Doc. Number :

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO.: N070ICG
SUFFIX: L21

Customer:

APPROVED BY **SIGNATURE**

Name / Title
Note

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

CONTENTS

REVISION HISTORY

Version	Date	Page	Description
2.0	Nov.24. 2011	All	Spec Ver.2.0 was first issued.

1. GENERAL DESCRIPTION

1.1 OVERVIEW

N070ICG-L21 is a 7” (6.95” diagonal) TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1280 x 800 WXGA mode.

1.2 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Screen Size	6.95” diagonal		
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1280 x R.G.B. x 800	pixel	-
Pixel Pitch	0.117 (H) x 0.117 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16777216 (8 bit)	color	-
Transmissive Mode	Normally Black	-	-
Surface Treatment	Hard coating (3H), Glare	-	-
Luminance, White	400	Cd/m2	-
Power Consumption	Total 2.25W(Max.), Cell 0.86W(Max.), BLU. 1.39W(Max.)		(1)

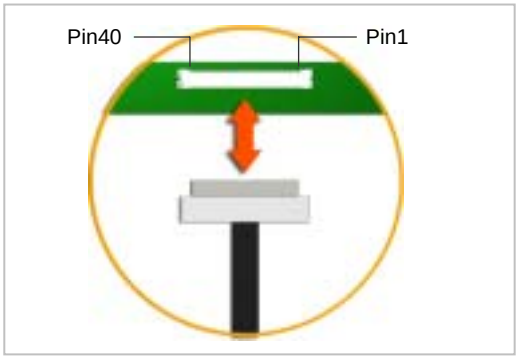
Note (1) The specified power consumption (without converter efficiency) is under the conditions at VCCS = 3.3 V, fv = 60 Hz, whereas mosaic pattern is displayed.

2. MECHANICAL SPECIFICATIONS

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

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	160.75	161	161.25	mm	(1)
	Vertical (V)	106.75	107	107.25	mm	
	Thickness_ Top (T)	-	2.15	2.35	mm	
	Thickness_ Bottom (T)	-	-	4.06	mm	
Bezel Area	Horizontal	151.46	151.76	152.06	mm	
	Vertical	95.3	95.6	95.9	mm	
Active Area	Horizontal	149.46	149.76	150.06	mm	
	Vertical	93.3	93.6	93.9	mm	
Weight		-	-	80	g	

2.1 INTERFACE CONNECTION



Please refer Appendix Outline Drawing for detail design.

Connector Part No.: I-PEX 20455-040E-12 or equivalent

User’s connector Part No: I-PEX 20453-040T-01 or equivalent

3. ABSOLUTE MAXIMUM RATINGS

3.1 ABSOLUTE RATINGS OF ENVIRONMENT

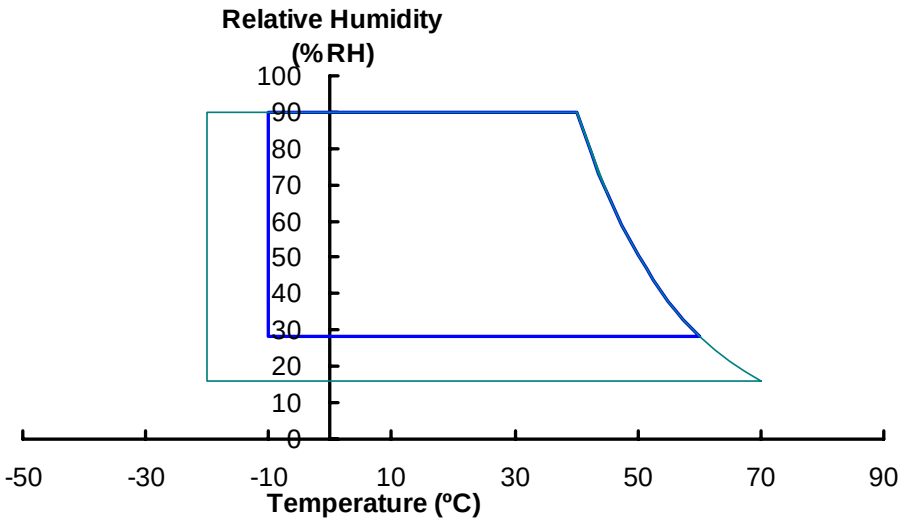
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+70	ºC	(1)
Operating Ambient Temperature	T_{OP}	-10	+60	ºC	(1), (2)

Note (1) (a) 90 %RH Max. (Ta <= 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel surface should be -10 ºC min. and 70 ºC max.



3.2 ELECTRICAL ABSOLUTE RATINGS

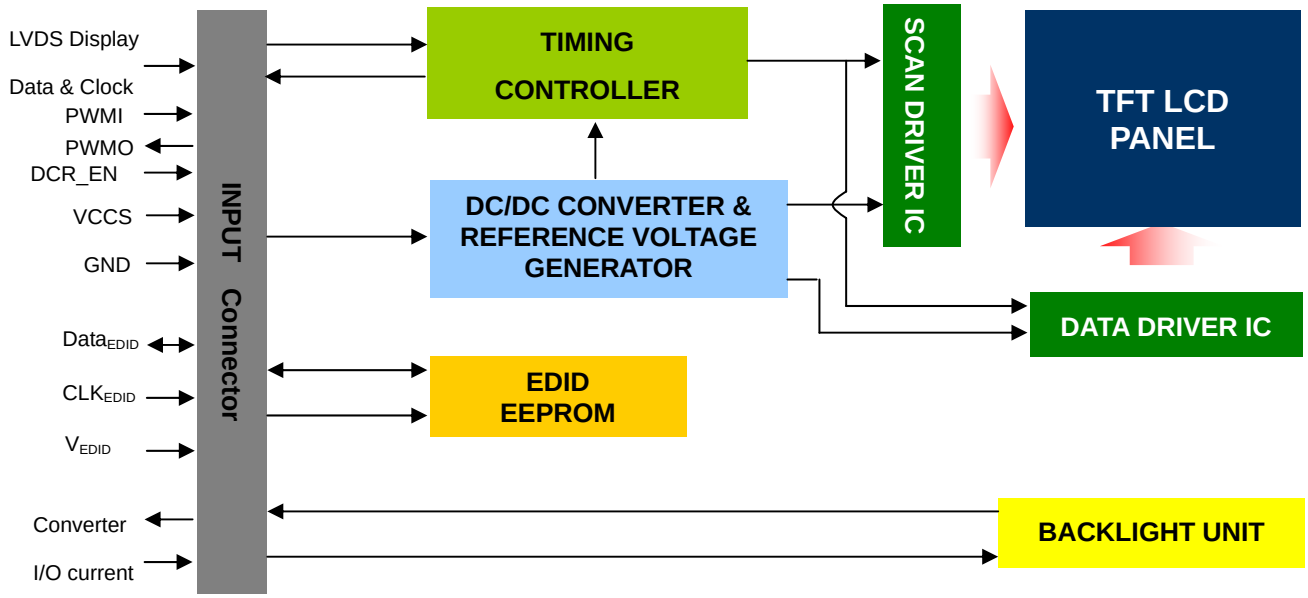
3.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCCS	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	VCCS+0.3	V	
System PWM signal input for dimming	PWMI	-0.3	5	V	(1)
Dynamic backlight control	DCR_EN	-0.3	5	V	(1)

