TFT LCD Approval Specification

MODEL NO.: N154C6-P04

Customer: _____

Approved by: _____

Note:

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REVISION HISTORY

Version	Date	Section	Description
Ver. 2.0	Aug, 25 '09	-	N154C6-P04 Approval Specifications was first issued。

1. GENERAL DESCRIPTION

1.1 OVERVIEW

The N154C6-P04 is a 15.4-inch TFT LCD cell with driver ICs and a 40-pin-and-2ch-LVDS circuit board. The product supports 1440 x 900 WXGA mode and can display up to 262,144 colors. The backlight unit is not built in.

1.2 FEATURES

- WXGA+ (1440 x 900 pixels) resolution
- 3.3V LVDS (Low Voltage Differential Signaling) interface
- No LED converter embedded

1.3 APPLICATION

-TFT LCD Notebook

-TFT LCD Monitor

-TFT LCD TV

1.4 GENERAL SPECIFICATI0NS

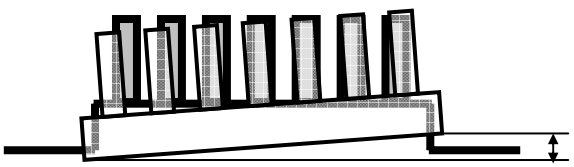
Item	Specification	Unit	Note
Active Area	331.344(H) x 207.09(V) (15.4” diagonal)	mm	(1)
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1440 (H) x 3 (R.G.B.) x 900 (V)	pixel	-
Pixel Pitch	0.2301 (H) x 0.2301 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally White	-	-
Surface Treatment	Glare, N2T (Reflection rate< 0.5%), 3H	-	-

1.5 MECHANICAL SPECIFICATIONS

Item	Min.	Typ.	Max.	Unit	Note
Weight	-	229	234	g	-
I/F connector mounting position	The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

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

(2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT (BASED ON CMO MODULE N154I3-L02)

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)

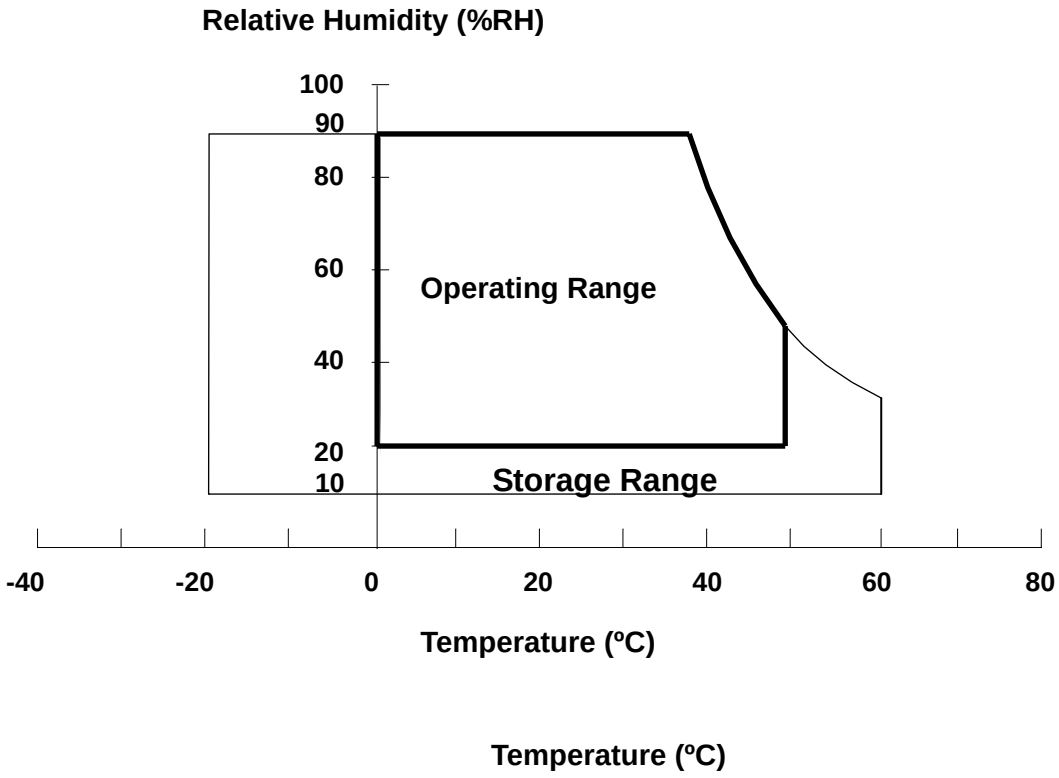
Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≦ 40 ºC).

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

(c) No condensation.

Note (2) The temperature of panel surface should be 0 ºC Min. and 60 ºC Max.



Temperature (ºC)

2.2 ABSOLUTE RATINGS OF ENVIRONMENT (OPEN CELL)

High temperature or humidity may reduce the performance of panel. Please store LCD panel within the specified storage conditions.

Storage Condition: With packing.

Storage temperature range: 25±5 ºC.

Storage humidity range: 50±10%RH.

Shelf life: 30days

2.3 ELECTRICAL ABSOLUTE RATINGS (OPEN CELL)

Item	Symbol	Value		Unit	Note
		Min	Max		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC}+0.3	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.

