

**SPECIFICATION  
FOR  
LCD Module**

**Customer P/N:**

**Santek P/N: ST1040C1WY-RSLW-C**

**DOC. Revision: RS06**

**Customer Approval:**

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	<b>SIGNATURE</b>	<b>DATE</b>
<b>PREPARED BY</b>	Vivian Huang	2017-10-10
<b>CHECKED BY</b>	Tom Liao	2017-10-11
<b>APPROVED BY</b>	Natty Lee	2017-Nov-7

Document Revision History

Revision	Date	Description	Changed by
RS01	2011-02-24	First issue	Vivian
RS02	2011-12-25	Modify cover page title	Jack
RS03	2012-04-28	Update the TP drawing	Alisa
RS04	2013-08-05	Added the frame rate	Luke
RS05	2013-08-27	Modified the brightness in page 4	
		Modified the weight in page 5 and 26	
		Added the surface treatment in page 4	Luke
RS06	2017-10-10	Modify to San Technology Inc.	Vivian

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## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

ST1040C1WY-RSLW-C is a 10.4" TFT Liquid Crystal Display module with Touch Panel and LED backlight unit and 30-pin - and-1ch LVDS interface. This product supports 1024x768 XGA format and can display true 16.2M colors (6-bits colors with FRC). The converter module for LED backlight is built-in.

### 1.2 FEATURES

- Excellent brightness (280 nits)
- Ultra high contrast ratio (1000:1)
- Fast response time (Ton+Toff average 25 ms)
- High color saturation NTSC 57%
- XGA (1024 x 768 pixels) resolution
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Ultra wide viewing angle: 176(H)/ 176(V) (CR>10) Super MVA technology
- 180 degree rotation display option
- Color reproduction (nature color)
- Wide operation and storage temperature range

### 1.3 APPLICATION

- TFT LCD monitor for industrial applications
- High brightness, multi-applications display

### 1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	210.4 (H) x 157.8 (V) (10.4" diagonal)	mm	(1)
Bezel Opening Area	215.4 (H) x 161.8 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch (Sub Pixel)	0.0685 (H) x 0.2055 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.2 M	color	-
Display Operation Mode	Transmissive mode / Normally black	-	-
Total Power Consumption(typ)	5.1	W	typ
Surface Treatment	Anti Glare	-	-

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

**1.5 MECHANICAL SPECIFICATIONS**

Item	Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	-	238.6	-	(1)
	Vertical (V)	-	175.8	-	
	Depth (D)	-	7.5	-	mm
Weight	-	405	-	g	-

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

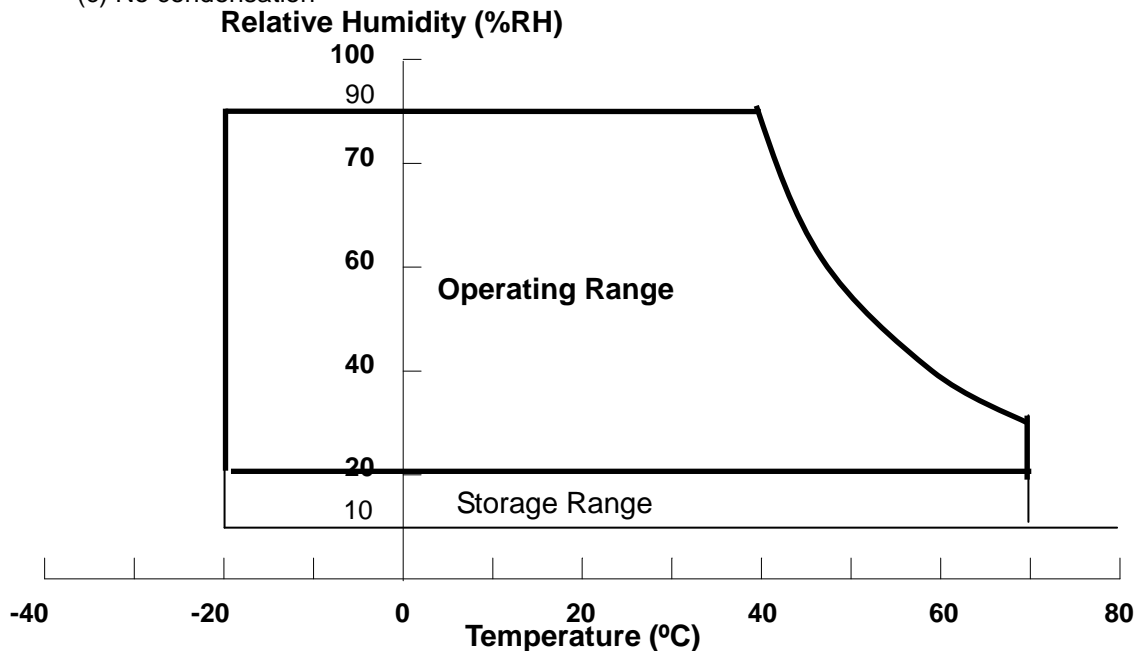
**2. ABSOLUTE MAXIMUM RATINGS**

**2.1 ABSOLUTE RATINGS OF ENVIRONMENT**

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Operating Ambient Temperature	T <sub>OP</sub>	-20	+70	°C	
Storage Temperature	T <sub>ST</sub>	-20	+70	°C	

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

- (a) 90 %RH Max. (Ta ≤ 40 °C).
- (b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).
- (c) No condensation



**2.2 ELECTRICAL ABSOLUTE RATINGS**

**2.2.1 TFT LCD MODULE**

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	7	V	(1)

**2.2.2 LED CONVERTER**

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Converter Voltage	V <sub>i</sub>	-0.3	22	V	(1), (2)
Enable Voltage	EN	---	5.5	V	
Backlight Adjust	ADJ	---	5.5	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.

Note (2) Specified values are for LED light ba (Refer to 3.2 for further information).

### 3. ELECTRICAL CHARACTERISTICS

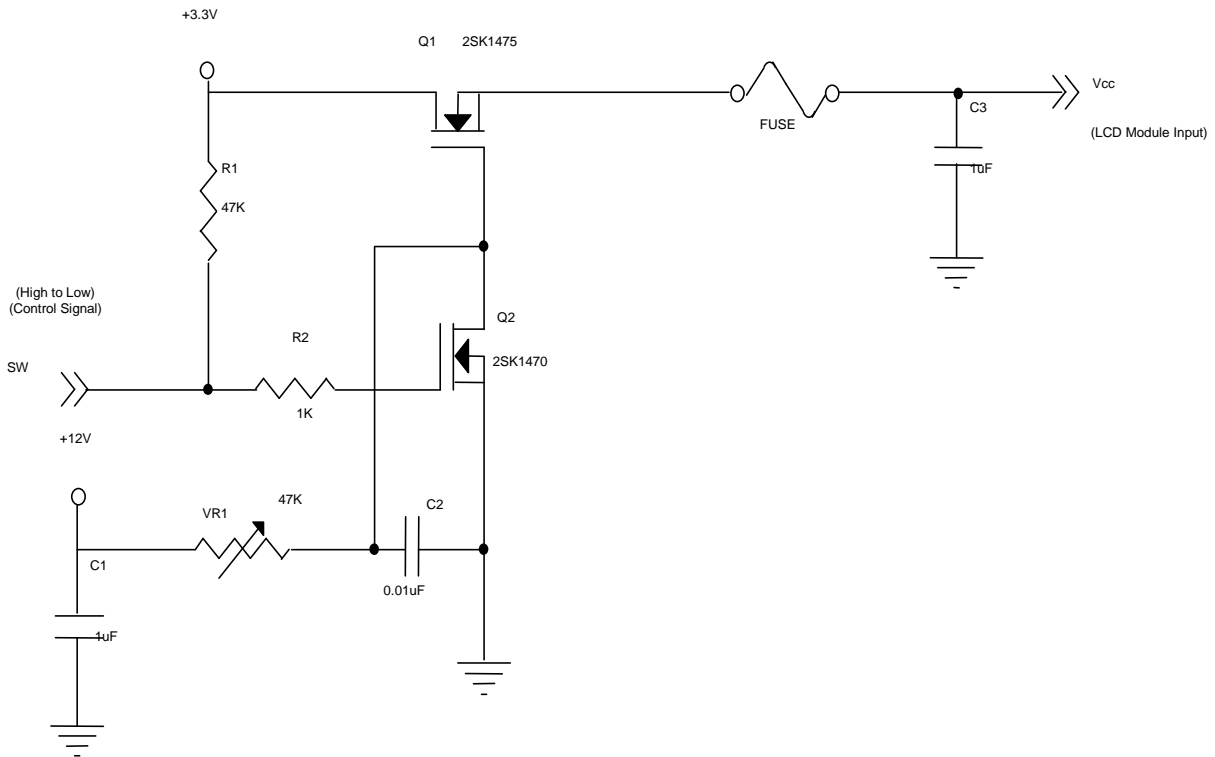
#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