Note (1) Stresses beyond those listed in above “ELECTRICAL ABSOLUTE RATINGS” may cause permanent damage to the device. Normal operation should be restricted to the conditions described in “ELECTRICAL CHARACTERISTICS”.

4. ELECTRICAL SPECIFICATIONS

4.1 FUNCTION BLOCK DIAGRAM



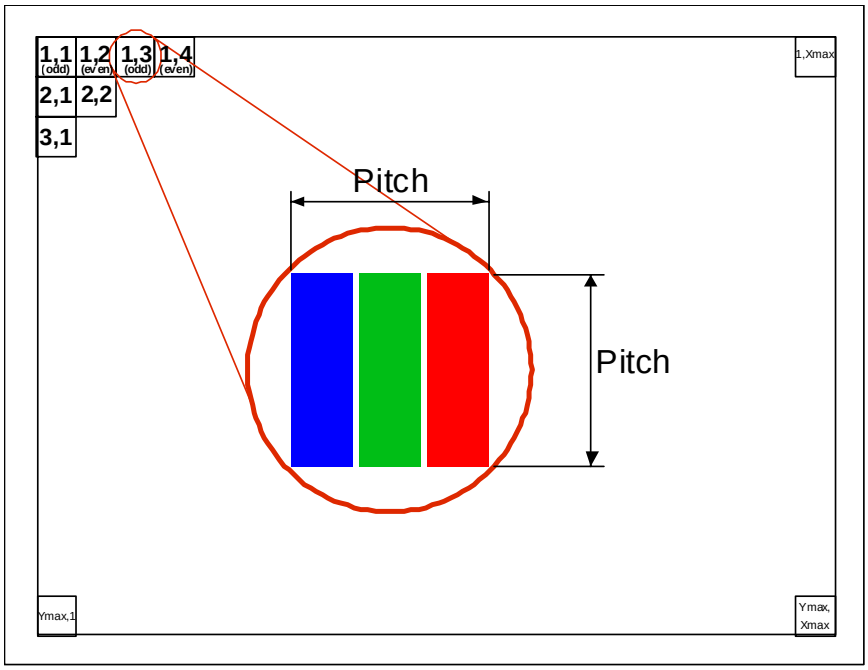
4.2 INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Symbol	Description	Remark
1	NC	No Connection (Reserved for CMI test)	
2	VCCS	Power Supply (3.3V typ.)	
3	VCCS	Power Supply (3.3V typ.)	
4	VEDID	DDC 1.8V ~ 3.3V power	
5	NC	No Connection (Reserved for CMI test)	
6	CLKEDID	DDC clock	
7	DATAEDID	DDC data	
8	Rxin0-	LVDS differential data input	R0-R5, G0
9	Rxin0+	LVDS differential data input	
10	VSS	Ground	
11	Rxin1-	LVDS differential data input	G1~G5, B0, B1
12	Rxin1+	LVDS differential data input	
13	VSS	Ground	
14	Rxin2-	LVDS Differential Data Input	B2-B5,HS,VS, DE
15	Rxin2+	LVDS Differential Data Input	
16	VSS	Ground	
17	RxCLK-	LVDS differential clock input	LVDS CLK
18	RxCLK+	LVDS differential clock input	
19	VSS	Ground	
20	Rxin3-	LVDS Differential Data Input	R[6],R[7],G[6],G[7],B[6],B[7]
21	Rxin3+	LVDS Differential Data Input	
22	VSS	Ground	
23	NC	No Connection (Reserve)	

24	DCR_EN	Dynamic backlight control (CABC_EN)	
25	PWM_IN	System PWM signal input for dimming	
26	PWM_OUT	Panel PWM signal output to system	
27	NC	No Connection (Reserve)	
28	NC	No Connection (Reserve)	
29	NC	No Connection (Reserve)	
30	NC	No Connection (Reserve)	
31	LED_CA1	LED Cathode 1	
32	LED_CA2	LED Cathode 2	
33	LED_CA3	LED Cathode 3	
34	LED_CA4	LED Cathode 4	
35	NC	No Connection (Reserve)	
36	NC	No Connection (Reserve)	
37	NC	No Connection (Reserve)	
38	NC	No Connection (Reserve)	
39	VLED Output	LED driver output	
40	VLED Output	LED driver output	

Note (1) The first pixel is odd as shown in the following figure.



Note (2) The setting of DCR function are as follows.

Pin	Enable	Disable
DCR_EN	Hi	Lo or Open

Hi = High level, Lo = Low level.

