text{Contrast Ratio (CR)} = \frac{\text{Surface Luminance of L1023}}{\text{Surface Luminance of L0}}$$

L1023: Luminance of gray level 1023

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (6).

Note (3) Definition of Gray-to-Gray Switching Time :



The driving signal means the signal of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023.

Gray to gray average time means the average switching time of gray level 0, 124, 252, 380, 508, 636, 764, 892 and 1023 to each other.

Note (4) Definition of Luminance of White (L_C) :

Measure the luminance of gray level 1023 at center point.

L_C = L (5), where L (x) is corresponding to the luminance of the point X at the figure in Note (6).

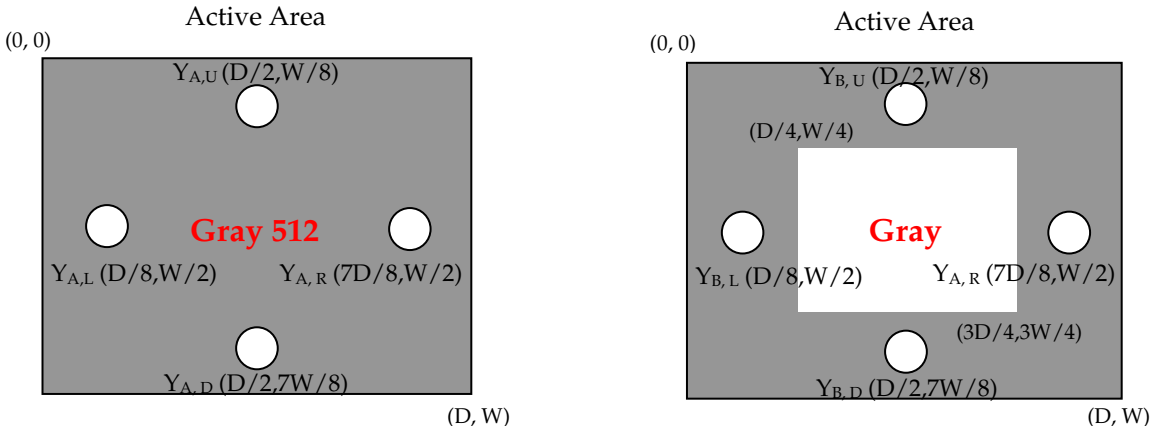
Note (5) Definition of Cross Talk (CT) :

$$CT = | Y_B - Y_A | / Y_A \times 100 (\%)$$

Where :

YA = Luminance of measured location without gray level 1023 pattern (cd/m2)

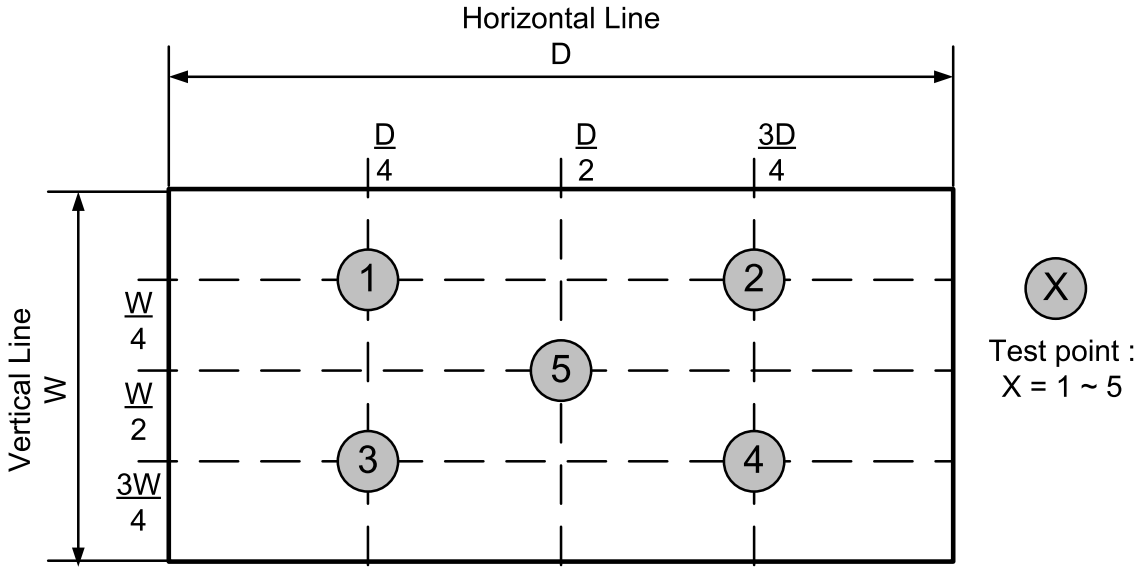
YB = Luminance of measured location with gray level 1023 pattern (cd/m2)



Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 1023 at 5 points

$$\delta W = \frac{\text{Maximum [L (1), L (2), L (3), L (4), L (5)]}}{\text{Minimum [L (1), L (2), L (3), L (4), L (5)]}}$$



7. PRECAUTIONS

7.1 ASSEMBLY AND HANDLING PRECAUTIONS

[1] Do not apply rough force such as bending or twisting to the module during assembly.

[2] Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.

[3] Bezel of Set can not press or touch the panel surface. It will make light leakage or scrape.

[4] It should be attached to the system firmly using all mounting holes.

[5] It is recommended to assemble or to install a module into the user's system in clean working areas. The dust and oil may cause electrical short or worsen the polarizer, do not press or scratch the surface harder than a HB pencil lead.

[6] Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

[7] Protection film for polarizer on the module should be slowly peeled off just before use so that the electrostatic charge can be minimized.

[8] Do not disassemble the module.

[9] Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.

[10] Do not plug in or pull out the I/F connector while the module is in operation, pins of I/F connector should not be touched directly with bare hands. Do not adjust the variable resistor located on the module.

[11] Moisture can easily penetrate into LCD module and may cause the damage during operation.

[12] When storing modules as spares for a long time, the following precaution is necessary.

[12.1] Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35℃ at normal humidity (under 70%) without condensation.

[12.2] The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

[13] When ambient temperature is lower than 10ºC, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of LED will be higher than that of room temperature.

[14] Use a soft dry cloth without chemicals and Ethyl Alcohol for cleaning, because the surface of polarizer is very soft and easily scratched. Do not use Ketone type materials (ex. Acetone), Toluene, Ethyl acid or Methyl chloride, these chemical solvent might permanently damage the polarizer due to chemical action.

7.2 SAFETY PRECAUTIONS

To optimize PID module's lifetime and functions, operating conditions should be followed as below

[1] Normal operating condition

[1.1] Operating temperature: -20~60℃

[1.2] Operating humidity: 20~90%

[2] Operation usage to protect against image sticking due to long-term static display.

[2.1] Suitable operating time : under 24 hours a day.

[2.2]Liquid Crystal refresh time is required. Cycling display between 5 minutes' information (static) display and 10 seconds' moving image.

[2.3] Periodical display contents should be changed from static image to moving picture.

[2.3.1] Different background and image colors changed respectively, and changed colors periodically.

[2.3.2] Background and image with large different luminance displayed at the same time should be avoided.

[2.3.3] Periodical power-off the system for a while or screen saver is needed after long-term static display.

[2.3.4] Moving picture or black pattern is strongly recommended for screen saver.

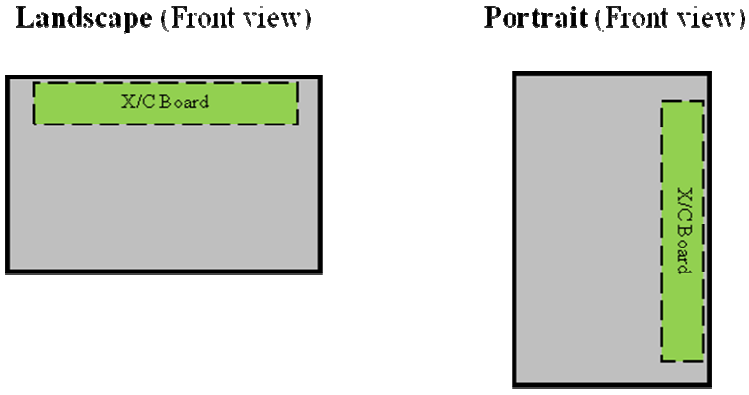
[3] The startup voltage of a Backlight may cause an electrical shock while assembling with the converter. Do not disassemble the module or insert anything into the Backlight unit.

[4] Do not connect or disconnect the module in the "Power On" condition.

[5] Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature…) Otherwise the module may be damaged.

[6] If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

[7] Module should be turned clockwise (front view perspective) when used in portrait mode.



