

INNOLUX DISPLAY CORPORATION

LCD MODULE

SPECIFICATION

Customer: _____

Model Name: PT035TN01

SPEC NO.: P035-01-TT-02

Date: 2005/12/12

Version: 02

- ☐ Preliminary Specification
☒ Final Specification

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by
	 12/19/05	 12/15/05

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Record of Revision

Version	Revise Date	Page	Content
1	2005/09/20		Initial release
2	2005/12/12	2	Modify the VSET for Pin Assignment from “Normally pull high” to “Normally pull low”.
		16	Update the figure of definition for viewing angle.
		23	Change the package drawing.
		15	Modify Luminance from Min.200 nits Typ.250 nits to Min.300 nits Typ.350 nits.

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1. General Specifications

No.	Item	Specification	Remark
1	LCD size	3.5" inch	
2	Driver element	a-Si TFT active matrix	
3	Resolution	320X3(RGB)X240	
4	Display mode	Normally White, Transmissive	
5	Dot pitch	0.073(W)X0.219(H) mm	
6	Active area	70.08(W)X52.56(H) mm	
7	Module size	78.2(W)X65.0(H)X3.5(D) mm	Note 1
8	Surface treatment	Anti Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight power consumption	0.44W(Typ.)	
12	Panel power consumption	44mW(Typ.)	
13	Weight	33g±10%	

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

Pin No.	Symbol	I/O	Function	Remark
1	NC	-	No connect	
2	GND	P	Ground for logic circuit	
3	V _{CC}	P	Supply voltage of logic control circuit	
4	V _{GL}	P	Negative power for scan driver	
5	V _{GH}	P	Positive power for scan driver	
6	V _{COM}	I	V _{COM} input	
7	GND	P	Ground for logic circuit	
8	RSTB	I	Reset Pin, Active low.	
9	VSET	I	Gamma correction voltage is set internally or externally. Normally pull low.	Note 1
10	U/D	I	UP/DOWN Setting.	Note 3
11	L/R	I	LEFT/RIGHT Setting	Note 3
12	IF2	I	Data format selection	Note 2
13	IF1	I	Data format selection	Note 2
14	SPENA	I	Serial port Data Enable Signal. Normally pull high	
15	SPCK	I	Serial port Clock .Normally pull high	
16	SPDA	I/O	Serial port Data input/output	
17	POL	O	Polarity select for the line inversion control signal.	
18	NC	-	No connect	
19	GND	P	Ground for logic circuit	
20	GLED2	P	GND for LED	
21	VLED2	P	Power for LED	
22	GLED1	P	GND for LED	
23	VLED1	P	Power for LED	
24	AV _{DD}	P	Analog power supply(+5V)	

25	V8	P	Gamma Correction reference voltage	
26	V7	P	Gamma Correction reference voltage	
27	V6	P	Gamma Correction reference voltage	
28	V5	P	Gamma Correction reference voltage	
29	V4	P	Gamma Correction reference voltage	
30	V3	P	Gamma Correction reference voltage	
31	V2	P	Gamma Correction reference voltage	
32	V1	P	Gamma Correction reference voltage	
33	AGND	P	Analog ground.	
34	D07	I	Data INPUT (MSB)	
35	D06	I	Data INPUT	
36	D05	I	Data INPUT	
37	D04	I	Data INPUT	
38	D03	I	Data INPUT	
39	D02	I	Data INPUT	
40	D01	I	Data INPUT	
41	D00	I	Data INPUT(LSB)	
42	CLK	I	Clock signal	Note 2
43	IHS	I	Horizontal sync input in digital RGB mode. Or HREF input in CCIR601 mode. (Short to GND if no used)	Note 2
44	IVS	I	Vertical sync input in digital RGB mode. Or V123 input in CCIR601 mode. (Short to GND if no used)	Note 2
45	DEN	I	Input data enable control	Note 2
46	STB	I	Standby mode control. Normally pull high	
47	V _{CC}	P	Supply voltage of logic control circuit	
48	GND	P	Ground for logic circuit	
49	V _{COM}	I	V _{COM} input	
50	V _{GL}	I	Negative power for scan driver	

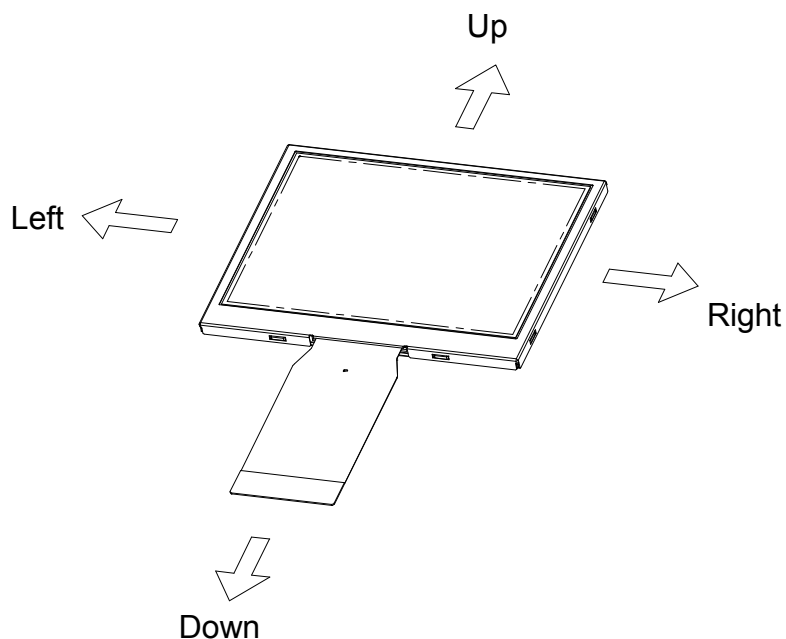
Note: 1. VSET: Low internally gamma correction
 High external gamma correction

Note 2:

IF2, IF1	Input data format	Pin42	Pin43	Pin44	Pin45	Mark
L, L	Serial RGB	CLK	IHS	IVS	NC	Sync Mode
			IHS	IVS	DEN	DE Mode
H, L	CCIR601	CLK	IHS	IVS	GND	
H,H	CCIR656	CLK	GND	GND	GND	

Note 3: Selection of scanning mode

Setting of scan control input		Scanning direction
U/D	L/R	
GND	V _{CC}	Up to down, left to right
V _{CC}	GND	Down to up, right to left
GND	GND	Up to down, right to left
V _{CC}	V _{CC}	Down to up, left to right



3. Operation Specifications

3.1. Absolute Maximum Rating

(GND=AGND=0V, Note 1)

Item	Symbol	Values		Unit	Remark
		Min.	Max.		
Power voltage	V_{CC}	-0.3	7	V	
	AV_{DD}	-0.3	7	V	
	V_{GH}	-0.3	18	V	
	V_{GL}	-15	0.3	V	
	$V_{GH}-V_{GL}$	-	33	V	
Operation Temperature	T_{OP}	-20	70	°C	
Storage Temperature	T_{ST}	-30	80	°C	

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.