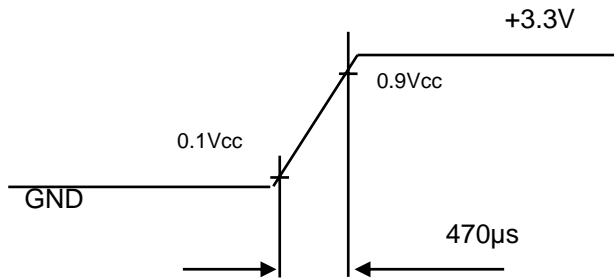
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V <sub>CC</sub>	3.0	3.3	3.6	V	(1)
Rush Current	I <sub>RUSH</sub>	-	-	4.0	A	(2)
Power Supply Current	White	530	570	620	mA	(3)
	Black	380	420	460	mA	
Power Consumption	P <sub>L</sub>	---	1.9	---	W	
LVDS Differential Input Voltage	VID	100	-	600	mV	-
LVDS Common Input Voltage	VICM	0.7	-	1.6	V	-

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

Note (2) Measurement Conditions:

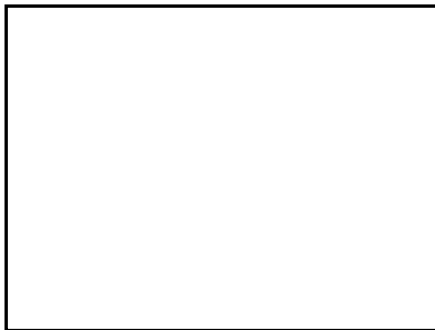


**Vcc rising time is 470us**



Note (3) The specified power supply current is under the conditions at V<sub>cc</sub> = 3.3 V, T<sub>a</sub> = 25 ± 2 °C, f<sub>v</sub> = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



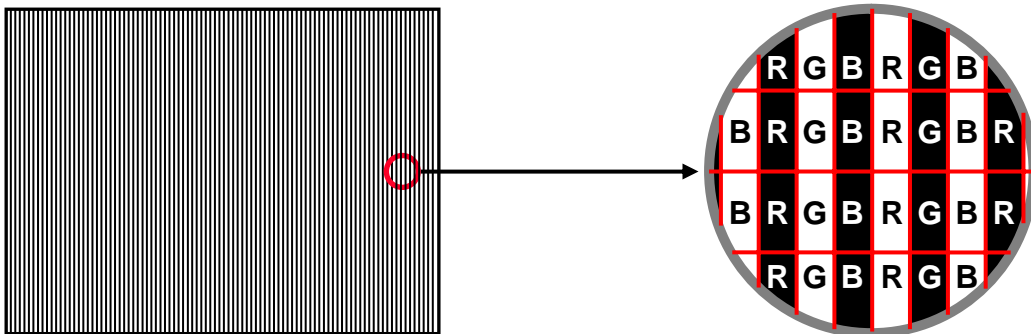
Active Area

b. Black Pattern



Active Area

c. Vertical Stripe Pattern



Active Area

3.2 BACKLIGHT UNIT

Ta = 25 ± 2 °C

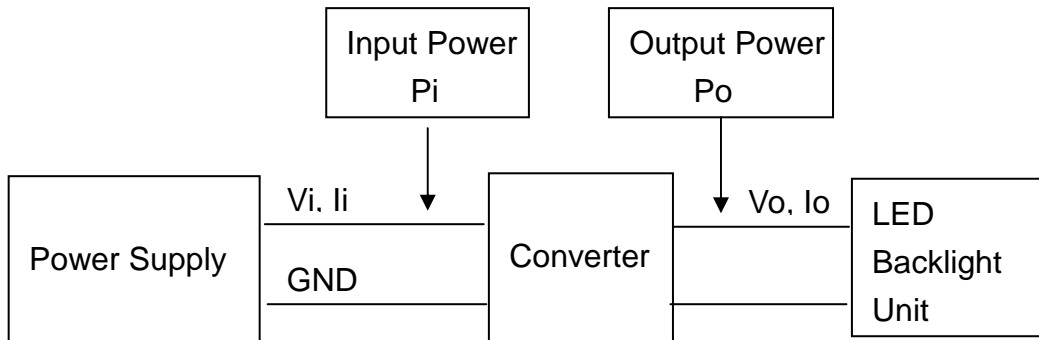
Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Power Supply Voltage	$V_i$	7	12.0	17	V	(Duty 100%)
Converter Power Supply Current	$I_i$	---	0.28	---	A	@ $V_i = 12V$ (Duty 100%)
LED Power Consumption	$P_{LED}$	---	3.1	---	W	@ $V_i = 12V$ (Duty 100%)
EN Control Level	Backlight on	2.0	---	5	V	
	Backlight off	0	---	0.8	V	
PWM Control Level	PWM High Level	2.0	---	5	V	
	PWM Low Level	0	---	0.15	V	
PWM Control Duty Ratio		2		100	%	
PWM Control Frequency	$f_{PWM}$	190	200	20k	Hz	(2)
LED Life Time	$L_L$	30,000			Hrs	(3)

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

Note (2) :At 190 ~1KHz PWM control frequency, duty ratio range is restricted from 2% to 100%.

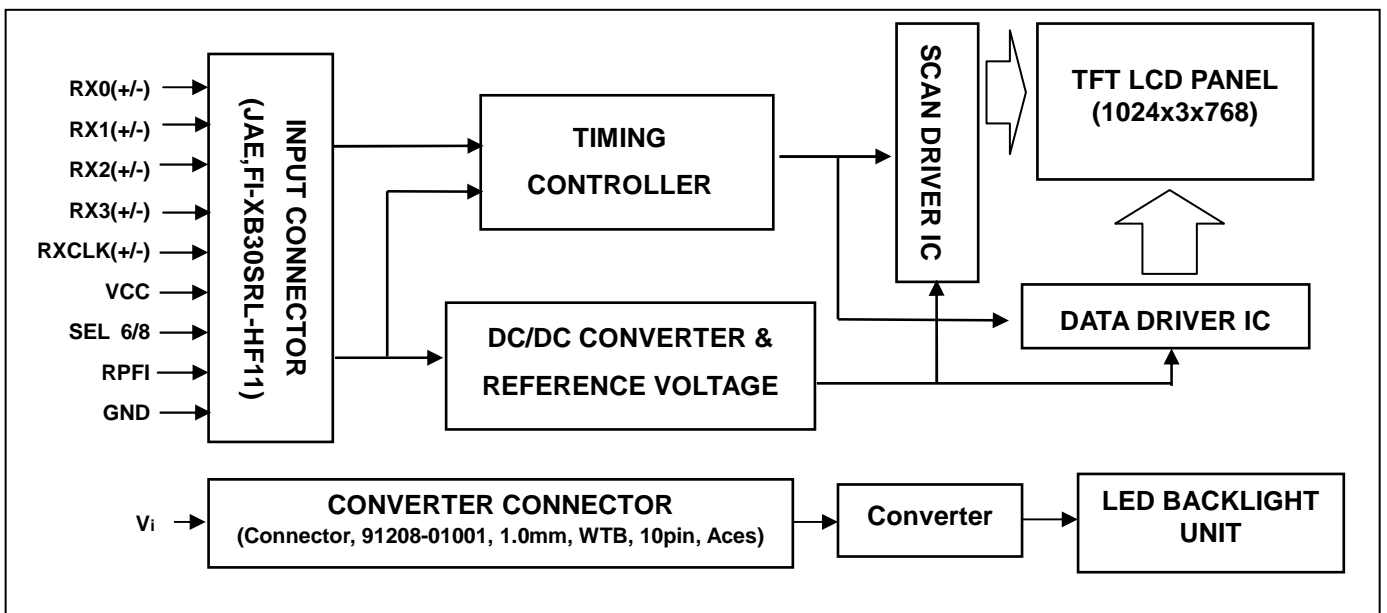
1K ~20KHz PWM control frequency , minimum duty on-time ≥ 20 us.

Note (3) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ± 2 °C and  $I_{LED} = 20mA_{DC}$ (LED forward current) until the brightness becomes ≤ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.



