



INNOLUX DISPLAY CORPORATION

LCD MODULE SPECIFICATION

Customer: _____
Model Name: AT056TN53 V.1
SPEC NO.: A056-53-TT-11
Date: 2007/03/02
Version: 01

☒ **Preliminary Specification**

☐ **Final Specification**

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by

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Record of Revision

Version	Revise Date	Page	Content
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1.General Specifications

No.	Item	Specification	Remark
1	LCD size	5.6 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	640X(RGB)X480	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	0.0588(W)X0.1764(H) mm	
6	Active area	112.896 (W)X84.672(H) mm	
7	Module size	126.5(W)X100(H)X7.2(D) mm	Note 1
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight Power consumption	TBD	
12	Panel Power consumption	TBD	
13	Weight	TBD	

Note 1: Refer to Mechanical Drawing.

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2.Pin Assignment

TFT LCD Panel Driving Section

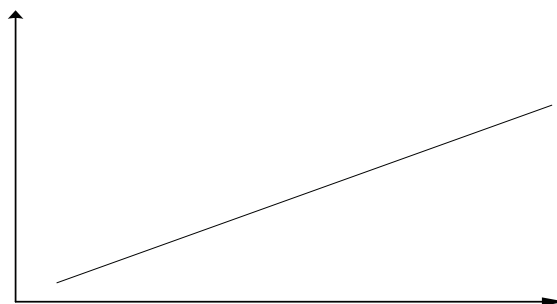
Pin No.	Symbol	I/O	Function	Remark
1	VLED	P	Voltage for LED circuit	
2	VLED	P	Voltage for LED circuit	
3	ADJ	I	Adjust the led brightness	Note1,2
4	GLED	P	Ground for LED circuit	
5	GLED	P	Ground for LED circuit	
6	VCC	P	Power supply for digital circuit	
7	VCC	P	Power supply for digital circuit	
8	MODE	I	DE or HV mode control	Note3
9	DE	I	Data enable	
10	VS	I	Vsync signal input	
11	HS	I	Hsync signal input	
12	GND	P	Power ground	
13	B5	I	Blue data input (MSB)	
14	B4	I	Blue data input	
15	B3	I	Blue data input	
16	GND	P	Power ground	
17	B2	I	Blue data input	
18	B1	I	Blue data input	
19	B0	I	Blue data input(LSB)	
20	GND	P	Power ground	
21	G5	I	Green data input(MSB)	
22	G4	I	Green data input	
23	G3	I	Green data input	
24	GND	P	Power ground	
25	G2	I	Green data input	
26	G1	I	Green data input	
27	G0	I	Green data input(LSB)	
28	GND	P	Power ground	
29	R5	I	Red data input(MSB)	
30	R4	I	Red data input	
31	R3	I	Red data input	
32	GND	P	Power ground	
33	R2	I	Red data input	
34	R1	I	Red data input	
35	R0	I	Red data input(LSB)	
36	GND	P	Power ground	
37	DCLK	I	Sample clock	

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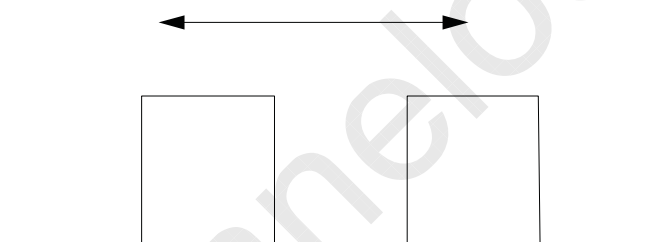
38	GND	P	Power ground	
39	L/R	I	Select left to right scanning direction	Note4
40	U/D	I	Select up or down scanning direction	Note4

Note: I: input, O: output t, P: Power

Note1:ADJ adjust brightness to control Pin,Pulse duty the bigger brighter.



Note 2:ADJ signal=0~3.3V,operation frequency:100~300Hz



Note 3:

MODE: Mode=1 DE Mode

Mode=0 HV Mode

Note 4:

L/R U/D

Setting of scan control input		IN / OUT state for start pulse				Scanning direction
U/D	L/R	STVD	STVU	STHR	STHL	
0	1	OUT	IN	OUT	IN	up to down, left to right
1	0	IN	OUT	IN	OUT	down to up, right to left
0	0	OUT	IN	IN	OUT	up to down, right to left
1	1	IN	OUT	OUT	IN	down to up, left to right

