Winstar Display Co., LTD
華凌光電股份有限公司
住址: 407 台中市中清路 163 號
No.163 Chung Ching RD.,
Taichune, Taiwan, R.O.C
WEB: http://www.winstar.com.tw
E-mail: sales@winstar.com.tw
Tel:886-4-24262208 Fax：886-4-24262207

SPECIFICATION

CUSTOMER : _____

MODULE NO.: **WF102ATIAGD0#000**

APPROVED BY: **(FOR CUSTOMER USE ONLY)**	**PCB VERSION:** **DATA:**

SALES BY	APPROVED BY	CHECKED BY	PREPARED BY

VERSION	DATE	REVISED PAGE NO.	SUMMARY
A	2011.12.09	27 5	Update Contour Drawing. &View Direction

Winstar Display Co., LTD
華凌光電股份有限公司

MODLE NO：

DOC. FIRST ISSUE

RECORDS OF REVISION

VERSION	DATE	REVISED PAGE NO.	SUMMARY
0	2011/04/19		First issue
A	2011.12.09	27 5	Update Contour Drawing. &View Direction

Contents

1.Module Classification Information

W F 102 A T I A G D 0#000
① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨⑩ ⑪

① Brand：WINSTAR DISPLAY CORPORATION
② Display Type：H→Character Type, G→Graphic Type F→TFT Type
③ Display Size：10.2” TFT
④ Model serials no.
⑤ Backlight Type： F→CCFL, White T→LED, White

⑥ LCD Polarize Type/ Temperature range/ Gray Scale Inversion Direction

A→Reflective, N.T, 6:00	H→Transflective, W.T,6:00
D→Reflective, N.T, 12:00	K→Transflective, W.T,12:00
G→Reflective, W. T, 6:00	C→Transmissive, N.T,6:00
J→Reflective, W. T, 12:00	F→Transmissive, N.T,12:00
B→Transflective, N.T,6:00	I→Transmissive, W. T, 6:00
E→Transflective, N.T.12:00	L→Transmissive, W.T,12:00

⑦ A: TFT LCD
B: TFT+FR+CONTROL BOARD
C: TFT+FR+A/D BOARD
D:TFT+FR+A/D BOARD+CONTROL BOARD

⑧ Solution: A: 128160 B:320234 C:320240 D:480234
G:800480
⑨ D: Digital A: Analog

⑩ Version

⑪ Special Code #:Fit in with ROHS directive regulations
00:Sales code 0:Version(Add TS)

General Specifications

No.	Item	Specification	Remark
1	LCD size	10.2 inch(Diagonal)	
2	Driver element	a-Si TFT active matrix	
3	Resolution	800 × 3(RGB) × 480	
4	Display mode	Normally white, Transmissive	
5	Dot pitch	0.0925(W) × 0.276(H) mm	
6	Active area	222.0(W) × 132.48(H) mm	
7	Module size	235.0(W) × 145.8(H) ×7.75(D) mm	Note 1
8	Surface treatment	Anti-Glare	
9	Color arrangement	RGB-stripe	
10	Interface	Digital	
11	Backlight power consumption	1.86W(Typ.)	
12	Panel power consumption	0.25W(Typ.)	
13	Weight	332g(Typ.)	
14	View Direction	12 o'clock	
15	Gray Scale Inversion Direction	6 o'clock	

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

2.1. TFT LCD Panel Driving Section

FPC connector is used for the module electronics interface. The recommended model is " AF 730L-A2G1T" manufactured by P-TWO.

Pin No.	Symbol	I/O	Function	Remark
1	POL	I	Polarity selection	
2	STVD	I/O	Vertical start pulse input when U/D= H	Note 1
3	OEV	I	Output enable	
4	CKV	I	Vertical clock	
5	STVU	I/O	Vertical start pulse input when U/D= L	Note 1
6	GND	P	Power ground	
7	EDGSL	I	Select rising edge or rising/falling edge	
8	V_{CC}	P	Power supply for digital circuit	
9	V9	I	Gamma voltage level 9	
10	V_{GL}	P	Gate OFF voltage	
11	V2	I	Gamma voltage level 2	
12	V_{GH}	P	Gate ON voltage	
13	V6	I	Gamma voltage level 6	
14	U/D	I	Up/down selection	Note 1,2
15	V_{COM}	I	Common voltage	
16	GND	P	Power ground	
17	AV_{DD}	P	Power supply for analog circuit	
18	V14	I	Gamma voltage level 14	
19	V11	I	Gamma voltage level 11	
20	V8	I	Gamma voltage level 8	
21	V5	I	Gamma voltage level 5	
22	V3	I	Gamma voltage level 3	
23	GND	P	Power ground	
24	R5	I	Red data(MSB)	
25	R4	I	Red data	
26	R3	I	Red data	
27	R2	I	Red data	
28	R1	I	Red data	

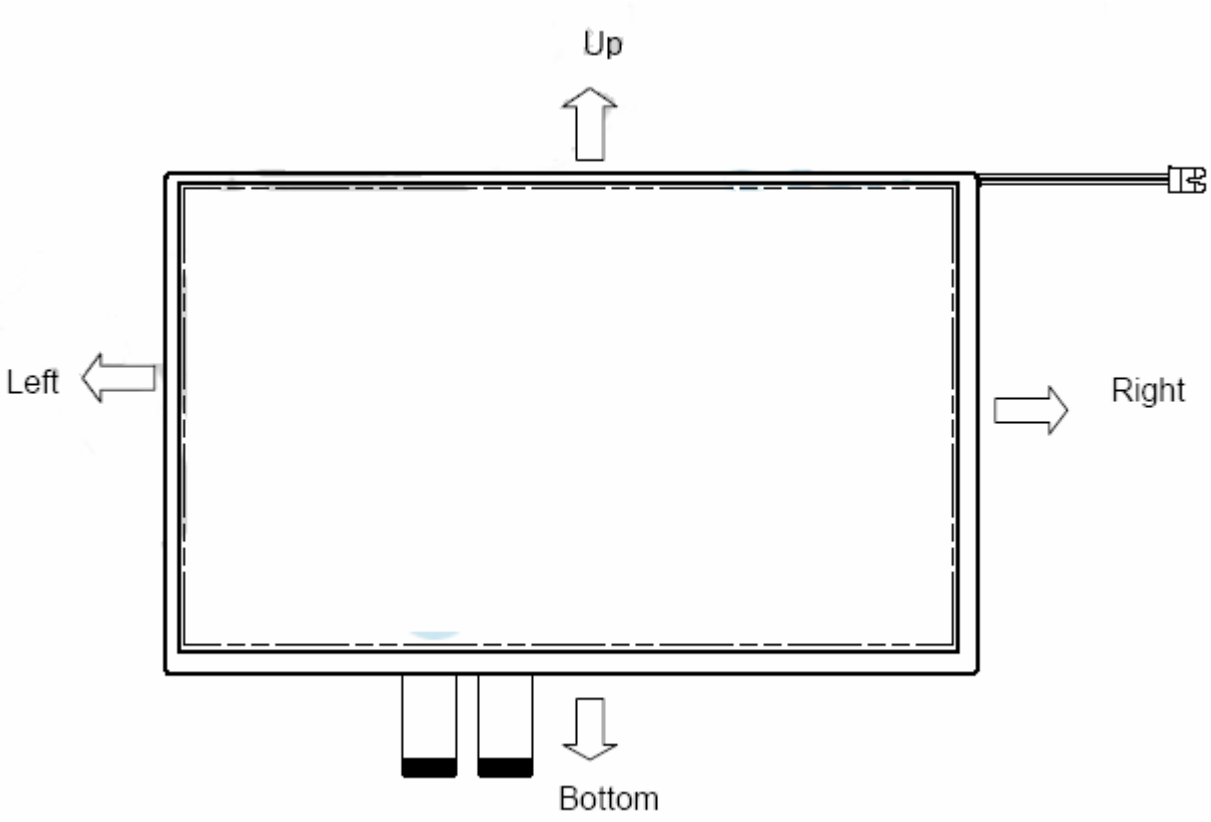
29	R0	I	Red data(LSB)	
30	GND	P	Power ground	
31	GND	P	Power ground	
32	G5	I	Green data(MSB)	
33	G4	I	Green data	
34	G3	I	Green data	
35	G2	I	Green data	
36	G1	I	Green data	
37	G0	I	Green data(LSB)	
38	STHL	I/O	Horizontal start pulse input when R/L = L	Note 1
39	REV	P	Control signal are inverted or not	Note 3
40	GND	I	Power ground	
41	DCLK	I	Sample clock	
42	V_{CC}	P	Power supply for digital circuit	
43	STHR	I/O	Horizontal start pulse input when R/L = H	Note 1
44	LD	I	Latches the polarity of outputs and switches the new data to outputs	
45	B5	I	Blue data (MSB)	
46	B4	I	Blue data	
47	B3	I	Blue data	
48	B2	I	Blue data	
49	B1	I	Blue data	
50	B0	I	Blue data (LSB)	
51	R/L	I	Right/ left selection	Note 1,2
52	V1	I	Gamma voltage level 1	
53	V4	I	Gamma voltage level 4	
54	V7	I	Gamma voltage level 7	
55	V10	I	Gamma voltage level 10	
56	V12	I	Gamma voltage level 12	
57	V13	I	Gamma voltage level 13	
58	AV_{DD}	P	Voltage for analog circuit	
59	GND	P	Power ground	
60	V_{COM}	I	Common voltage	

I: input, O: output, P: Power

Note 1: Selection of scanning mode

Setting of scan control input		IN/OUT state for start pulse				Scanning direction
U/D	R/L	STVD	STVU	STHR	STHL	
GND	VCC	O	I	I	O	Up to down, left to right
VCC	GND	I	O	O	I	Down to up, right to left
GND	GND	O	I	O	I	Up to down, right to left
VCC	VCC	I	O	I	O	Down to up, left to right

Note 2: Definition of scanning direction.
Refer to the figure as below:



Note 3: When REV=”L” , normally
REV=”H”, these data will be inverted.

