Version: 5.0

TECHNICAL SPECIFICATION

MODEL NO : PM070WX5

The content of this information is subject to be changed without notice.
Please contact E Ink or its agent for further information.

☐Customer's Confirmation

Customer _____

Date _____

By _____

☐E Ink's Confirmation

Confirmed By _____

Prepared By _____

Revision History

Rev.	Issued Date	Revised Contents
1.0	22.Dec,2006	Release version
2.0	Apr.01, 2008	Page 7 5. Input / Output Terminals Modify Note Page 26 Add 14. Handling Cautions d) Please following the tear off direction as figure 14-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized.
3.0	Aug.13 , 2009	Modify Page 29 16.Packing Diagram
4.0	Dec.02 , 2010	**Modify** Change company's name Page 5 4. Mechanical Drawing of TFT-LCD module Add outline drawing mask
5.0	July.28.2011	Update to E Ink logo

TECHNICAL SPECIFICATION

CONTENTS

1.Application

This data sheet applies to a color TFT LCD module, PM070WX5.

PM070WX5 module applies to OA product, portable DVD, car TV(must use Analog to Digital driving board), which requires high quality flat panel display. If you must use in severe reliability environment, please don't extend over EIH's reliability test conditions.

If you use PM070WX5, Prime View advises your systems use EIHI's timing controller IC (PVI-2003A) which will generate proper timing signals to control PM070WX5.

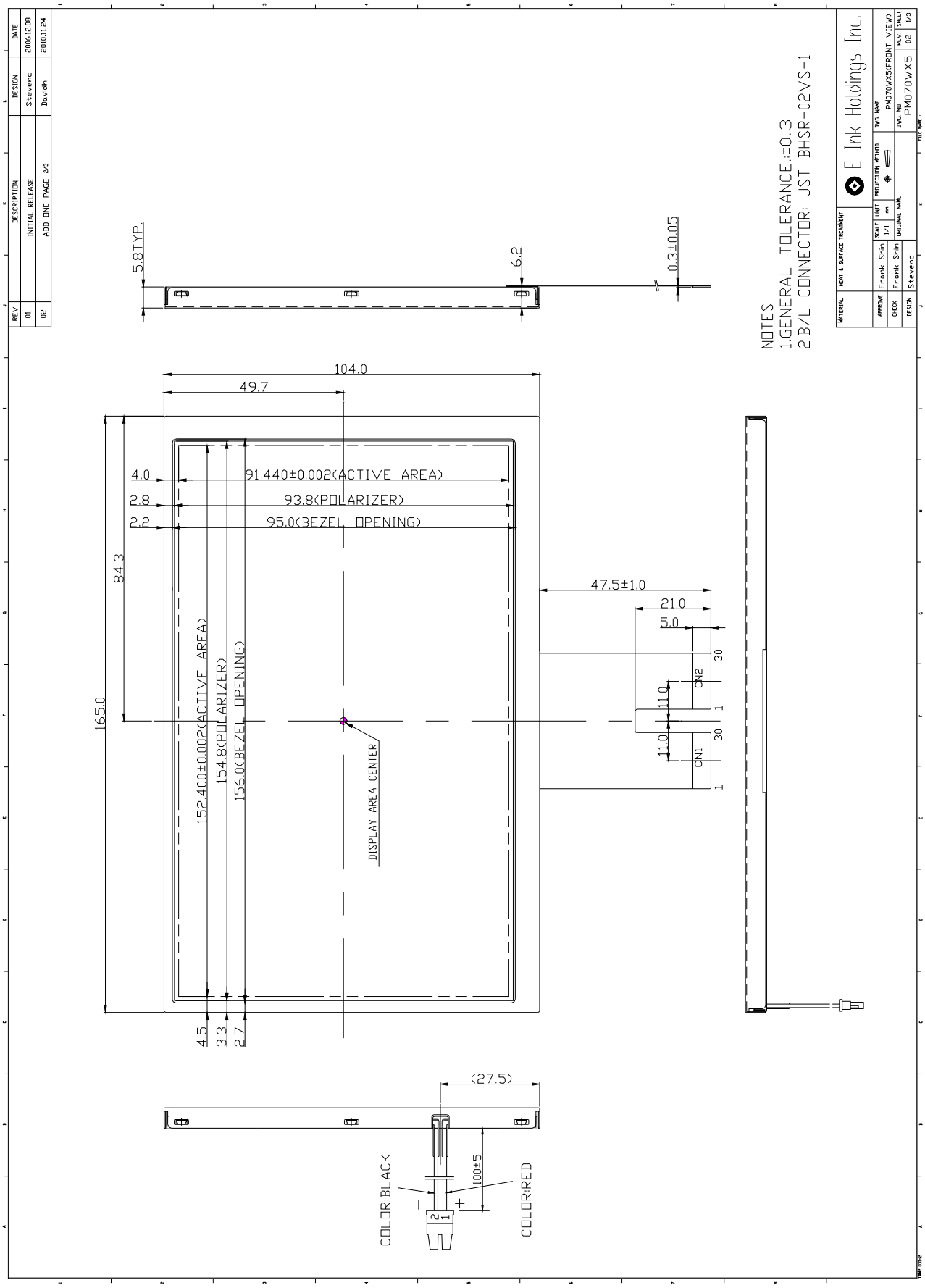
2. Features

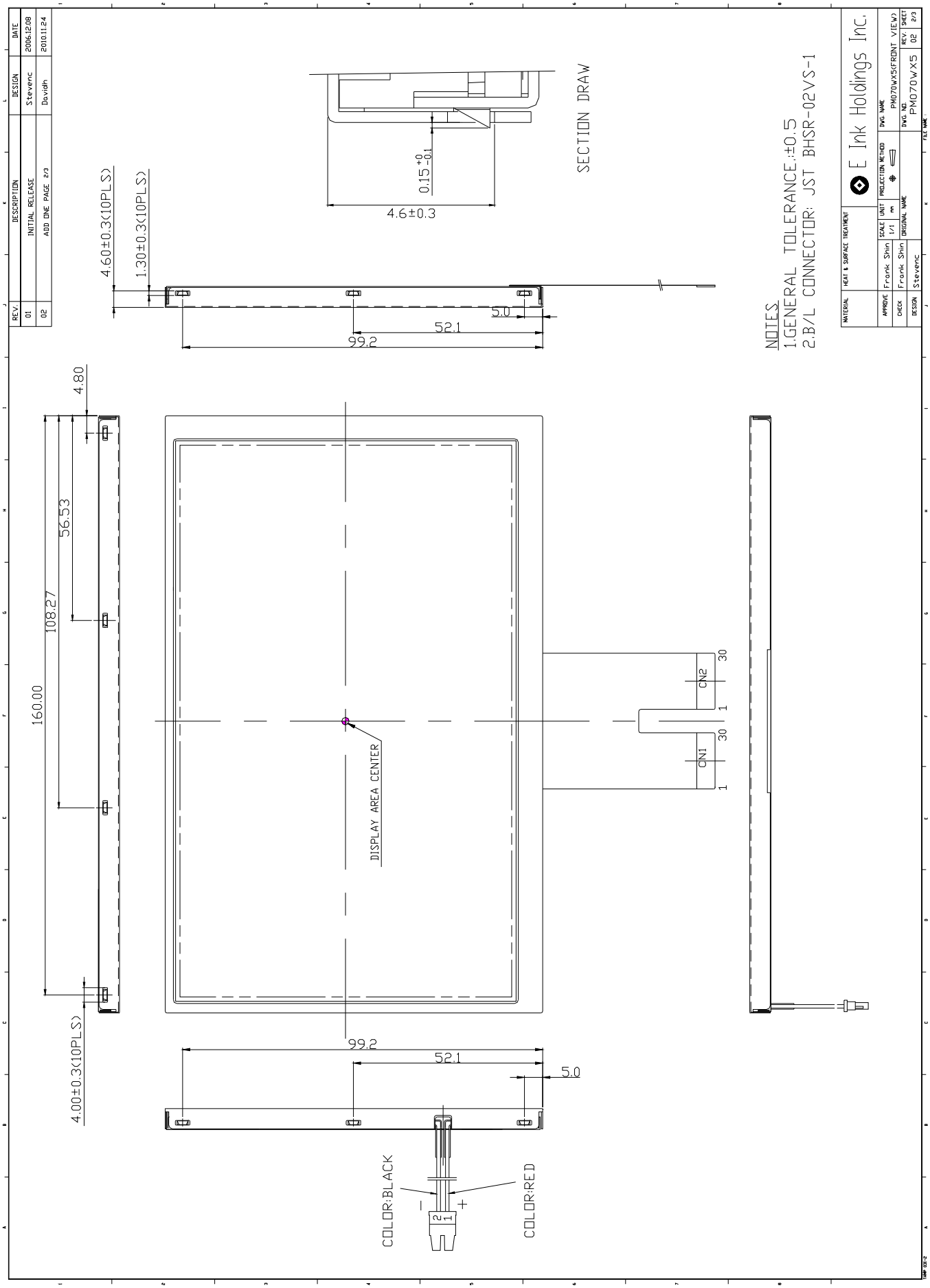
. Wide VGA (800*480 pixels) resolution
. Amorphous silicon TFT LCD panel with LED back-light unit
. Pixel in stripe configuration
. Thin and light weight
. Display Colors：262,144 colors
. Wide viewing angle