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Luminance

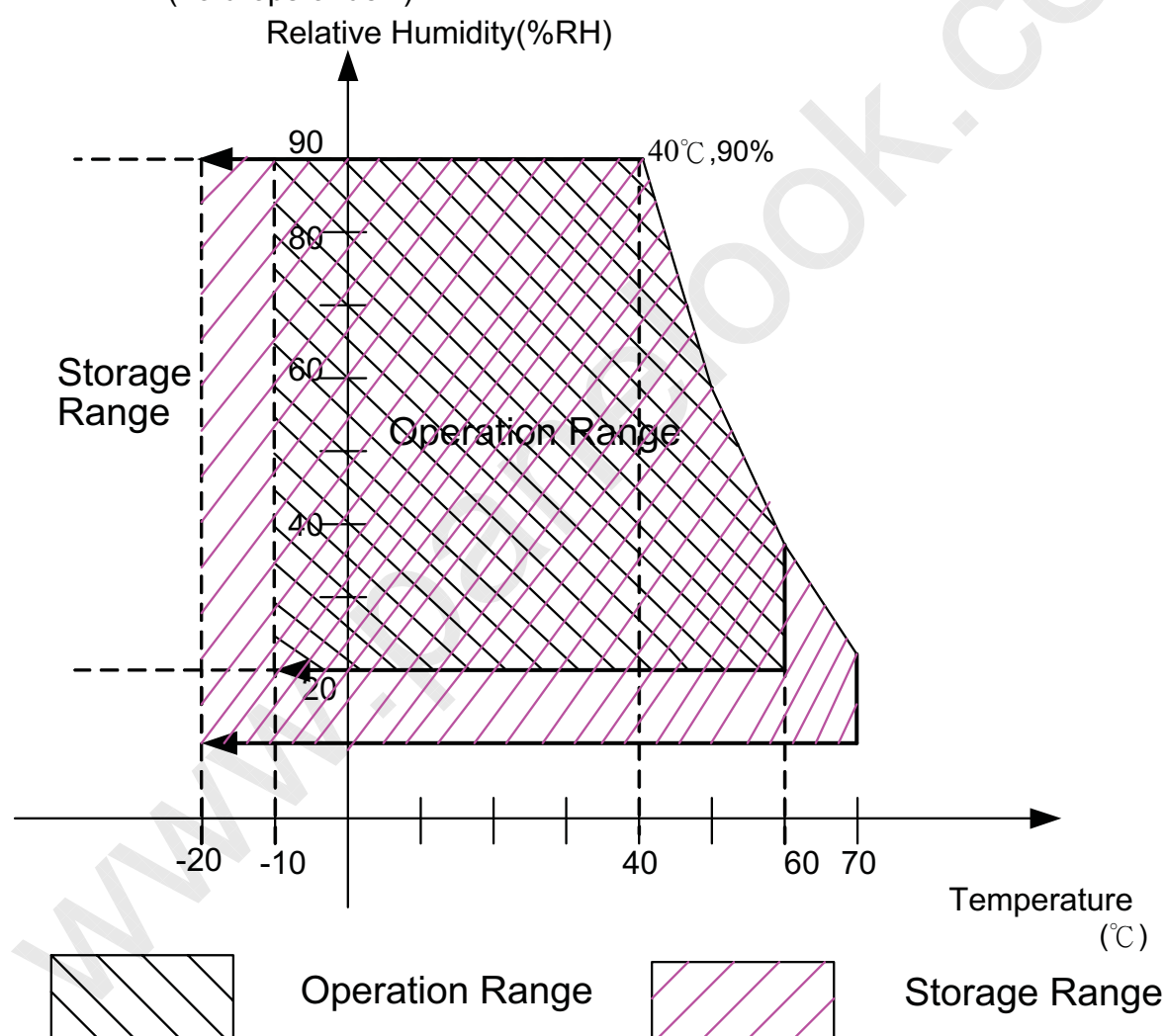
3.Operation Specifications

3.1. Absolute Ratings of Environment

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Operation temperature	T _{OP}	-10	60	°C	Note 1, 2
Storage temperature	T _{ST}	-20	70	°C	Note 1, 2

Note 1 : 90% RH Max.(Max wet temp. is 40°C)

Maximum wet-bulb temperature is at 38°C or less. And No condensation
(no drops of dew)



Note 2: In case of below 0 the response time of liquid crystal (LC) becomes slower and the color of panel darker than normal one. Level of retardation depends on temperature, because of LC's characteristics.

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3.2.Absolute Maximum Rating

(Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	V_{LED}	4.5	5.5	V	
	V_{DD}	(-0.3)	(7)	V	
LED Forward Voltage	V_r	3.1	3.5	V	Each LED Note 2
LED Forward Current	I_f	-	25	mA	Each LED

Note 1: The absolute maximum rating values of the module should not be exceeded. Once exceeded absolute maximum rating values, the characteristics of the module may not be recovered. Even in an extreme condition, may result in module permanently destroyed.

Note 2: V_r Conditions: Zener Diode 20mA



3.2.1. Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	V_{DD}	3.1	3.3	3.5	V	
	V_{LED}	4.6	5.0	5.4	V	
Input logic high voltage	V_{IH}	$0.7V_{DD}$	-	$1V_{DD}$	V	Note 1
Input logic low voltage	V_{IL}	0	-	$0.3V_{DD}$	V	

Note 1: R0~R5,G0~G5,B0~B5,HSYNC,VSYNC,DE,SPENA,SPCK,SPDA.

3.2.2.Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{DD}	-	130	200	mA	$V_{DD} = 3.3V$
Current for Backlight	I_{LED}	-	380	450	mA	$V_{LED} = 5.0V$

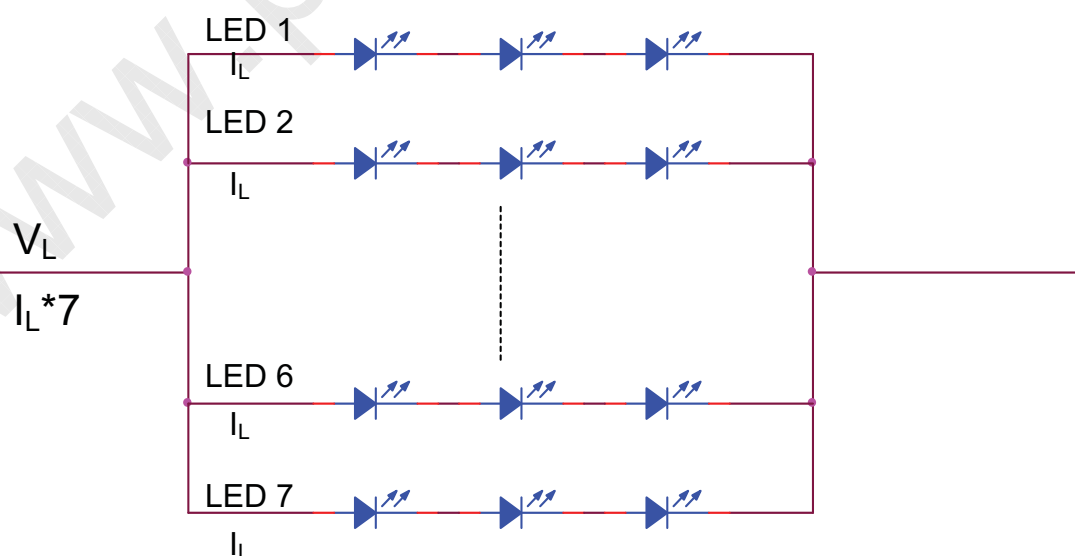
3.2.3. Backlight Driving Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED forward voltage	V_L	9.3	9.9	10.5	V	Note 2,3
LED forward current	I_L	18	20	22	mA	Note 3
LED life time	-	20,000	-	-	Hr	Note 1

Note 1: The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a = 25^{\circ}C$ and $I_L = 20mA$. The LED lifetime could be decreased if operating I_L is larger than 20 mA.