2.2. Backlight Unit Section

LED Light Bar connector is used for the the integral backlight system. The recommended model is “BHSR-02VS-1” manufactured by JST.

Pin No.	Symbol	I/O	Function	Remark
1	V_{LED+}	P	Power for LED backlight anode	Pink
2	V_{LED-}	P	Power for LED backlight cathode	White

3. Operation Specifications

3.1. Absolute Maximum Rating

Item	Symbol	Values		Unit	Remark
		Min	Max		
Power voltage	VCC	-0.3	5	V	
	AVDD	-0.5	12	V	
	VGH	13	19	V	
	VGL	-12	-2	V	
	VGH-VGL	-	31	V	
Input signal voltage	V1~V7	-0.4AVDD	AV_{DD}-0.1	V	Note 1
	V8~V14	-0.3	$0.6AV_{DD}$	V	
Operation temperature	TOP	-30	80	°C	
Storage temperature	TST	-30	80	°C	
LED Reverse Voltage	VR	-	1.2	V	Each LED Note 3
LED Forward Current	IF	-	25	MA	Each LED

Note 1: AV_{DD} - 0.1≧V1≧V2≧V3≧V4≧V5≧V6≧V7≧V8≧V9≧V10>V11≧V12≧V13≧V14≧AVSS + 0.1

Note 2: 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 3: Vr conditions: Zener Diode 20mA.

3.1.1 Typical Operation Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ	Max		
Power voltage	V_{CC}	3.0	3.3	3.6	V	
	AV_{DD}	9.0	9.2	9.4	V	
	V_{GH}	15.3	16.0	16.7	V	
	V_{GL}	-7.7	-7.0	-6.3	V	
Input signal voltage	V_{COM}	3.65	3.85	4.05	V	(V1+V14)/2 =4.5V
	V1~V7	0.4 AV_{DD}	-	AV_{DD} -0.1	V	
	V8~V14	0.1	-	0.6 AV_{DD}	V	
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: Be sure to apply GND, V_{CC}, and V_{GL}, to the LCD first, and then apply V_{GH}.

3.1.2 Current Consumption

Item	Symbol	Values			Unit	Remark
		Min.	Typ	Max		
Current for Driver	I_{GH}	-	0.3	0.5	mA	V_{GH} =16V
	I_{GL}	-	0.2	1.0	mA	V_{GL} = -7V
	I_{CC}	-	4	10	mA	V_{CC} =3.3V
	IAV_{DD}	-	25	50	mA	AV_{DD} =9.2V

3.1.3 Backlight Driving Conditions

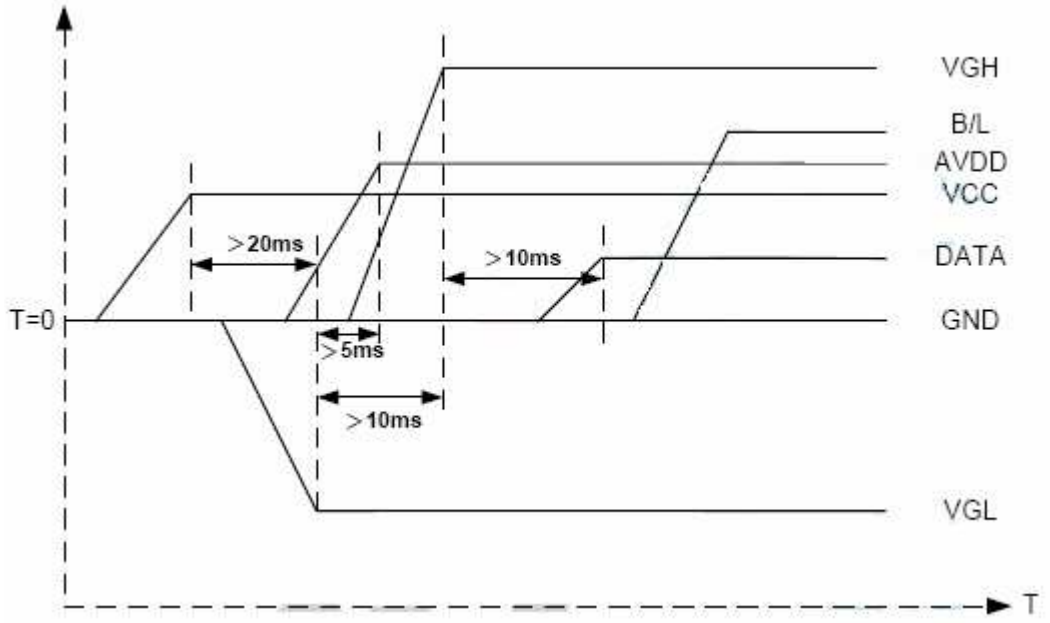
Item	Symbol	Values			Unit	Remark
		Min.	Typ	Max		
LED forward voltage	V_L	8.4	9.3	10.5	V	Note 1
LED forward current	I_L	180	200	220	mA	
LED life time	-	20,000	-	-	Hr	Note 2

Note 1: The LED Supply Voltage is defined by the number of LED at Ta=25℃ and I_L =200mA.

Note 2: The " LED life time" is defined as the module brightness decrease to 50% original
brightness at Ta=25℃ and I_L =200mA. The LED lifetime could be decreased if operating I_L is larger than 200 mA.

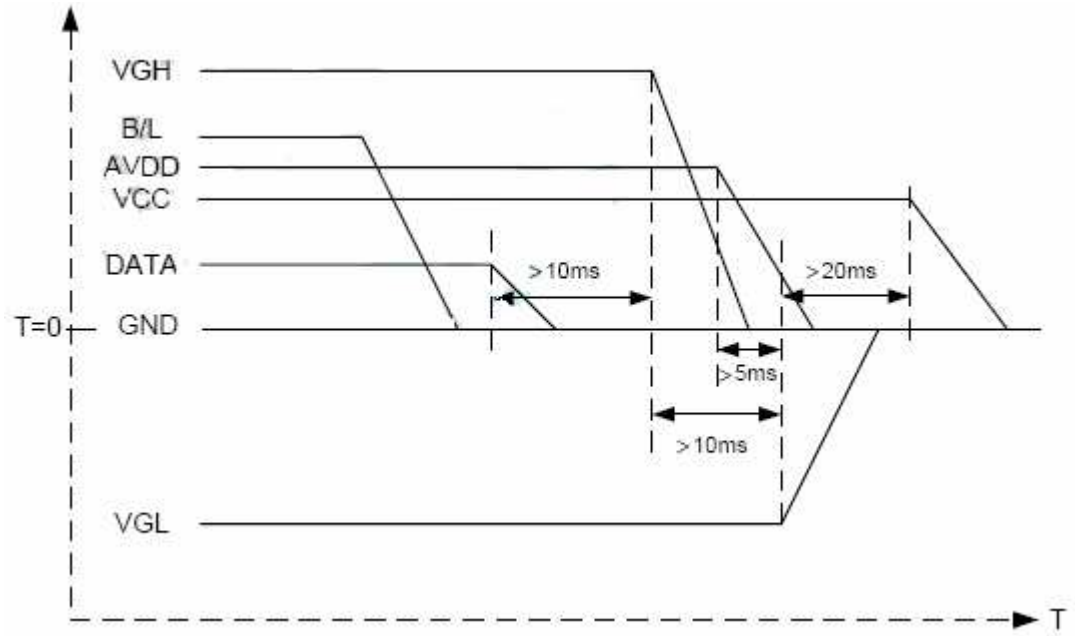
3.2 Power Sequence

3.2.1 Power on:



VCC→ VGL→ AVDD→ VGH→ Data→ B/L

3.2.2 Power off:



B/L→ Data→ VGH→ AVDD→ VGL→ VCC

Note: Data includes POL, STVD, OEV, CKV, STVU, EDGSL, STHL, REV, DCLK, , STHR, LD.