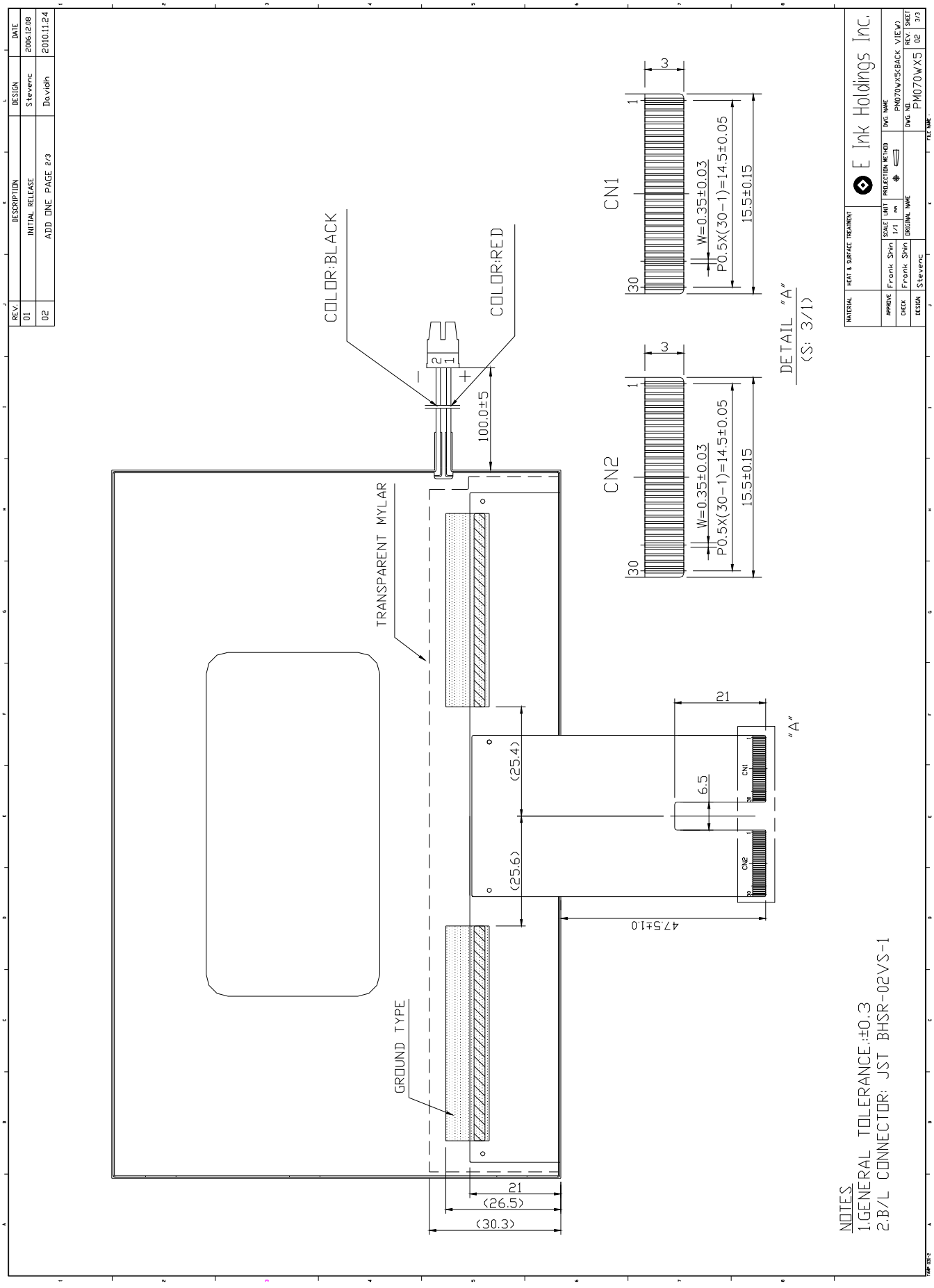
3.Mechanical Specifications

Parameter	Specifications	Unit
Screen Size	7.0(diagonal)	inch
Display Format	800×(R, G, B)×480	dot
Display Colors	262,144	
Active Area	152.4(H)×91.44(V)	mm
Pixel Pitch	0.1905(H)×0.1905(V)	mm
Pixel Configuration	Stripe	
Outline Dimension	165.0(w)×104.0 (H)×5.8 (typ.) (D)	mm
Weight	174±10	g
Back-light	33-LED	
Surface treatment	Anti-glare and Wide View Film	
Display mode	Normally white	
Gray scale inversion direction	6 o'clock [ref to Note 13-1]	

4.Mechanical Drawing of TFT-LCD Module







5.Input / Output Terminals

5-1) TFT-LCD Panel Driving

CN 1

Pin No.	Symbol	I/O	Function	Remark
1	DIO1	I/O	Horizontal Start Pulse Signal Input or Output	Note 5-1
2	VSS1	I	Ground	
3	VDD1	I	Power Supply	
4	CLK	I	Horizontal Shift Clock	
5	VSS1	I	Ground	
6	R/L	I	Right / Left selection	Note 5-1
7	R0	I	Red Data (LSB)	
8	R1	I	Red Data	
9	R2	I	Red Data	
10	R3	I	Red Data	
11	R4	I	Red Data	
12	R5	I	Red Data (MSB)	
13	VSS1	I	Ground	
14	G0	I	Green Data (LSB)	
15	G1	I	Green Data	
16	G2	I	Green Data	
17	G3	I	Green Data	
18	G4	I	Green Data	
19	G5	I	Green Data (MSB)	
20	VSS1	I	Ground	
21	B0	I	Blue Data (LSB)	
22	B1	I	Blue Data	
23	B2	I	Blue Data	
24	B3	I	Blue Data	
25	B4	I	Blue Data	
26	B5	I	Blue Data (MSB)	
27	LD	I	Load output signal	Note 5-2
28	REV	I	Data invert control	Note 5-3
29	POL	I	Polarity selection	Note 5-4
30	DIO2	I/O	Horizontal Start Pulse Signal Input or Output	Note 5-1

CN 2

Pin No.	Symbol	I/O	Function	Remark
1	VSS2	I	Ground	
2	V1	I	Gamma Voltage 1	Note 5-10
3	V2	I	Gamma Voltage 2	Note 5-10
4	V3	I	Gamma Voltage 3	Note 5-10
5	V4	I	Gamma Voltage 4	Note 5-10
6	V5	I	Gamma Voltage 5	Note 5-10
7	V6	I	Gamma Voltage 6	Note 5-10
8	V7	I	Gamma Voltage 7	Note 5-10
9	VSS2	I	Ground	
10	V8	I	Gamma Voltage 8	Note 5-10
11	V9	I	Gamma Voltage 9	Note 5-10
12	V10	I	Gamma Voltage 10	Note 5-10
13	V11	I	Gamma Voltage 11	Note 5-10
14	V12	I	Gamma Voltage 12	Note 5-10
15	V13	I	Gamma Voltage 13	Note 5-10
16	V14	I	Gamma Voltage 14	Note 5-10
17	VSS2	I	Ground	
18	VDD2	I	Voltage for analog circuit	Note 5-10
19	VCOM	I	Common Voltage	
20	XON	-	NC	Note 5-11
21	OE	I	Output Enable	Note 5-5
22	U/D	I	Up / Down Selection	Note 5-6
23	CKV	I	Vertical Shift Clock	Note 5-7
24	STVU	I/O	Vertical Shift Pulse Signal Input or Output	Note 5-6
25	STVD	I/O	Vertical Shift Pulse Signal Input or Output	Note 5-6
26	VGG	I	Gate On Voltage	Note 5-8
27	GND	I	Ground	
28	VCC	I	Voltage for logic circuit	
29	GND	I	Ground	
30	VEE	I	Gate Off Voltage	Note 5-9

Note 5-1: Select left or right shift

R/L	DIO1	DIO2	Shift
1	Input	Hi-Z	Left to right
0	Hi-Z	Input	Right to left

Note 5-2: Latch the polarity of outputs and switch the new data to outputs
At the rising edge (LD), latch the “POL” signal to control the polarity of the outputs.

Note 5-3: Control whether the Data R0~G5 are inverted or not. (EIH suggests connecting to GND)
When “REV=1”, these data will be inverted.
EX: “00”→”3F”, “07”→”38”, “15”→”2A”

Note 5-4: Polarity selector for dot-inversion control. Available at the rising edge of LD.
When POL=1: Even outputs range from V1~V7, and Odd outputs range from V8~V14;
When POL=0: Even outputs range from V8~V14, and Odd outputs range from V1~V7.

Note 5-5: When OE is connected to high “1”, the driver outputs are disabled (Gate output = V_{EE}).
Under this condition, the operation of registers will not be affected.