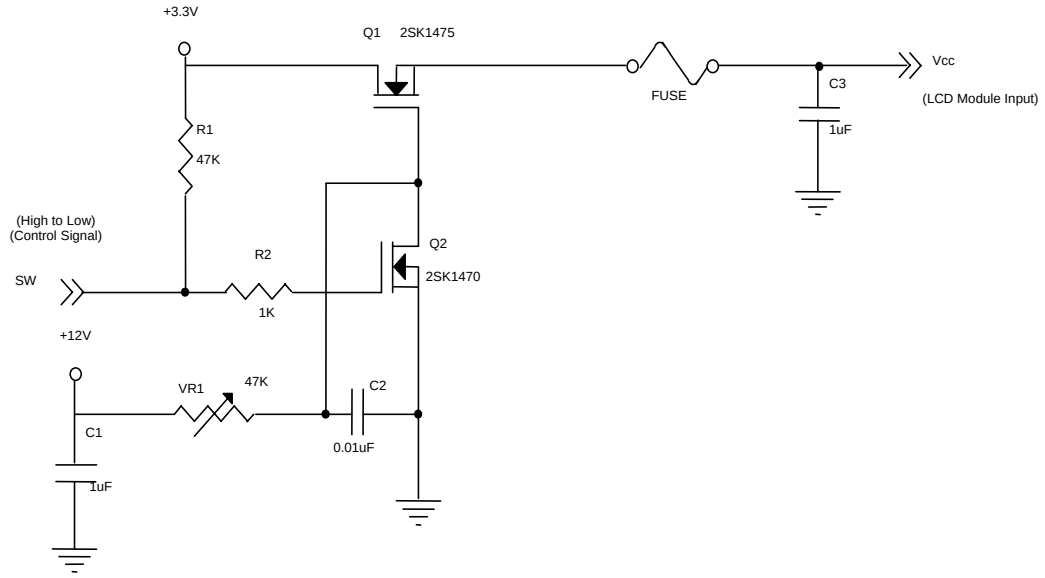
3. ELECTRICAL CHARACTERISTICS

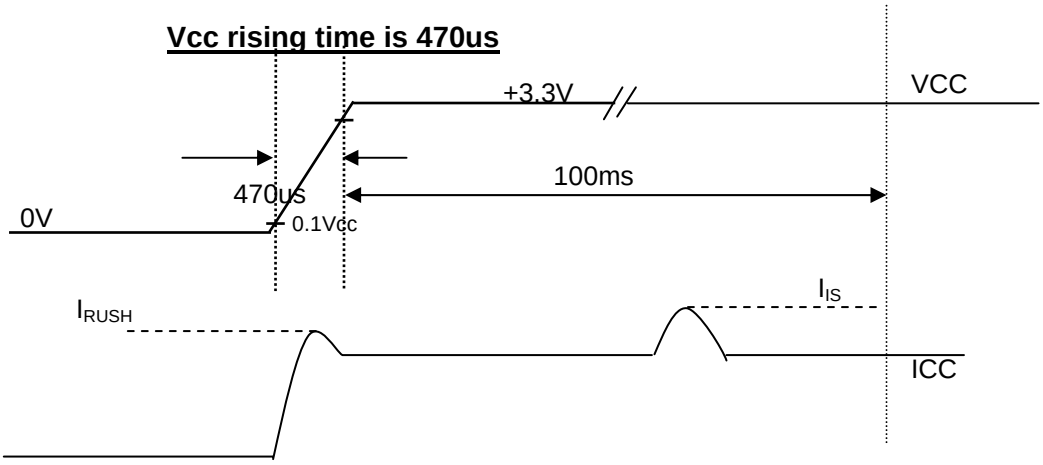
3.1TFT LCD OPEN CELL

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Ripple Voltage		V_{RP}	-	50		mV	-
Rush Current		I_{RUSH}	-	-	1.5	A	(2)
Initial Stage Current		I_{IS}	-	-	1.0	A	(2)
Power Supply Current	White	Icc	-	320	-	mA	(3)a
	Black		-	380	480	mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$	-	-	+100	mV	(5), V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$	-100	-	-	mV	(5) V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125	-	1.375	V	(5)
LVDS Differential Input Voltage		$\|V_{ID}\|$	100	-	600	mV	(5)
Terminating Resistor		R_T	-	100	-	Ohm	-

Note (1) The module should be always operated within above ranges.

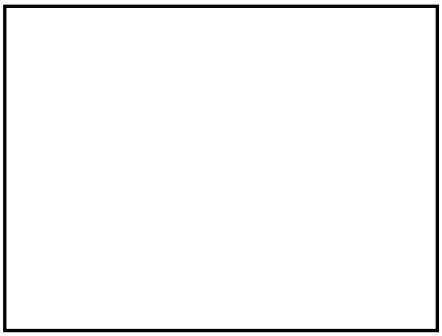
Note (2) Measurement Conditions:





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

a. White Pattern



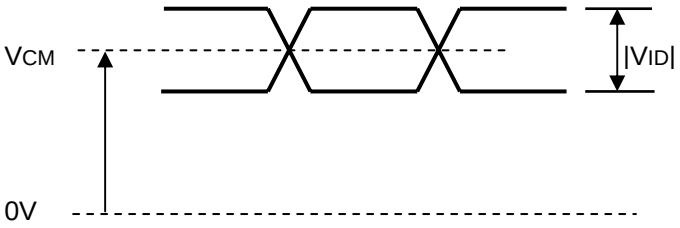
Active Area

b. Black Pattern

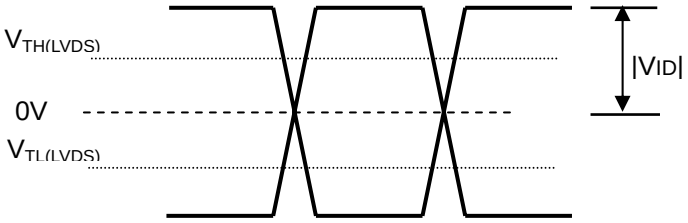
Active Area

Note (4) The parameters of LVDS signals are defined as the following figures.