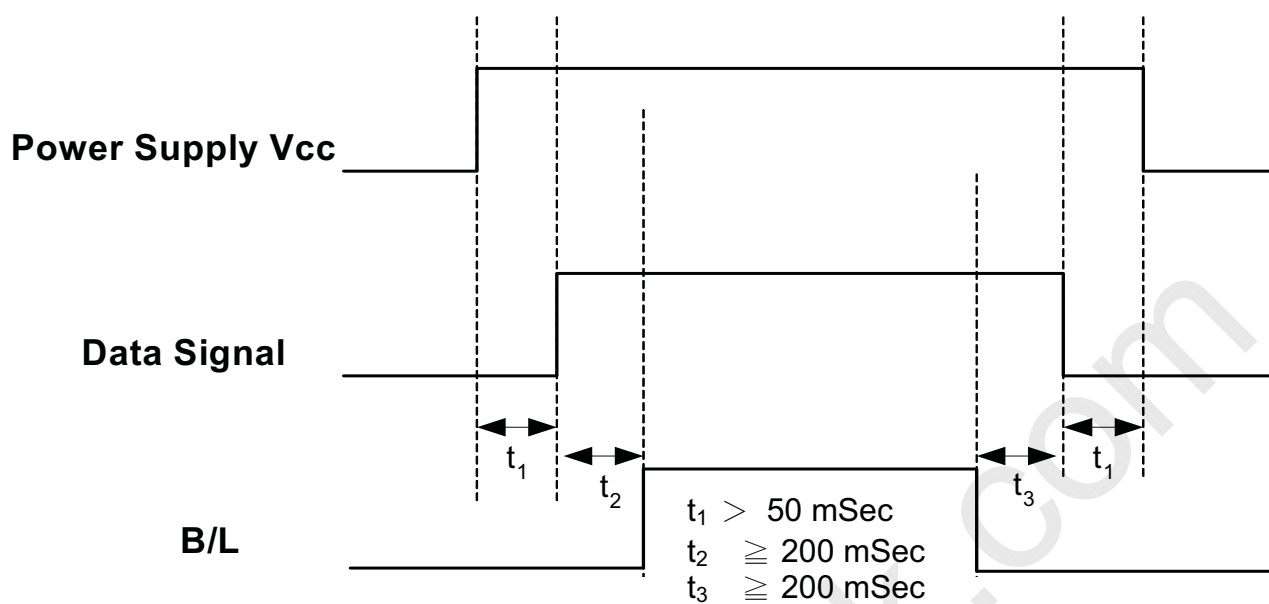
Note 2: The LED Supply Voltage is defined by the number of LED at $T_a = 25^{\circ}C$ and $I_L = 20mA$.

Note 3: The LED driving condition is defined for each LED module.(3 LED Serial)



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3.3.Power Sequence



Note: Data includes DE, VS, HS, B0~B5, G0~G5, R0~R5, DCLK.



3.4. Timing Characteristics

3.4.1. Timing Conditions

Input/Output Timing

Item	Symbol	Values			Unit.	Remark
		Min.	Typ.	Max.		
PXLCLK clock time	Tclk	-		37	ns	
PXLCLK pulse duty	Tcwh	40	50	60	%	Tclk
DATA set-up time	Tdsu	12	-	-	ns	DATA to PXLCLK
DATA hold time	Tdhd	12	-	-	ns	DATA to PXLCLK
DE setup time	Tesu	12	-	-	ns	DE to PXLCLK
VSYNC setup time	Tvst	12	-	-	ns	
VSYNC hold time	Tvhd	12	-	-	ns	
HSYNC setup time	Thst	12	-	-	ns	
HSYNC hold time	Thhd	12	-	-	ns	
HSYNC period time	Th	60	63.56	67	us	
HSYNC width	Thwh	1	-	-	Tclk	
VSYNC width	Tvwh	1	-	-	Th	
HSYNC to CLKIN	Thc	-	-	1	Tclk	

DE Mode input Timing Limitation

DE Mode	Values			Unit	Remark
	Min.	Typ.	Max.		
TCLK	33.3	39.7	--	ns	1tclk
THC	48	160	765	tclk	
THD	640	640	640	tclk	
TH	688	800	1405	tclk	1TH=1line
TVC	6	45	255	line	
TVD	480	480	480	line	
TV	486	525	735	line	1TV=1field

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HV Mode input Timing Limitation

HV Mode	Values			Unit	Remark
	Min.	Typ.	Max.		
Tclk	33.3	39.7	-	ns	1tclk
Thwh	-	10	-	tclk	
Thbp	-	134	-	tclk	
Thfp	-	16	-	tclk	
THD	-	640	-	tclk	
TH	-	800	-	line	
Tvwh	-	2	-	line	
Tvbp	-	11	-	line	
Tvfp	-	32	-	line	
TVD	-	480	-	line	
TV	-	525	-	line	1TV=1field