4.3 ELECTRICAL CHARACTERISTICS

4.3.1 LCD ELETRONICS SPECIFICATION

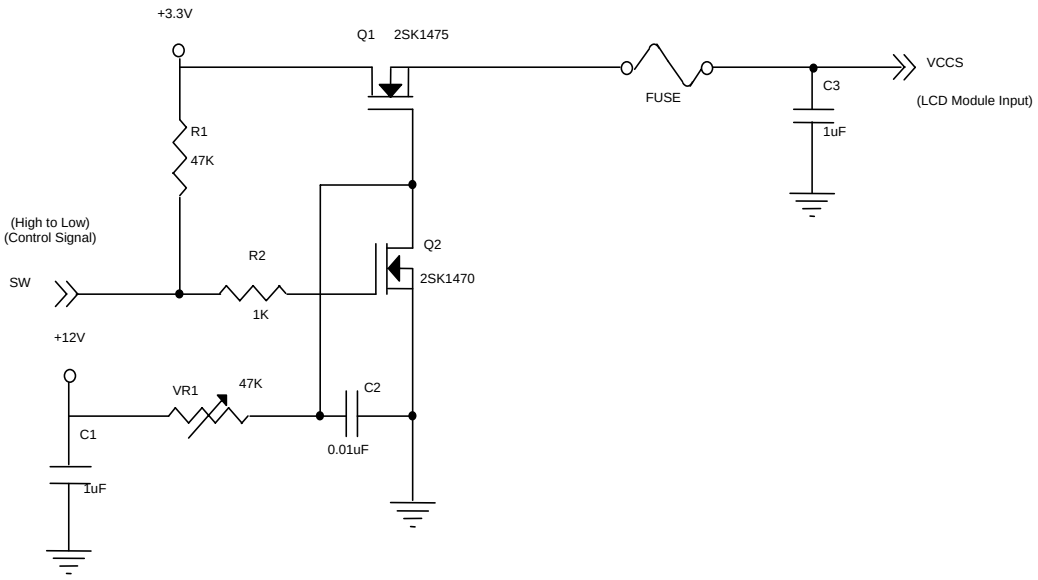
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)-
Ripple Voltage		V_{RP}	-	50	-	mV	(1)-
DCR_EN Input Voltage	High Level	V_{IHCABC}	2.3	-	3.6	V	
	Low Level	V_{ILCABC}	0	-	0.5	V	
PWMI Input Voltage	High Level		2.3	-	3.6	V	
	Low Level		0	-	0.5	V	
PWM Input Frequency		f_{PWM}	190	-	20K	Hz	
PWMO Output Voltage	High Level		2.0	-	2.5	V	
	Low Level		0	-	0.5	V	
Inrush Current		I_{RUSH}	-	-	1.5	A	(1),(2)
Power Supply Current	Mosaic	Icc	-	232	258	mA	(3)a
	White		-	260	294	mA	(3)b

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

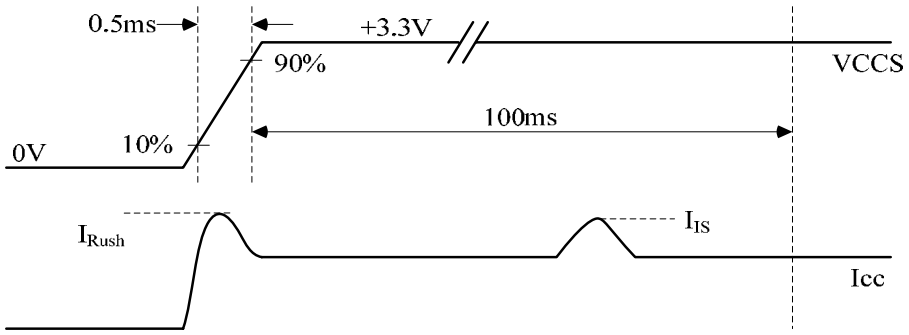
Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: white.

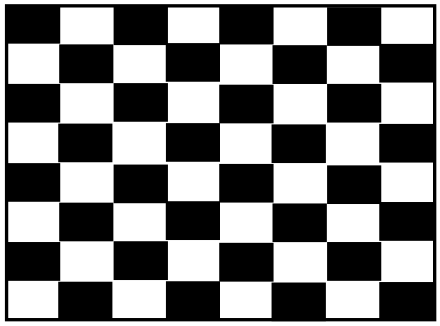


VCCS rising time is 0.5ms



Note (3) The specified power supply current is under the conditions at VCCS = 3.3 V, Ta = 25 ± 2 ºC, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. Mosaic Pattern



Active Area

b. White Pattern

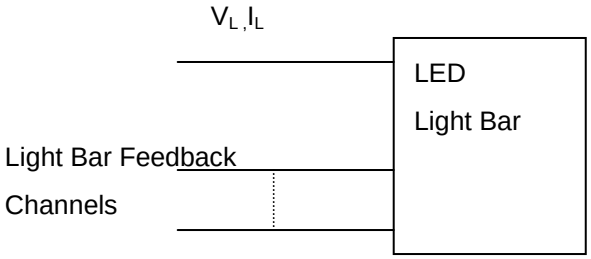
Active Area

4.3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ºC

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	14	15	16.5	V	(1)(2)(Duty100%)
LED Light Bar Power Supply Current	I_L	76	80	84	mA	
Power Consumption	P_L	1.06	1.20	1.39	W	(3)
LED Life Time	L_{BL}	10000	-	-	Hrs	(4)

Note (1) LED current is measured by utilizing a high frequency current meter as shown below :



Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.

Note (3) $P_L = I_L \times V_L$ (Without LED converter transfer efficiency)

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ^oC and I_L = 20 mA(Per EA) until the brightness becomes $\leqq$ 50% of its original value.

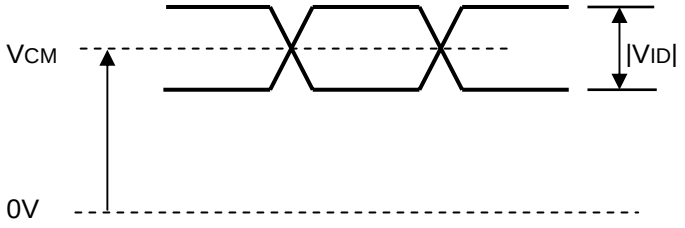
4.4 LVDS INPUT SIGNAL TIMING SPECIFICATIONS

4.4.1 LVDS DC SPECIFICATIONS

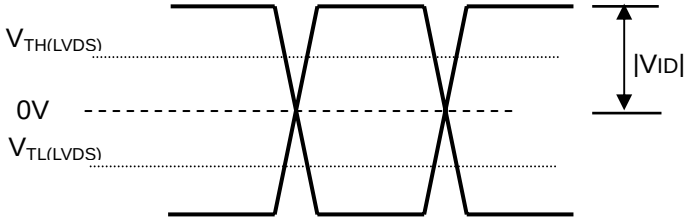
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LVDS Differential Input High Threshold	$V_{TH(LVDS)}$	-	-	+100	mV	(1), V_{CM}=1.2V
LVDS Differential Input Low Threshold	$V_{TL(LVDS)}$	-100	-	-	mV	(1) V_{CM}=1.2V
LVDS Common Mode Voltage	V_{CM}	1.125	-	1.375	V	(1)
LVDS Differential Input Voltage	$\|V_{ID}\|$	100	-	600	mV	(1)
LVDS Terminating Resistor	R_T	-	100	-	Ohm	-

Note (1) The parameters of LVDS signals are defined as the following figures.