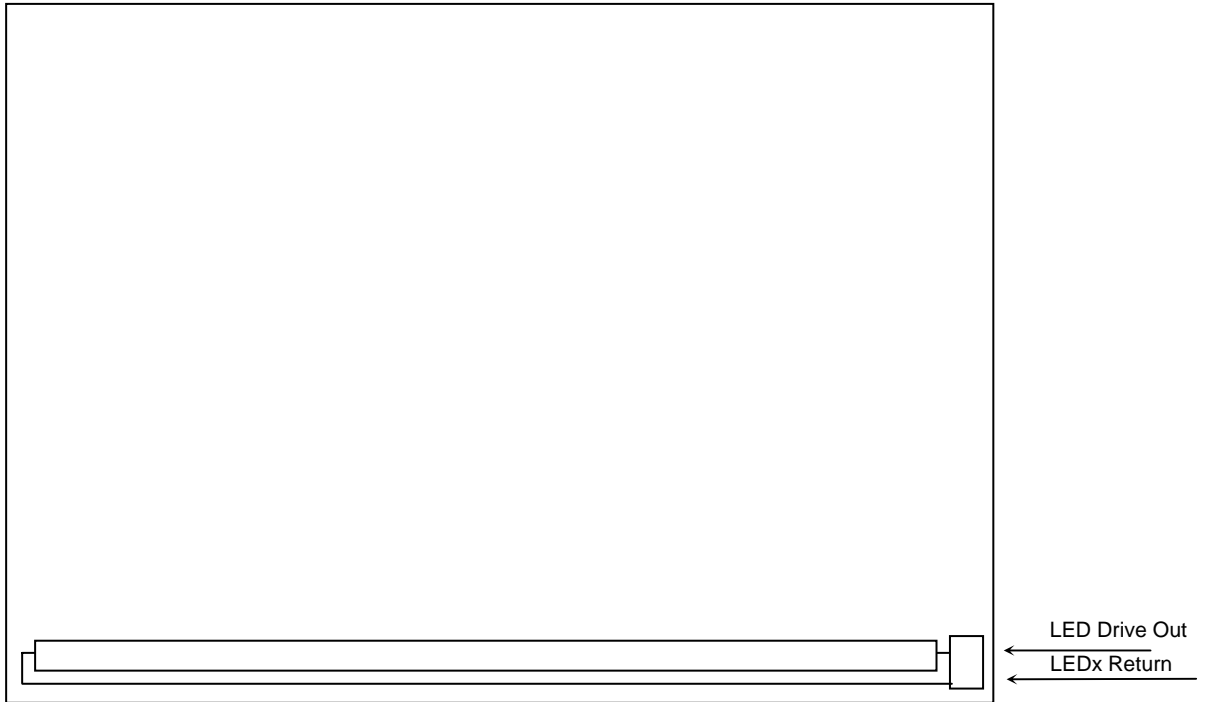
4. BLOCK DIAGRAM

4.1 TFT LCD MODULE





#### 4.2 BACKLIGHT UNIT



### 5. INTERFACE PIN CONNECTION

#### 5.1 TFT LCD MODULE

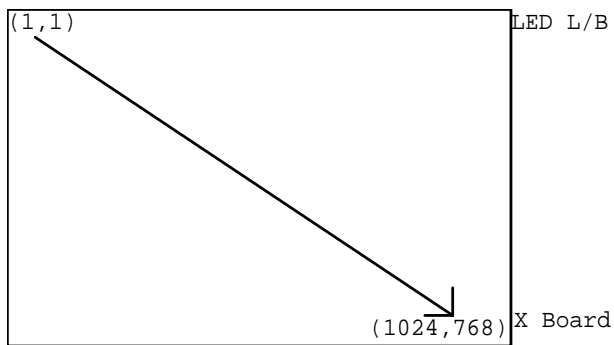
##### CN1 Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	VCC	Power supply: +3.3V	-
2	VCC	Power supply: +3.3V	-
3	VCC	Power supply: +3.3V	-
4	GND	Ground	-
5	GND	Ground	-
6	GND	Ground	-
7	RPFI	Reverse Panel Function (Display Rotation)	( 2 )
8	NC	No Connection	
9	NC	No Connection	-
10	NC	No Connection	-
11	SEL6/8	LVDS 6/8 bit select function control, Low or NC → 8 bit Input Mode High → 6bit Input Mode	( 2 )
12	GND	Ground	-
13	NC	No Connection	-
14	GND	Ground	-
15	RX0-	Negative transmission data of pixel 0	-
16	RX0+	Positive transmission data of pixel 0	-
17	GND	Ground	-
18	RX1-	Negative transmission data of pixel 1	-

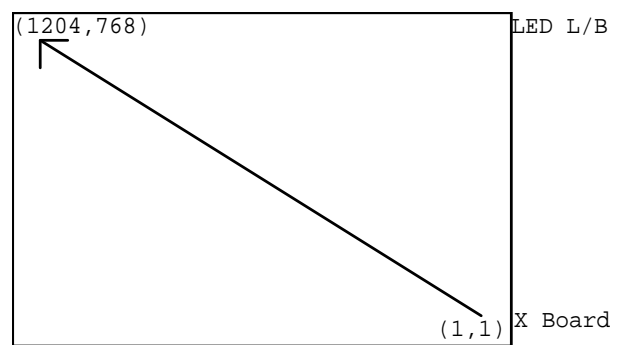
19	RX1+	Positive transmission data of pixel 1	-
20	GND	Ground	-
21	RX2-	Negative transmission data of pixel 2	-
22	RX2+	Positive transmission data of pixel 2	-
23	GND	Ground	-
24	RXCLK-	Negative of clock	-
25	RXCLK+	Positive of clock	-
26	GND	Ground	-
27	RX3-	Negative transmission data of pixel 3	-
28	RX3+	Positive transmission data of pixel 3	-
29	GND	Ground	-
30	NC	No Connection	( 2 )

Note (1) Connector Part No.: JAE, FI-XB30SRL-HF11 or compatible connector

Note (2) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected"

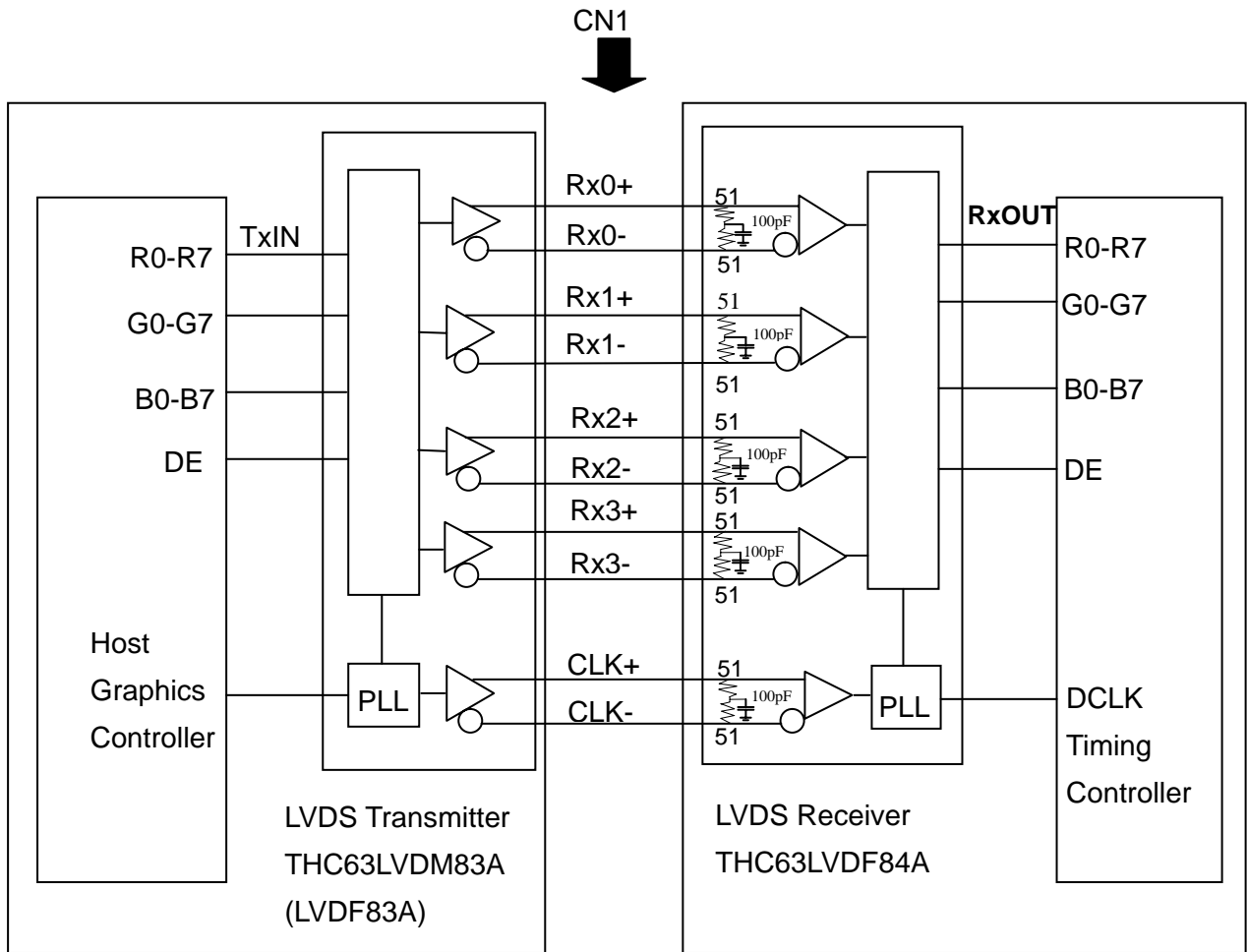


RPF = Low/ floating : normal display (default)



RPF = High : display with 180 degree rotation

5.2 BLOCK DIAGRAM OF INTERFACE



R0~R7 : Pixel R Data ,  
 G0~G7 : Pixel G Data ,  
 B0~B7 : Pixel B Data ,  
 DE : Data enable signal

Note (1) The system must have the transmitter to drive the assembly.

Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

**5.3 BACKLIGHT UNIT(Converter connector pin)**

Pin	Symbol	Description	Remark
1	$V_i$	Converter input voltage	12V
2	$V_i$	Converter input voltage	12V
3	$V_i$	Converter input voltage	12V
4	$V_i$	Converter input voltage	12V
5	$V_{GND}$	Converter ground	Ground
6	$V_{GND}$	Converter ground	Ground
7	$V_{GND}$	Converter ground	Ground
8	$V_{GND}$	Converter ground	Ground
9	EN	Enable pin	3.3V
10	ADJ	Backlight Adjust	PWM Dimming

Note (1) Connector Part No.: 91208-01001(ACES) or equivalent

Note (2) User's connector Part No.: 91209-01011(ACES) or equivalent

5.4 LVDS INTERFACE

	SIGNAL	TRANSMITTER THC63LVDM83A		INTERFACE CONNECTOR		RECEIVER THC63LVDF84A		TFT CONTROL INPUT
		PIN	INPUT	Host	TFT-LCD	PIN	OUTPUT	
24 bit	R0	51	TxIN0			27	Rx OUT0	R0
	R1	52	TxIN1			29	Rx OUT1	R1
	R2	54	TxIN2	TA OUT0+	Rx 0+	30	Rx OUT2	R2
	R3	55	TxIN3			32	Rx OUT3	R3
	R4	56	TxIN4			33	Rx OUT4	R4
	R5	3	TxIN6	TA OUT0-	Rx 0-	35	Rx OUT6	R5
	G0	4	TxIN7			37	Rx OUT7	G0
	G1	6	TxIN8			38	Rx OUT8	G1
	G2	7	TxIN9			39	Rx OUT9	G2
	G3	11	TxIN12	TA OUT1+	Rx 1+	43	Rx OUT12	G3
	G4	12	TxIN13			45	Rx OUT13	G4
	G5	14	TxIN14			46	Rx OUT14	G5
	B0	15	TxIN15	TA OUT1-	Rx 1-	47	Rx OUT15	B0
	B1	19	TxIN18			51	Rx OUT18	B1
	B2	20	TxIN19			53	Rx OUT19	B2
	B3	22	TxIN20			54	Rx OUT20	B3
	B4	23	TxIN21	TA OUT2+	Rx 2+	55	Rx OUT21	B4
	B5	24	TxIN22			1	Rx OUT22	B5
	DE	30	TxIN26			6	Rx OUT26	DE
	R6	50	TxIN27	TA OUT2-	Rx 2-	7	Rx OUT27	R6
	R7	2	TxIN5			34	Rx OUT5	R7
	G6	8	TxIN10			41	Rx OUT10	G6
	G7	10	TxIN11			42	Rx OUT11	G7
	B6	16	TxIN16	TA OUT3+	Rx 3+	49	Rx OUT16	B6
B7	18	TxIN17			50	Rx OUT17	B7	
RSVD 1	25	TxIN23			2	Rx OUT23	NC	
RSVD 2	27	TxIN24	TA OUT3-	Rx 3-	3	Rx OUT24	NC	
RSVD 3	28	TxIN25			5	Rx OUT25	NC	
	DCLK	31	TxCLK IN	TxCLK OUT+ TxCLK OUT-	RxCLK IN+ RxCLK IN-	26	RxCLK OUT	DCLK

R0~R7: Pixel R Data (7; MSB, 0; LSB)

G0~G7: Pixel G Data (7; MSB, 0; LSB)

B0~B7: Pixel B Data (7; MSB, 0; LSB)

DE: Data enable signal

Notes (1) RSVD(reserved)pins on the transmitter shall be "H" or "L".

5.5 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	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	1	1	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	1	1	1	1	1	1	1	1	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	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	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	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
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
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
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	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	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
	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	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	1	0
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	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	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

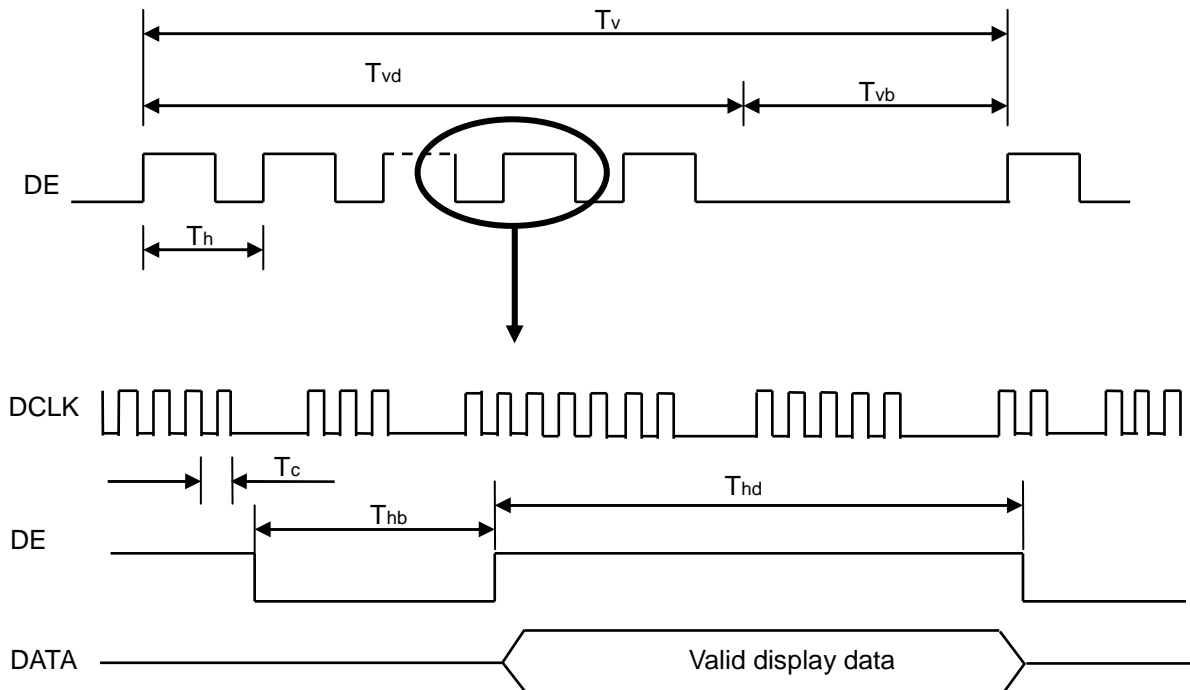
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	Fc	55	65	75	MHZ	
Vertical Active Display Term	Frame Rate	Fv	50	60	70	Hz	
	Total	Tv	770	806	950	Th	Tv=Tvd+Tvb
	Display	Tvd	768	768	768	Th	-
Horizontal Active Display Term	Blank	Tvb	2	38	182	Th	-
	Total	Th	1104	1344	1800	Tc	Th=Thd+Thb
	Display	Thd	1024	1024	1024	Tc	-
	Blank	Thb	76	320	776	Tc	-