Note 5-6: Select up or down shift

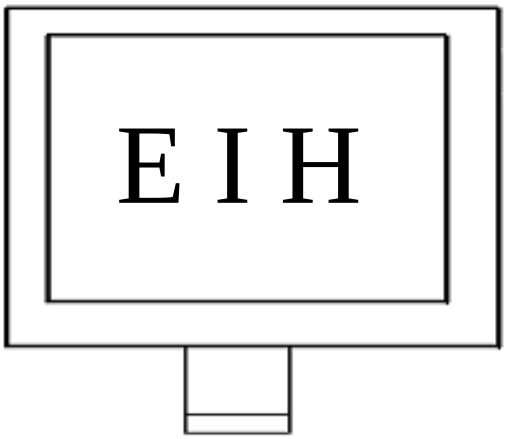
U/D	STVU	STVD	Shift
1	Hi-Z	Input	Down to Up
0	Input	Hi-Z	Up to Down

Note 5-7: Gate driver shift clock

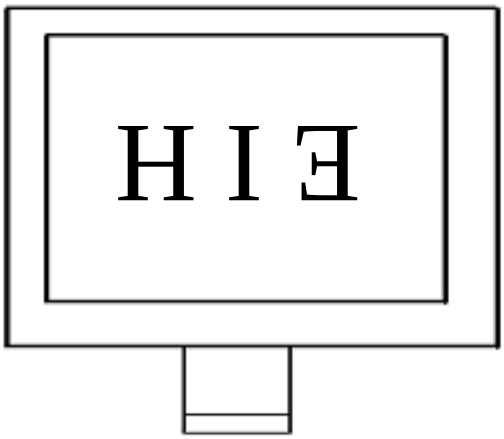
Note 5-8: Gate on voltage, V_{GG}=+17 V.

Note 5-9: Gate off voltage, V_{EE}=- 8 V.

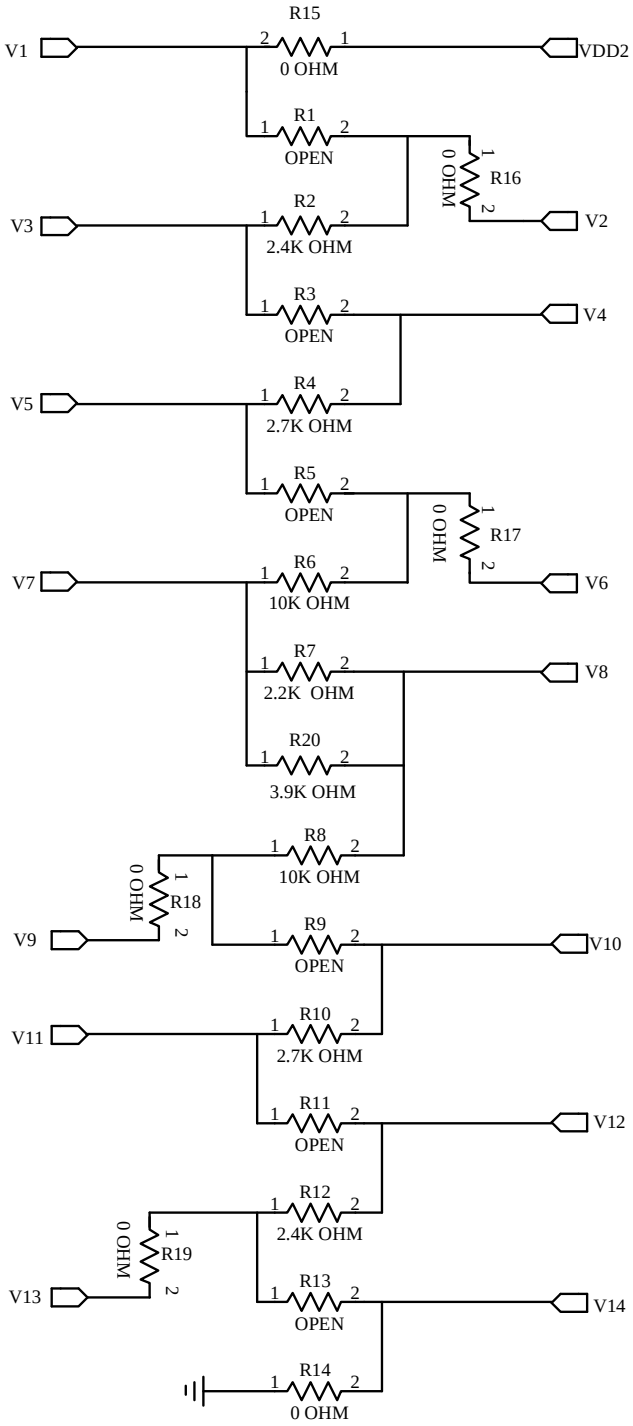
U/D(PIN22)=0 R/L(PIN6)=1



U/D(PIN22)=1 R/L(PIN6)=0



Note 5-10: Typical Application Circuit (When $V_{DD2(TYP.)}$ = +9.5V)



Note 5-11 :This pin is NC or must connect VDD1

5-2) Backlight driving

Connector type: JST BHSR-02VS-1

Pin No	Symbol	Description	Remark
1	+	Input terminal (Positive electrode side)	Wire color : Red
2	-	Input terminal (Ground side)	Wire Color : Black

6.Absolute Maximum Ratings:

Vss1=Vss2=GND=0V, Ta=25℃

Parameters	Symbol	MIN.	MAX.	Unit	Remark
Supply Voltage	V_{DD1}	-0.3	+5.0	V	
	V_{CC}			V	
	V_{DD2}	-0.5	+12.0	V	
	V_{GG}	-0.3	+40.0	V	
	V_{GG}-V_{EE}	-	40	V	
	V_{EE}	-20	+0.3	V	

7.Electrical Characteristics

7-1) Recommended Operating Conditions:

Vss1=Vss2=GND = 0V，Ta = 25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Voltage for Source Driver	V_{DD1}	+3.0	+3.3	+3.6	V	
	V_{DD2}	+9	+9.5	+10	V	
Supply Voltage for Gate Driver	V_{GG}	-	+17	-	V	
	V_{EE}	-	-8.0	-	V	
	V_{CC}	3.0	3.3	3.6	V	
Digital Input Voltage	V_{IH}	$0.8V_{DD1}$	-	V_{DD1}	V	
	V_{IL}	0	-	$0.2V_{DD1}$	V	
V_{com} Voltage	V_{com}	-	3.1	-	V	

7-2) Recommended driving condition for LED back light

Ta = 25℃

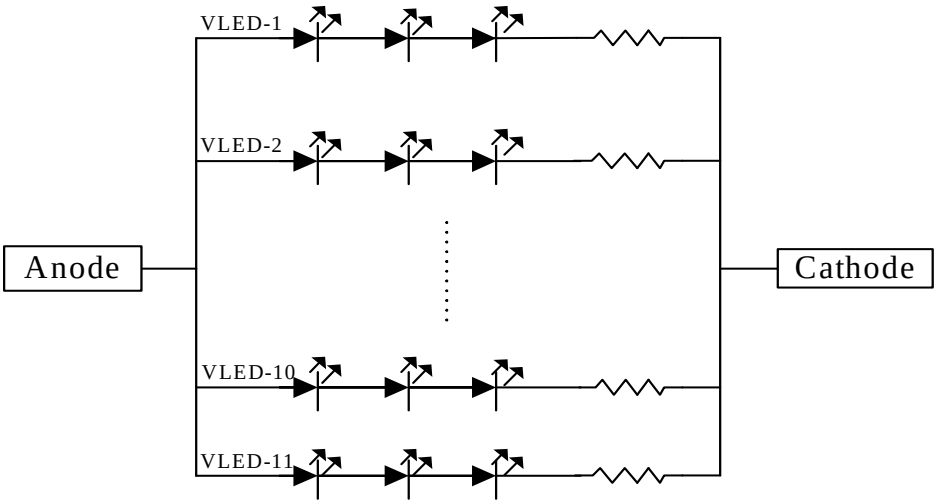
Parameter	Symbol	Min	TYP	MAX	Unit	Remark
Supply voltage of LED backlight	V_{LED}	-	11.0	11.5	V	Note 7-1
Supply current of LED backlight	I_{LED}	-	20	-	mA	Note 7-2
Backlight Power Consumption	P_{LED}	-	2.42	2.53	W	Note 7-1/Note 7-3

Note 7-1 : I_{LED} = 20mA(Constant Current).