[8] Ultra-violet ray filter is necessary for outdoor operation.

[9] Only when PID module is operated under right operating conditions, lifetime in this spec can be guaranteed. After the module's end of life, it is not harmful in case of normal operation and storage.

[10] LCD system is required to place in well-ventilated environment. Adapting active cooling system is highly

recommended.

[11] Product reliability and functions are only guaranteed when the product is used under right operation usages. If product will be used in extreme conditions, especially combining severe conditions such as high temperature/humidity, display stationary patterns, or long operation time etc…, it is strongly recommended to contact INX for field application engineering advice. Otherwise, the panel may be damaged and its reliability and function may not be guaranteed. Extreme conditions are commonly found at airports, transit stations, banks, stock market and full outdoor display.

7.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

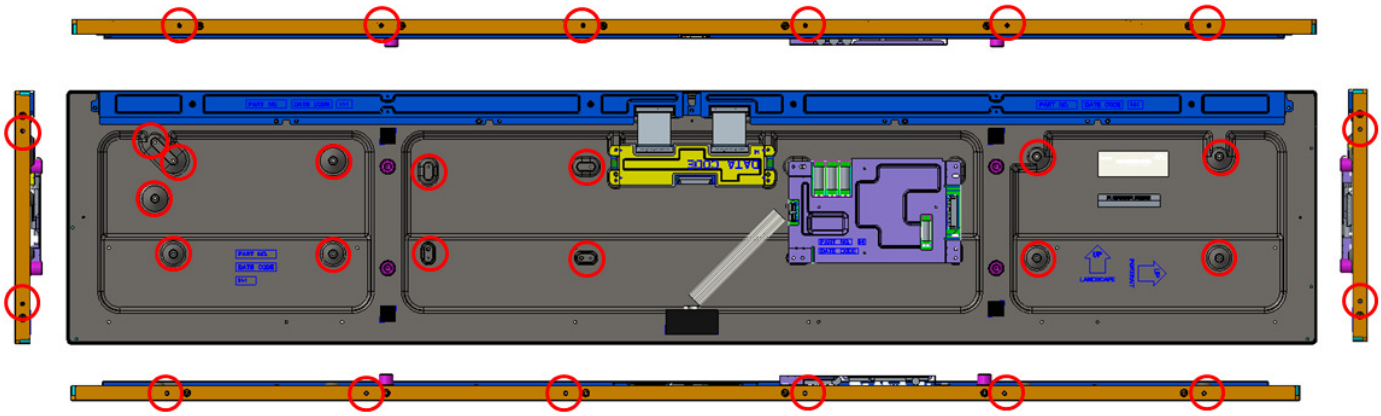
Regulatory	Item	Standard
Audio/video, Information and Communication Technology Equipment	UL	UL 62368-1, 3rd Edition, 2019-12-13
	cUL	CAN/CSA C22.2 No. 62368-1-19, 3rd Edition, 2019-12-13
	CB	IEC 62368-1:2018

If the module displays the same pattern for a long period of time, the phenomenon of image sticking may be occurred .

7.4 DUST RESIST

[1] INX module dust test is conducted with marked holes (see Figure 7.4,marked with red circle) sealed to comply with JIS D 0207.

[2] Module users should design set with these holes used/sealed (if not used) or covered by set mechanism to prevent dust from entering. The INX testing procedure cannot replicate all different real world scenarious,module users should apply set dust resistance solution to meet user's requirement.



7.5 Precautions for Strong Light Exposure

[1] Strong light exposure causes degradation of polarizer and color filter. Since the product design is not protected by

CG(cover glass), the deterioration of the polarizer due to sun exposure or water drenching is not guarantee.

[2] To keep display function well as a digital signage application, especially the component of TFT is very sensitive to sunlight, it is necessary to set up blocking device protecting panel from radiation of ambient environment.