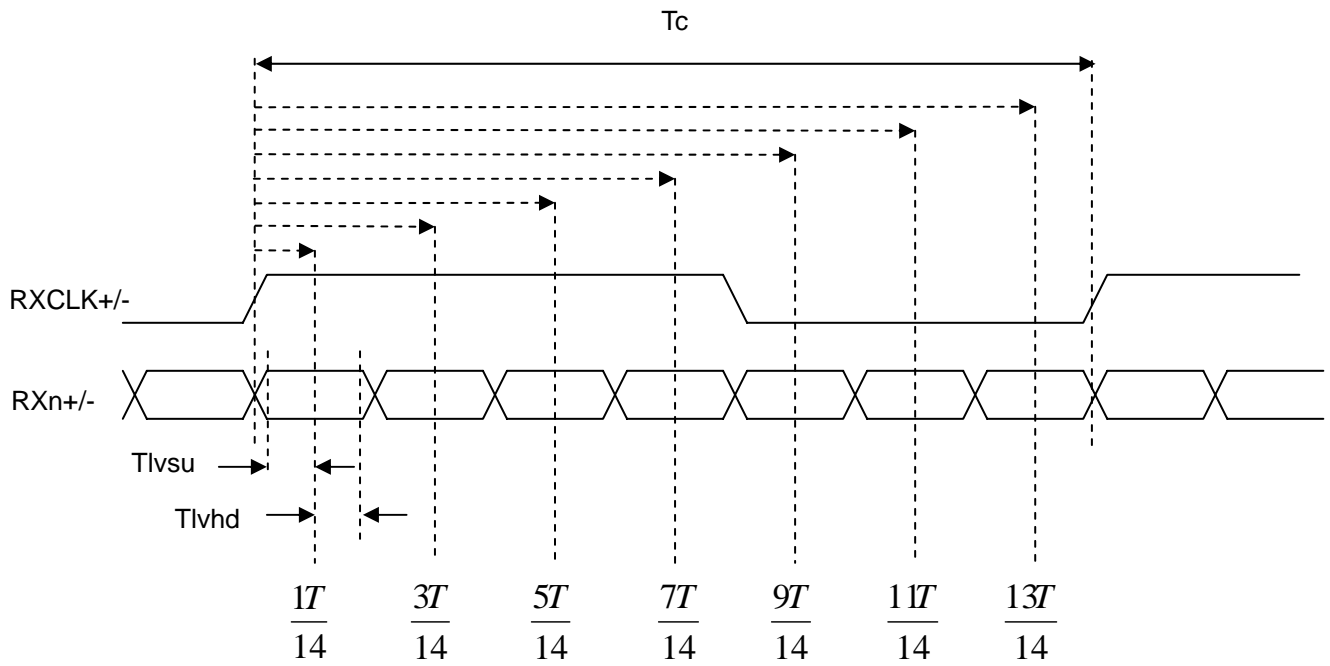
Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this assembly would operate abnormally.

(2) Frame rate is 60Hz

**INPUT SIGNAL TIMING DIAGRAM**



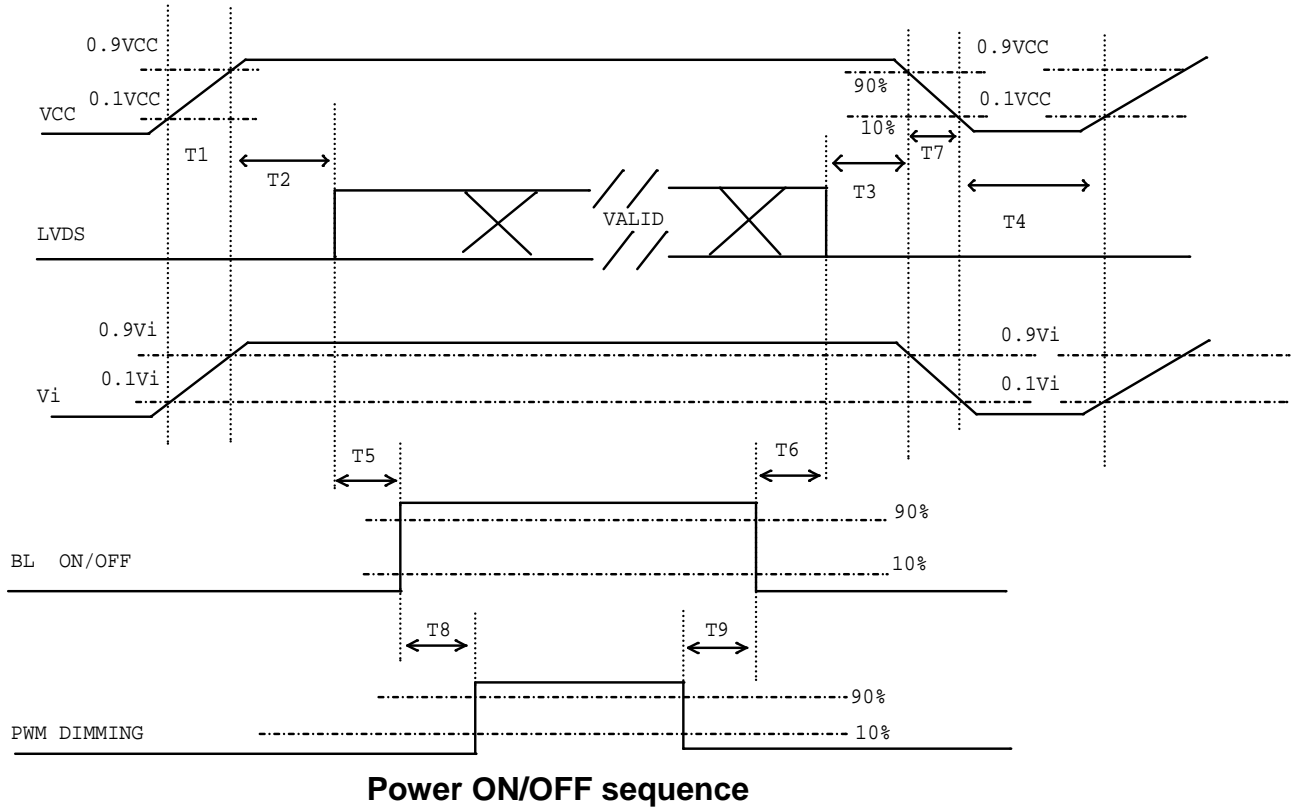
**LVDS RECEIVER INTERFACE TIMING DIAGRAM**





## 6.2 POWER ON/OFF SEQUENCE

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



Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

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

Parameter	Value			Units
	Min	Typ	Max	
<b>T1</b>	<b>0.5</b>	-	<b>10</b>	<b>ms</b>
<b>T2</b>	<b>0</b>	-	<b>50</b>	<b>ms</b>
<b>T3</b>	<b>0</b>	-	<b>50</b>	<b>ms</b>
<b>T4</b>	<b>500</b>	-	-	<b>ms</b>
<b>T5</b>	<b>200</b>	-	-	<b>ms</b>
<b>T6</b>	<b>20</b>	-	-	<b>ms</b>
<b>T7</b>	<b>5</b>	-	300	<b>ms</b>
<b>T8</b>	<b>10</b>	-	-	<b>ms</b>
<b>T9</b>	<b>10</b>	-	-	<b>ms</b>

7. TOUCH SCREEN PANEL SPECIFICATIONS

7.1 ELECTRICAL CHARACTERISTICS

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal Resistance	100	-	840	$\Omega$	X(Film side)
	260	-	1240	$\Omega$	Y(Glass side)
Insulation Resistance	10	-	-	M $\Omega$	DC 25V
Voltage	-	7	-	V	DC
Chattering	-	-	15	ms	100k $\Omega$ pull-up
Transparency	80	-	-	%	

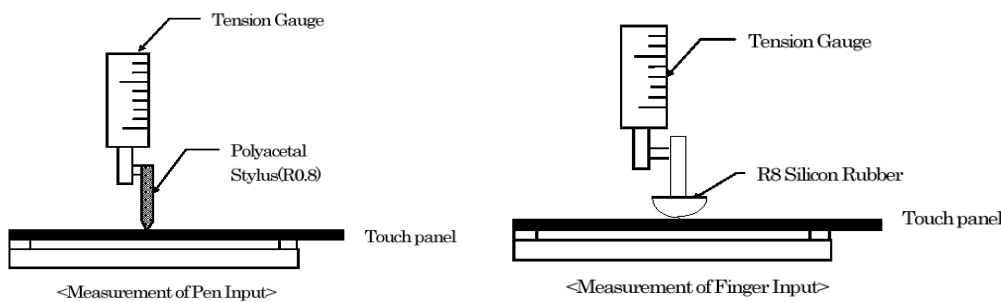
Note: Avoid operating with hard or sharp material such as a ball point pen or a mechanical pencil except for a polyacetal pen (tip R0.8mm or less) or a finger.