3.2. Electrical Characteristics

3.2.1. Typical Operation Conditions

(GND=AGND=0V, Note 2)

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power voltage	V_{CC}	3.0	3.3	3.6	V	
	AV_{DD}	-	5.0	-	V	
	V_{GH}	14.3	15	15.7	V	
	V_{GL}	-10.5	-10	-9.5	V	
V_{COM}	V_{CAC}	-	5.5	-	V	Note 1
	V_{CDC}	0.5	0.7	0.9	V	DC component
Input logic high voltage	V_{IH}	$0.7V_{CC}$	-	V_{CC}	V	
Input logic low voltage	V_{IL}	0	-	$0.3V_{CC}$	V	

Note 1: The brightness of LCD panel could be changed by adjusting the AC component of V_{COM} .

Note 2: GND, V_{CC} , and V_{GL} are applied to LCD first and then V_{GH} is applied.

3.2.2. Current Consumption

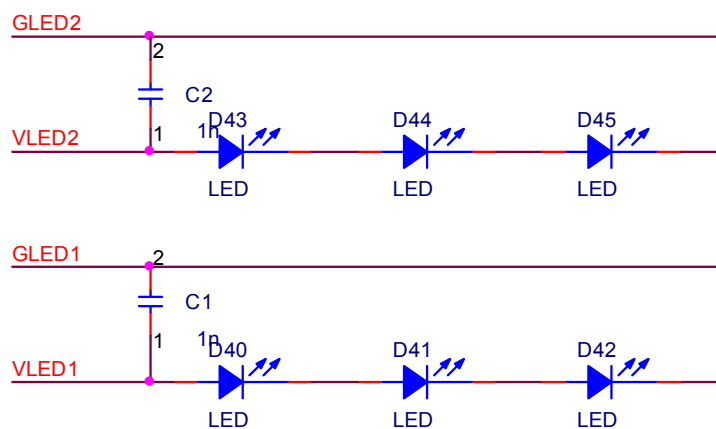
(GND=AGND=0V)

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Current for Driver	I_{GH}	-	100	300	uA	$V_{GH} = 15V$
	I_{GL}	-	-100	-300	uA	$V_{GL} = -10V$
	I_{CC}	-	6.5	10	mA	$V_{CC} = 3.3V$
	I_{DD}	-	4	10	mA	$AV_{DD} = 5V$

3.2.3. Backlight Driving Condition

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
LED voltage	V_L	-	10.8	-	V	Note 1
LED current	I_L	-	20	-	mA	Note 1
LED life time	-	20,000	-	-	Hr	Note 2

Note 1: The LED driving condition is defined for each LED module.(See the figure)



Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C and $I_L = 20mA$.

3.3. Timing Characteristics

3.3.1. Timing Conditions

Digital Serial RGB Interface

Item		Symbol	Values			Unit.	Remark
			Min.	Typ.	Max.		
CLK		T _{OSC}	-	52	-	ns	
Data setup time		T _{SU}	12	-	-	ns	
Data hold time		T _{HD}	12	-	-	ns	
IHS period		T _H	-	1224	-	T _{OSC}	
IHS pulse width		T _{HS}	5	90	-	T _{OSC}	
IHS rising time		T _{Cr}	-	-	700	ns	
IHS falling time		T _{Cf}	-	-	300	ns	
IVS pulse width		T _{VS}	1	3	5	T _H	
IVS rising time		T _{Vr}	-	-	700	ns	
IVS falling time		T _{Vf}	-	-	1.5	us	
IVS falling to HIS rising time for odd field		T _{HVO}	3	-	-	T _{OSC}	
IVS falling to HIS falling time for even field		T _{HVE}	3	-	-	T _{OSC}	
IVS-DEN time	NTSC	T _{VSE}	-	18	-	T _H	
	PAL			26			
IHS-DEN time		T _{HE}	108	204	264	T _{OSC}	
DEN pulse width		T _{EP}	-	960	-	T _{OSC}	
DEN-STH time		T _{DES}	-	3	-	T _{OSC}	
IVS period	NTSC		-	262.5	-	T _H	
	PAL		-	312.5	-	T _H	

CCIR601/656Interface

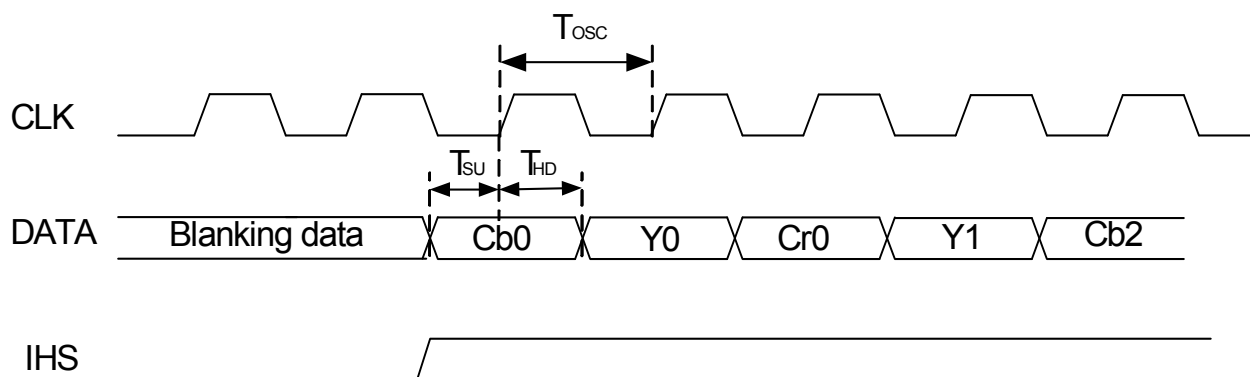
Item	Symbol	Values			Unit.	Remark
		Min.	Typ.	Max.		
CLK period	T _{OSC}	-	37	-	ns	
Data setup time	T _{SU}	12	-	-	ns	
Data hold time	T _{HD}	12	-	-	ns	