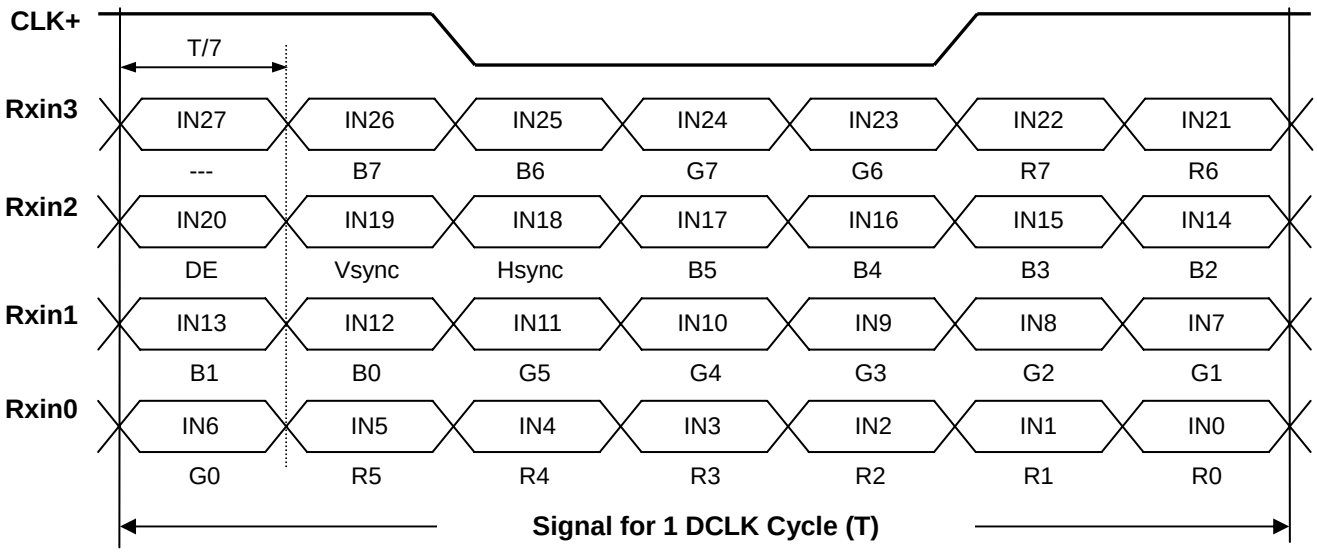
Single Ended



Differential



4.4.2 LVDS DATA FORMAT



4.4.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 8-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					
		R7	R6	…	R2	R1	R0	G7	G6	…	G2	G1	G0	B7	B6	…	B2	B1	B0
Basic Colors	Black	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	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0

	Blue(0)/Dark	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	1
Gray	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Scale	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Of	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Blue	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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

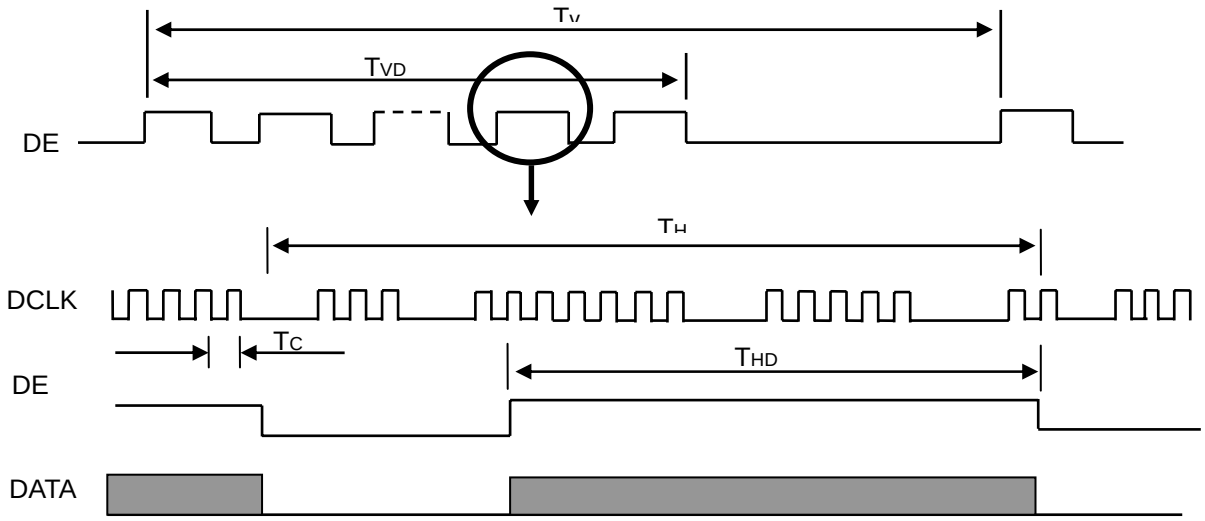
4.5 DISPLAY TIMING SPECIFICATIONS

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

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	67.55	71.11	78.22	MHz	-
DE	Vertical Total Time	TV	813	823	833	TH	-
	Vertical Active Display Period	TVD	800	800	800	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	23	TV-TVD	TH	-
	Horizontal Total Time	TH	1410	1440	1470	Tc	-
	Horizontal Active Display Period	THD	1280	1280	1280	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	160	TH-THD	Tc	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