7.2 MECHANICAL & RELIABILITY CHARACTERISTICS

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Activation force	80	-	-	gf	Note 1
Durability-surface scratching	Write 100,000	-	-	characters	Note 2
Durability-surface pitting	1,000,000	-	-	touches	Note 3
Surface hardness	3	-	-	H	JIS K 5400

Note 1: Activation force test condition

- (1) Input DC 5V on X direction, Drop off Polyacetal Stylus (R0.8), until output voltage stabilize ,then get the activation force °
- (2) R8.0mm Silicon rubber for finger Activation force test
- (3) Test point: 9 points



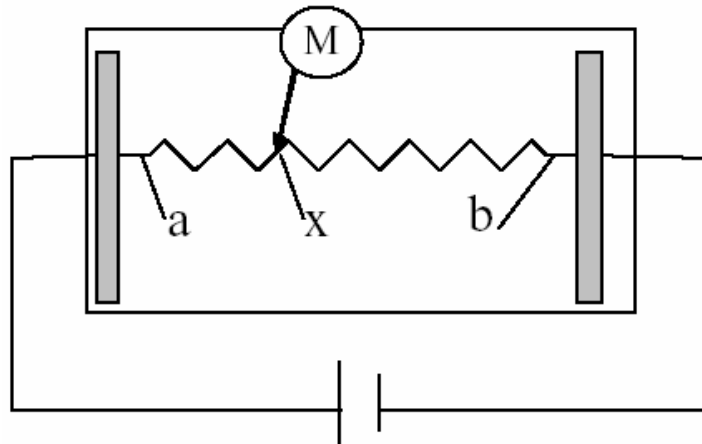
Note 2: Measurement for surface area.

- Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.
- Force: 250gf.
- Speed: 60mm/sec.
- Stylus: R0.8 polyacetal tip.

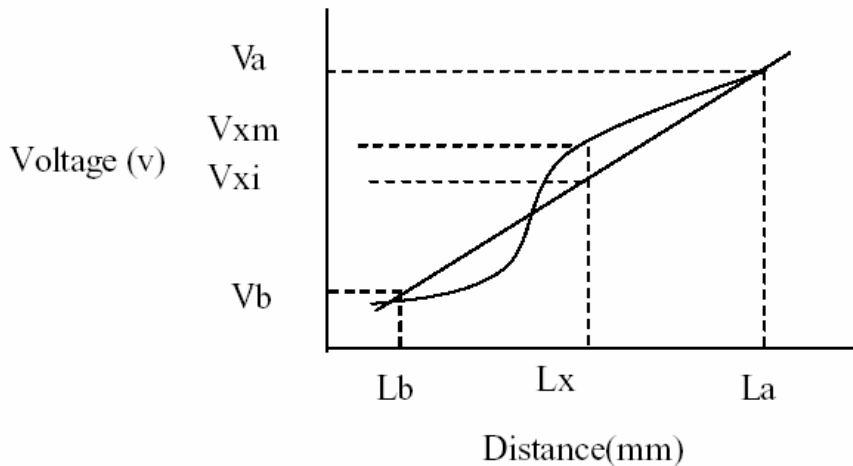
Note 3: Pit 1,000,000 times on the film with a R0.8 silicon rubber.

- Force: 250gf.
- Speed: 2times/sec.

7.3 LINEARITY DEFINITION

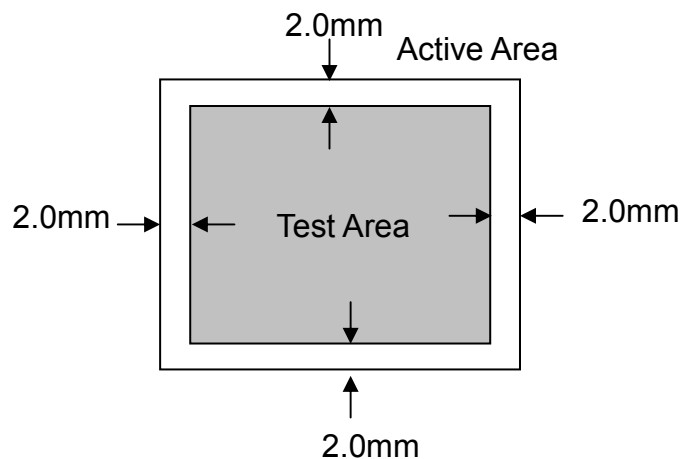


Va: maximum voltage in the active area of touch panel  
 Vb: minimum voltage in the active area of touch panel  
 X: random measuring point  
 Vxm: actual voltage of Lx point  
 Vxi: theoretical voltage of Lx point



$$\text{Linearity} = \frac{|Vxi - Vxm|}{(Va - Vb)} * 100\%$$

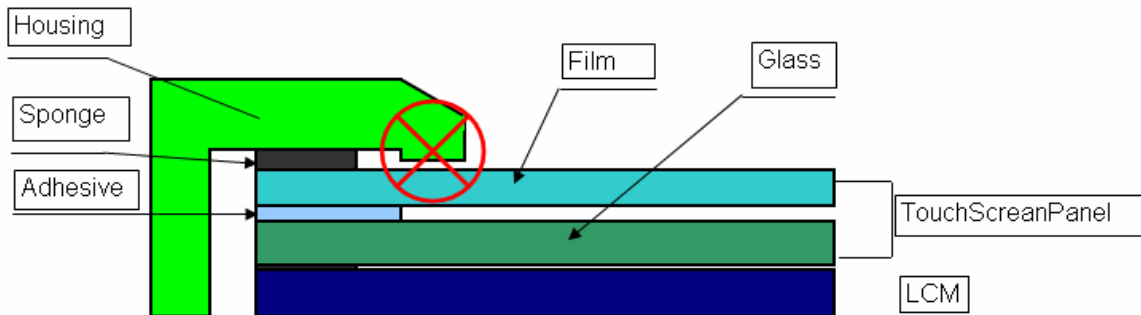
Note: Test area is as follows and operation force is 150gf



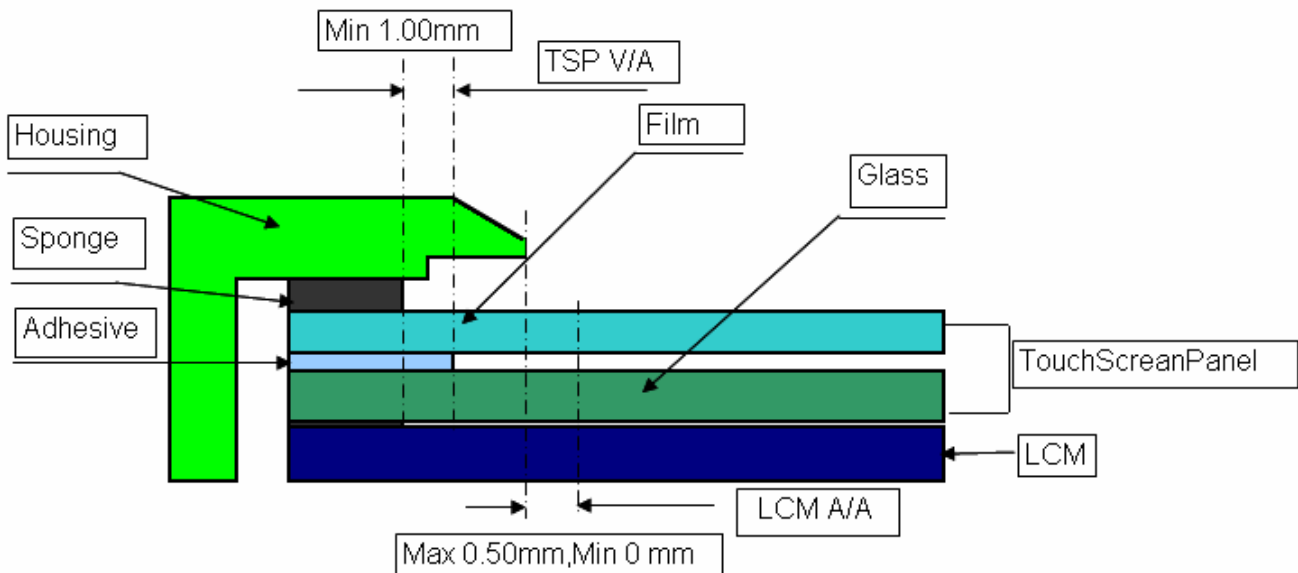
### 7.4 HOUSING DESIGN GUIDE

Housing design follow as below

- 1) Avoid the design that housing overlap and press on the active area of the LCM
- 2) Give enough gap(over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



- 3) Use a buffer material(Gasket) between the TSP and and wrong operating
- 4) Avoid the design that buffer material overlap and press on the inside of TSP view area



## 8. OPTICAL CHARACTERISTICS

### 8.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	T <sub>a</sub>	25±2	°C
Ambient Humidity	H <sub>a</sub>	50±10	%RH
Supply Voltage	V <sub>CC</sub>	5	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Converter Current	I <sub>L</sub>	20±1mA	mA