3.3 Timing Characteristics

3.3.1 Timing Conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
DCLK frequency	F_{dclk}	-	40	45	MHz	
DCLK cycle	T_{cph}	22	25	-	ns	
DCLK pulse width	T_{cw}	8	-	-	ns	
Data set-up time	T_{su}	4	-	-	ns	
Data hold time	T_{hd}	2	-	-	ns	
Time that the last data to LD	T_{ld}	1	-	-	Tcph	
Pulse width of LD	T_{wld}	2	-	-	Tcph	
Time that LD to STHL/R	T_{lds}	5	-	-	Tcph	
POL set-up time	T_{psu}	6	-	-	ns	
POL hold time	T_{phd}	6	-	-	ns	
CKV frequency	F_{vclk}	-	-	200	KHz	
CKV rise time	T_{rck}	-	-	100	ns	
CKV falling time	T_{fck}	-	-	100	ns	
CKV pulse width	P_{WCLK}	500	-	-	ns	
Horizontal display timing range	T_{dh}	-	800	-	Tcph	
Horizontal timing range	T_{h}	-	1056	-	Tcph	
STVU/D setup time	T_{suv}	200	-	-	ns	
STVU/D hold time	T_{hdv}	300	-	-	ns	
STVU/D delay time	T_{dt}	-	-	500	ns	
Driver output delay time	T_{do}	-	-	900	ns	
Output rise time	T_{tlh}	-	500	1000	ns	
Output falling time	T_{thl}	-	400	800	ns	
OEV pulse width	T_{wcl}	1	-	-	us	
OEV to Driver output delay time	T_{oe}	-	-	900	ns	
Horizontal lines per field	T_{v}	512	525	610	Line	
Vertical display timing range	T_{vd}	-	480	-	Line	