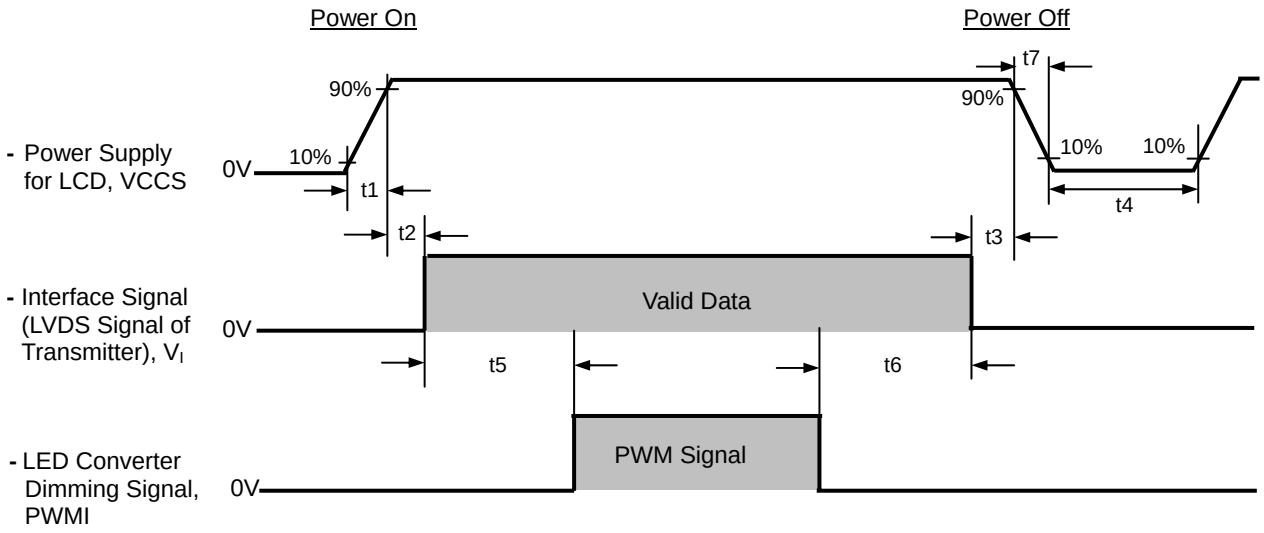
INPUT SIGNAL TIMING DIAGRAM



4.6 POWER ON/OFF SEQUENCE

The power sequence specifications are shown as the following table and diagram**.**

Symbol	Value			Unit	Note
	Min.	Typ.	Max.		
t1	0.5	-	10	ms	
t2	0	-	50	ms	
t3	0	-	50	ms	
t4	500	-	-	ms	
t5	200	-	-	ms	
t6	200	-	-	ms	
t7	0.5	-	10	ms	



Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) Please avoid floating state of the interface signal during signal invalid period.

5. OPTICAL CHARACTERISTICS

5.1 TEST CONDITIONS

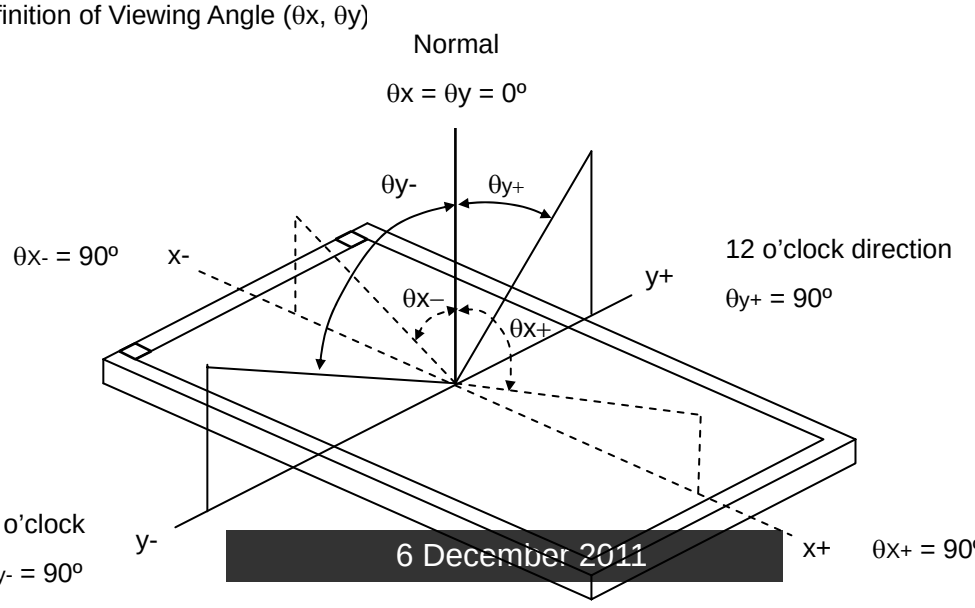
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Light Bar Input Current	I_L	80	mA

The measurement methods of optical characteristics are shown in Section 5.2. The following items should be measured under the test conditions described in Section 5.1 and stable environment shown in Note (5).

5.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_x=0°, θ_Y =0° Viewing Normal Angle	600	800	-	-	(2), (5),(7)
Response Time		T_R		-	14	17	ms	(3),(7)
		T_F		-	11	14	ms	
Average Luminance of White		L_{AVE}		340	400	-	cd/m^2	(4), (6),(7)
Color Chromaticity	Red	Rx		Typ - 0.03	(0.590)	Typ + 0.03	-	(1),(7)
		Ry			(0.340)		-	
	Green	Gx			(0.310)		-	
		Gy			(0.587)		-	
	Blue	Bx			(0.151)		-	
		By			(0.117)		-	
	White	Wx			0.308		-	
		Wy			0.324		-	
Viewing Angle	Horizontal	θ_x+	CR≥10	80	89	-	Deg.	(1),(5), (7)
		θ_x-		80	89	-		
	Vertical	θ_Y+		80	89	-		
		θ_Y-		80	89	-		
White Variation of 5 Points		δW_{5p}	θ_x=0°, θ_Y =0°	80	-	-	%	(5),(6), (7)

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



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

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

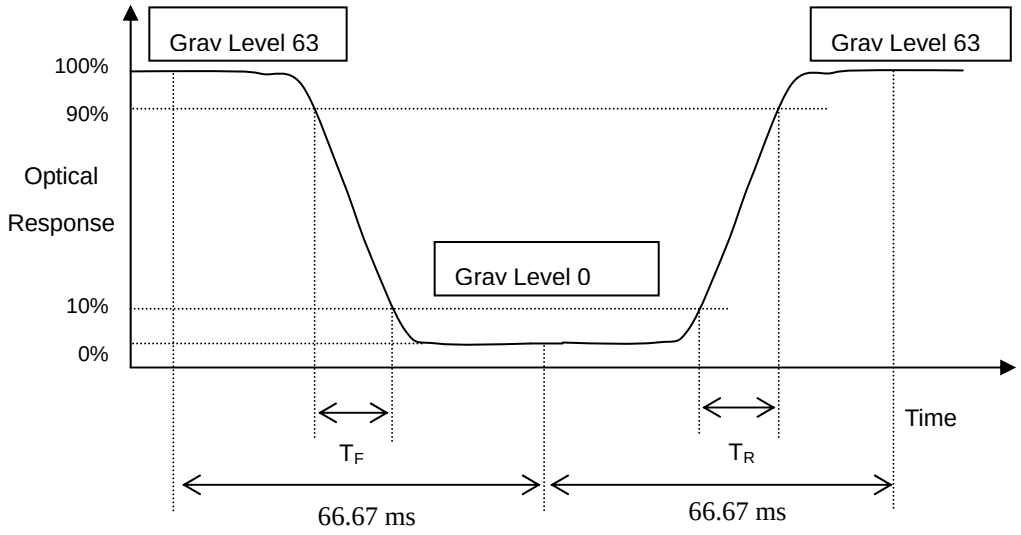
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