Hardware reset timing

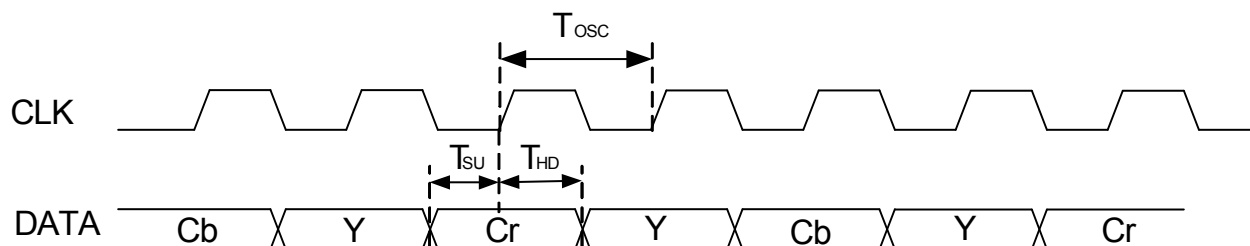
Item	Symbol	Values			Unit.	Remark
		Min.	Typ.	Max.		
RESETB low pulse width	T _{RSB}	10	-	-	μs	

3.3.2. Timing Diagram

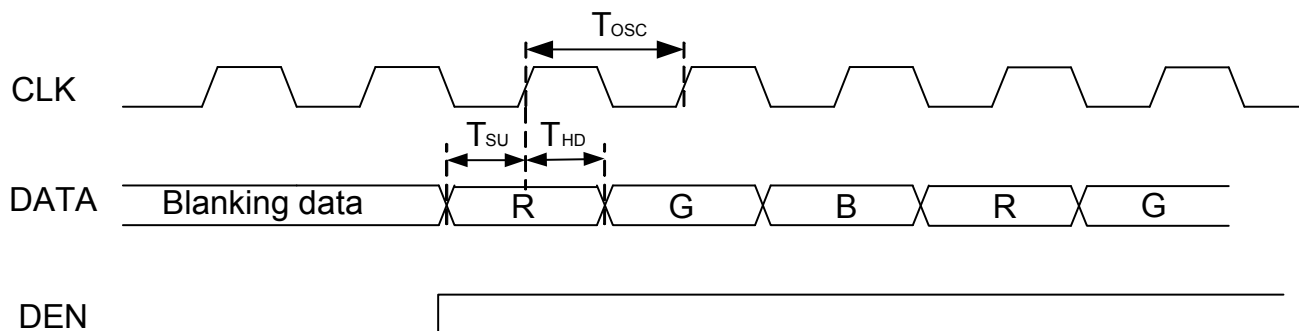
CCIR601



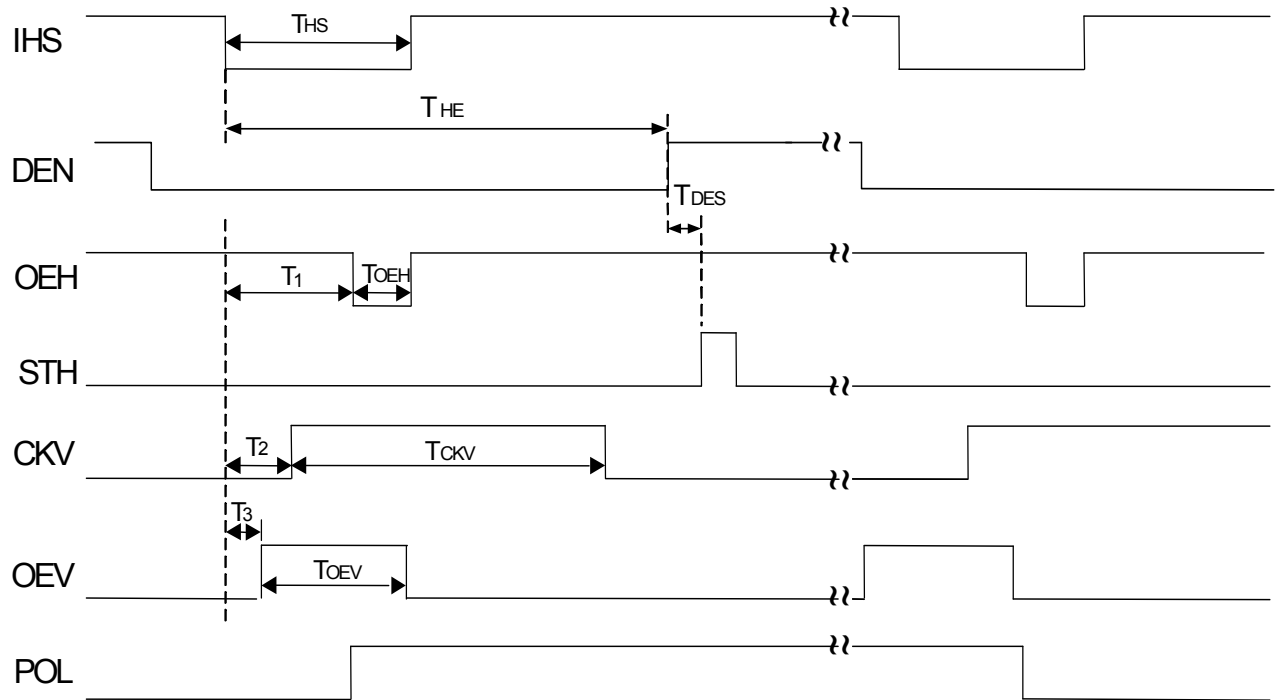