8. DEFINITION OF LABELS

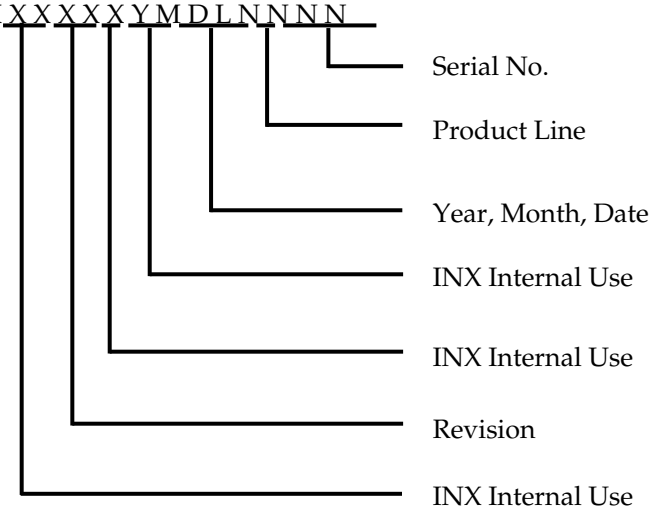
8.1 MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: S485AJ1-A01

(b) Revision: Rev. XX, for example: A0, A1… B1, B2… or C1, C2…etc.

(c) Serial ID: X X X X X X X Y M D L N N N N



Serial ID includes the information as below:

(a) Manufactured Date: Year: 0~9, for 2010~2019

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

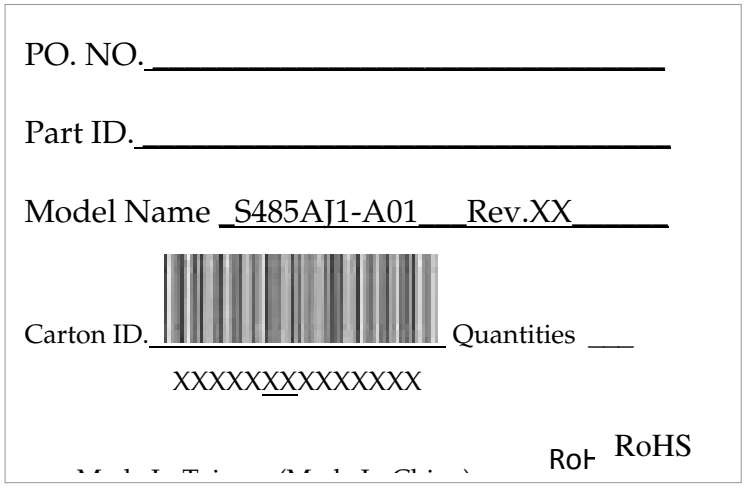
(b) Revision Code: Cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 → Line1, 2 → Line 2, …etc.

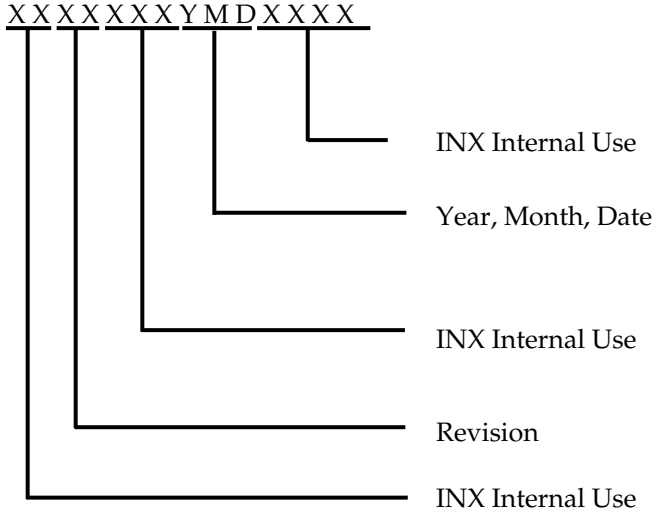
8.2 CARTON LABEL

The barcode nameplate is pasted on each box as illustration, and its definitions are as following explanation.



Model Name: S485AJ1-A01

Carton ID: X X X X X X Y M D X X X X



Serial ID includes the information as below :

Manufactured Date:

Year: 2010=0, 2011=1, 2012=2…etc.

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I ,O, and U.