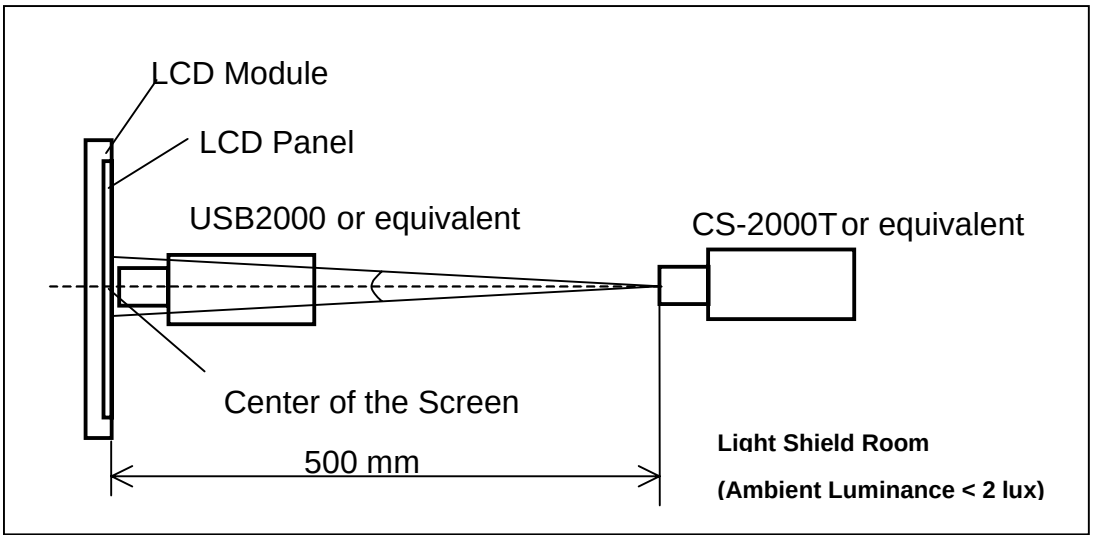
Measure the luminance of gray level 63 at 5 points

L_{AVE} = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5

L (x) is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

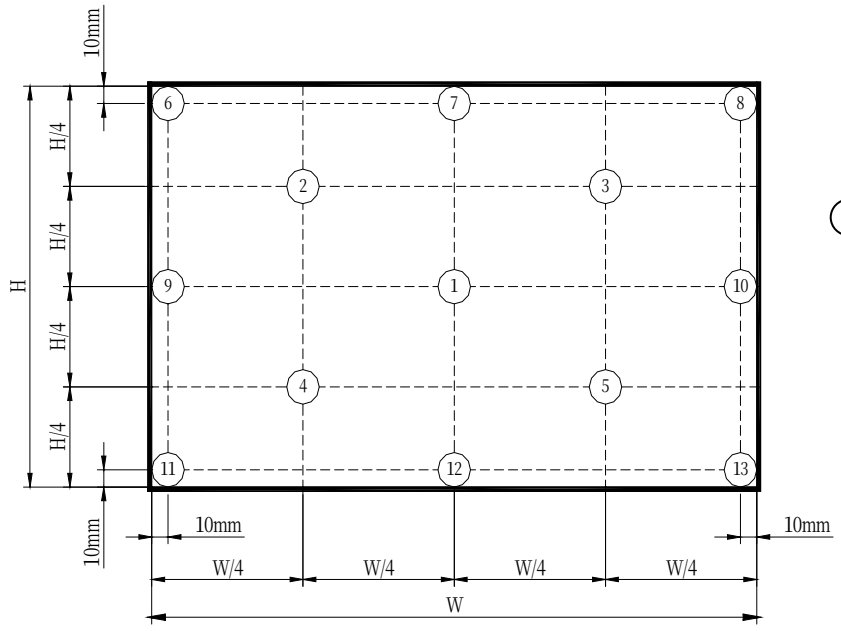
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



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

Measure the luminance of gray level 63 at 5 points

δW_{5p} = {Minimum [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / Maximum [L (1)+ L (2)+ L (3)+ L (4)+ L (5)]}*100%



Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

6. RABILITY TEST ITEM

Test Item	Test Condition	Note
High Temperature Storage Test	70ºC, 240 hours	(1) (2)
Low Temperature Storage Test	-20ºC, 240 hours	
Thermal Shock Storage Test	-20ºC, 0.5hour←→70℃, 0.5hour; 100cycles, 1hour/cycle	
High Temperature Operation Test	60ºC, 240 hours	
Low Temperature Operation Test	-10ºC, 240 hours	
High Temperature & High Humidity Operation Test	60ºC, 90%RH, 240hours	
Shock (Non-Operating)	180G, 2ms, half sine wave,1 time for each direction of ±X,±Y,±Z	(1)(3)
Vibration (Non-Operating)	1.5G / 10-500 Hz, Sine wave, 60 min/cycle, 1cycle for each X, Y, Z	(1)(3)

Note (1) criteria : Normal display image with no obvious non-uniformity and no line defect.

Note (2) Evaluation should be tested after storage at room temperature for more than two hour

Note (3) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

7.2 CARTON

Box Dimensions : 435(L)*350(W)*275(H)
Weight: Approx. 7.5kg(60 module .per. 1 box)