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3.4.2.Timing Diagram

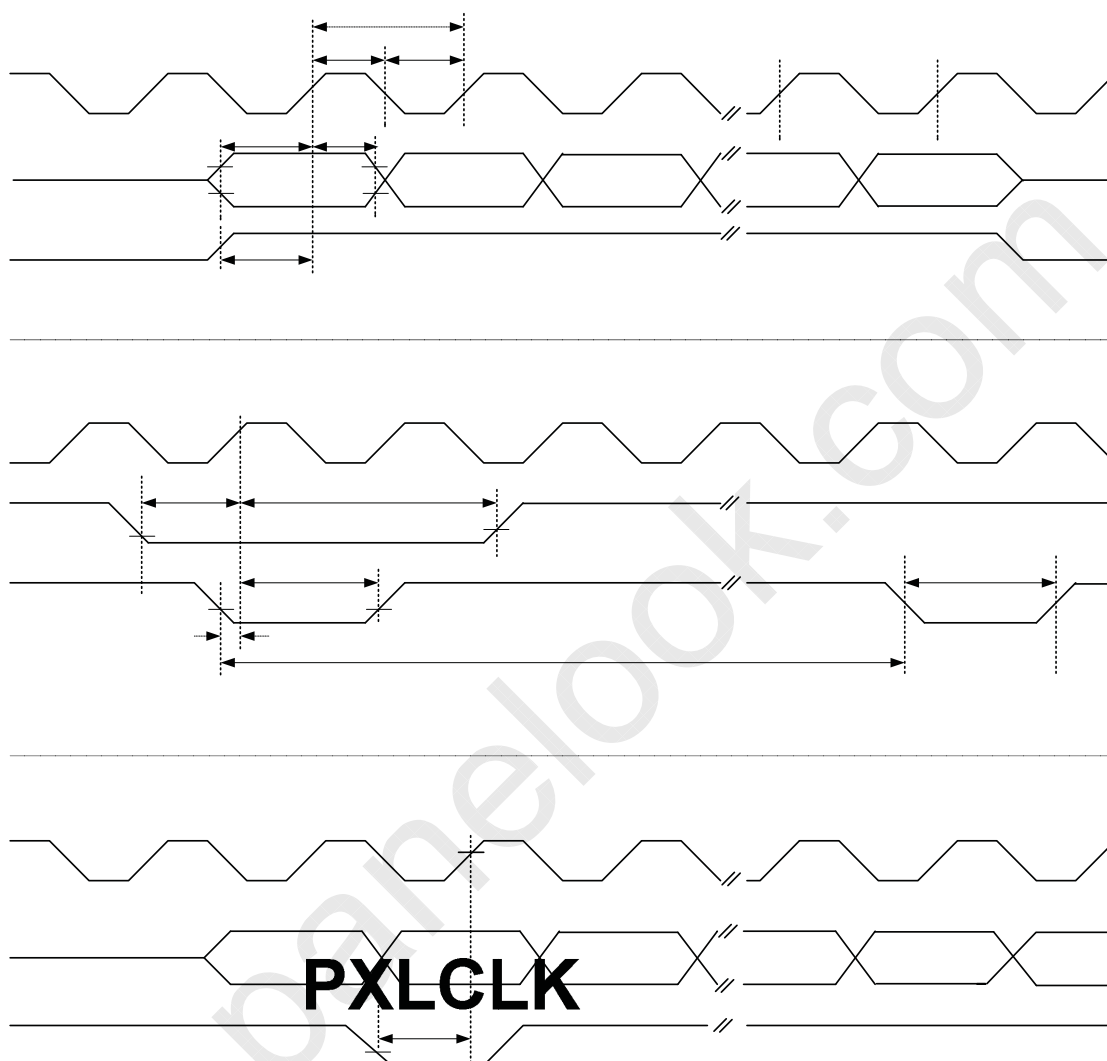


Fig.3-1 Clock and Data Input Timing Diagram

DATA**DE**

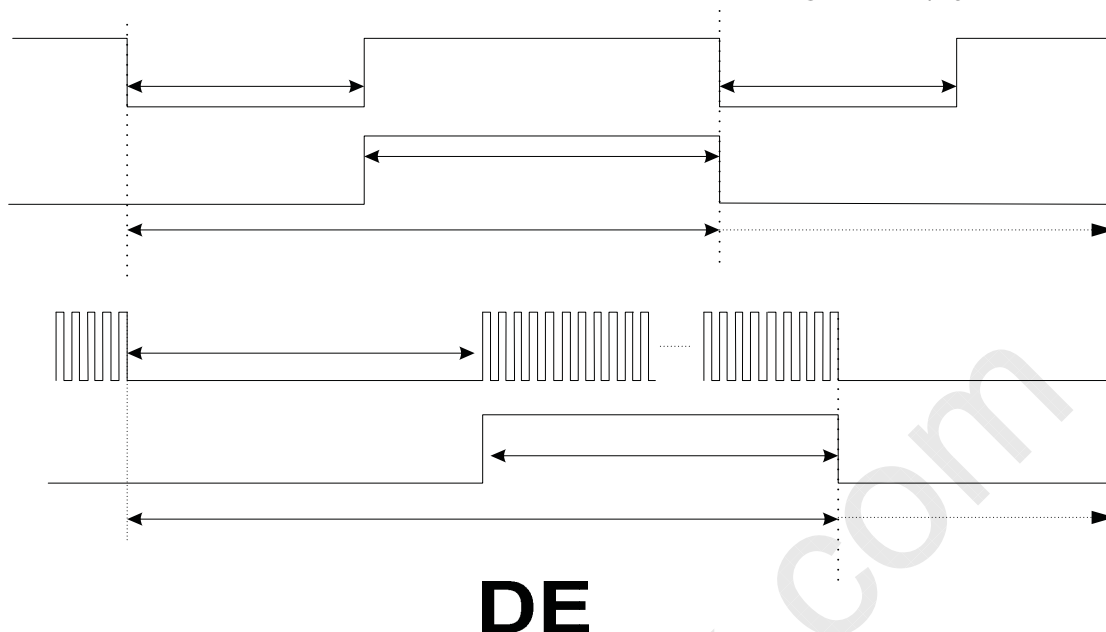