Revision Code: Cover all the change

9.PACKAGING

9.1 PACKAGING SPECIFICATIONS

(1) 11 LCD TV modules / 1 Box

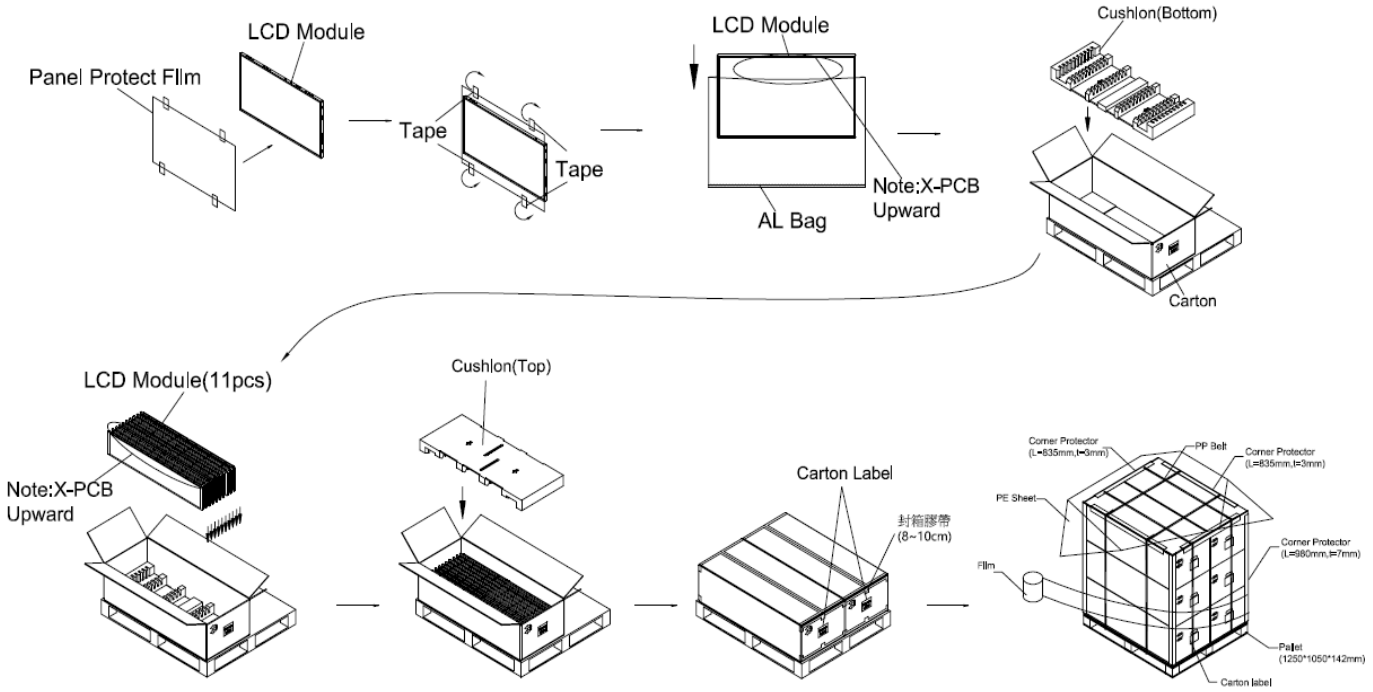
(2) Box dimensions: 1325(L) mmx565(W) mmx352(H) mm

(3) Weight: approximately 65.4 KG (11 modules per box)

9.2 PACKAGING METHOD

Notice : 1. When the products are stored, the package status must be kept as the same as shipping type.