CCIR656



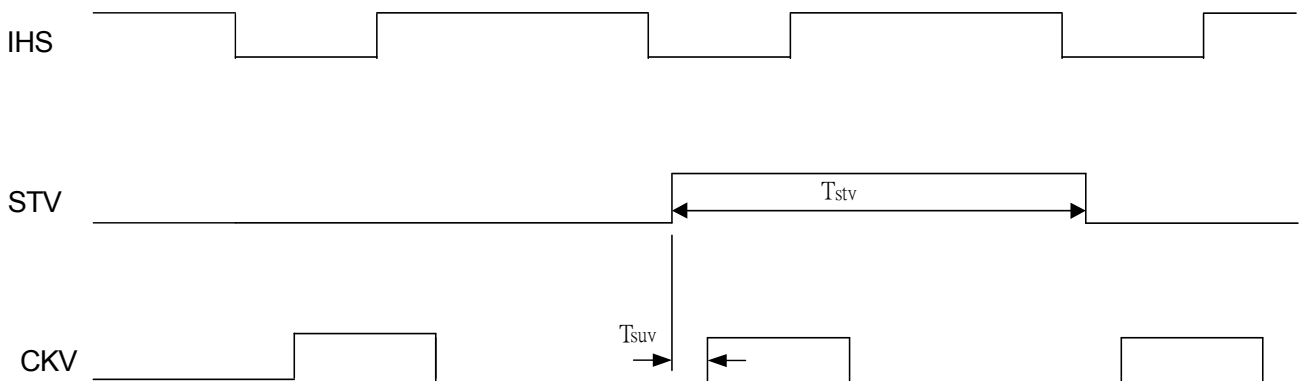
Digital Serial RGB



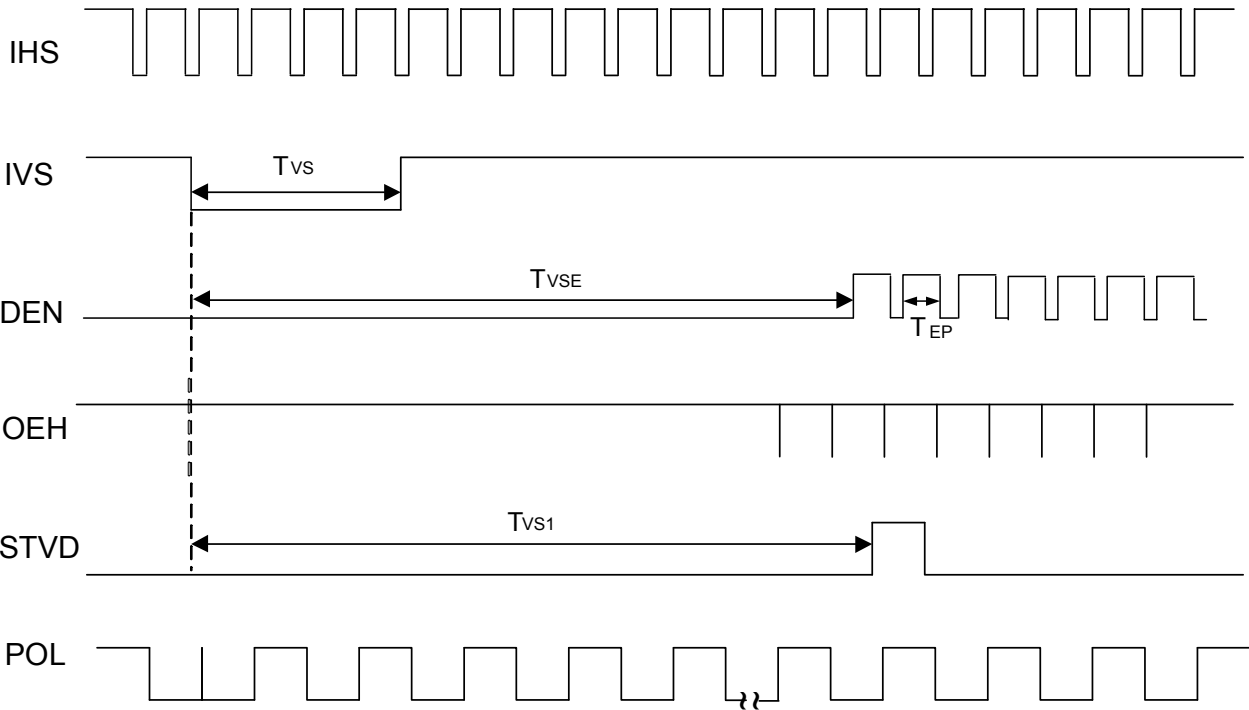
IHS and horizontal control timing waveform



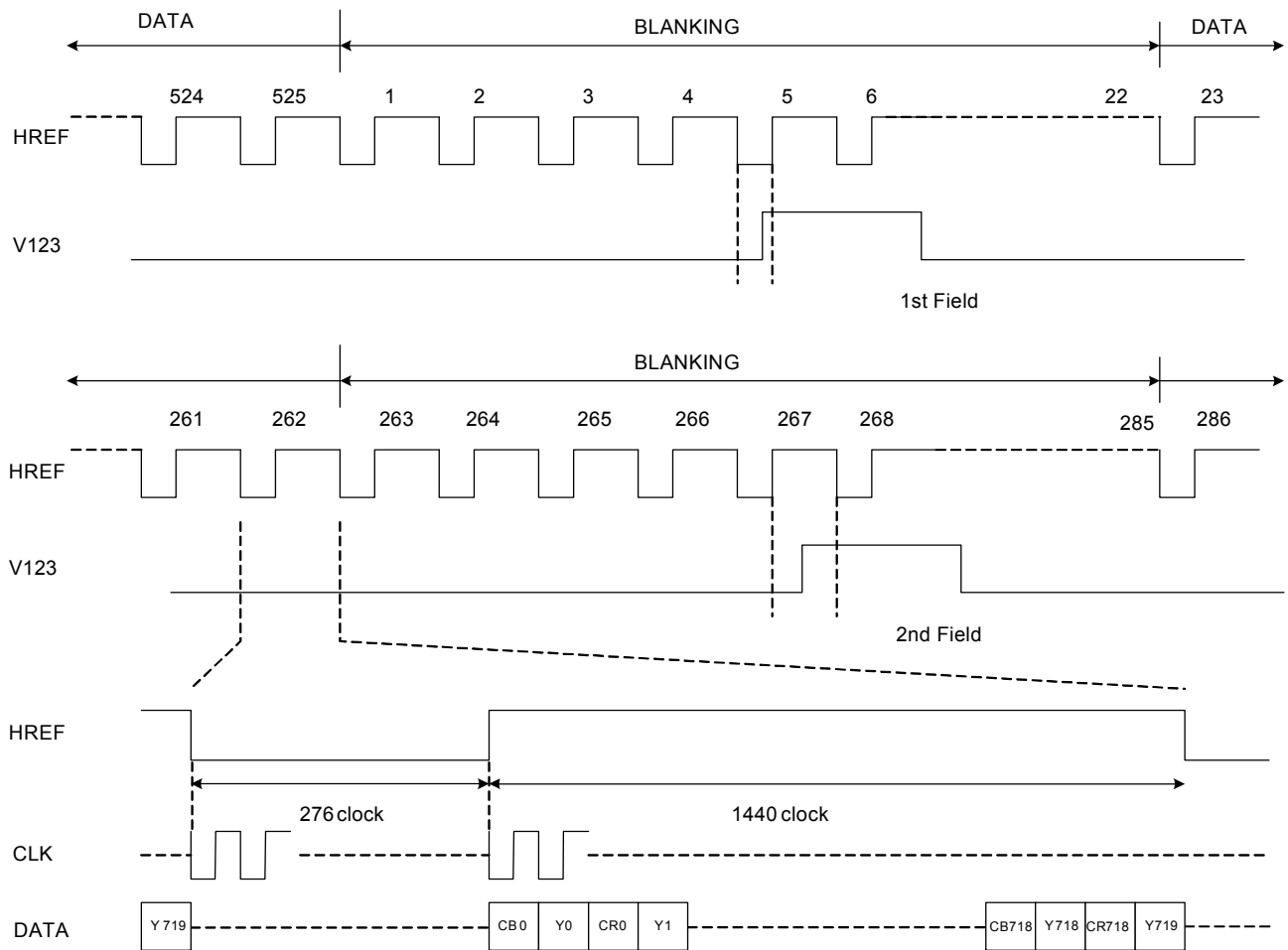
IHS and vertical shift clock timing waveform