3.3.2 Timing Diagram

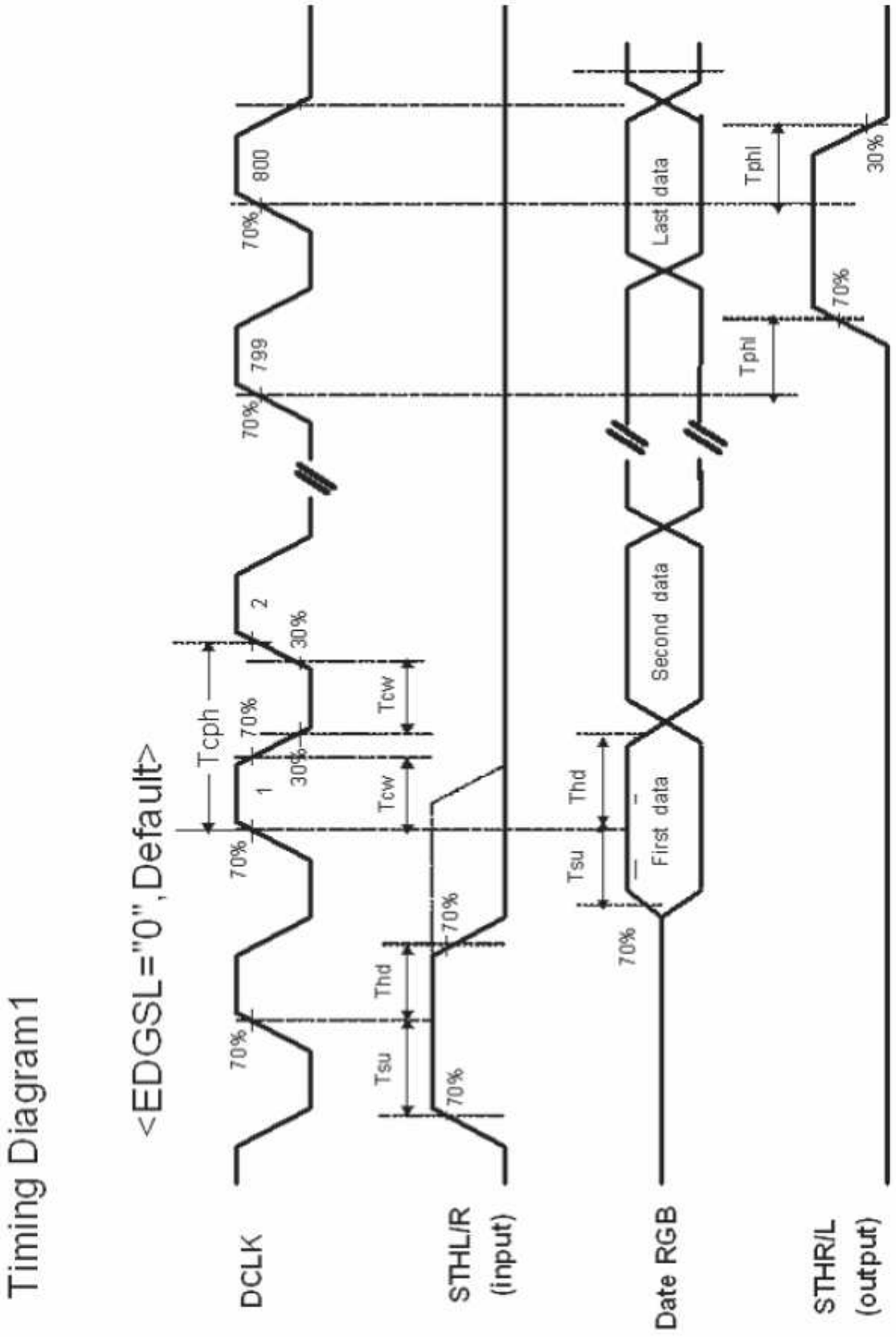


Fig.3-1 operation model 1

< EDGSL ="1">

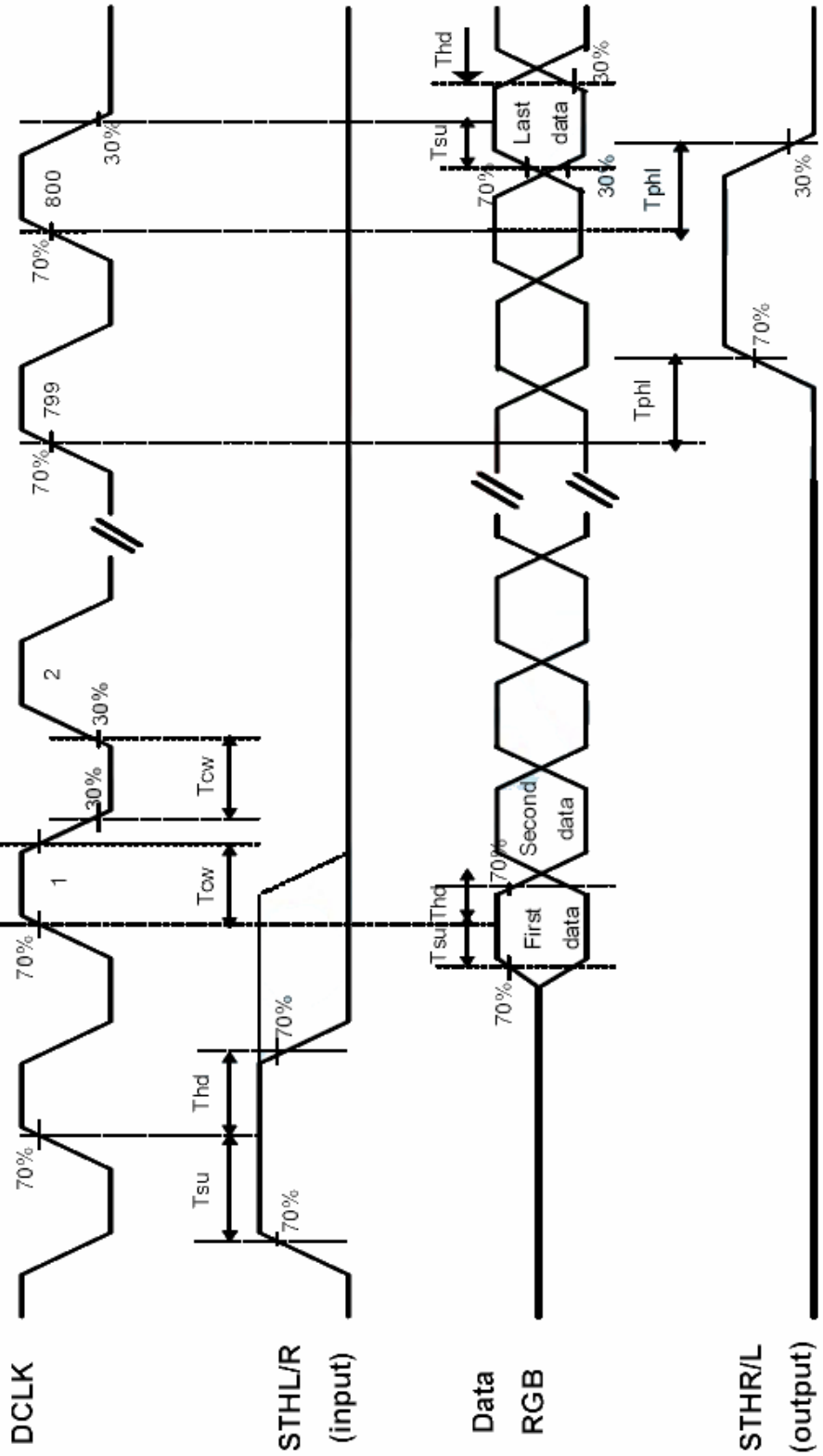


Fig.3-2 operation model 2

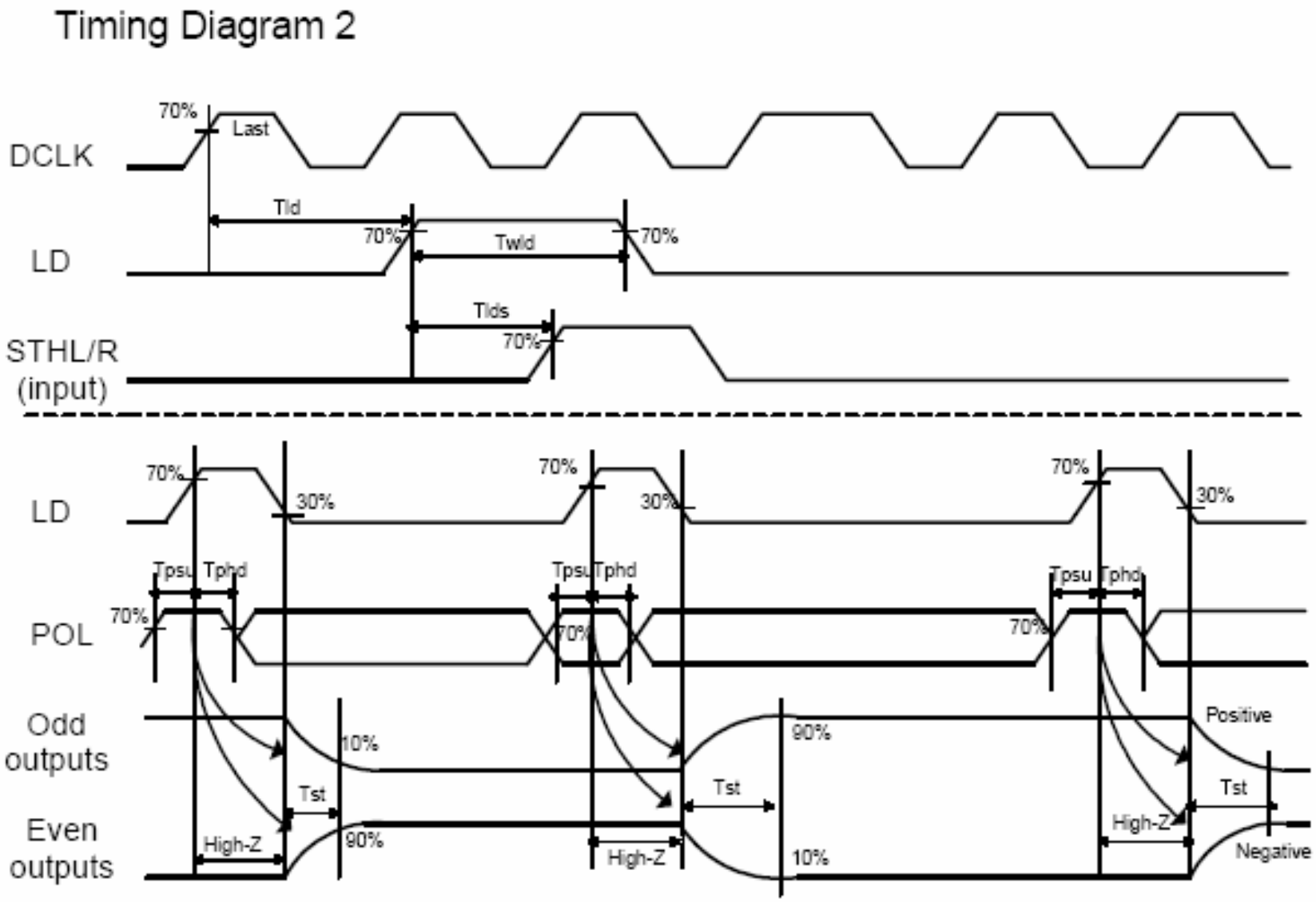


Fig.3-3 Horizontal timing 1