Note 7-2 : The LED driving condition is defined for each LED module. (3 LED Serial)

Input current = 20mA * 11 = 220mA

Note 7-3 : $P_{LED} = V_{LED-1} * I_{LED-1} + V_{LED-2} * I_{LED-2} \ \ldots\ldots + V_{LED-10} * I_{LED-10} + V_{LED-11} * I_{LED-11}$



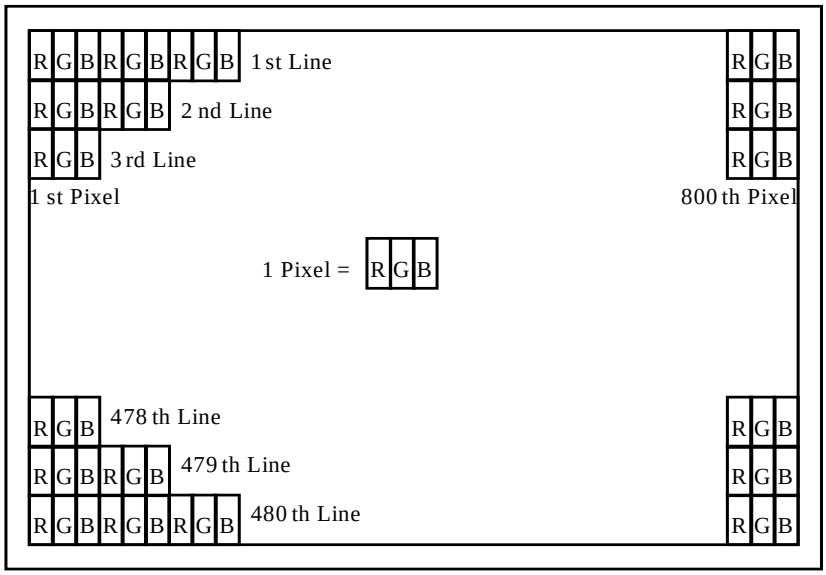
7-3) Power Consumption

GND = 0 V， Ta = 25℃

Parameter	Symbol	Condition	Typ.	Max.	Unit	Remark
Supply Current for Gate Driver (Hi level)	I_{GG}	V_{GG}=+17V	0.32	0.41	mA	
Supply Current for Gate Driver (Low level)	I_{EE}	V_{EE}=-8.0V	3.35	4.19	mA	
Supply Current for Source Driver (Digital)	I_{DD1}	V_{DD1}=+3.3V	6.0	10.0	mA	
Supply Current for Source Driver (Analog)	I_{DD2}	V_{DD2}=+9.5V	20	27.5	mA	
Supply Current for Gate Driver (Digital)	I_{CC}	V_{CC}=+3.3V	0.01	0.013	mA	
LCD Panel Power Consumption(W/O B/L)	-	-	251.97	347.26	mW	
Total Power Consumption	-	-	2.68	-	W	

8. Pixel Arrangement

The LCD module pixel arrangement is the stripe.

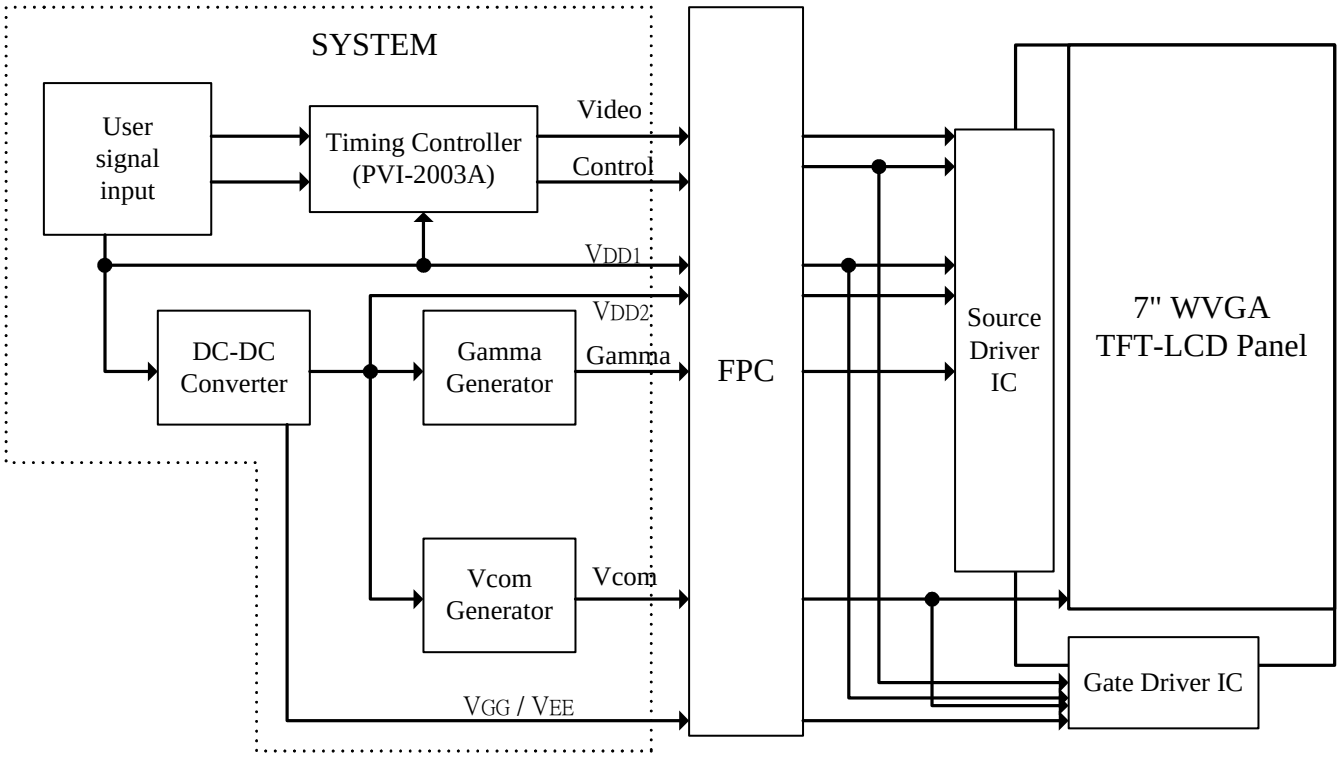


9. Display Color and Gray Scale Reference

Color		Input Color Data																	
		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 (63)	1	1	1	1	1	1	0	0	0	0	0	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
	Blue (63)	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
Red	Red (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (01)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (02)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker																		
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	Brighter																		
	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
Green	Green (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (01)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green (02)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker																		
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	Brighter																		
	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
Blue	Blue (00)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (01)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (02)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Darker																		
	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	Brighter																		
	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

10. Block Diagram

10-1) TFT-module Block Diagram



If you use PM070WX5, you can apply PVI-2003A(Timing controller) which will gernerate timing signals to support PM070WX5.

11. Interface Timing

11.1) Timing Parameters

AC Electrical Characteristics (V_{CC}=V_{DD1}=3.3V, V_{DD2}=9.5V, GND=V_{SS1}=V_{SS2}=0V, Ta=25℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK Frequency	Fclk	-	32	40	MHz
CLK Pulse Width	Tcw	25	-	-	ns
Data Set-up Time	Tsu	4	-	-	ns
Data Hold Time	Thd	2	-	-	ns
Propagation Delay of DIO2/1	Tphl	6	10	15	ns
Time That The Last Data to LD	Tld	1	-	-	Tcw
Pulse width of LD	Twld	2	-	-	Tcw
Time That LD to DIO1/2	Tlds	5	-	-	Tcw
POL Set-up Time	Tpsu	6	-	-	ns
POL Hold Time	Tphd	6	-	-	ns
OE Pulse Width	T_{OEV}	1	-	-	μs
CKV Pulse Width	T_{CKV}	500	-	-	ns
STV Set-up Time	T_{SUV}	400	-	-	ns
STV Hold Time	T_{HDV}	400	-	-	ns
Horizontal Display Period	T_{HDP}	-	800	-	Tcw
Horizontal Period Timing Range	T_{HP}	-	1056	-	Tcw
Horizontal Lines Per Field	T_V	484	508	620	T_{HP}
Vertical Display Timing Range	T_{DV}	-	480	-	T_{HP}