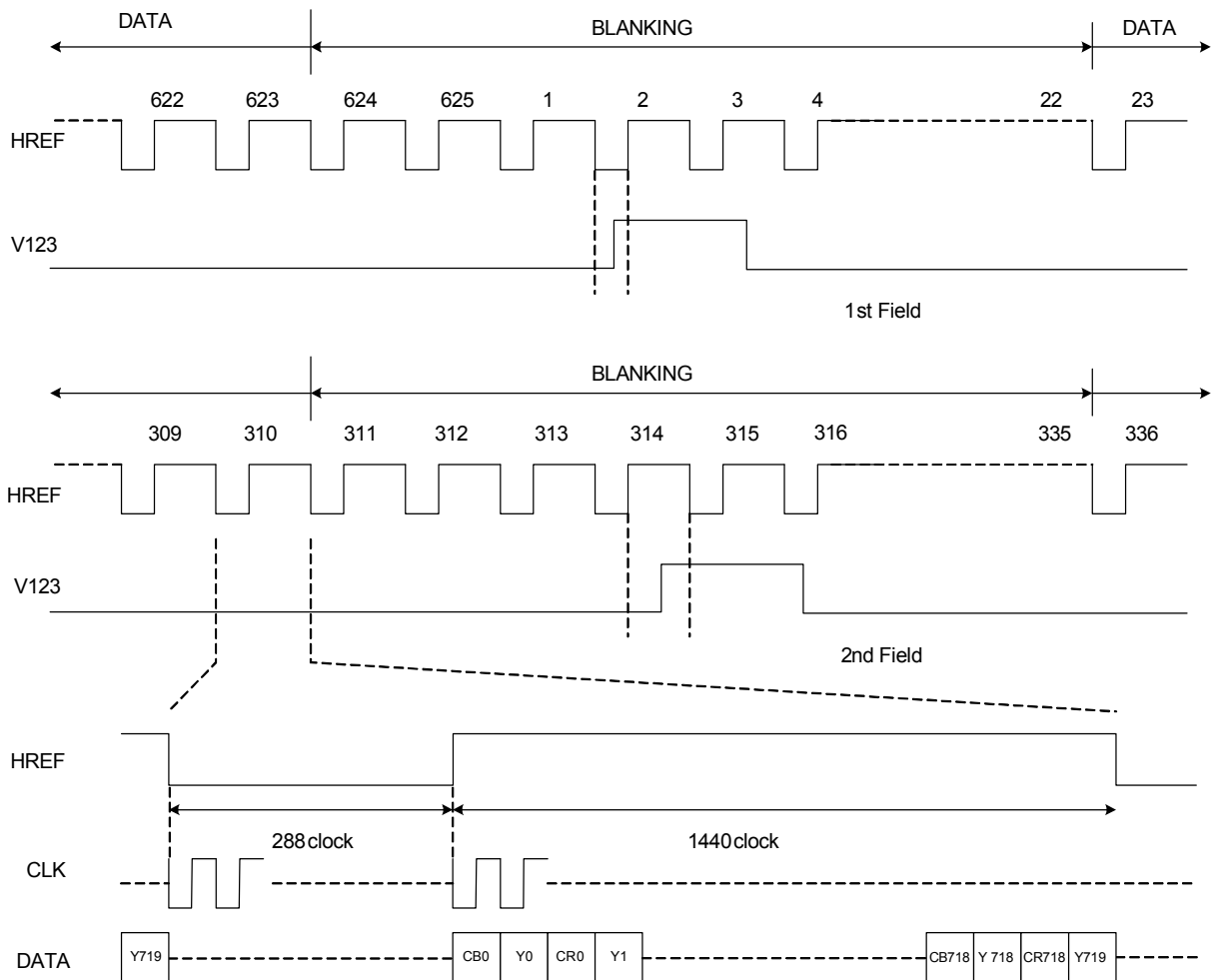
IHS and vertical control timing waveform



CCIR601 timing waveform



ITU-R BT. 601 NTSC Input Timing



ITU-R BT. 601 PAL Input Timing

4. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle (CR≥10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	55	60	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	55	60	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	35	40	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	55	60	-		
Response Time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	15	30	msec	Note 3
	T_{OFF}		-	20	50	msec	Note 3
Contrast ratio	CR		200	300	-	-	Note 4
Color chromaticity	W_X		0.27	0.32	0.37	-	Note 5 Note 6
	W_Y		0.30	0.35	0.40	-	
Luminance	L		300	350	-	cd/m ²	Note 6
Luminance uniformity	Y_U		70	75	-	%	Note 7

Test Conditions:

1. $V_{CC}=3.3V$, $AV_{DD}=5.0V$, $I_L=20mA$ (Backlight current), the ambient temperature is 25°C.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

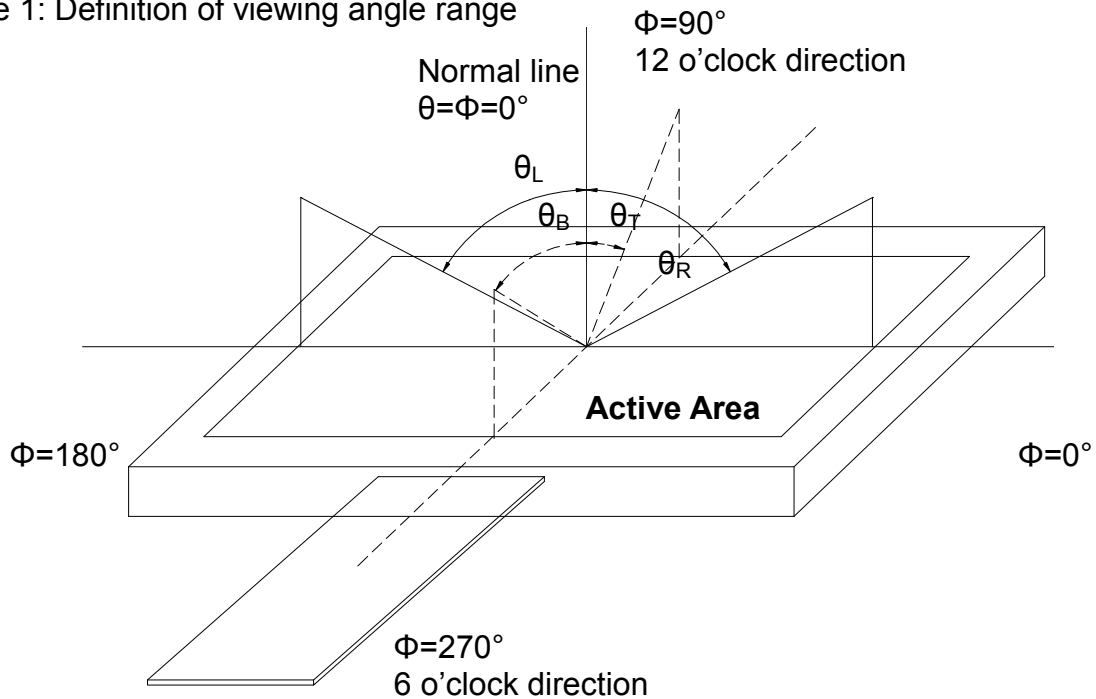


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. 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.)