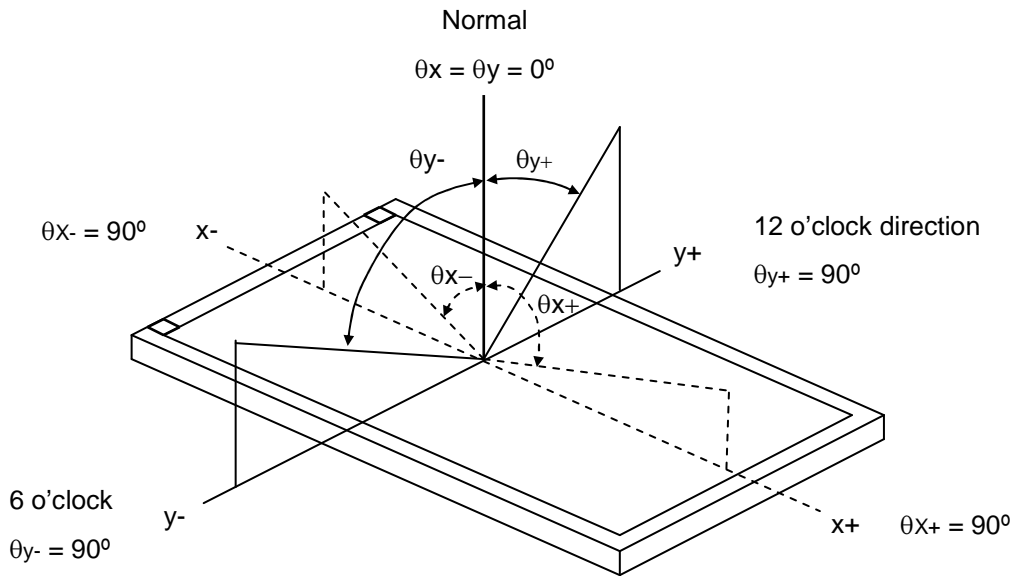
### 8.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions in 7.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio		CR	θ <sub>x</sub> =0°, θ <sub>y</sub> =0° Viewing angle at normal direction	700	1000	-	-	(2)	
Response Time		T <sub>R</sub>		-	14	19	ms	(3)	
		T <sub>F</sub>		-	11	16	ms		
Center Luminance of White		L <sub>C</sub>		240	280	-	cd/m <sup>2</sup>	(4)	
White Variation		δW		-	-	1.4	-	(7)	
Cross Talk		CT		-	-	4	%	(5)	
Chromaticity	Red	R <sub>x</sub>		θ <sub>x</sub> =0°, θ <sub>y</sub> =0° Viewing angle at normal direction	Typ. -0.05	0.610	Typ. +0.05	-	(6)
		R <sub>y</sub>				0.365		-	
	Green	G <sub>x</sub>				0.341		-	
		G <sub>y</sub>				0.564		-	
	Blue	B <sub>x</sub>	0.147			-			
		B <sub>y</sub>	0.087			-			
	White	W <sub>x</sub>	0.313			-			
		W <sub>y</sub>	0.329			-			
Viewing Angle	Horizontal	θ <sub>x+</sub>	CR≥10	80	88	-	Deg.	(1)	
		θ <sub>x-</sub>		80	88	-			
	Vertical	θ <sub>y+</sub>		80	88	-			
		θ <sub>y-</sub>		80	88	-			

Note (1) Definition of Viewing Angle ( $\theta_x, \theta_y$ ):

Viewing angles are measured by BM5A



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

The contrast ratio can be calculated by the following expression.

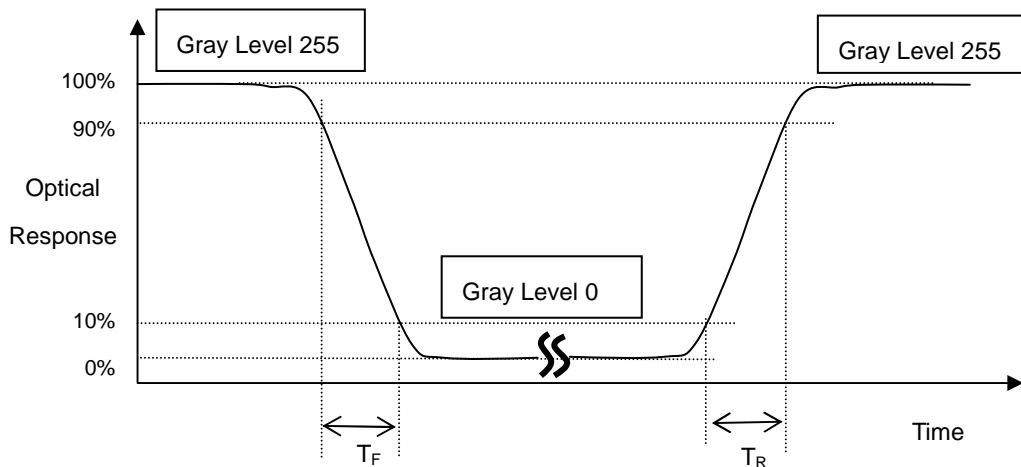
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

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 (7).

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



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

Measure the luminance of gray level 255 at center point and 5 points

$L_C = L(5)$ , where  $L(X)$  is corresponding to the luminance of the point  $X$  at the figure in Note (7).

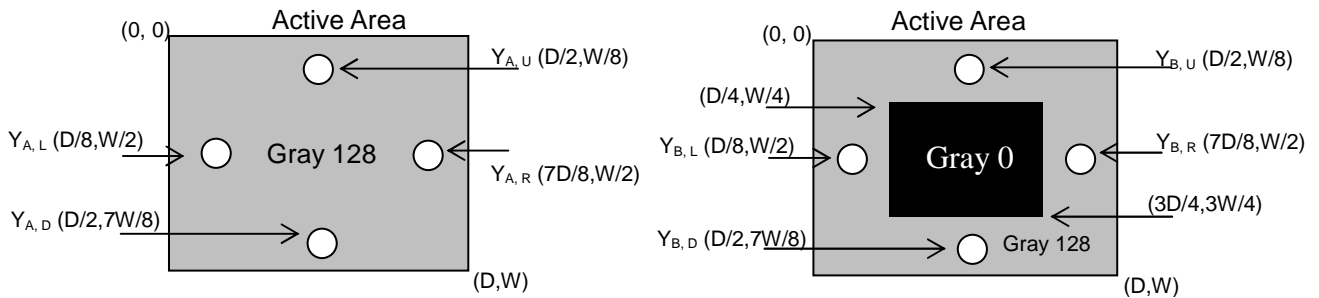
Note (5) Definition of Cross Talk (CT):

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

Where:

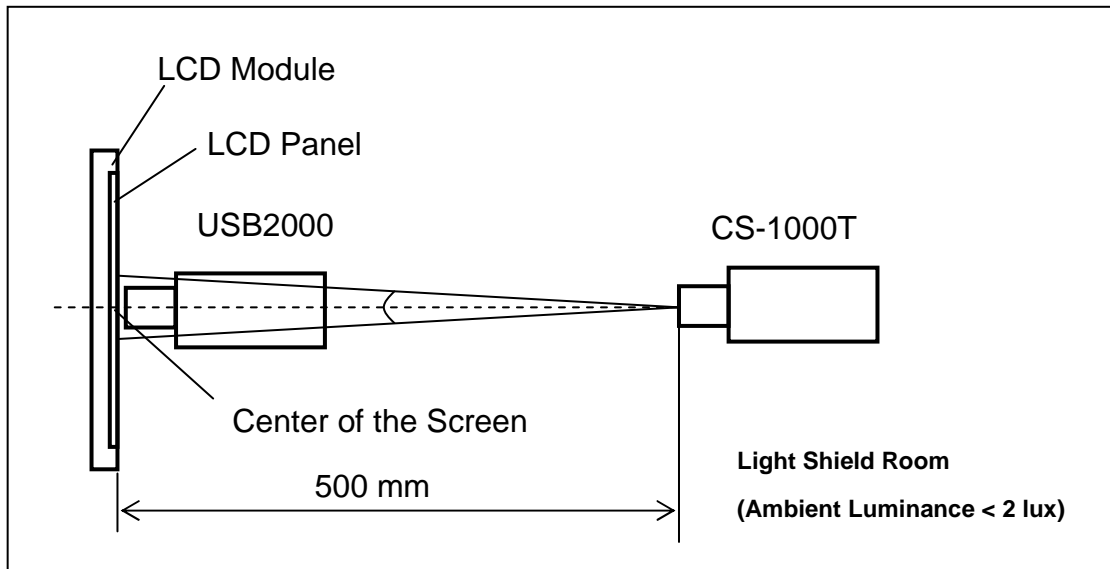
$Y_A$  = Luminance of measured location without gray level 0 pattern ( $cd/m^2$ )

$Y_B$  = Luminance of measured location with gray level 0 pattern ( $cd/m^2$ )



Note (6) Measurement Setup:

The LCD assembly should be stabilized at given temperature for 30 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30 minutes in a windless room.