Fig.3-2 DE Mode Input Timing

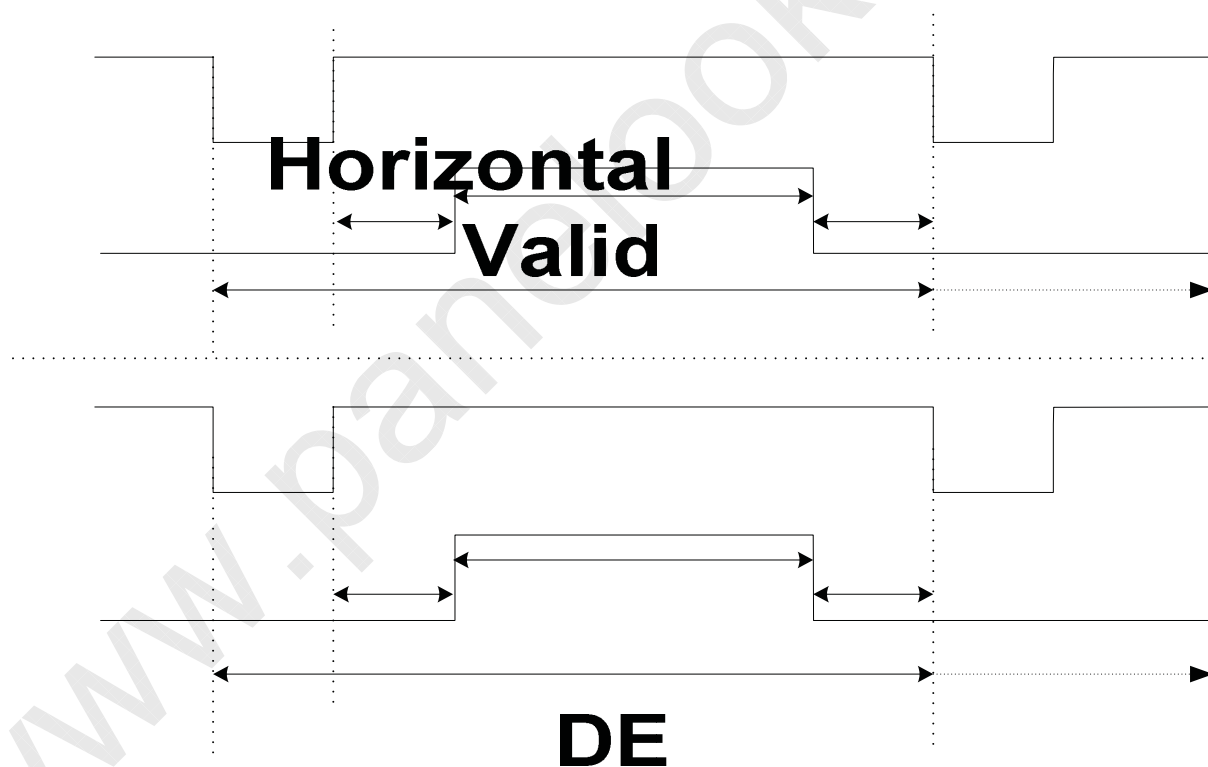


Fig.3-3 HV Mode Input Timing

Vertical
Valid

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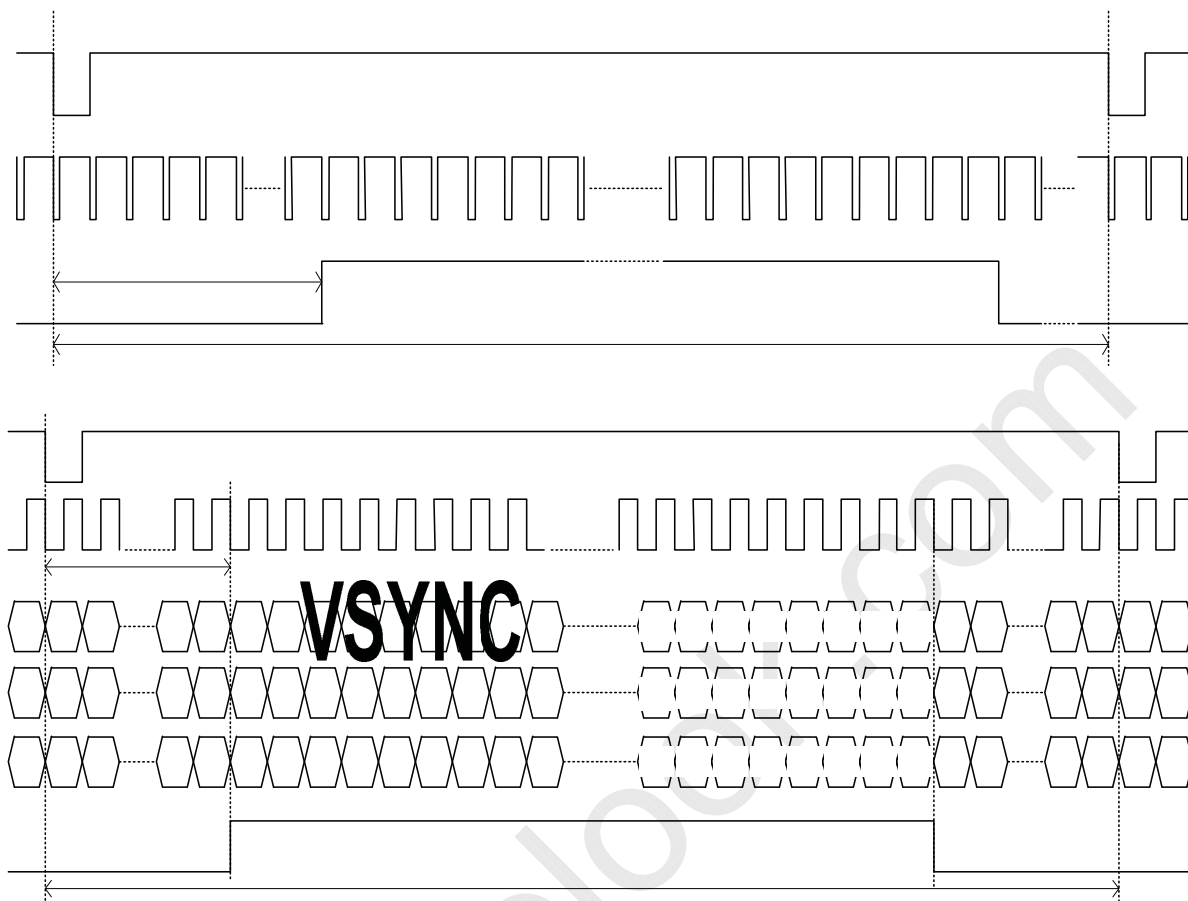