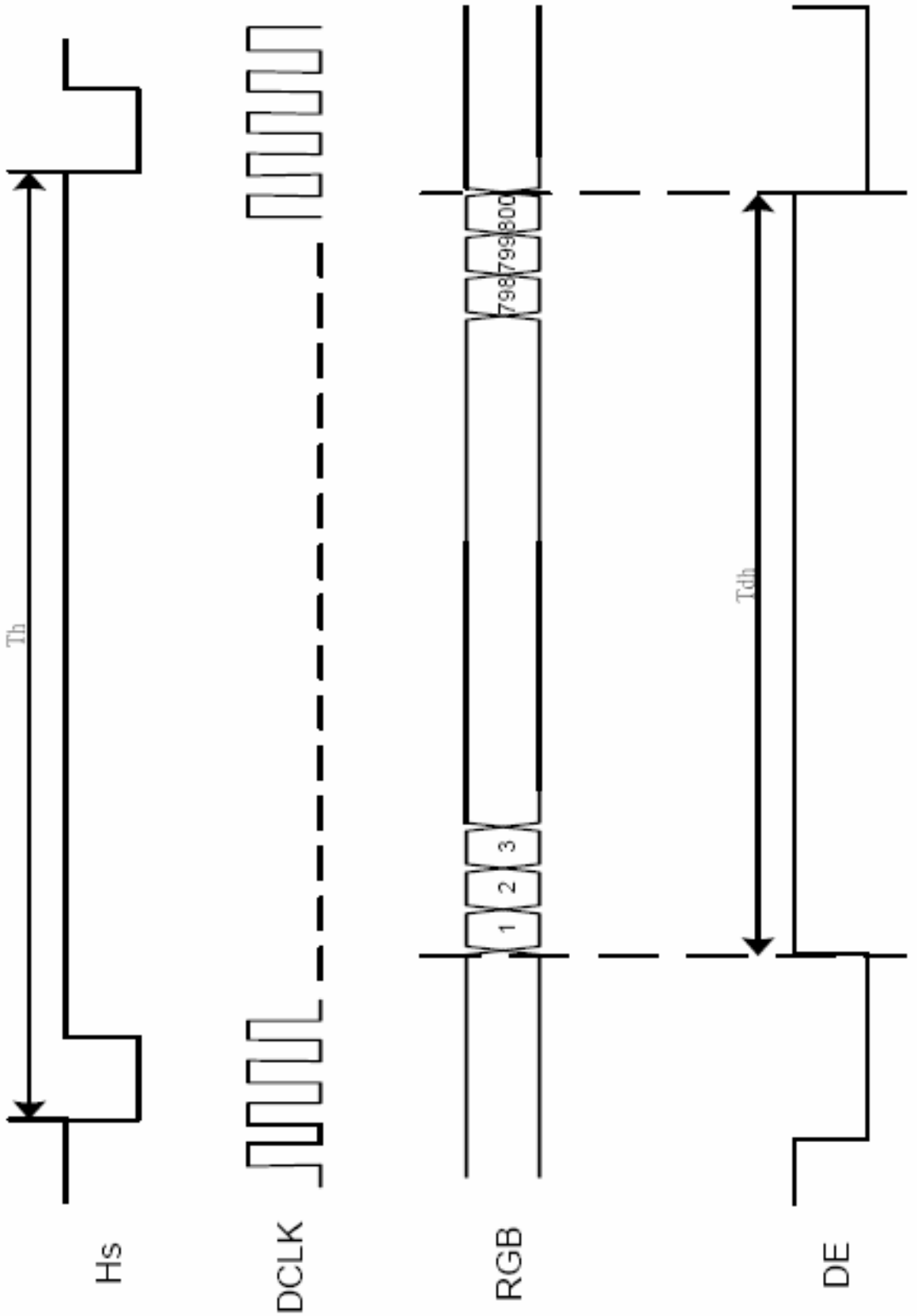


Fig.3-4 Horizontal timing 2

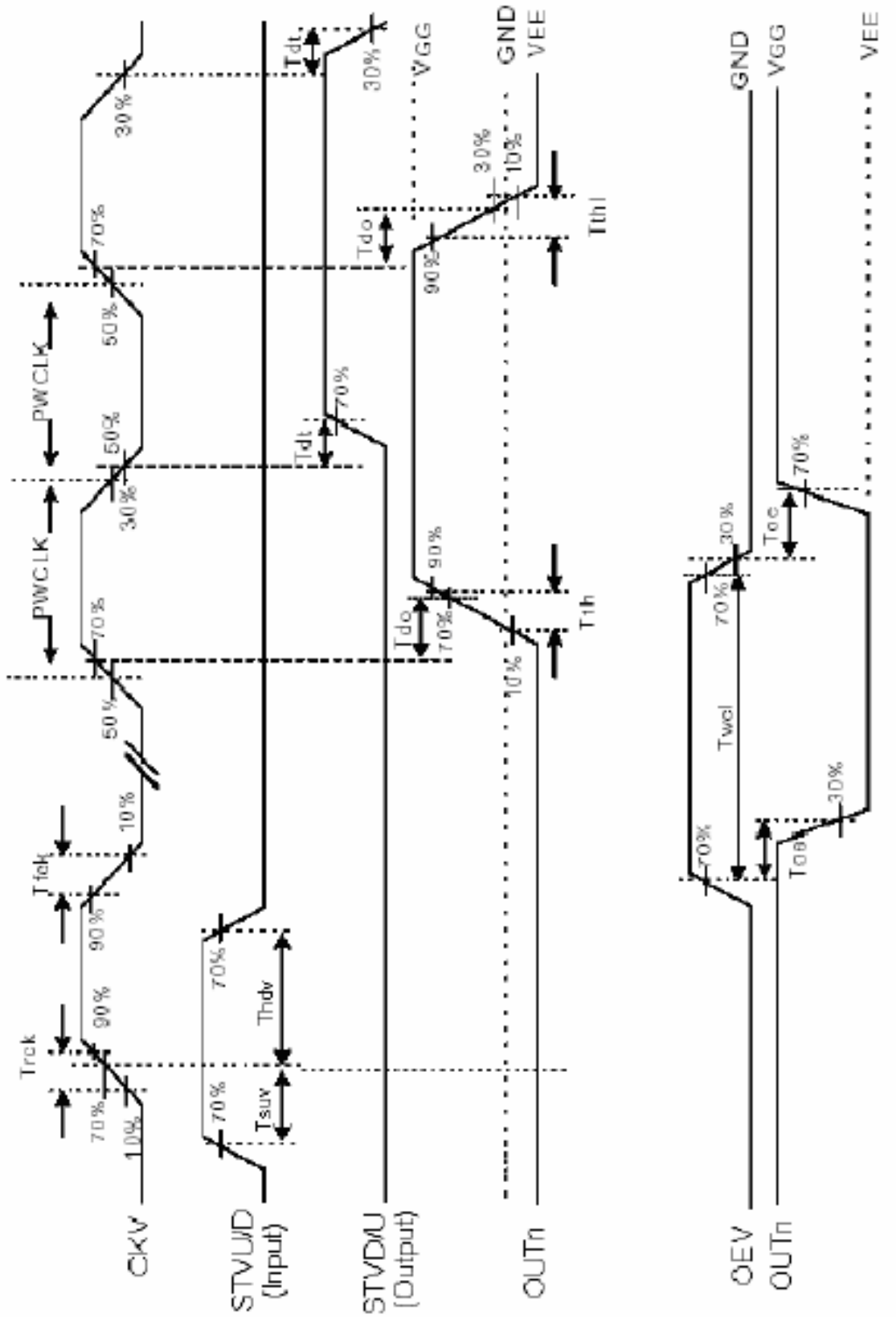


Fig.3-5 Vertical shift clock timing

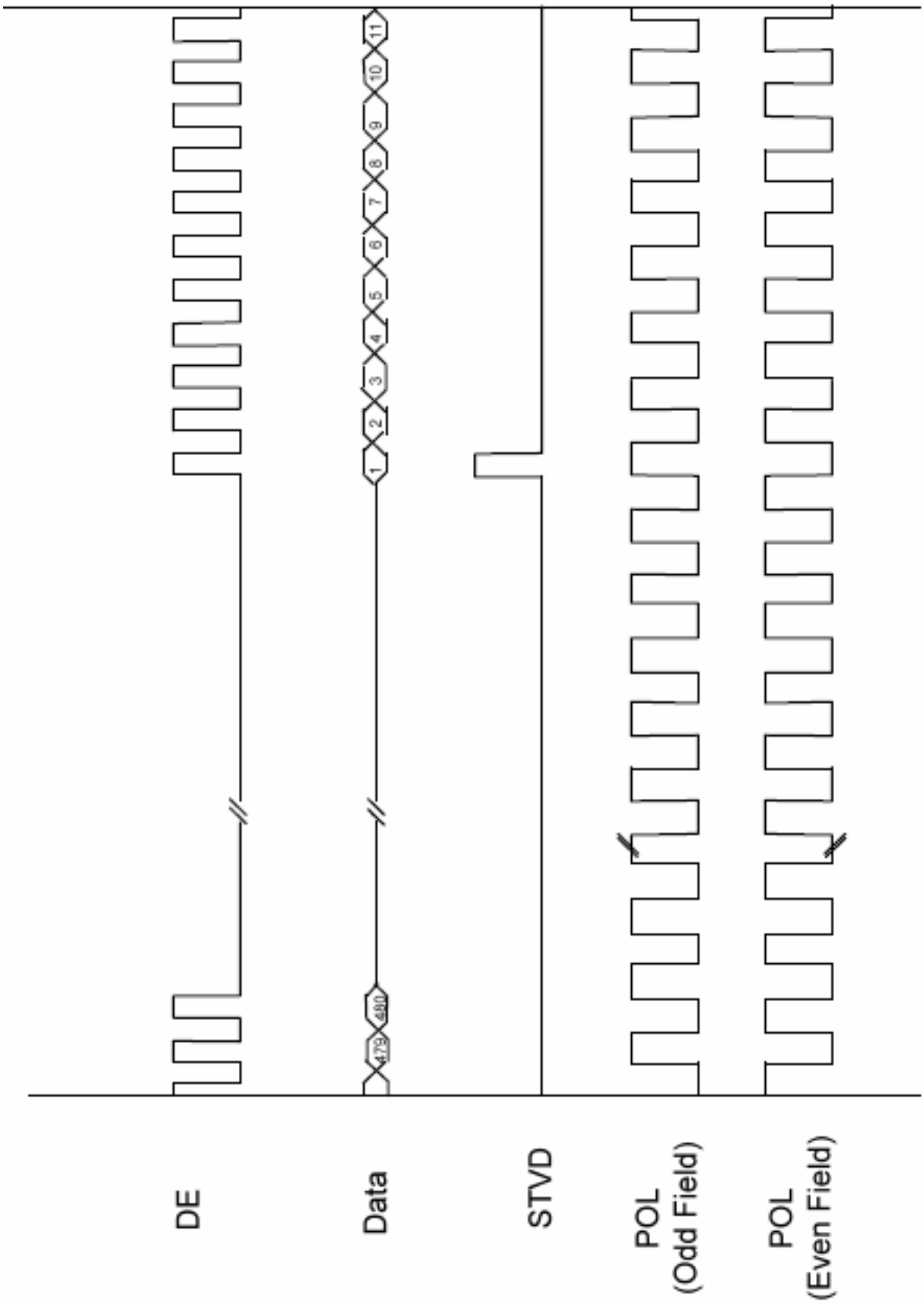


Fig.3-6 Vertical timing (from up to down)