Single Ended

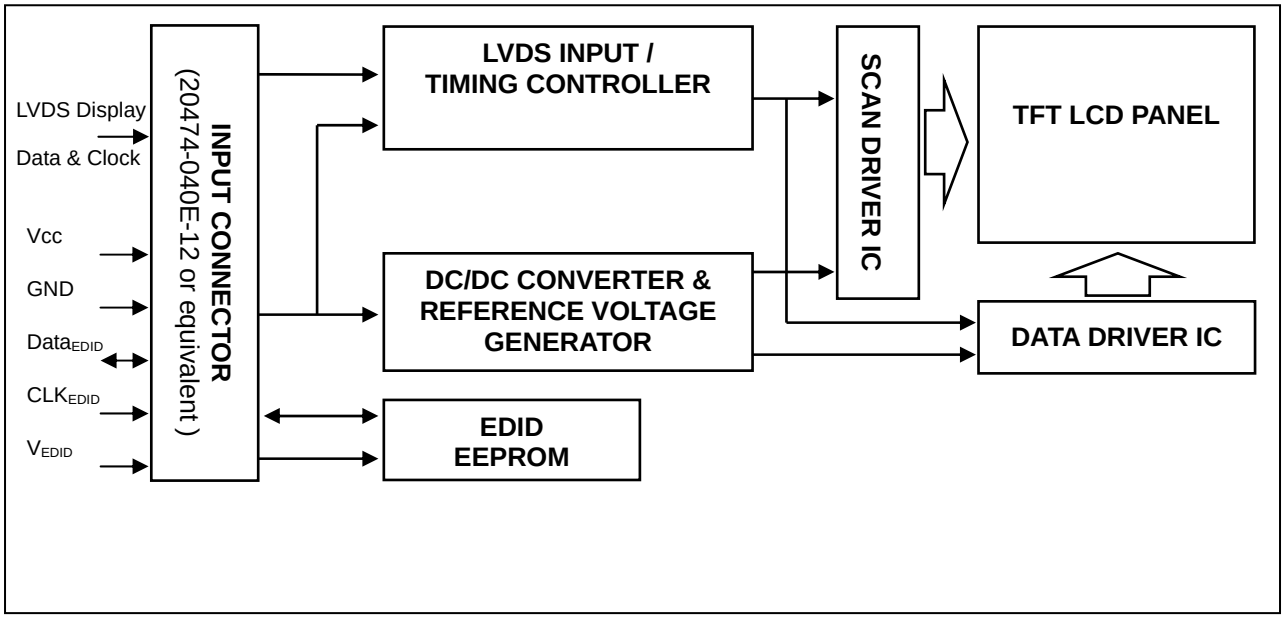


Differential



4. BLOCK DIAGRAM

4.1 TFT LCD OPEN CELL



5. INPUT TERMINAL PIN ASSIGNMENT

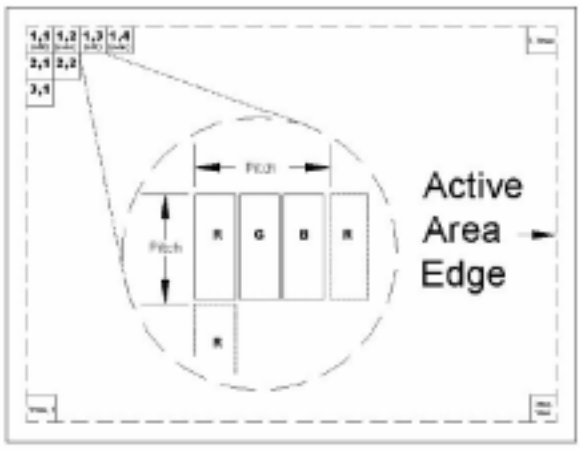
5.1 TFT LCD OPEN CELL

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V_{EDID}	DDC 3.3V Power		DDC 3.3V Power
5	NC	Non-Connection		
6	CLK_{EDID}	DDC Clock		DDC Clock
7	$DATA_{EDID}$	DDC Data		DDC Data R0~R5,G0
8	Rxin0-	LVDS Differential Data Input	Negative	
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		G1~G5, B0, B1
11	Rxin1-	LVDS Differential Data Input	Negative	
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		B2~B5, DE, Hsync, Vsync
14	Rxin2-	LVDS Differential Data Input	Negative	
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		LVDS Level Clock
17	CLK-	LVDS Clock Data Input	Negative	
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		
20	NC	Non-Connection		
21	NC	Non-Connection		
22	Vss	Ground		
23	NC	Non-Connection		
24	NC	Non-Connection		
25	Vss	Ground		
26	NC	Non-Connection		
27	NC	Non-Connection		
28	Vss	Ground		
29	NC	Non-Connection		
30	NC	Non-Connection		

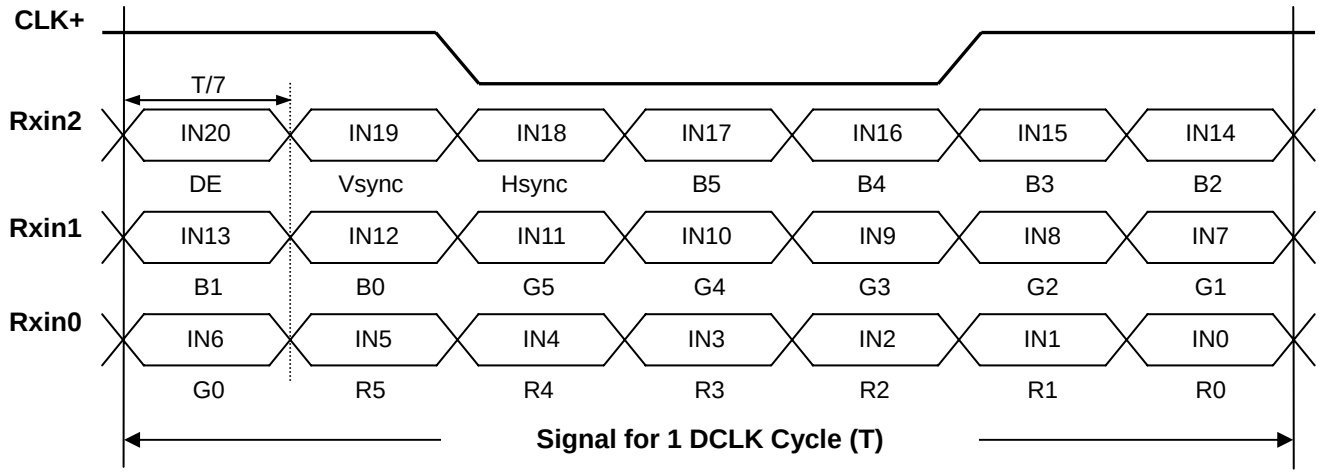
Note (1) Connector Part No.: 20474-040E-12 or equivalent

Note (2) User's connector Part No: 20472-040T-10 or equivalent

Note (3) The first pixel is odd as shown in the following figure.