Fig. 3-4 16-bit RGB mode for 640 x (RGB) x 480

Default = 13 lines

Valid Line**HSYNC****PXLCLK**

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1

2

143

144

145

4.Touch Screen Panel Specifications

4.1.Electrical Characteristics

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Linearity	-1.5	-	1.5	%	Analog X and Y directions
Terminal Resistance	150	-	850	Ω	X(Film side)
	200	-	950	Ω	Y(Glass side)
Insulation resistance	25	-	-	M Ω	DC 25V
Voltage	-	5	7	V	DC
Chattering	-	-	10	ms	100k Ω pull-up
Transparency	80	-	-	%	

Note: Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

4.2.Mechanical & Reliability Characteristics

Item	Value			Unit	Remark
	Min.	Typ.	Max.		
Activation force	80	-	-	g	Note 1
Durability-surface Sliding	Write 100,000	-	-	characters	Note 2
Durability-surface pitting	1,000,000	-	-	touches	Note 3
Surface hardness	3	-	-	H	JIS K5400, ASTM D3363

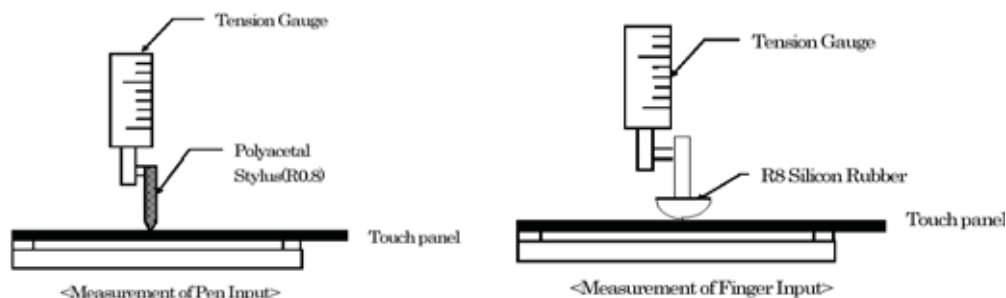
Note 1: Activation force test condition

(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

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Note 2: Measurement for surface area.

- Material of Pen: Polyacetal resin.
- End shape of Pen: R 0.8 mm (Stylus).
- Sliding 100,000 times straight line on the film with a stylus change every 20,000 times.
- Load force: 250gf.
- Sliding speed: 60mm/sec.

Note 3: Measurement for surface area.

- Material of Pen: Polyacetal resin
- End shape of Pen: 0.8mm (stylus).
- Force: 250gf.
- Speed: 2times/sec.



5. Optical Specifications

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	60	70	-	degree	Note 1 (Without touch screen)
	θ_R	$\Phi=0^\circ$ (3 o'clock)	60	70	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	40	50	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	60	70	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 3
	T_{OFF}		-	15	30	msec	Note 3
Contrast ratio	CR		450	500	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 2 Note 5 Note 6 (Without touch screen)
	W_Y		0.28	0.33	0.38	-	
Luminance	L_1		230	280	-	cd/m ²	Note 6 (With touch screen)
	L_2		300	350	-	cd/m ²	Note 6 (Without touch screen)
Luminance uniformity	Y_U		70	75	-	-	Note 7

Test Conditions:

1. $V_{DD}=3.3V$, $V_{LED}=5.0V$, $I_L=20mA$ rms , the ambient temperature is 25°C.
2. The test systems refer to Note 2.