11.2) Timing Diagram

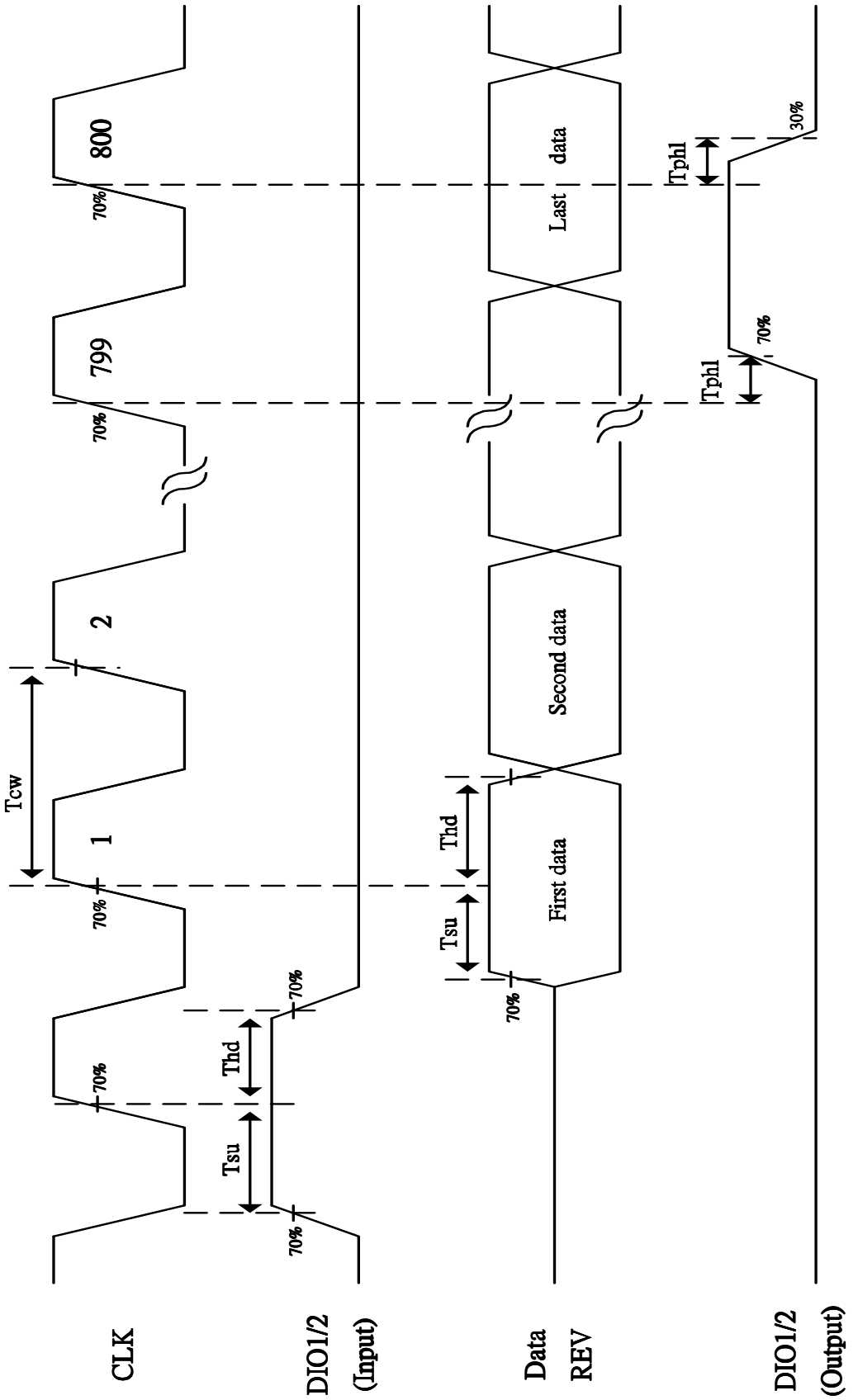


Fig. 11-1 Horizontal timing (1)

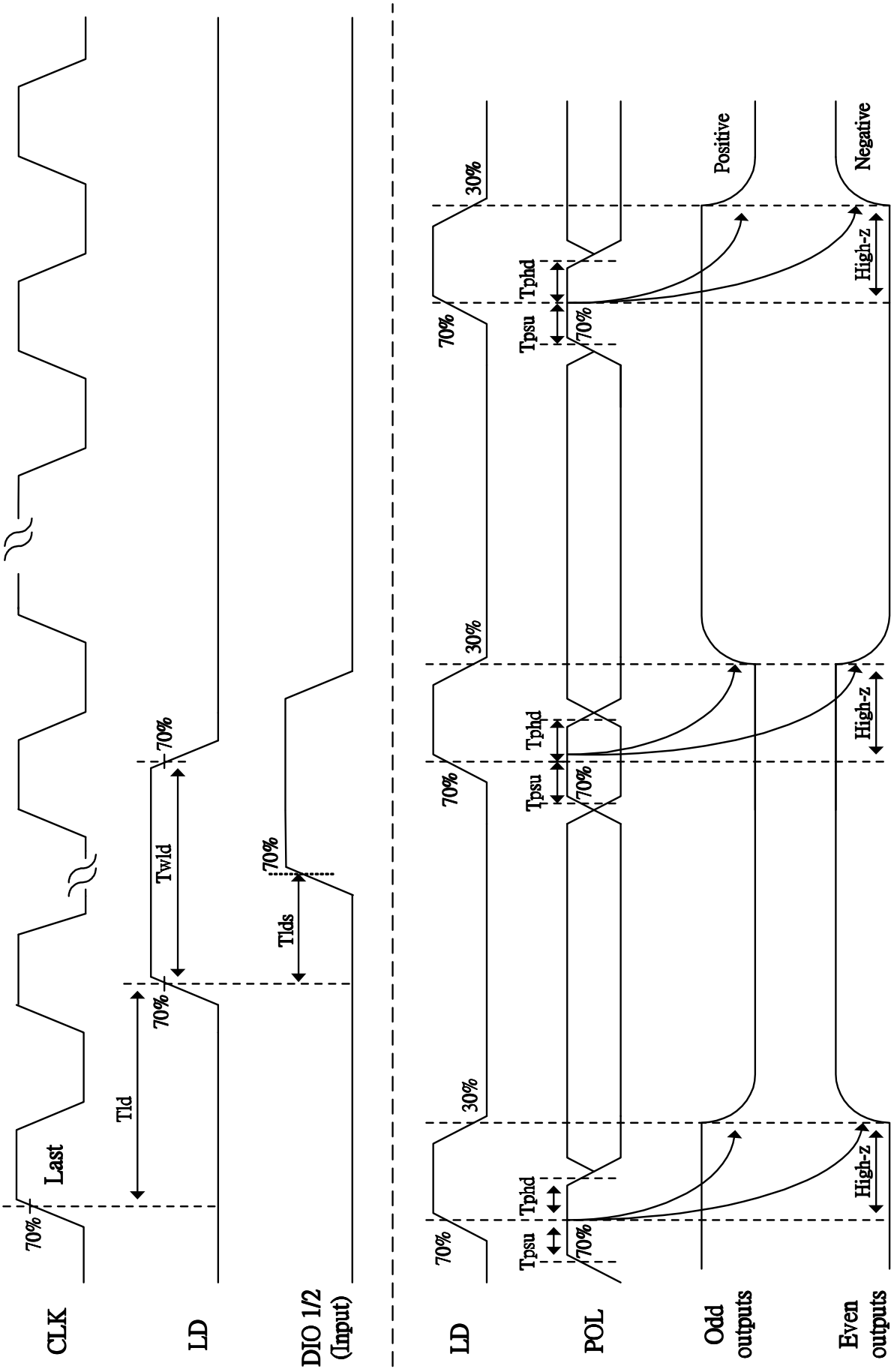


Fig. 11-2 Horizontal timing(2)