5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	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(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	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(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	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

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

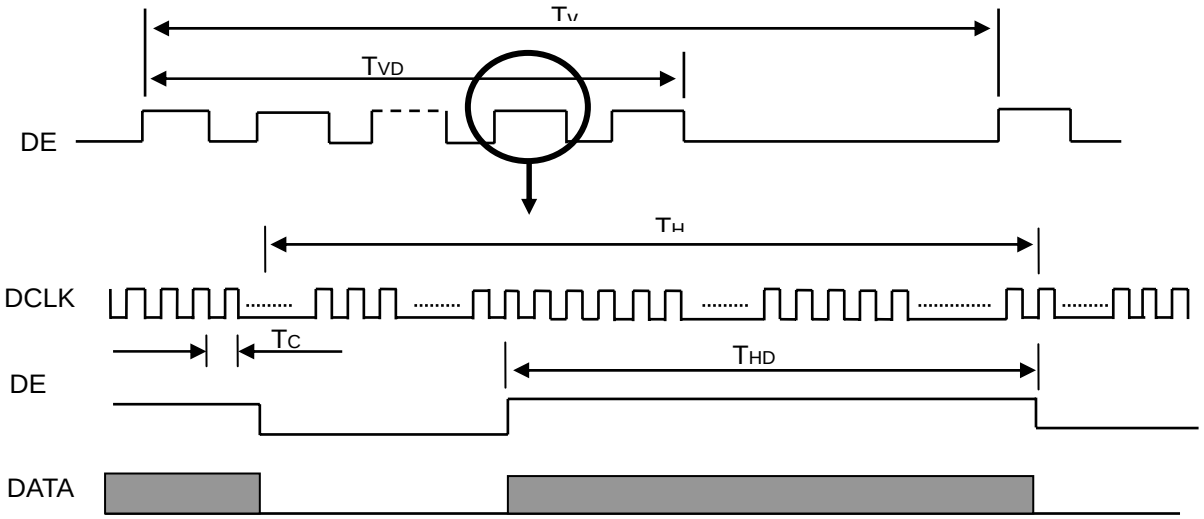
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	42.275	44.5	46.725	MHz	(2)
DE	Vertical Total Time	TV	910	926	1000	TH	-
	Vertical Active Display Period	TVD	900	900	900	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	26	TV-TVD	TH	
	Horizontal Total Time	TH	760	800	880	Tc	(2)
	Horizontal Active Display Period	THD	720	720	720	Tc	(2)
	Horizontal Active Blanking Period	THB	TH-THD	80	TH-THD	Tc	(2)

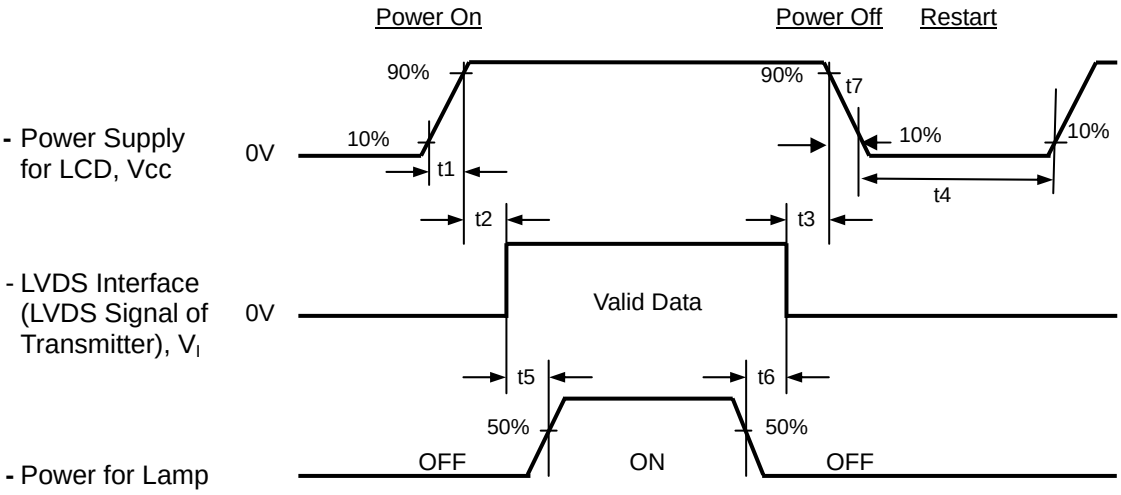
Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

Note (2) 1 channels LVDS input.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

0.5 ≦ t1 ≦ 10 ms

0 ≦ t2 ≦ 50 ms

0 ≦ t3 ≦ 50 ms

t4 ≧ 500 ms

t5 ≧ 200 ms

t6 ≧ 200 ms

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow 5ms≦t7≦300 ms.

7. OPTICAL CHARACTERISTICS

7.1 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"		

7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown as below. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