Note 1: Definition of viewing angle range

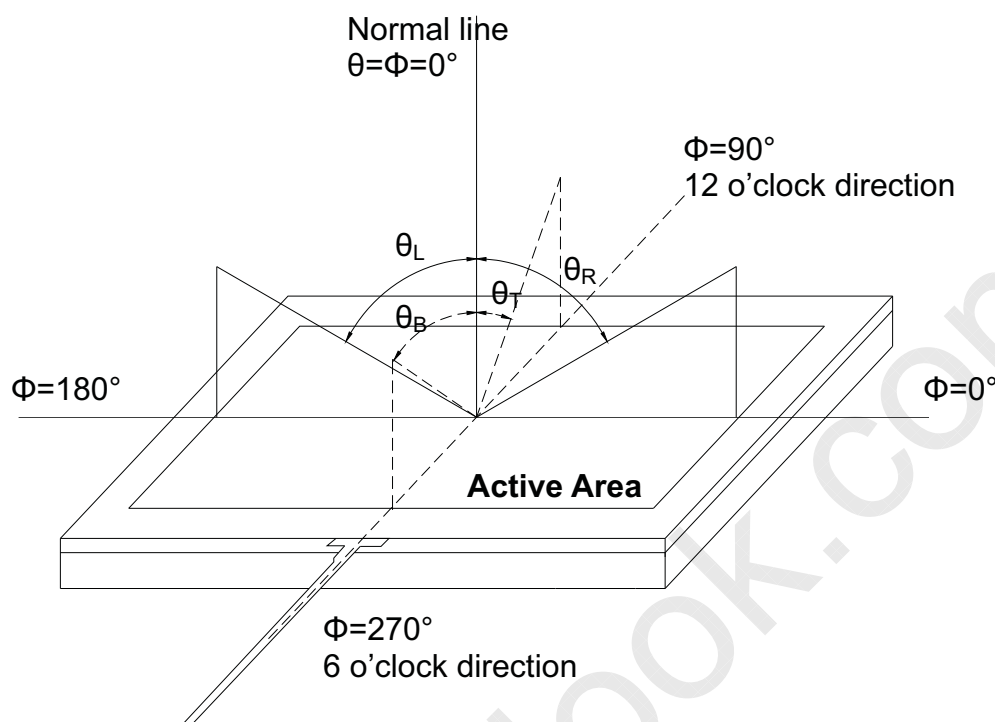


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

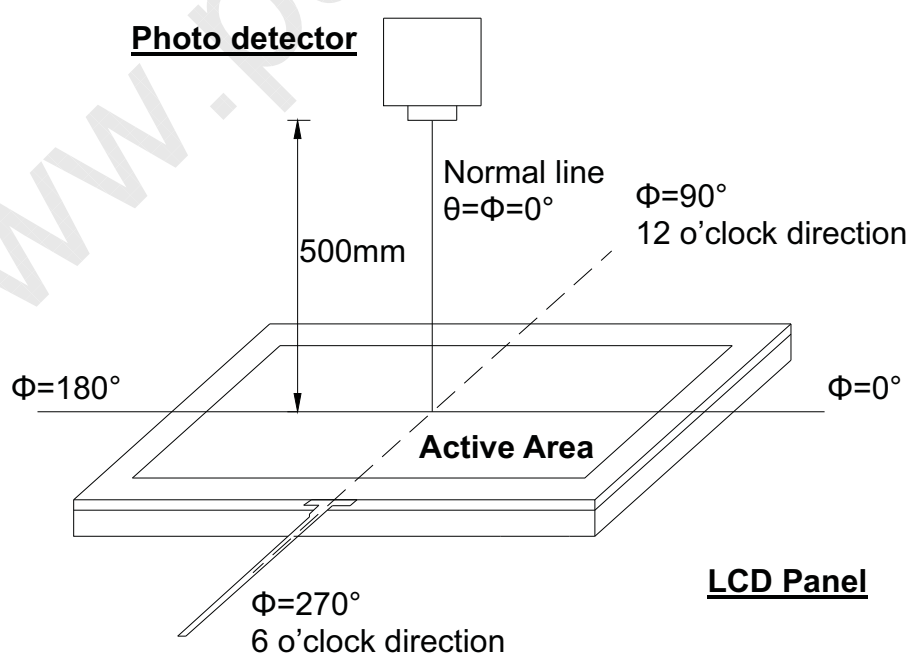


Fig. 4-2 Optical measurement system setup

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Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

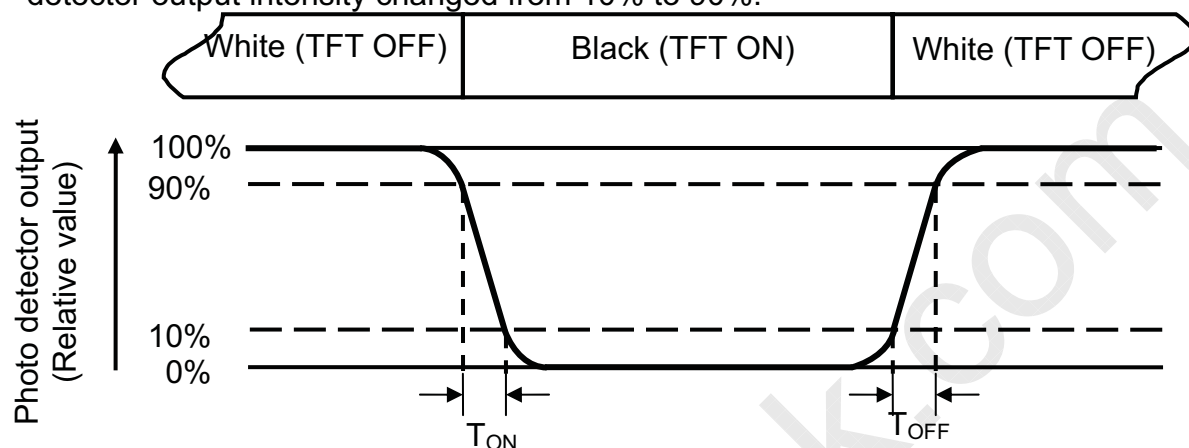


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_L=20\text{mA}$ of which each LED module is 3 LED serial.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{\min}}{B_{\max}}$$

L-----Active area length W----- Active area width

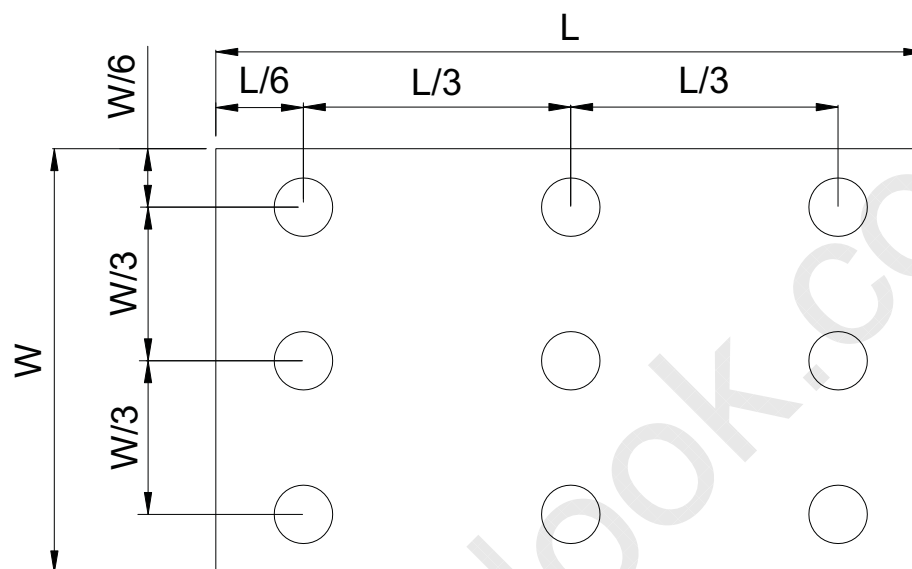


Fig. 4-4 Definition of measuring points

$B_{\max}$: The measured maximum luminance of all measurement position.