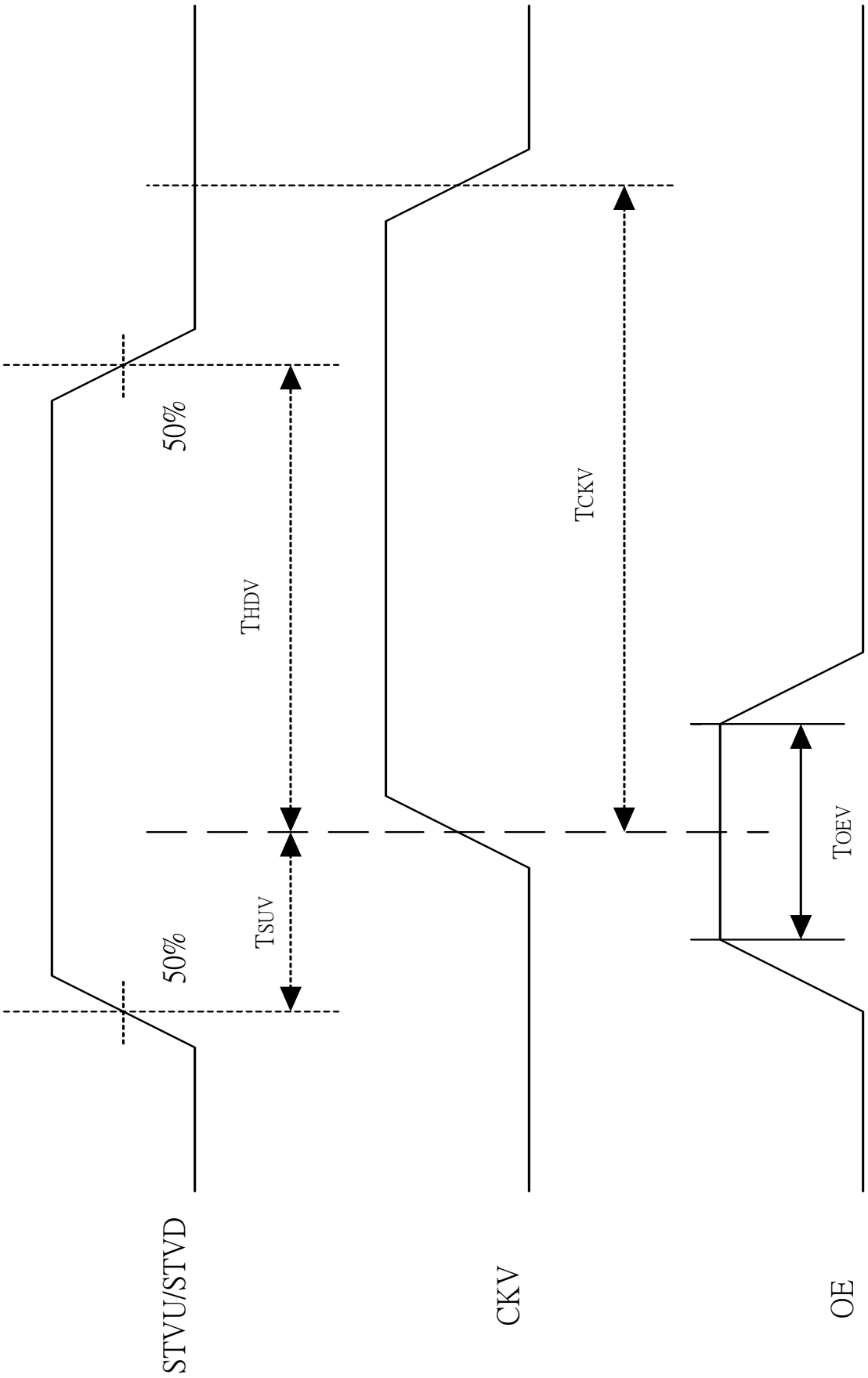


Fig. 11-3 Vertical shift clock timing

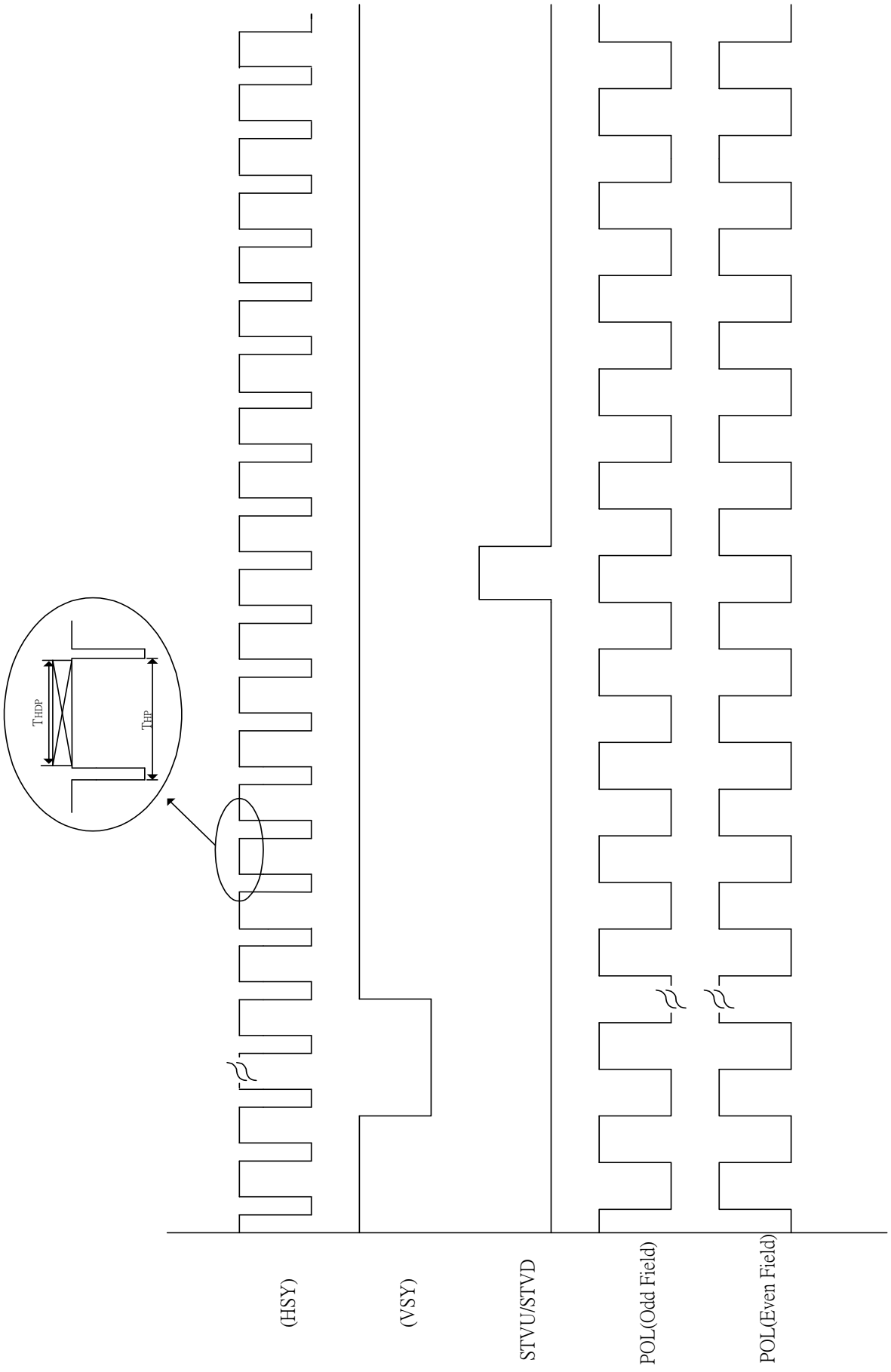
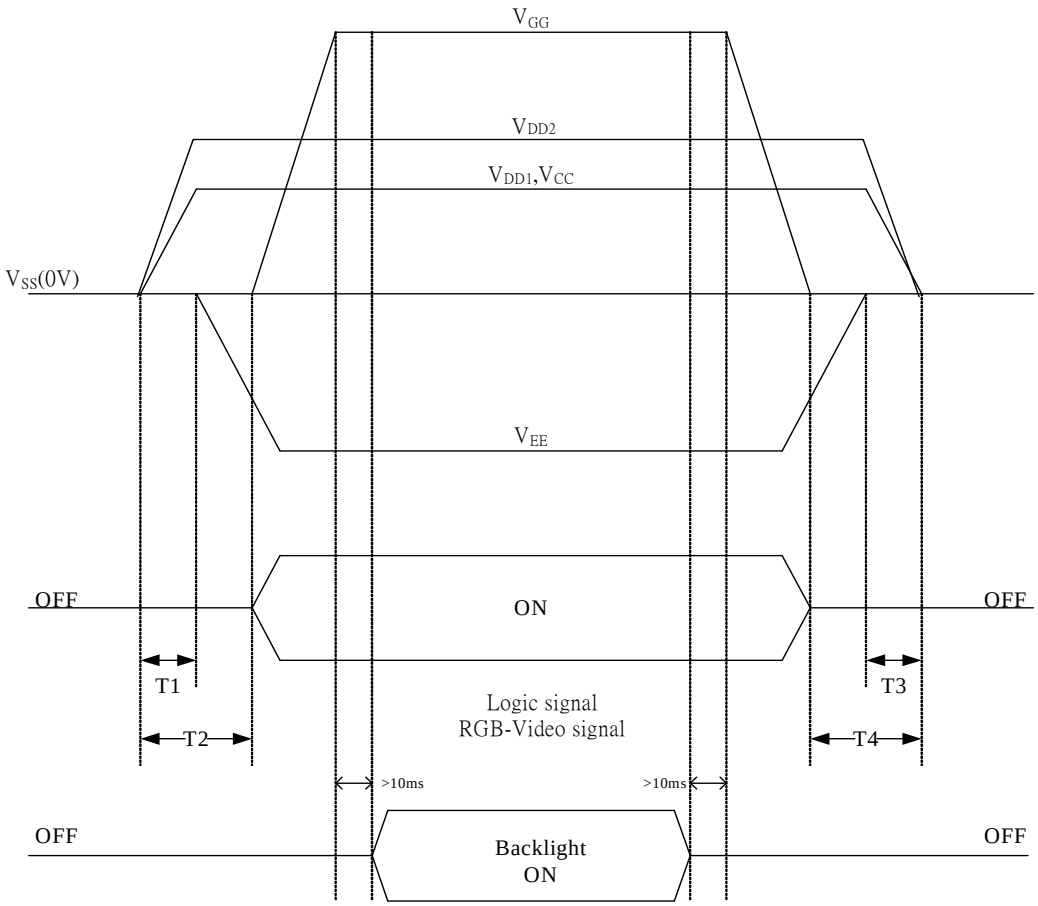


Fig. 11-4 Vertical timing

12. Power On Sequence



1.10ms≦T1＜T2

2. 0ms＜T3≦T4≦10ms

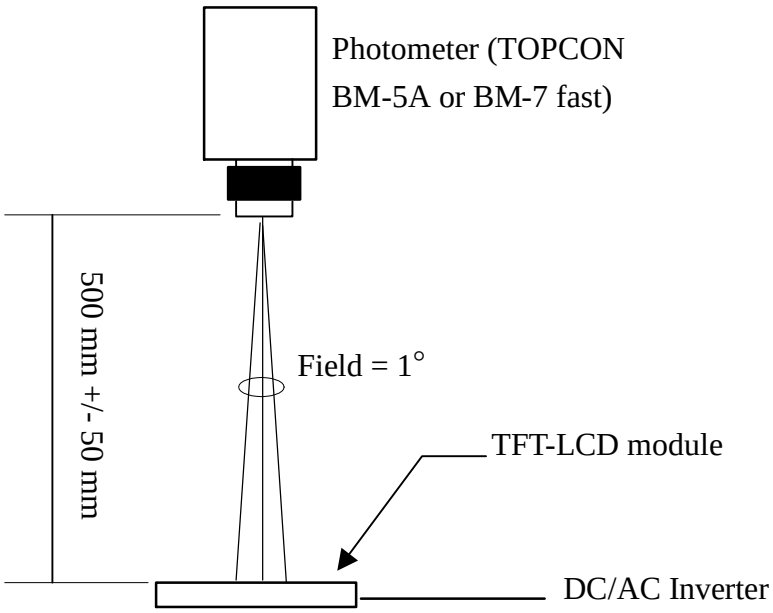
13. Optical Characteristics

13-1) Specification:

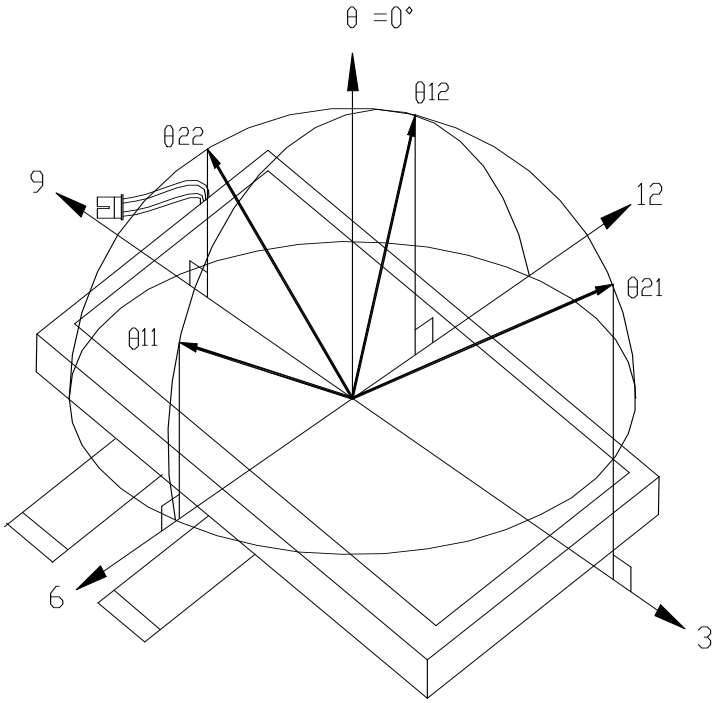
Ta=25℃

Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ 22.21	CR≥10	±55	±60	-	deg	Note 13-1
	Vertical	θ 12		35	40	-	deg	to 12 o'clock
		θ 11		50	55	-	deg	to 6 o'clock
Contrast Ratio		CR	-	250	400	-	-	Note 13-2
Response time	Rise	Tr	θ =0°	-	15	30	ms	Note 13-3
	Fall	Tf		-	25	50	ms	
Brightness		L	θ =0°/ φ =0	350	400	-	cd/㎡	
Luminance Uniformity		U	-	70	75	-	%	Note 13-4
White Chromaticity		x	θ =0°/ φ =0	0.28	0.31	0.34	-	
		y		0.30	0.33	0.37	-	
Cross Talk		-	θ =0°	-	-	3.5	%	Note 13-5
LED Life Time		-	25℃	20000	30000	-	hr	Note 13-6

All the optical measurement shall be executed 10 minutes after backlight being turn-on. The optical characteristics shall be measured in dark room (ambient illumination on panel surface less than 1 Lux). The measuring configuration shows as following figure.

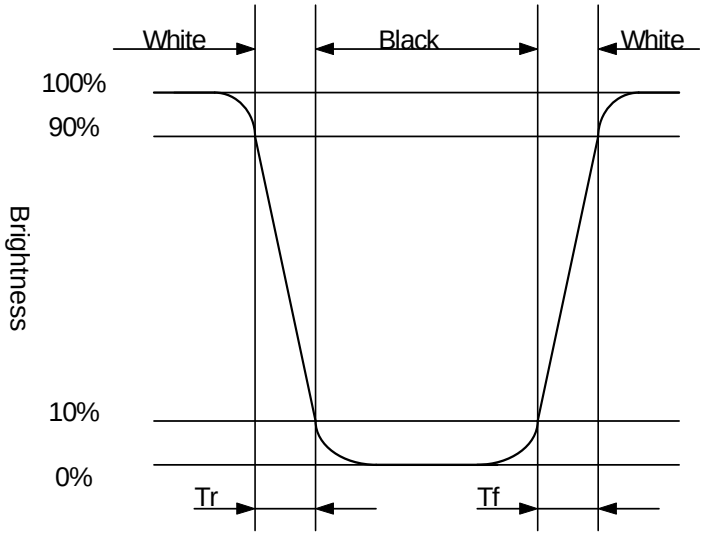


Note 13-1: The definitions of viewing angles are as follow



Note 13-2: The definition of contrast ratio $CR = \frac{\text{Luminance at gray level 63}}{\text{Luminance at gray level 0}}$

Note 13-3: Definition of Response Time T_r and T_f:



Note 13-4: The uniformity of LCD is defined as

$$U = \frac{\text{The Minimum Brightness of the 9 testing Points}}{\text{The Maximum Brightness of the 9 testing Points}}$$

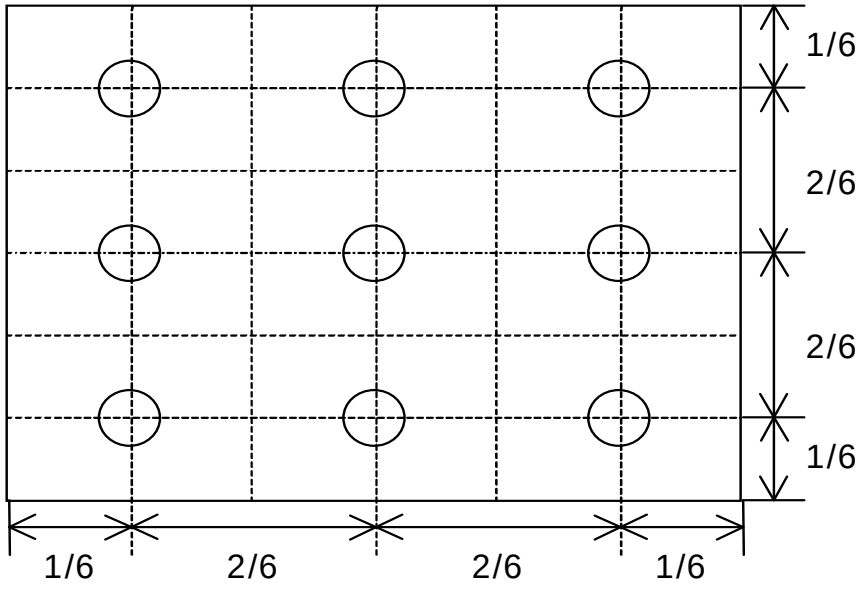
Luminance meter : BM-5A or BM-7 fast(TOPCON)

Measurement distance : 500 mm +/- 50 mm

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module

The test pattern is white (Gray Level 63).



Note 13-5: Cross Talk (CTK) = $\frac{|YA-YB|}{YA} \times 100\%$

YA: Brightness of Pattern A

YB: Brightness of Pattern B

Luminance meter : BM 5A or BM-7 fast (TOPCON)

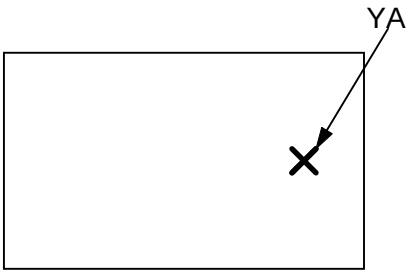
Measurement distance : 500 mm +/- 50 mm

Ambient illumination : < 1 Lux

Measuring direction : Perpendicular to the surface of module

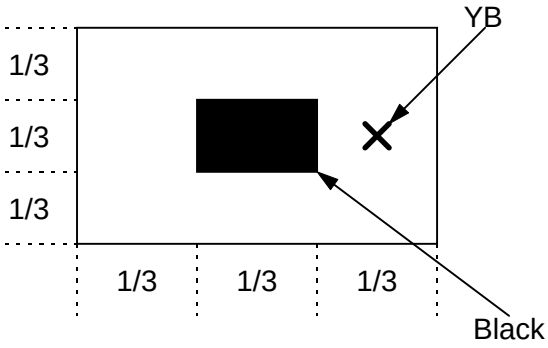
Pattern A

(Gray Level 31)



Pattern B

(Gray Level 31, central black box exclusive)



✕: Measuring Point (A and B are at the same point.)

(Gray Level 0)

Note 13-6: The “LED Life time “ is defined as the module brightness decrease to 50% original Brightness that the ambient temperature is 25℃ and I_{LED} =220mA.

14. Handling Cautions

14-1) Mounting of module

a) Please power off the module when you connect the input/output connector.
b) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.
c) Protective film (Laminator) is applied on surface to protect it against scratches and dirt.
d) Please following the tear off direction as figure 14-1 to remove the protective film as slowly as possible, so that electrostatic charge can be minimized.

14-2) Precautions in mounting

a) When metal part of the TFT-LCD module (shielding lid and rear case) is soiled, wipe it with soft dry cloth.
b) Wipe off water drops or finger grease immediately. Long contact with water may cause discoloration or spots.
c) TFT-LCD module uses glass which breaks or cracks easily if dropped or bumped on hard surface. Please handle with care.
d) Since CMOS LSI is used in the module. So take care of static electricity and earth yourself when handling.