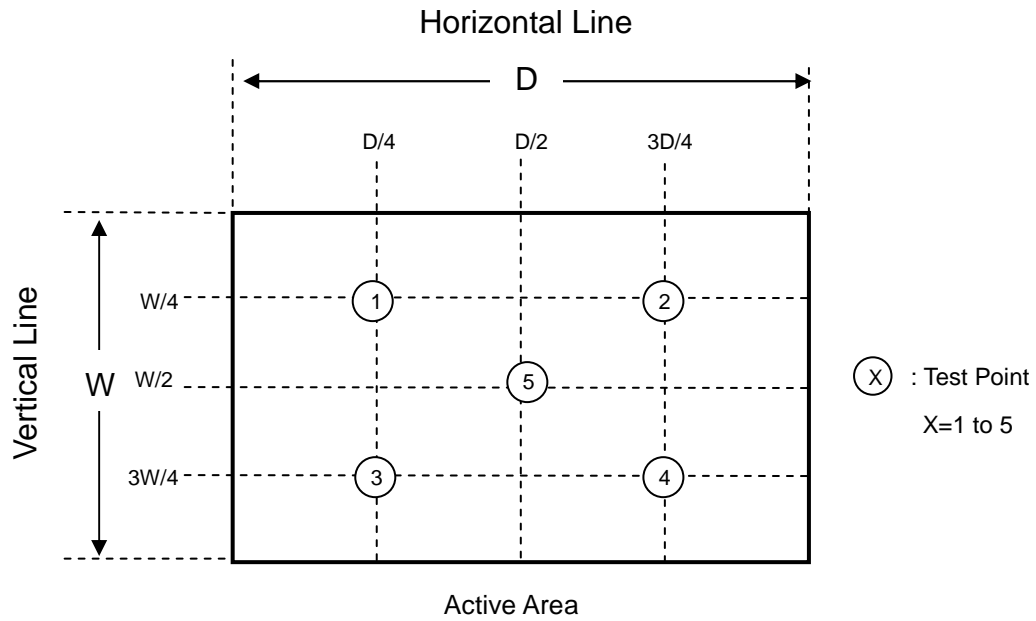




Note (7) Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 5 points

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



## 9. PACKAGING

### 9.1 PACKING SPECIFICATIONS

- (1) 18pcs LCD modules / 1 Box
- (2) Box dimensions: 465 (L) X 362 (W) X 314 (H) mm
- (3) Weight: approximately 10.6Kg (18 modules per box)

### 9.2 PACKING METHOD

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

Test Item	Test Conditions	Note
Vibration	ISTA STANDARD Random, Frequency Range: 2 – 200 Hz Top & Bottom: 30 minutes (+Z), 10 min (-Z), Right & Left: 10 minutes (X) Back & Forth 10 minutes (Y)	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 61 cm	Non Operation

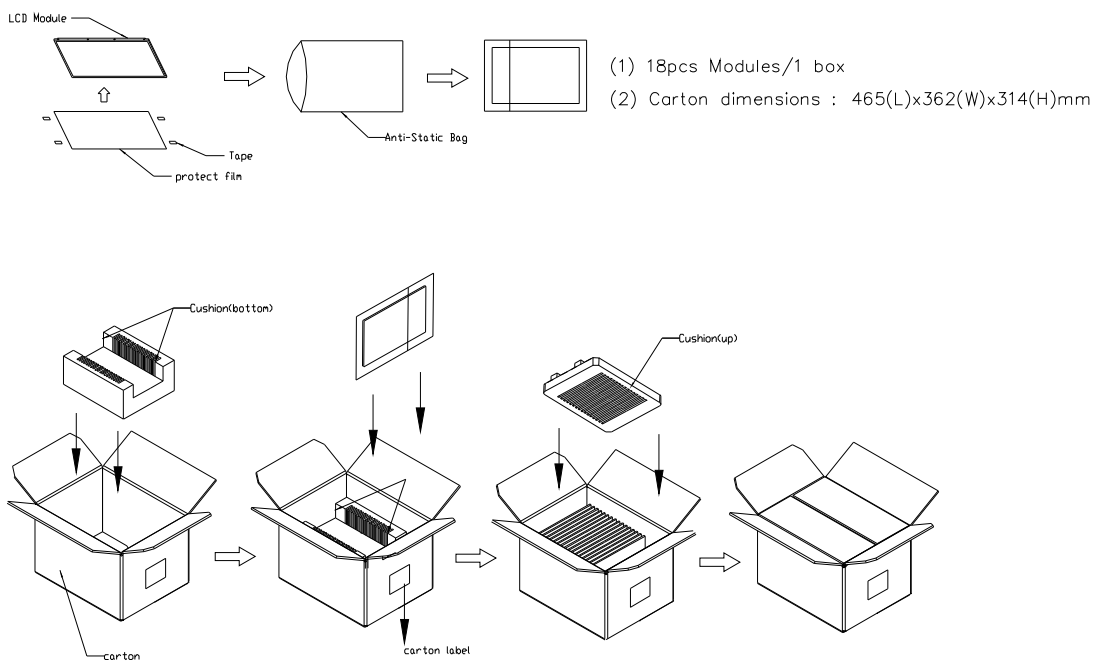


Figure.9-1 packing method

Sea / Land Transportation (40ft Container)

Air Transportation

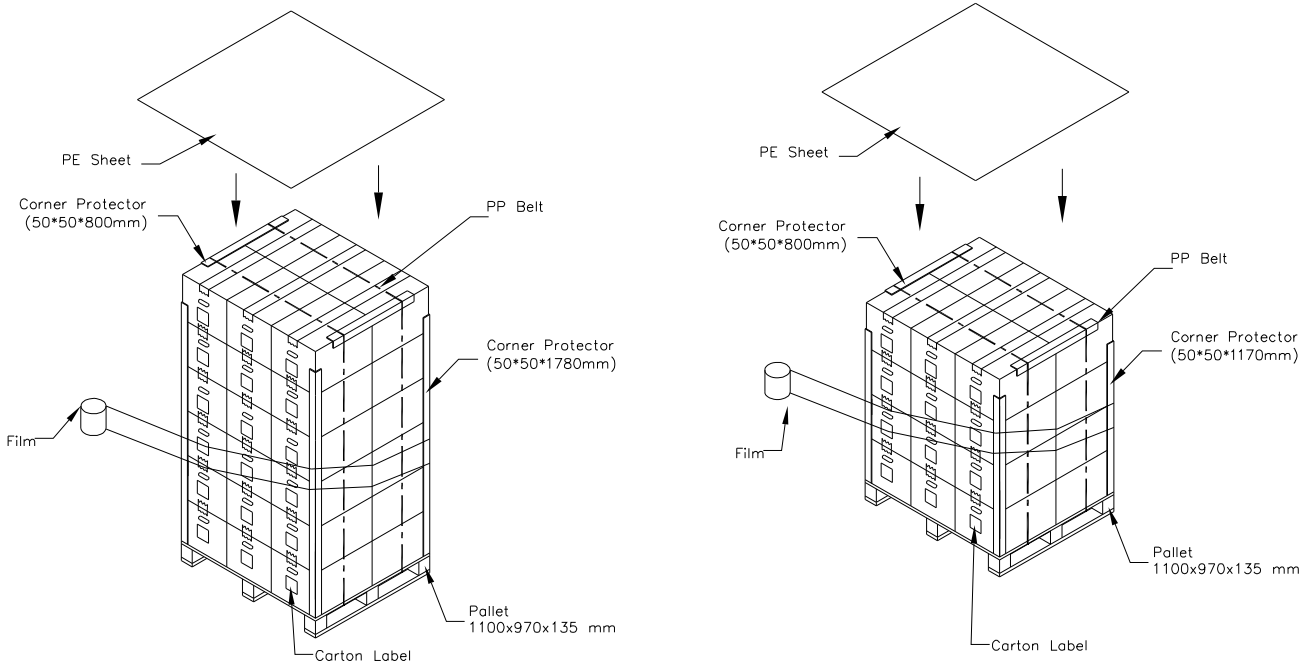


Figure. 9-2 Packing method

## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) 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.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and Backlight.
- (4) 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.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) Do not keep same pattern in a long period of time. It may cause image sticking on LCD.

### 10.2 SAFETY PRECAUTIONS

- (1) If the liquid crystal material leaks from the panel, it should be kept away from your eyes or mouth.  
In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (2) After the module's end of life, it is not harmful in case of normal operation and storage.

11. MECHANICAL CHARACTERISTICS