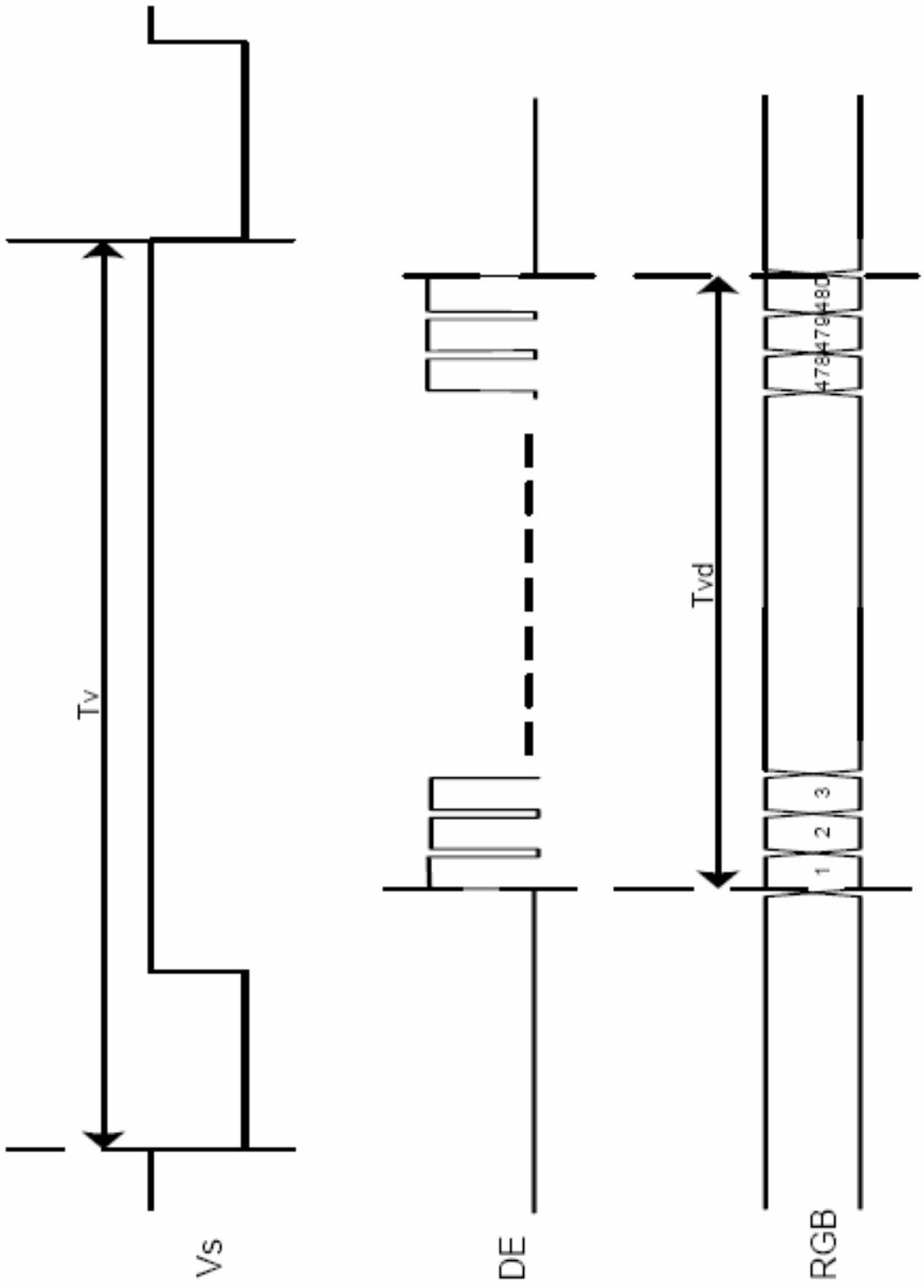


Fig.3-7 Vertical timing

4. Optical Specifications

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Response time		TON	θ=0°	-	15	30	ms	Note 3
		TOFF		-	20	40	ms	
Contrast ratio		CR		250	300	-	-	Note 4
Color Chromaticity	White	Wx		0.26	0.31	0.36	%	Note 2,5,6
		Wy		0.28	0.33	0.38		
Viewing Angle	Hor.	θ R	θ=180°	55	65	-	Degree	Note 1
		θ L	θ=0°	55	65	-		
	Ver.	θ T	θ=90°	35	45	-		
		θ B	θ=2700°	55	65	-		
Luminance		L	θ=0°	180	250	-	cd/m2	Note 6
Luminance uniformity		YU	θ=0°	70	75		%	Note 7

Test Conditions:

1. VCC=3.3V, IL=200mA (Backlight current), the ambient temperature is 25℃.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

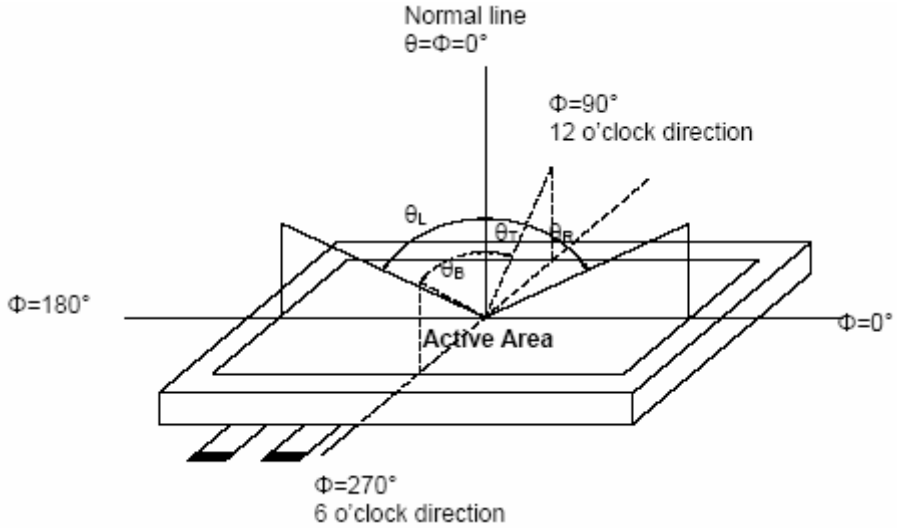


Fig. 4-1 Definition of viewing angle

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.)

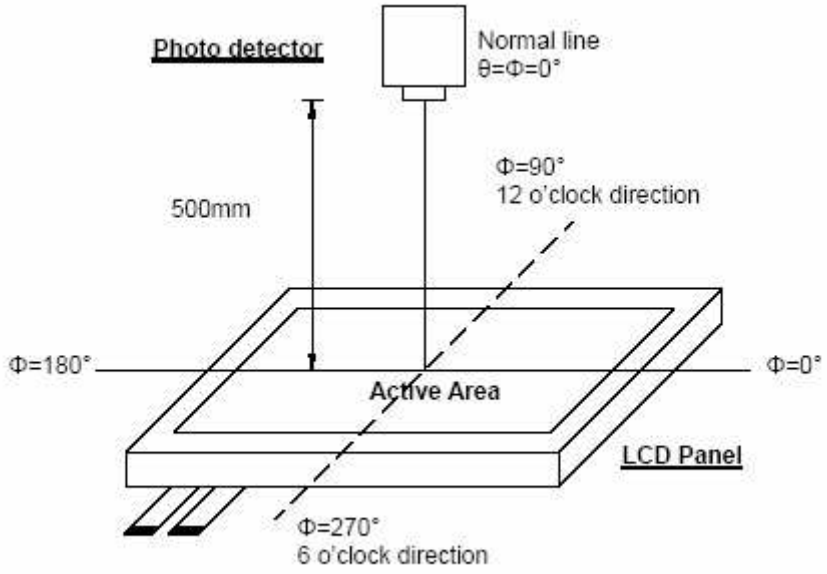


Fig. 4-2 Optical measurement system setup

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%.

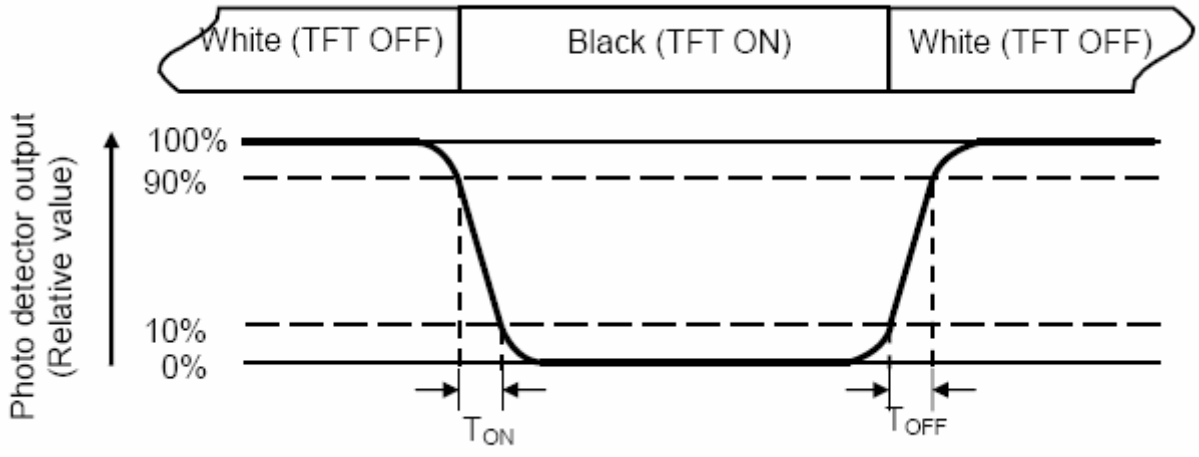


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

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. The LED driving condition is I_L=200mA.

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.

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

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

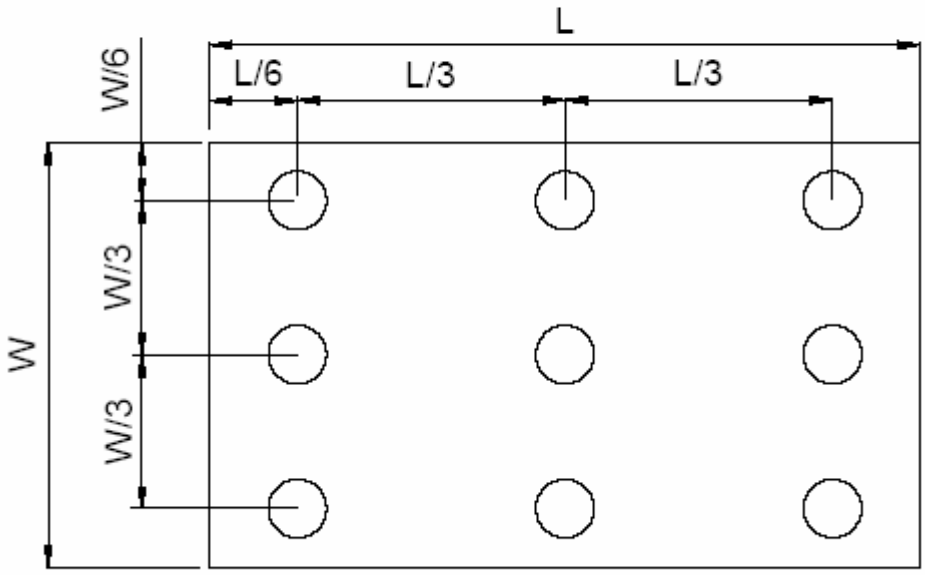


Fig. 4-4 Definition of measuring points

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

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

5. General Precautions

5.1 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.

5.2 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.

5.3 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.