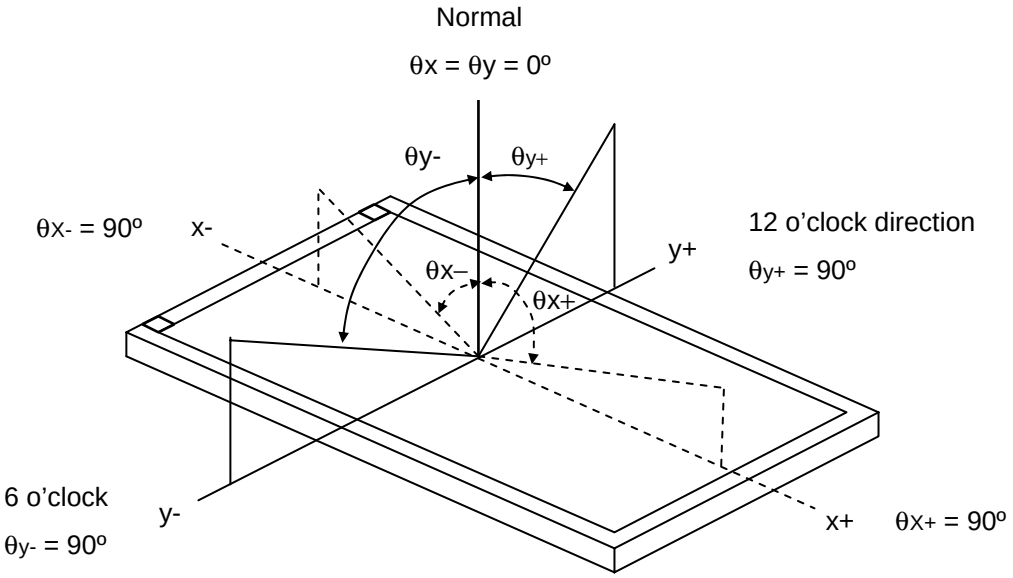
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rcx	θ_x=0° , θ_Y =0° CS-1000T Standard light source "C"	Typ - 0.03	0.623	Typ + 0.03	-	(0),(6)
		Rcy			0.330		-	
	Green	Gcx			0.297		-	
		Gcy			0.534		-	
	Blue	Bcx			0.147		-	
		Bcy			0.177		-	
	White	Wcx			0.306		-	
		Wcy			0.347		-	
Center Transmittance		T%	θ_x=0° , θ_Y =0° CS-1000T, CMO BLU	8.0	9.0	-		(1), (8)
Contrast Ratio		CR		300	500	-	-	(1), (3)
Response Time		T_R	θ_x=0° , θ_Y =0°	-	3	8	ms	(4)
		T_F		-	7	12	ms	
Transmittance uniformity		δT%	θ_x=0° , θ_Y =0° BM-5A	--	--	1.25	-	(1), (7)
Viewing Angle	Horizontal	θ_x+	CR≥10 BM-5A	50	60	-	Deg.	(1), (3) (6)
		θ_x-		50	60	-		
	Vertical	θ_Y+		40	50	-		
		θ_Y-		50	60	-		

Note (0) Light source is the standard light source "C" which is defined by CIE and driving voltages are based on suitable gamma voltages. The calculating method is as following：

1. Measure Module's and BLU's spectrums. White is without signal input and R, G, B are with signal input. BLU is supplied by CMO.
2. Calculate cell's spectrum.
3. Calculate cell's chromaticity by using the spectrum of standard light source "C"

Note (1) Light source is the BLU which is supplied by CMO and driving voltages are based on suitable gamma voltages. White is without signal input and R, G, B are with signal input. SPEC is judged by CMO's golden sample.

Note (2) Definition of Viewing Angle (θx, θy):



Note (3) Definition of Contrast Ratio (CR):

CR_{AVE}= [CR(1)+ CR(2)+ CR(3)+ CR(4)+ CR(5)] / 5

CR_{max}=Max value of CR at whole Viewing Angle

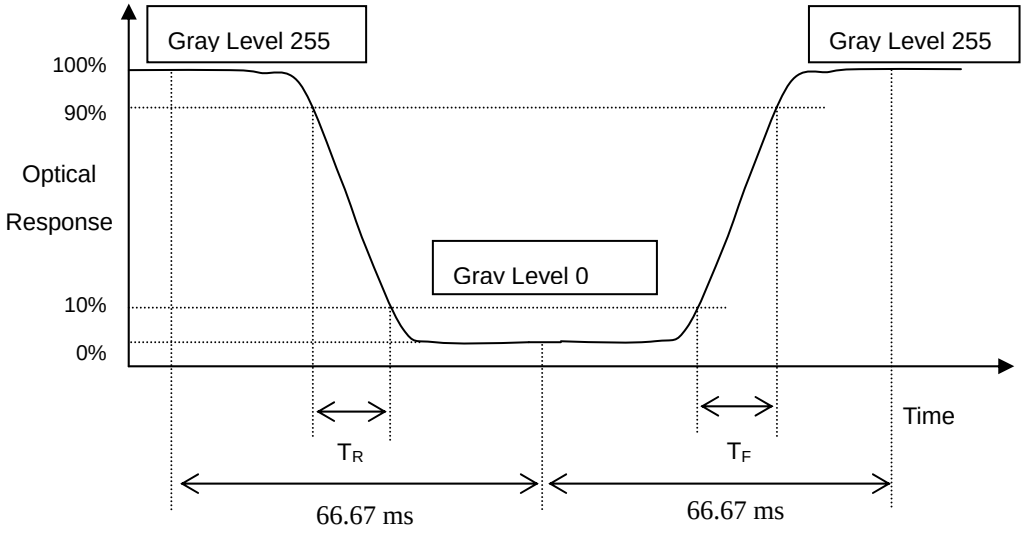
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

$$CR = \frac{\text{Luminance with all pixel white (Gmax)}}{\text{Luminance with all pixel black (Gmin)}}$$

Gmax: Luminance of gray max at the center point of panel.

Gmin: Luminance of gray min at the center point of panel.

Note (4) Definition of Response Time (T_R, T_F):



Note (5) Definition of Luminance of White (L_C):