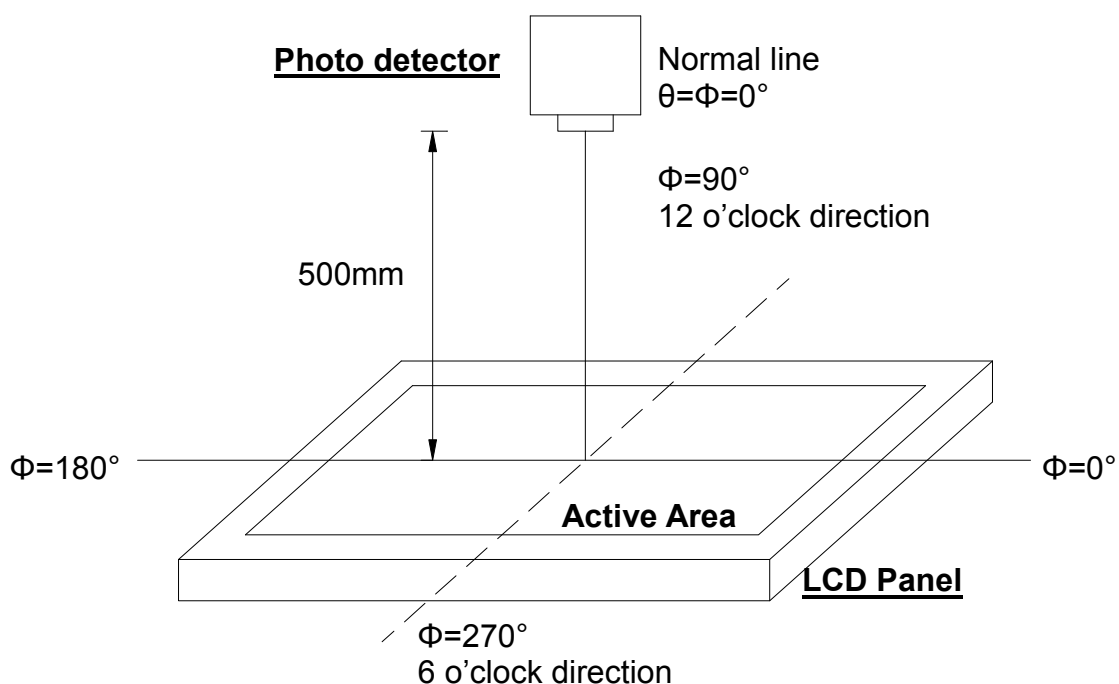


Fig. 4-2 Optical measurement system setup

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%.

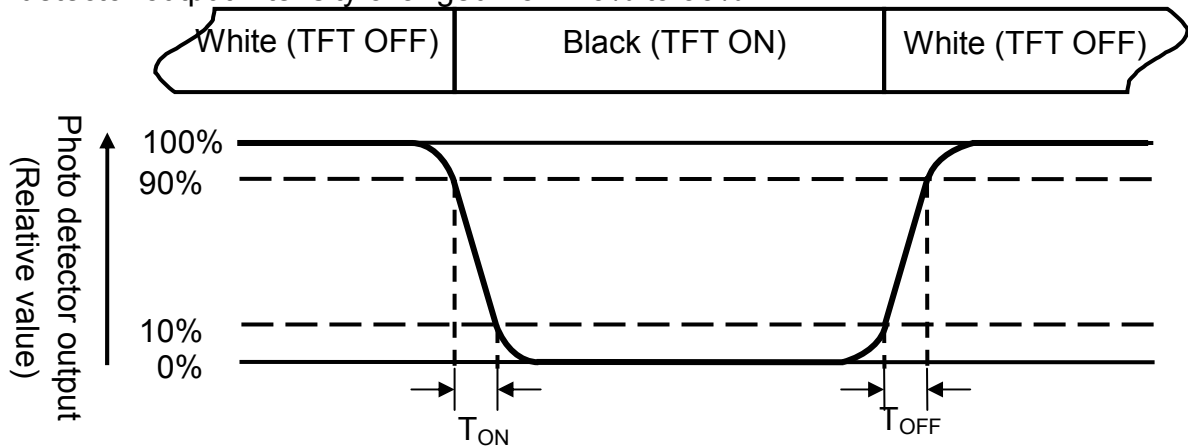


Fig. 4-3 Definition of response time

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 when measuring the center area of the panel.

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

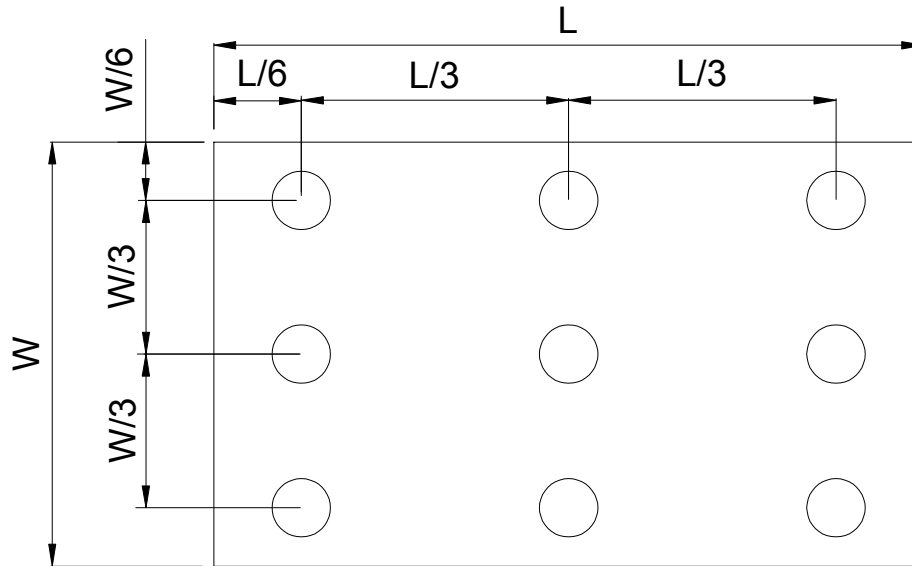


Fig. 4-4 Definition of measuring points

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

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

5. Reliability Test Items

(Note3)

Item	Test Conditions	Remark
High Temperature Storage	Ta = 80℃ 240 hrs	Note 1
Low Temperature Storage	Ta = -30℃ 240hrs	Note 1
High Temperature Operation	Ts = 70℃ 240hrs	Note 2
Low Temperature Operation	Ta = -20℃ 240hrs	Note 1
Operate at High Temperature and Humidity	+40℃, 90%RH max. 240 hrs	
Thermal Shock	-30℃/30 min ~ +80℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature	
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.