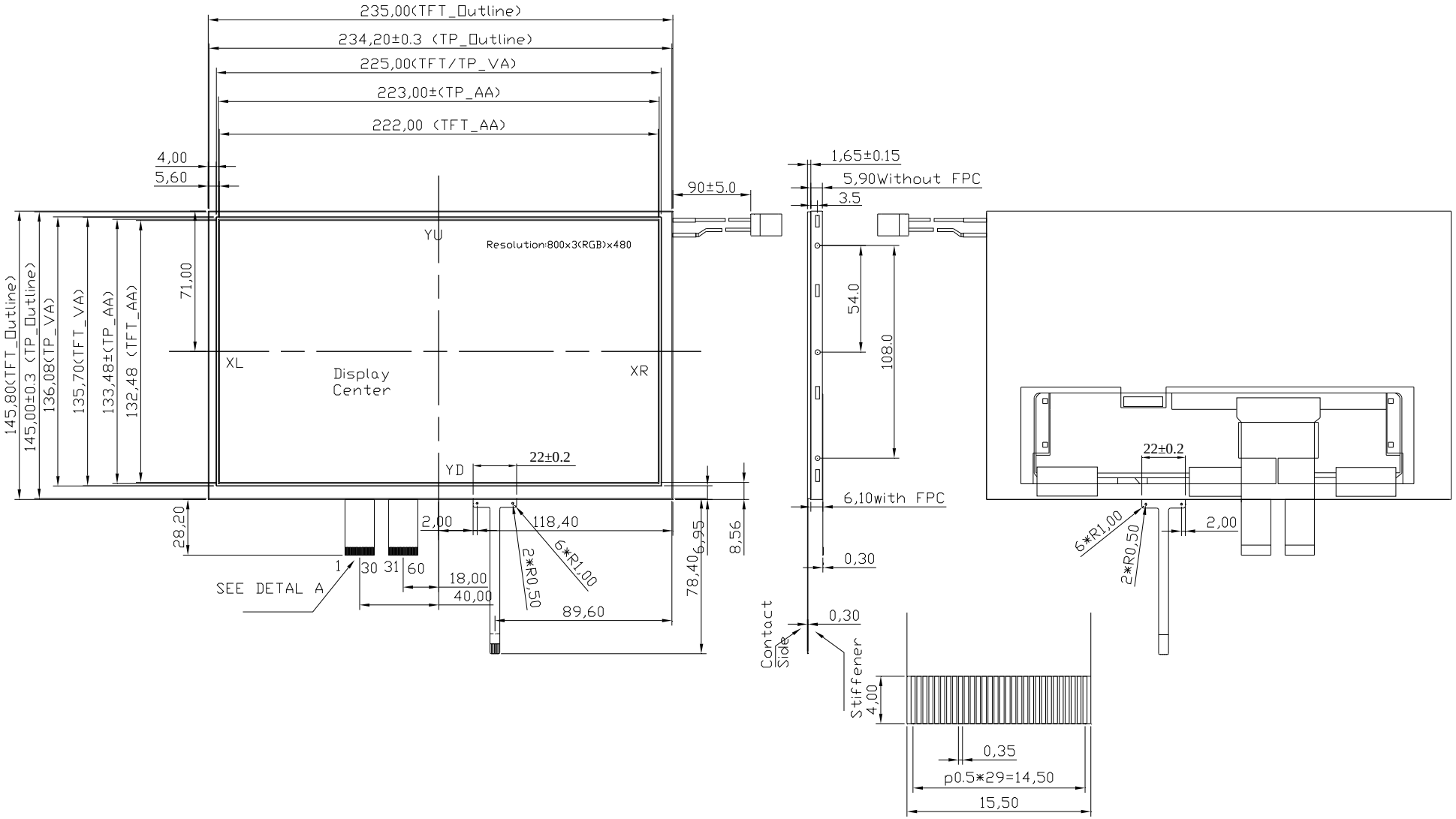
5.4 Storage

1. Store the module in a dark room where must keep at +25±10℃ 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.

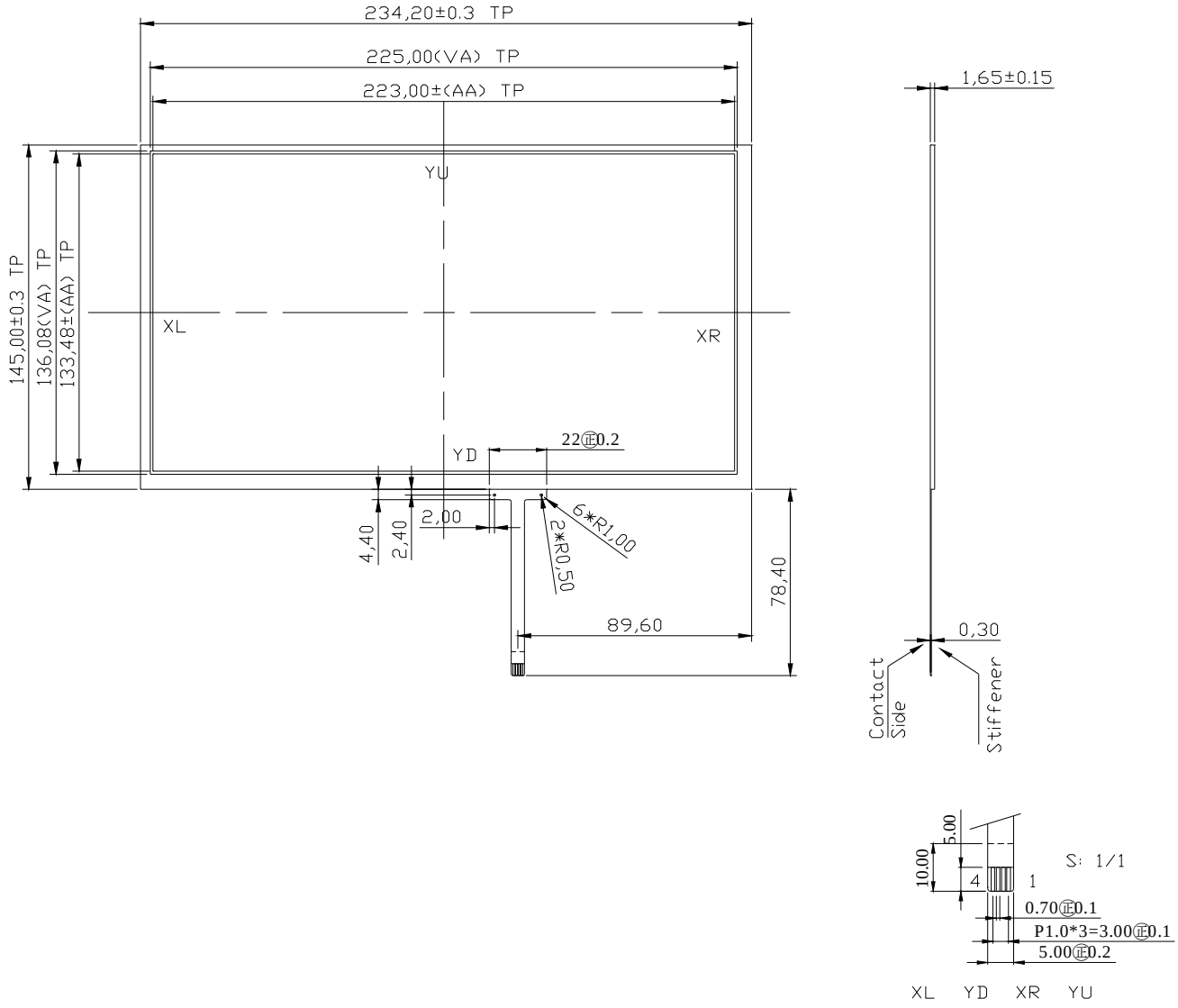
5.5 Cleaning

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.

6. Mechanical Drawing



7.Touch panel Information



Non-Proper Ways to handle the touch screen

1. Do not pull or crease the tail of the touch screen.
2. Tails, unless the drawing calls out for a bend, are to be free of permanent creases in the polyester, slight crease lines in the adhesive tail cover are allowed

8.Reliability Test

WIDE TEMPERATURE RELIABILITY TEST

NO.	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80℃	240 Hrs		Appearance without defect	
2	Low Temp. Storage	-30℃	240 Hrs		Appearance without defect	
3	High Temp. & High Humidity. Storage	60 ℃ 90%RH	240 Hrs		Appearance without defect	
4	High Temp. Operating Display	80℃	240 Hrs		Appearance without defect	
5	Low Temp. Operating Display	-30℃	240 Hrs		Appearance without defect	
6	Thermal Shock	-30 ℃, 30min. → 80℃, 30min. (1cycle)			Appearance without defect	100 cycles

Inspection Provision

1.Purpose

The WINSTAR inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of WINSTAR LCD produces.

2.Applicable Scope

The WINSTAR inspection provision is applicable to the arrangement in regard to outgoing inspection and quality assurance after outgoing.