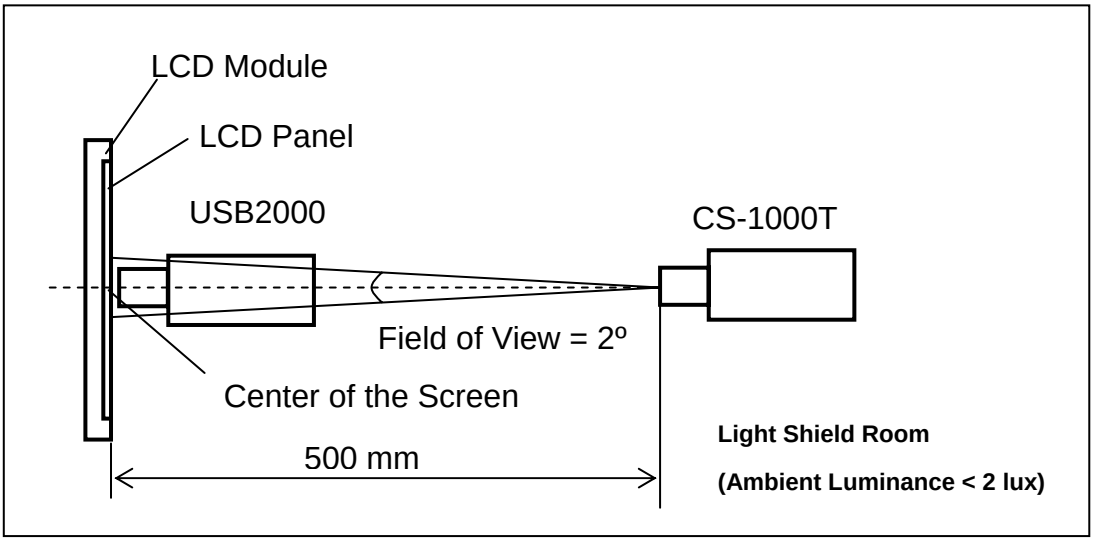
Measure the luminance of gray level 255 at center point

L_C = L (5)

L (x) is corresponding to the luminance of the point X at Figure in Note (7).

Note (6) Measurement Setup:

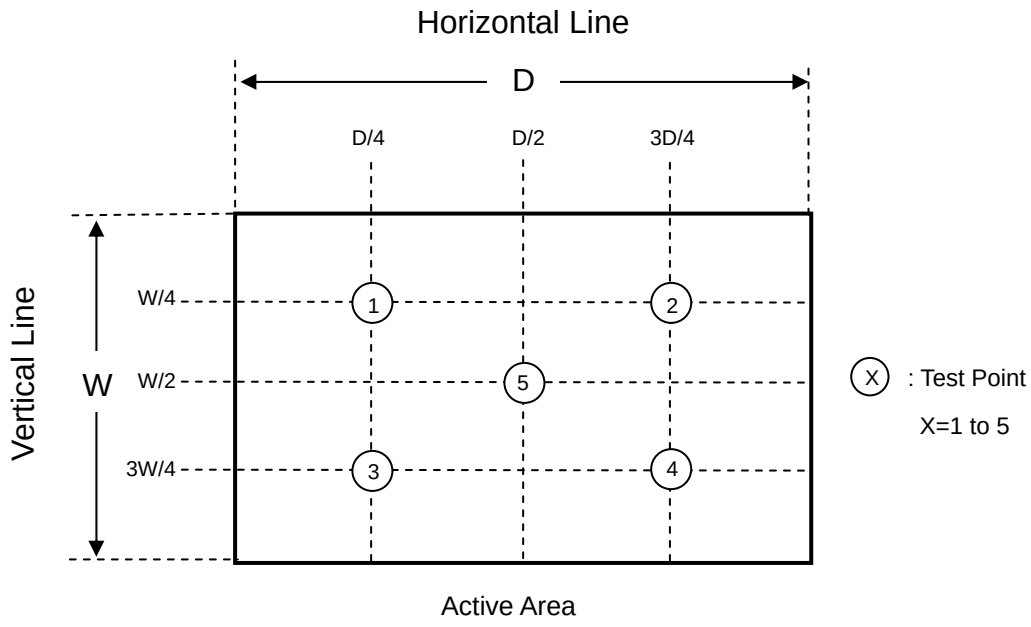
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (7) Definition of Transmittance Variation (δT%):

Measure the transmittance at 5 points

$$\delta T\% = \frac{\text{Maximum [T\%(1), T\%(2), … T\%(5)]}}{\text{Minimum [T\%(1), T\%(2), … T\%(5)]}}$$



Note (8) Definition of Transmittance (T%):

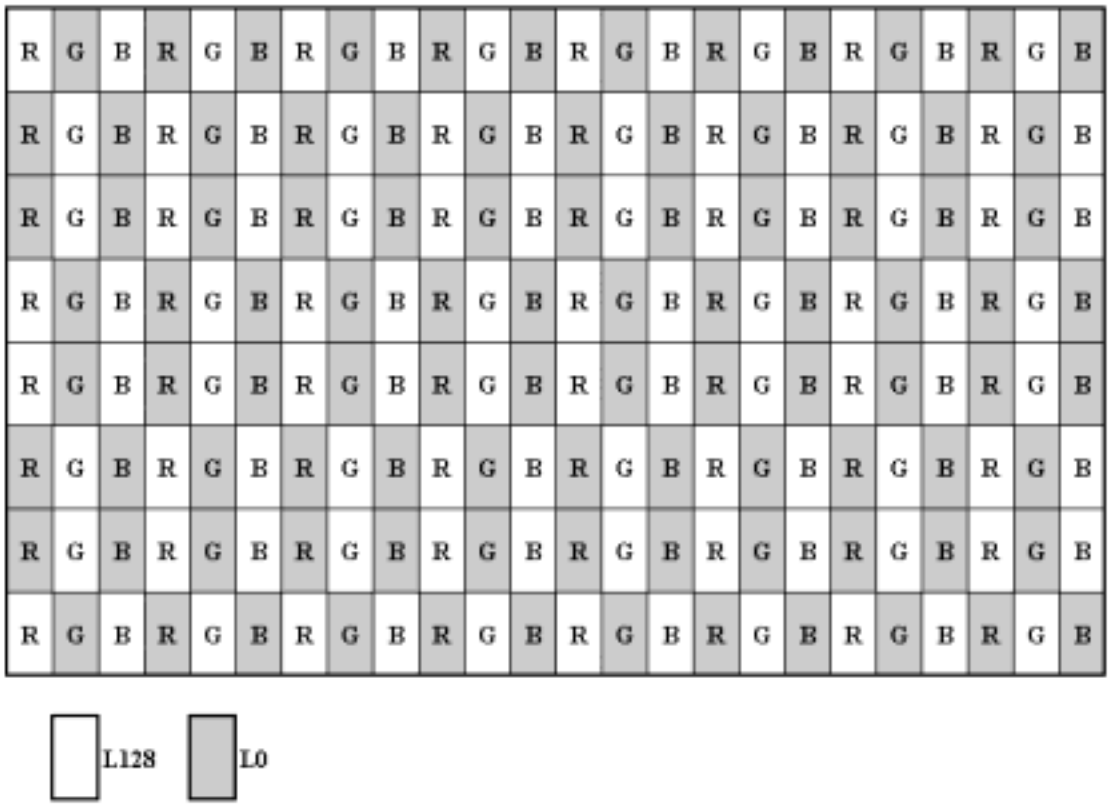
Module is without signal input.