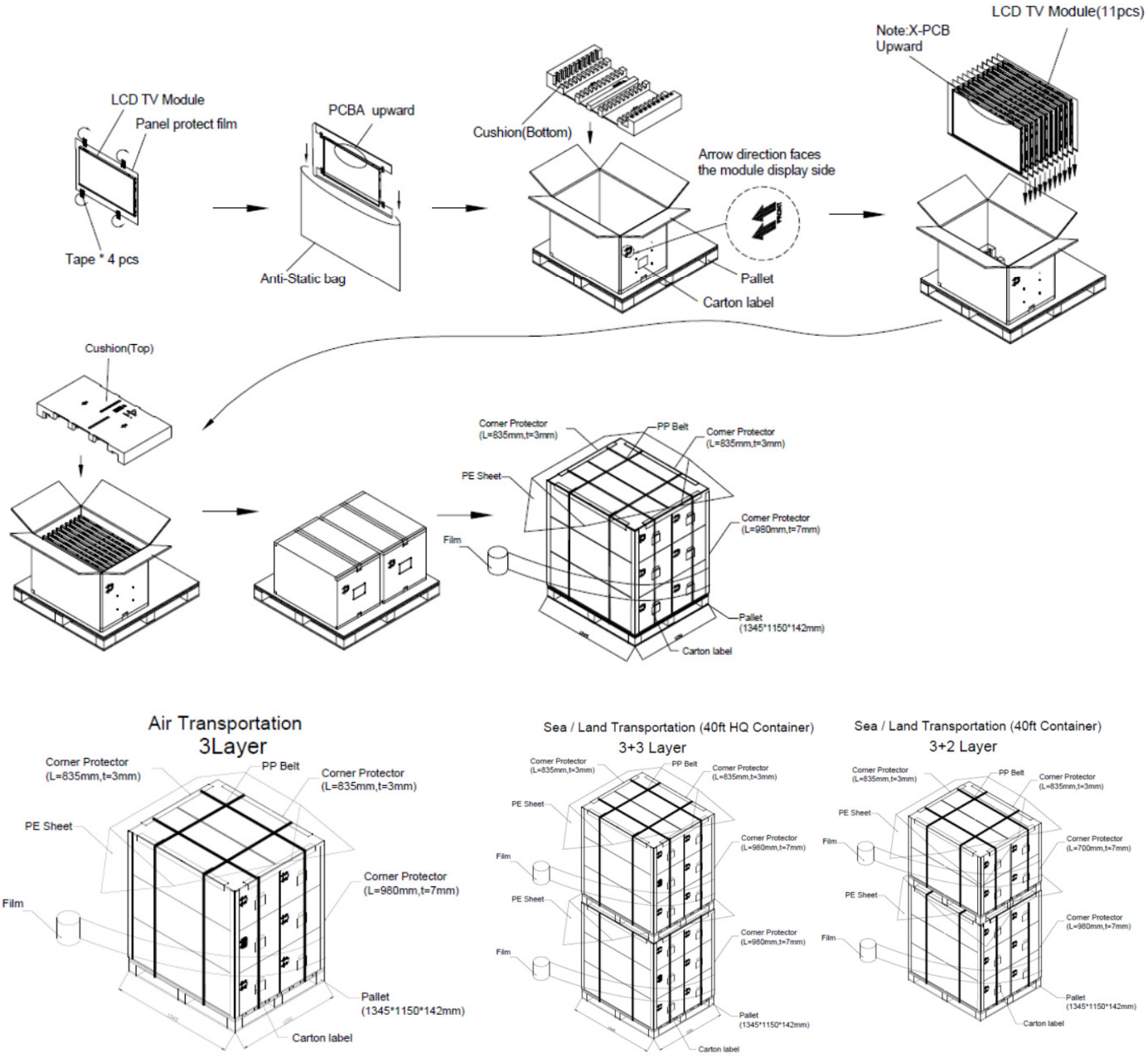
2. Stack is forbidden when the products are stocked over one month.



1.Carton dimensions: 1325(L)x565(W)x352(H)mm

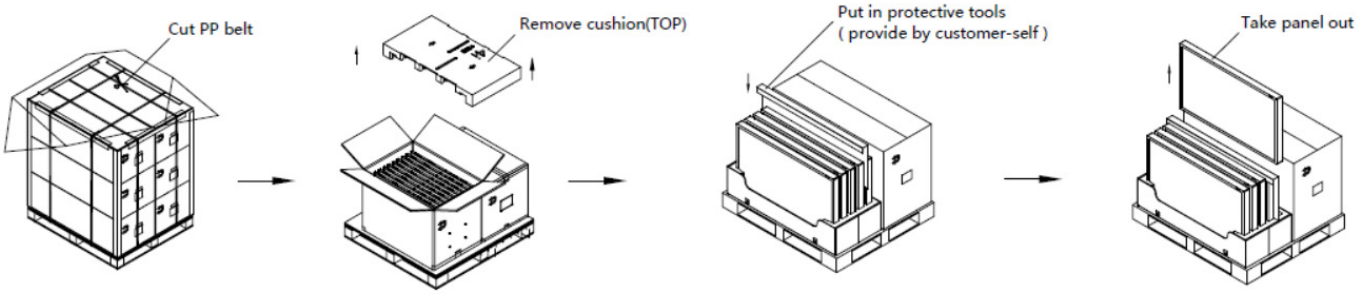
2. 11 modules / carton

模組包裝方式 (1) Carton dimensions：1325(L)x565(W)x352(H)mm
(2) 11 Modules / Carton



9.3 UN-PACKAGING METHOD

Un-packaging method is shown in following Figure.9-3.



10. MECHANICAL CHARACTERISTIC