3.Technical Terms

3-1 WINSTAR Technical Terms

4.Outgoing Inspection

4-1 Inspection Method

MIL-STD-105E Level Ⅱ Regular inspection

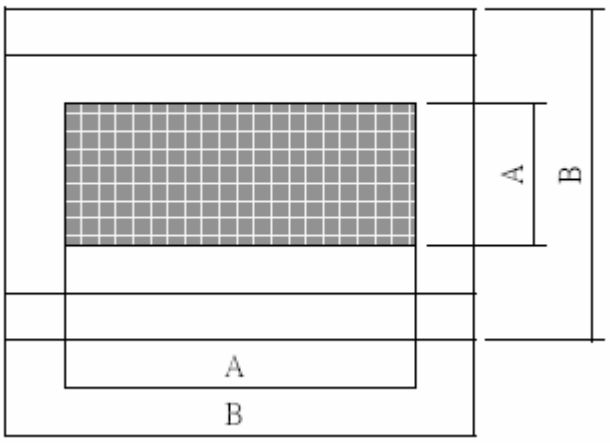
4-2 Inspection Standard

	Item		AQL(%)	Remarks
Major Defect	Dots	Opens Shorts Erroneous operation	0.4	Faults which substantially lower the practicality and the initial purpose difficult to achieve
	Solder appearance	Shorts Loose		
	Cracks	Display surface cracks		
	Dimensions	External from Dimensions	0.4	
Minor Defect	Inside the glass	Black spots	0.65	Faults which appear to pose almost no obstacle to the practicality, effective use, and operation
	Polarizing plate	Scratches, foreign Matter, air bubbles, and peeling		
	Dots	Pinhole, deformation		
	Color tone	Color unevenness		
	Solder appearance	Cold solder Solder projections		

4-3 Inspection Provisions

*Viewing Area Definition

Fig. 1



A : Zone Viewing Area

B : Zone Glass Plate Outline

*Inspection place to be 500 to 1000 lux illuminance uniformly without glaring.
The distance between luminous source(daylight fluorescent lamp and cool white fluorescent lamp) and sample to be 30 cm to 50 cm.

*Test and measurement are performed under the following conditions, unless otherwise specified.

Temperature 20 ± 15℃

Humidity 65 ± 20%R.H.

Pressure 860~1060hPa(mmbar)

In case of doubtful judgment, it is performed under the following conditions.

Temperature 20 ± 2℃

Humidity 65 ±5%R.H.

Pressure 860~1060hPa(mmbar)

5.Specification for quality check

5-1-1 Electrical characteristics :

NO.	Item	Criterion
1	Non operational	Fail
2	Miss operating	Fail
3	Contrast irregular	Fail
4	Response time	Within Specified value

5-1-2 Components soldering :

Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mounting position, etc.

5-2 Inspection Standard for TFT panel

5-2-1 The environmental condition of inspection :

The environmental condition and visual inspection shall be conducted as below.

(1) Ambient temperature : 25±5℃

(2) Humidity : 25~75% RH

(3) External appearance inspection shall be conducted by using a single 20W fluorescent lamp or equivalent illumination.

(4) Visual inspection on the operation condition for cosmetic shall be conducted at the distance 30cm or more between the LCD panels and eyes of inspector. The viewing angle shall be 90 degreeto the front surface of display panel.

(5) Ambient Illumination : 300~500 Lux for external appearance inspection.

(6) Ambient Illumination : 100~200 Lux for light on inspection.

5-2-2 Inspection Criteria

(1) Definition of dot defect induced from the panel inside

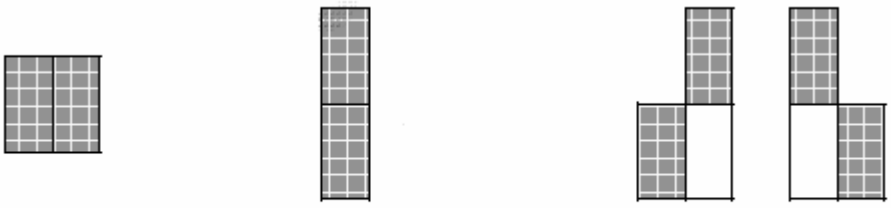
a) The definition of dot : The size of a defective dot over 1/2 of whole dot is regarded as one defective dot

b) Bright dot : Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

c) Dark dot : Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue pattern.

d) 2 dot adjacent = 1 pair = 2 dots

Picture :



2 dot adjacent　　2 dot adjacent (vertical)　　2 dot adjacent (slant)

(2) Display Inspection

NO.	Item			Acceptable Count
1	Dot defect	Bright Dot	Random	N ≦ 2
			2 dots adjacent	N ≦ 0
		Dark Dot	Random	N ≦ 3
			2 dots adjacent	N ≦ 1
		Total bright and dark dot		N ≦ 4
	Functional failure (V-line/ H-line/Cross line etc.)			Not allowable
	Mura	It's OK if mura is slight visible through 6% ND filter. (Judged by limit sample if it is necessary)		
2	Newton ring (touch panel)	Orbicular of interference fringes is not allowed in the optimum contrast within the active area under viewing angle.		

(3) Appearance inspection

NO.	Item	Standards
1	Panel Crack	Not allow. It is shown in Fig.1.
2	Broken CF Non -lead Side of TFT	The broken in the area of W > 2mm is ignored, L is ignored. It is shown in Fig.2.
3	Broken Lead Side of TFT	FPC lead, electrical line or alignment mark can't be damaged. It is shown in Fig.3.
4	Broken Corner of TFT at Lead Side	FPC lead. electrical line or alignment mark can't be damaged. It is shown in Fig.4.
5	Burr of TFT / CF Edge	The distance of burr from the edge of TFT / CF, W ≦ 0.3mm. It is shown in Fig.5.
6	Foreign Black / White/Bright Spot	(1) 0.15 < D ≦ 0.5 mm, N≦ 4 ; (2) D ≦ 0.15mm, Ignore. It is shown in Fig.6.
7	Foreign Black / White/Bright Line	(1) 0.05<W≦ 0.1 mm, 0.3<L≦2 mm, N≦ 4.
		(2) W ≦ 0.05mm and L≦ 0.3mm Ignore.
		It is shown in Fig.7.
8	Color irregular	Not remarkable color irregular.

Fig 1.

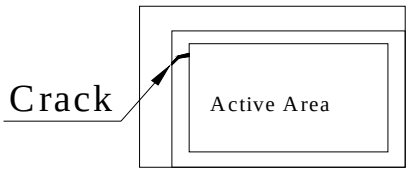


Fig 2.

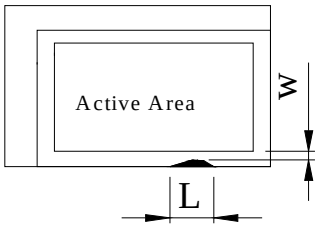


Fig 3.

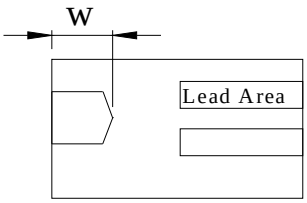


Fig 4.

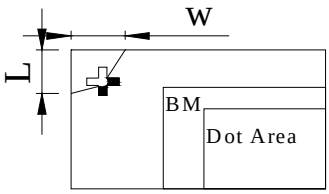


Fig 5.

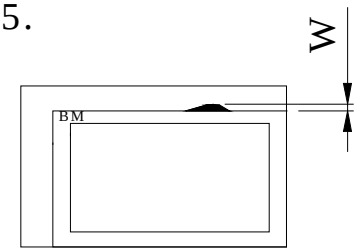
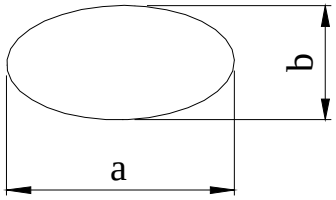


Fig 6.



D=(a+b)/2

Fig 7.

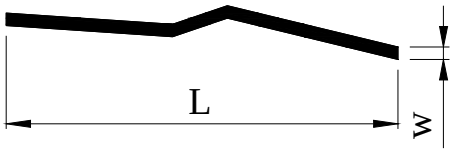
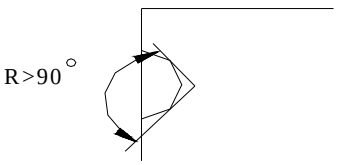


Fig8.



Notes
1.W:Widh
2.Lengh
3.D:Average Diameter
4.N:Count
5.All the anhle of the broken must be larger than 90～.It is shown in Fig.8.(R>90～)

NOTICE:

- SAFETY

1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING

1. Avoid static electricity which can damage the CMOS LSI.
2. Do not remove the panel or frame from the module.
3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
5. Do not use ketonics solvent & Aromatic solvent. Use a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE

1. Store the panel or module in a dark place where the temperature is 25±5℃ and the humidity is below 65% RH.
2. Do not place the module near organics solvents or corrosive gases.
3. Do not crush, shake, or jolt the module.

- TERMS OF WARRANT

1. Acceptance inspection period

The period is within one month after the arrival of contracted commodity at the buyer's factory site.

2. Applicable warrant period

The period is within twelve months since the date of shipping out under normal using and storage conditions.