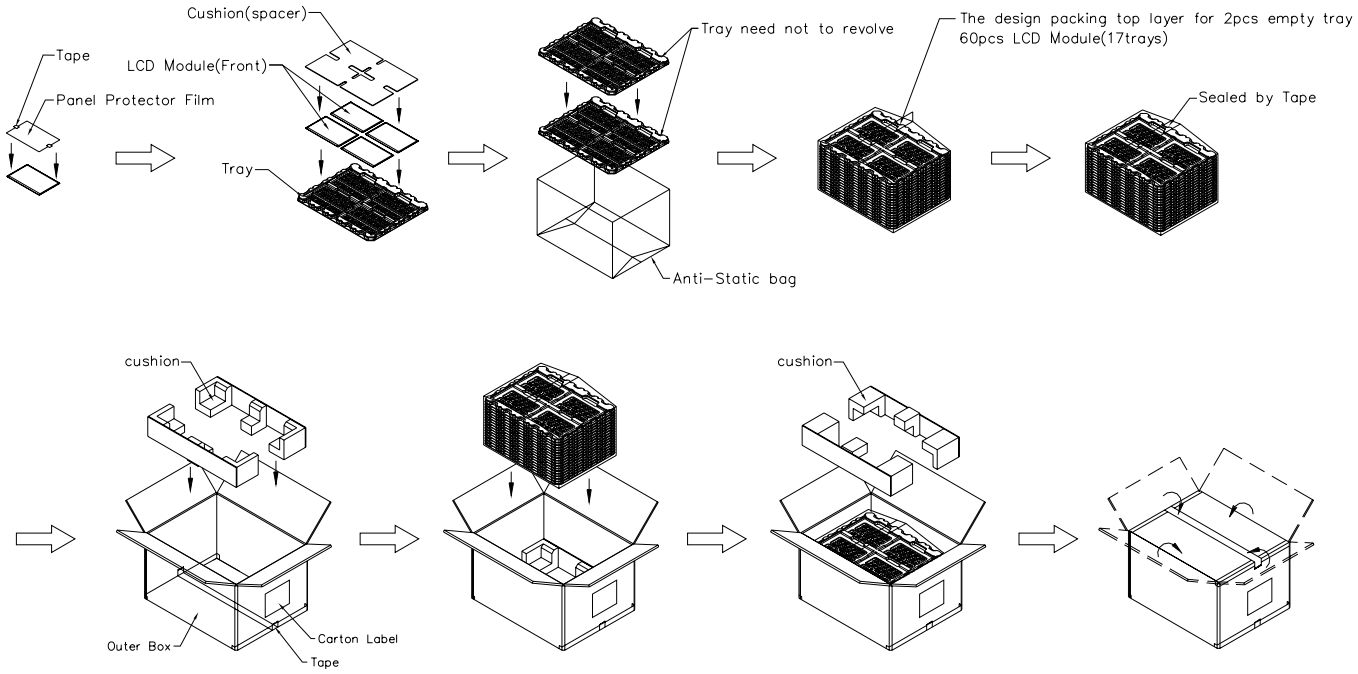


Figure. 7-2 Packing method

7.3 PALLET

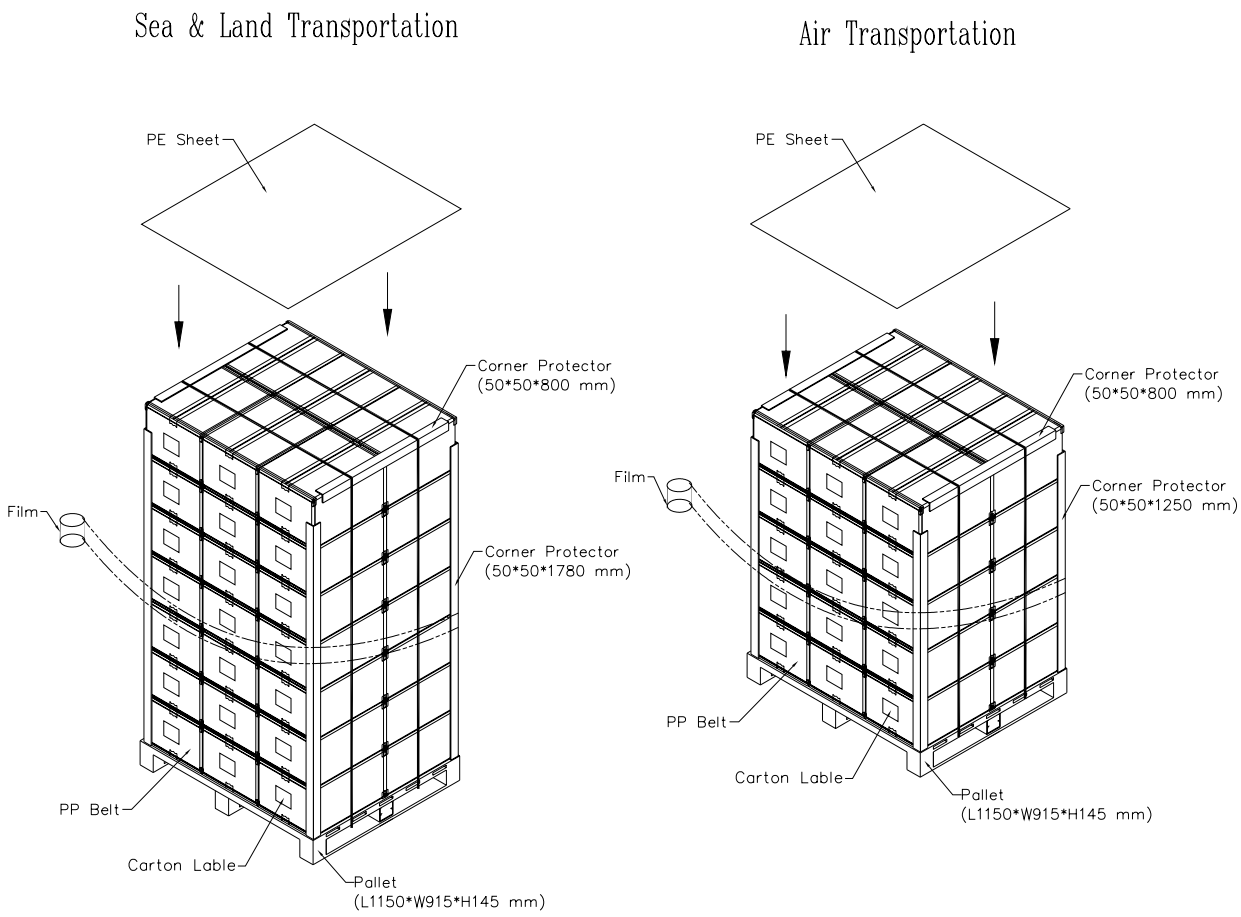


Figure. 7-3 Packing method

8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) 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.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) 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.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the LED wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