BLU is supplied by CMO.

$$\text{Transmittance} = \frac{\text{Luminance of LCD module}}{\text{Luminance of backlight}} * 100\%$$

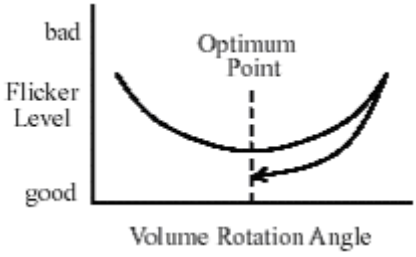
7.3 Flicker Adjustment

(1) Adjustment Pattern: 2H1V checker pattern as follows.



(2) Adjustment Method:

Flicker should be adjusted by turning the volume for flicker adjustment by the ceramic driver. It is adjusted to the point with least flickering of the whole screen. After making it surely overrun at once, it should be adjusted to the optimum point.



8. PACKAGING

8.1 PACKING SPECIFICATIONS

(1) 24 open cells / 1 Box

(2) Box dimensions: 524mm(L) X 432mm(W) X 480mm(H)

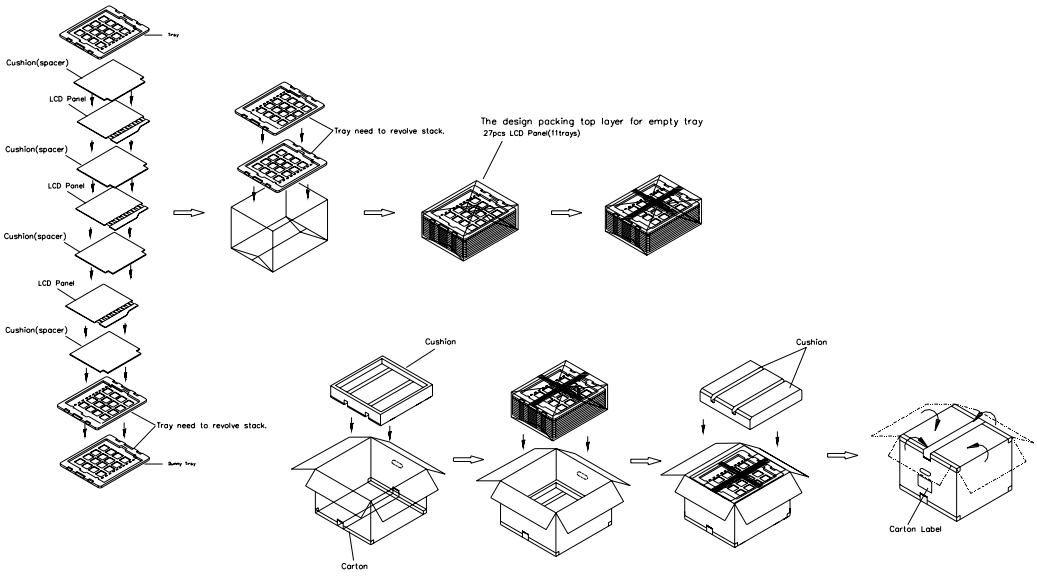
(3) Weight: approximately 12.3Kg (24 open cells per box)

8.2 PACKING METHOD

(1) Carton Packing should have no failure in the following reliability test items

Test Item	Test Conditions	Note
Packing Vibration	ISTA STANDARD Random, Frequency Range: 1 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation

(2) Packing method.

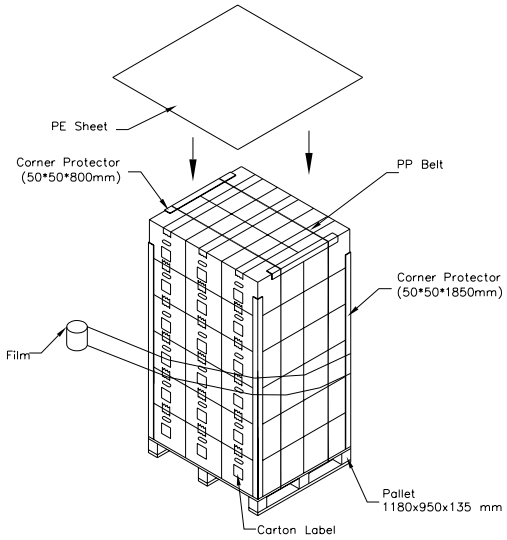


(1) 27 LCD Cells+PCB/1 box

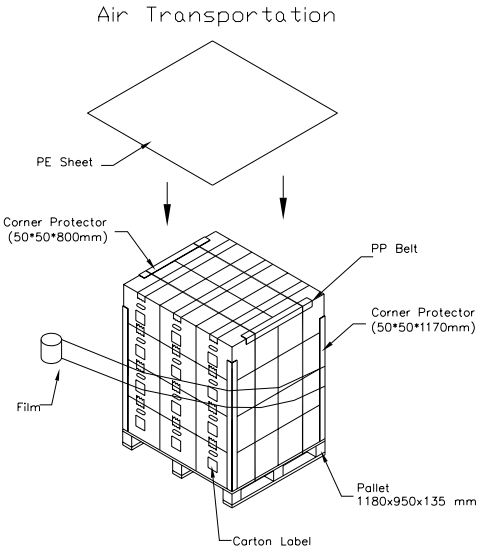
(2) Carton dimensions : 475(L)x390(W)x320(H)mm

(3) Weight :approximately 16.5kg(27 Cells per Carton).