14-3) Adjusting module

a) Adjusting volumes on the rear face of the module have been set optimally before shipment.
b) Therefore, do not change any adjusted values. If adjusted values are changed, the specifications described may not be satisfied.

14-4) Others

a) Do not expose the module to direct sunlight or intensive ultraviolet rays for many hours.
b) Store the module at a room temperature place.
c) The voltage of beginning electric discharge may over the normal voltage because of leakage current from approach conductor by to draw lump read lead line around.
d) If LCD panel breaks, it is possibly that the liquid crystal escapes from the panel. Avoid putting it into eyes or mouth. When liquid crystal sticks on hands, clothes or feet. Wash it out immediately with soap.
e) Observe all other precautionary requirements in handling general electronic components.
f) Please adjust the voltage of common electrode as material of attachment by 1 module.

14-5) Polarizer mark

The polarizer mark is to describe the direction of wide view angle film how to mach up with the rubbing direction.

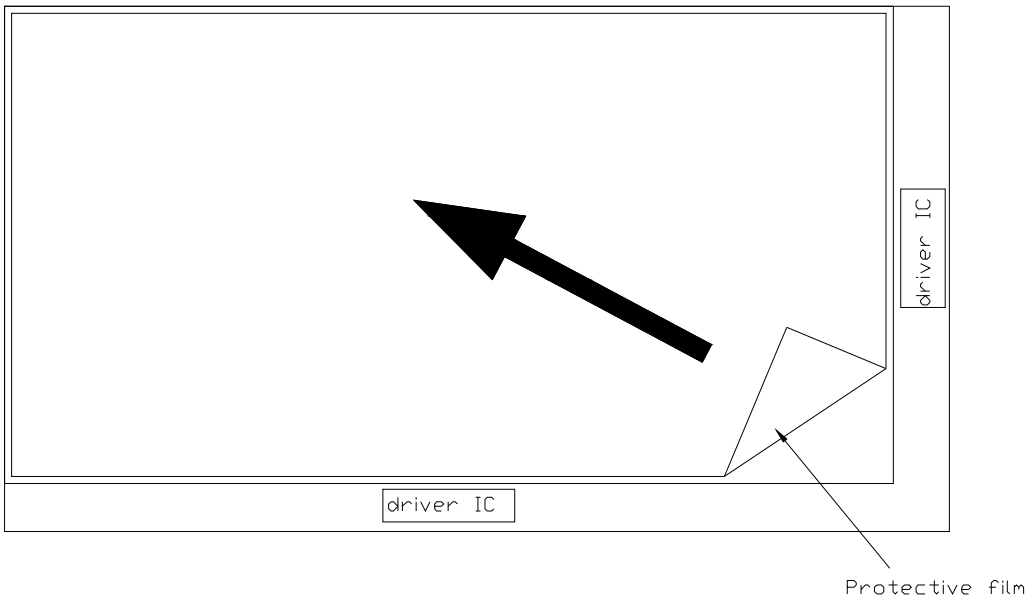


Figure 14-1 the way to peel off protective film

15. Reliability Test

No	Test Item	Test Condition	Remark
1	High Temperature Storage Test	Ta = +85℃, 240 hrs	
2	Low Temperature Storage Test	Ta = -40℃, 240 hrs	
3	High Temperature Operation Test	Ta = +80℃, 240 hrs	
4	Low Temperature Operation Test	Ta = -30℃, 240 hrs	
5	High Temperature & High Humidity Operation Test	Ta = +60℃, 90%RH, 240 hrs (No Condensation)	
6	Thermal Cycling Test (non-operating)	-30℃→+80℃, 200 Cycles 30min 30min	
7	Vibration Test (non-operating)	Frequency：10 ~ 55 H_Z, Amplitude：1 mm Sweep time: 11 min Test Period: 6 Cycles for each direction of X, Y, Z	
8	Shock Test (non-operating)	100G, 6ms Direction: ±X, ±Y, ±Z Cycle: 3 times	
9	Electrostatic Discharge Test (non-operating)	200pF, 0Ω ±200V 1 time / each terminal	

Ta: ambient temperature

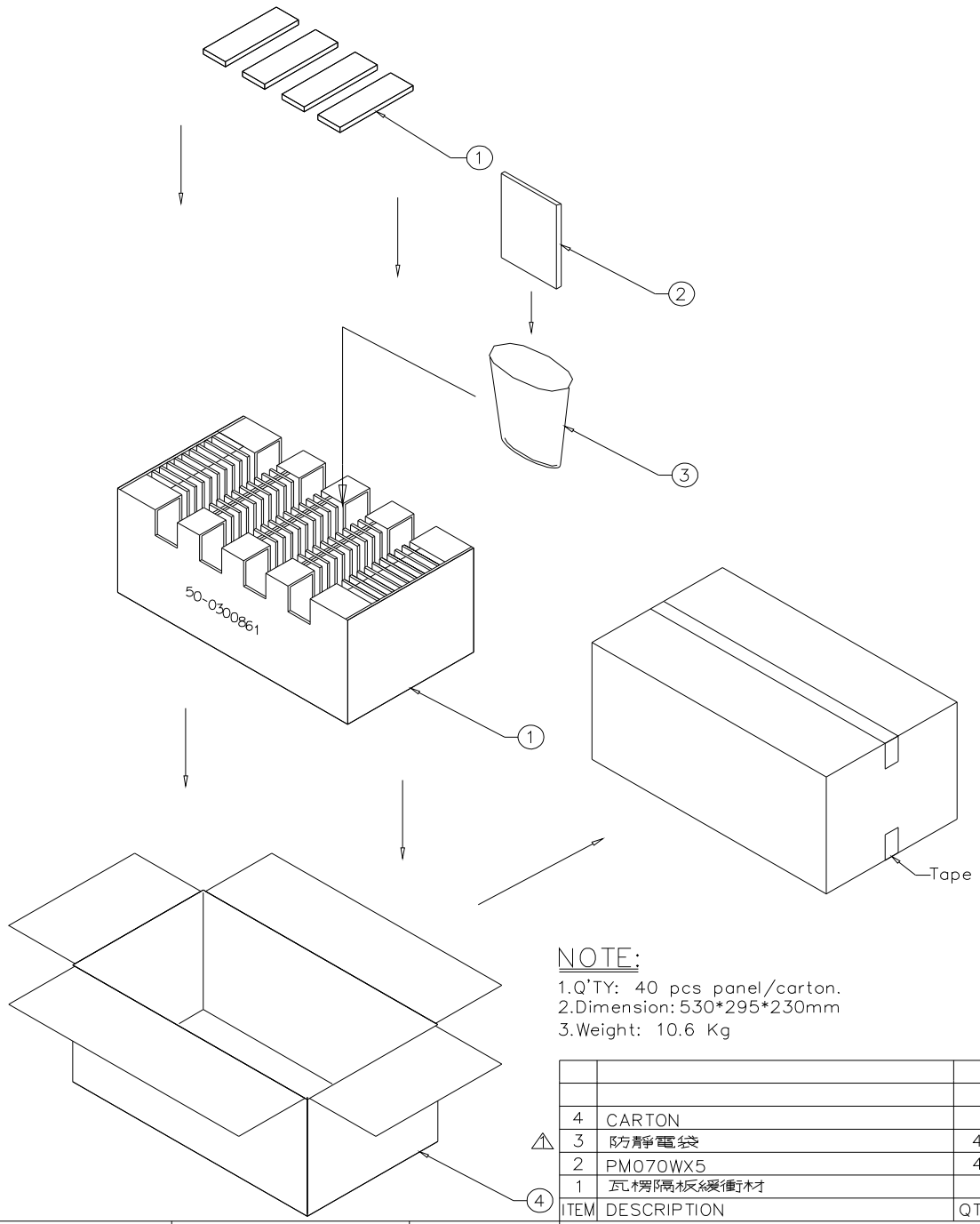
Note: The protective film must be removed before temperature test.

[Criteria]

In the standard conditions, there is not display function NG issue occurred. (including : line defect ,no image). All the cosmetic specification is judged before the reliability stress.

16. Packing Diagram

REV.	DESCRIPTION	Design	DATE
	INITIAL RELEASE	Stevenc	2006.12.14
1	變更防靜電袋料號(50-0500181->50-0500182)	Joseph	2009.08.13
2	Modify the Name from PVI to EIH	Doris	2010.12.02



NOTE:
1.Q'TY: 40 pcs panel/carton.
2.Dimension: 530*295*230mm
3.Weight: 10.6 Kg

ITEM	DESCRIPTION	QTY	REMARK
4	CARTON	1	
3	防靜電袋	40	抗靜電
2	PM070WX5	40	
1	瓦楞隔板緩衝材	1	上蓋+底座

MTL.SPEC.	UNSPECIFIED TOL'S ANGLE ROUGHNESS	REMARK	E Ink Holdings Inc.

APPROVE	Patrick lin	09.08.13	SCALE	UNIT	SHEET 1 OF 1	DWG.TITLE: 7"WVGA(LED B/L) Packing
CHECK	Patrick lin	09.08.13				
DRAWN	Joseph	09.08.13	MTL.NO.		DWG FILE:	REV. 01 / A4 SIZE