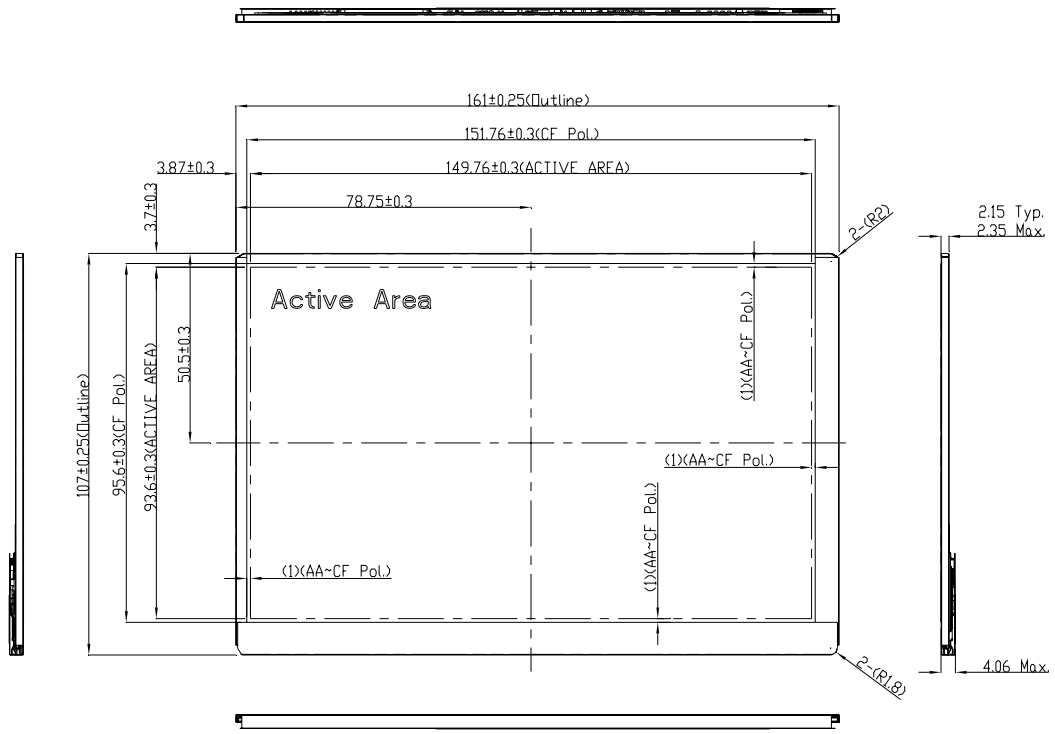
8.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

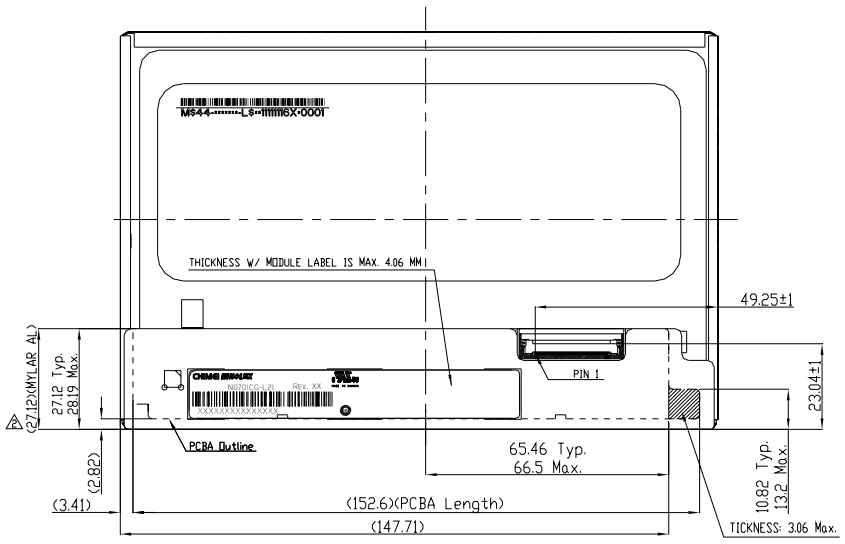
(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

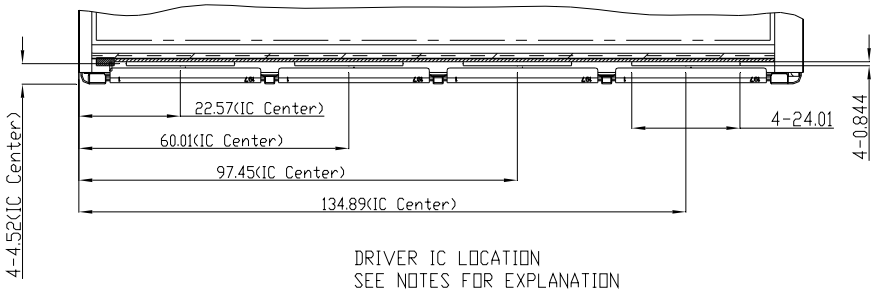
(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

Appendix. OUTLINE DRAWING

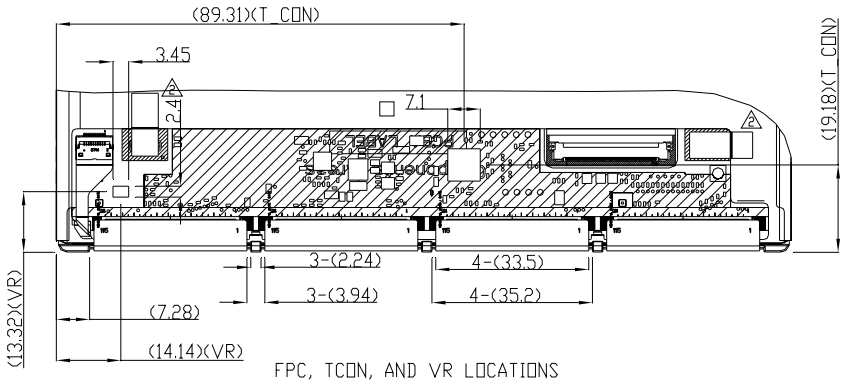


NOTES :
1. LCD MODULE INPUT CONNECTOR : I-PEX 20455-040E-12 OR EQUIVALENT.
2. IN ORDER TO AVOID ABNORMAL DISPLAY, POOLING AND WHITE SPOT,
   NO OVERLAPPING IS SUGGESTED AT CABLES, ANTENNAS, CAMERA, WLAN, WAN OR
   FOREIGN OBJECTS OVER FPC, T-CON AND VR LOCATIONS.
3. LVDS CONNECTOR IS MEASURED AT PIN1 AND ITS MATING LINE.
4. MODULE FLATNESS SPEC 0.5mm MAX.
5. "( )" MARKS THE REFERENCE DIMENSIONS.





DRIVER IC LOCATION
SEE NOTES FOR EXPLANATION



FPC, TCON, AND VR LOCATIONS
SEE NOTES FOR EXPLANATION