$B_{\min}$: The measured minimum luminance of all measurement position.



6. Reliability Test

(Note3)

Item	Test Conditions		Remark
High Temperature Storage	Ta = 80℃	240 hrs	Note 1, Note 4
Low Temperature Storage	Ta = -30℃	240hrs	Note 1, Note 4
High Temperature Operation	Ts = 70℃	240hrs	Note 2, Note 4
Low Temperature Operation	Ta = -20℃	240hrs	Note 1, Note 4
Operate at High Temperature and Humidity	+40℃, 90%RH	240 hrs	Note 5
Thermal Shock	-30℃/30 min ~ +80℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature		Note 4
Vibration Test	Frequency range: 10~55Hz Stroke: 1.5mm Sweep: 10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)		
Mechanical Shock	100G 6ms, ±X, ±Y, ±Z 3 times for each direction		
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)		
Package Drop Test	Height: 60 cm 1 corner, 3 edges, 6 surfaces		
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω		

Note 1: Ta is the ambient temperature of samples.

Note 2: Ts is the temperature of panel's surface.

Note 3: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 4: Before cosmetic and function tests, the product must have enough recovery time, at least 2 hours at room temperature.

Note 5: Before function test, the product must have enough recovery time, at least 24 hours at room temperature.

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7. General Precautions

7.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

7.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

7.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

7.4. Storage

1. Store the module in a dark room where must keep at $+25\pm 10^{\circ}\text{C}$ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

7.5. Cleaning

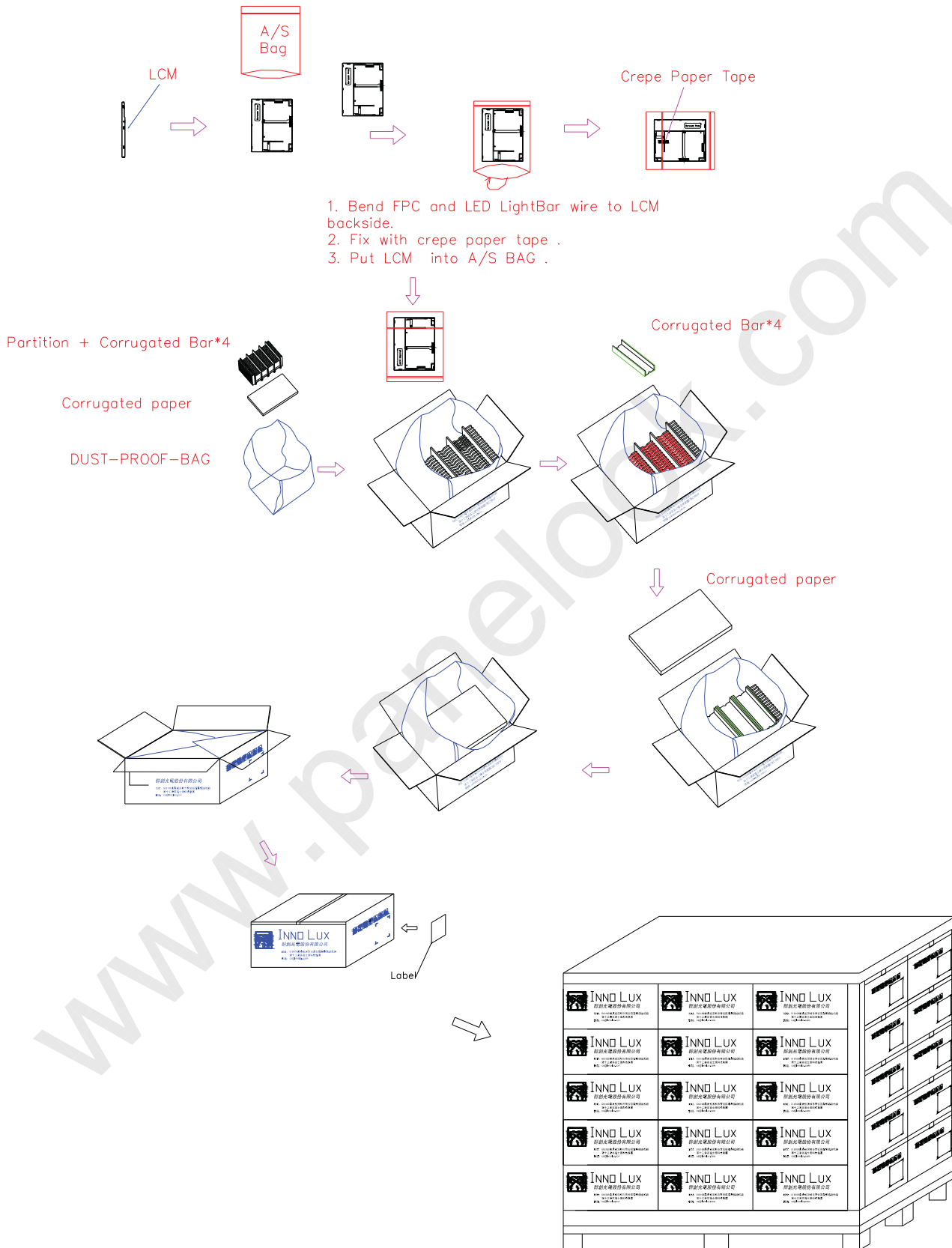
1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

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9.PackageDrawing



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