Sea and Land Transportation



Air Transportation



9. DEFINITION OF LABELS

9.1 CARTON LABEL

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

(a) Model Name: N154C6 –P04

(b) Carton ID: CMO internal control

(c) Quantities: 27

10. PRECAUTIONS

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

(1) Do not apply rough force such as bending or twisting to the product during assembly.

(2) To assemble backlight or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.

(3) It's not permitted to have pressure or impulse on the module because the LCD panel will be damaged.

(4) Always follow the correct power sequence when the product is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.

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

(6) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.

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

(8) High temperature or humidity may reduce the performance of module. Please store this product within the specified storage conditions.

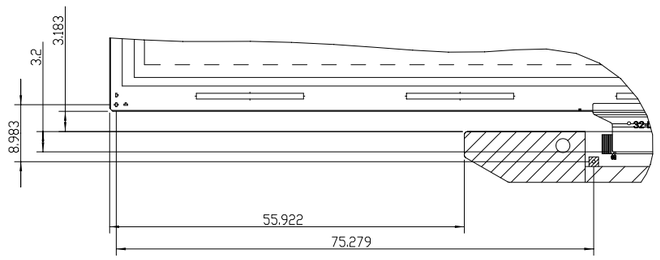
(9) When ambient temperature is lower than 10ºC may reduce the display quality. For example, the response time will become slowly.

10.2 SAFETY PRECAUTIONS

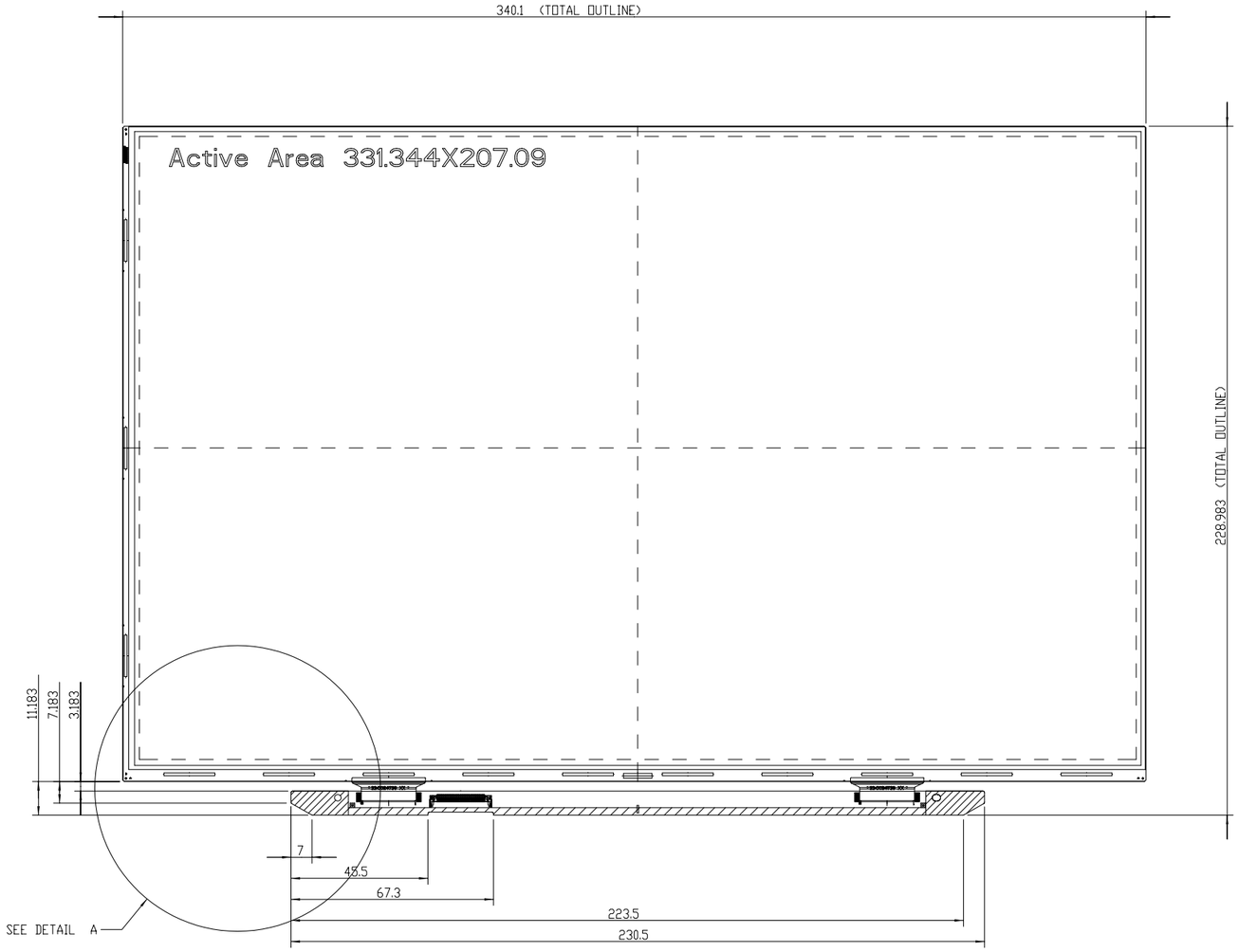
(1) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

(2) After the product's end of life, it is not harmful in case of normal operation and storage.

11. MECHANICAL DRAWING



DETAIL A
SCALE 2:1



Mark	Description	Date	Changed_By	Approved_By	ECN No.	Remark

TITLE	PCB+FPC+PANEL DRAWING N154C6-L04				2D REV.	A
					3D REV.	1.10+
Approved	Shunnan	Drawing No.	N154P4112A			
Checked	Jackson Chen	Part No.	NA			
Drawer	Uny Lee	Material	NA		Sheet	1 / 1 A1
Designer	Uny Lee	Date	5-NOV-2008	Scale 1:1	Unit:mm	

CHI MEI OPTOELECTRONICS CORP.