6. Handling Precautions

6.1. 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.

6.2. 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.

6.3. 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.

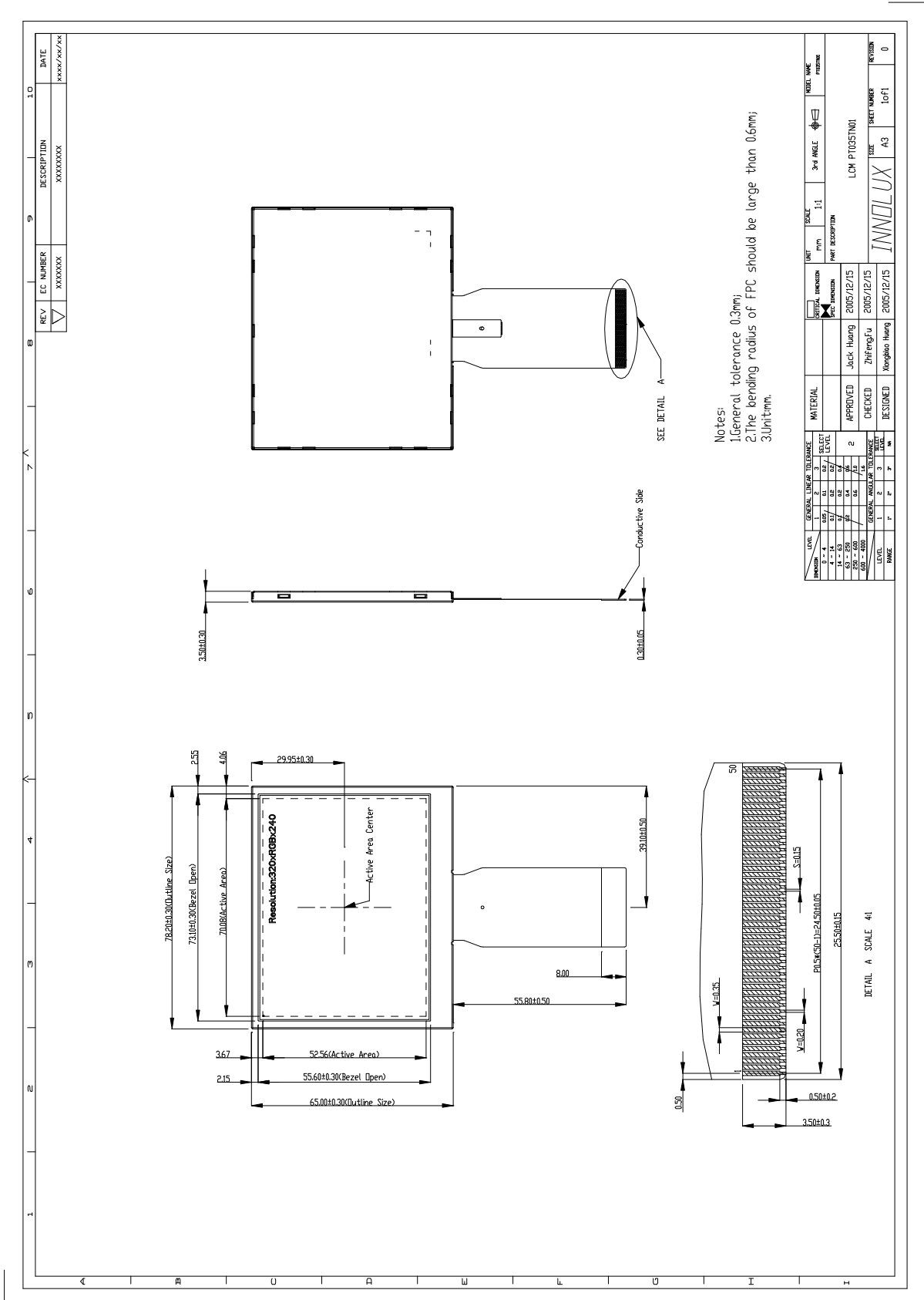
6.4. Storage

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.

6.5. Cleaning

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

7. Mechanical Drawing



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8. Package Drawing

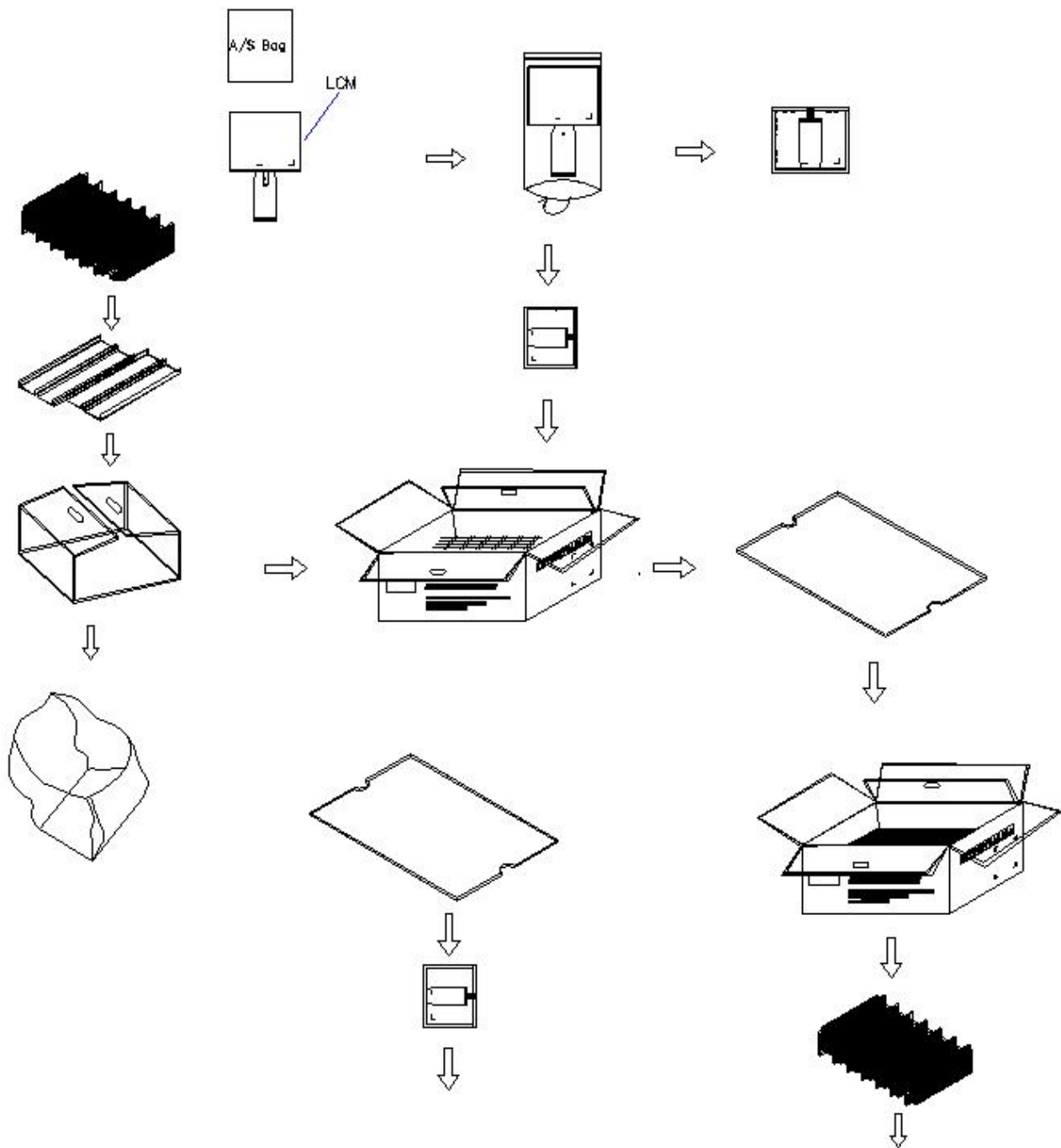
8.1. Packaging Material Table

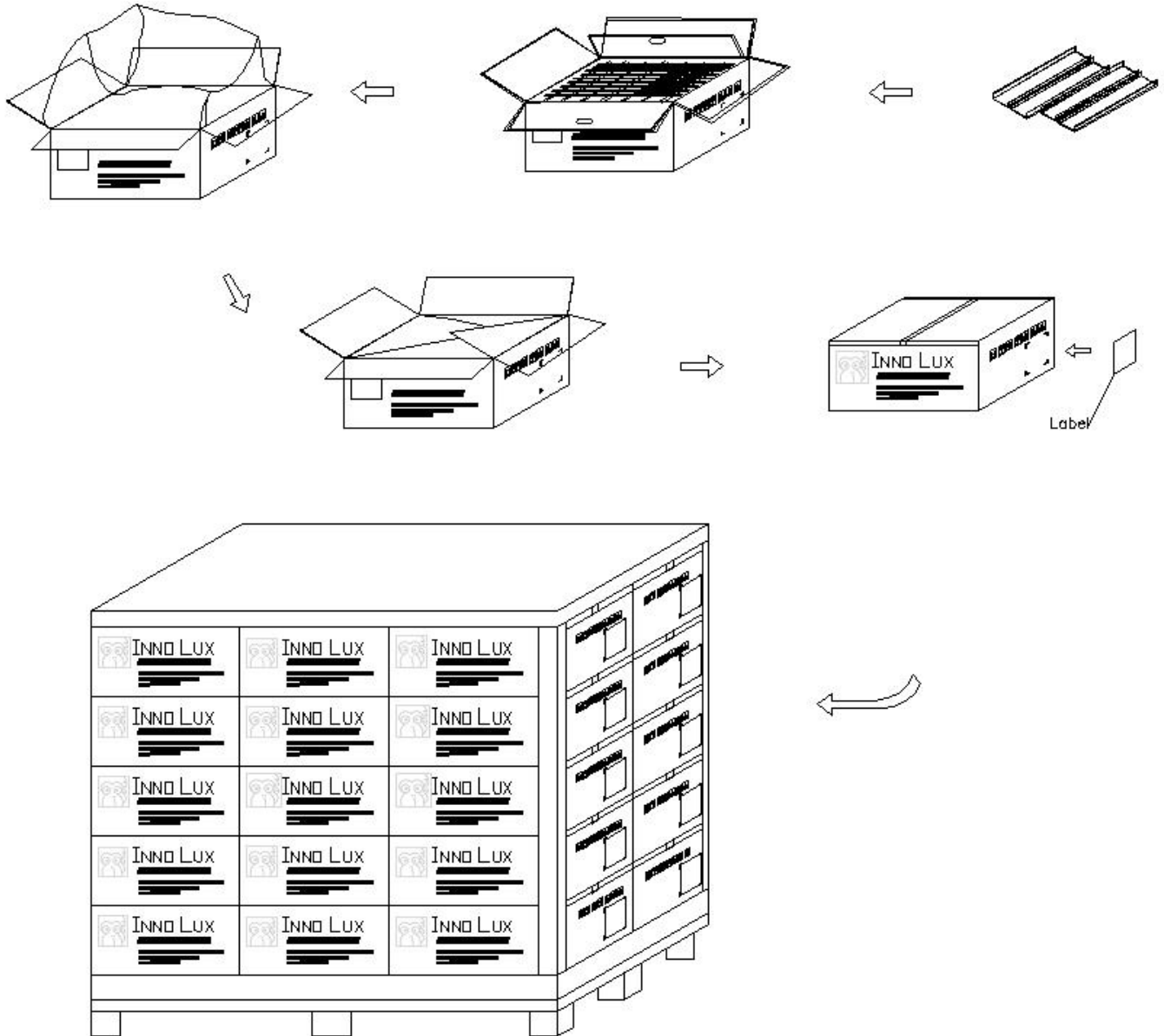
No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity (pcs)	Remark
1	LCM module	PT035TN01	78.2 ×65 ×3.5	0.033	260	
2	Corrugated Board-1	BC Corrugated Paper	510×343	0.130	2	
3	Corrugated Board-2	B Corrugated Paper	1152×512	0.26	1	
4	Corrugated Bar	B Corrugated Paper	343×104	0.020	12	
5	Partition	BC Corrugated Paper	512×343×106	1.045	2	
6	Dust-Proof Bag	PE	700×530	0.0604	1	
7	A/S Bag	PE	112×90	1.1108×10^{-3}	260	
8	Carton	Corrugated Paper	530×355×255	1.1	1	
9	Total weight	12.8± 5%Kg				

8.2. Packaging Quantity

(1) LCM quantity per Partition:	2 row x 21 pcs + 4 row x 22 pcs = 130 pcs
(2) Total LCM quantity in Carton:	2 layer x 130 pcs per Partition = 260 pcs

8.3. Packaging Drawing





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