Version : 2.0

TECHNICAL SPECIFICATION

MODEL NO : PD050SX2

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☐Customer's Confirmation

Customer _____

Date _____

By _____

☐E Ink's Confirmation

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Revision History

Rev.	Issued Date	Revised Content
1.0	Apr 25, 2011	New
2.0	July.28.2011	Update to E Ink logo

TECHNICAL SPECIFICATION

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1. Application

This data sheet applies to a color TFT LCD module, PD050SX2.This module applies to OA product, computer peripheral, image communication and multi-media. If you must use in severe reliability environment, please don't extend over E Ink's reliability test conditions.

If you use PD050SX2, E Ink advises your systems use E Ink's timing controller IC (PVI-2003A), which will generate proper timing, signals to control it.

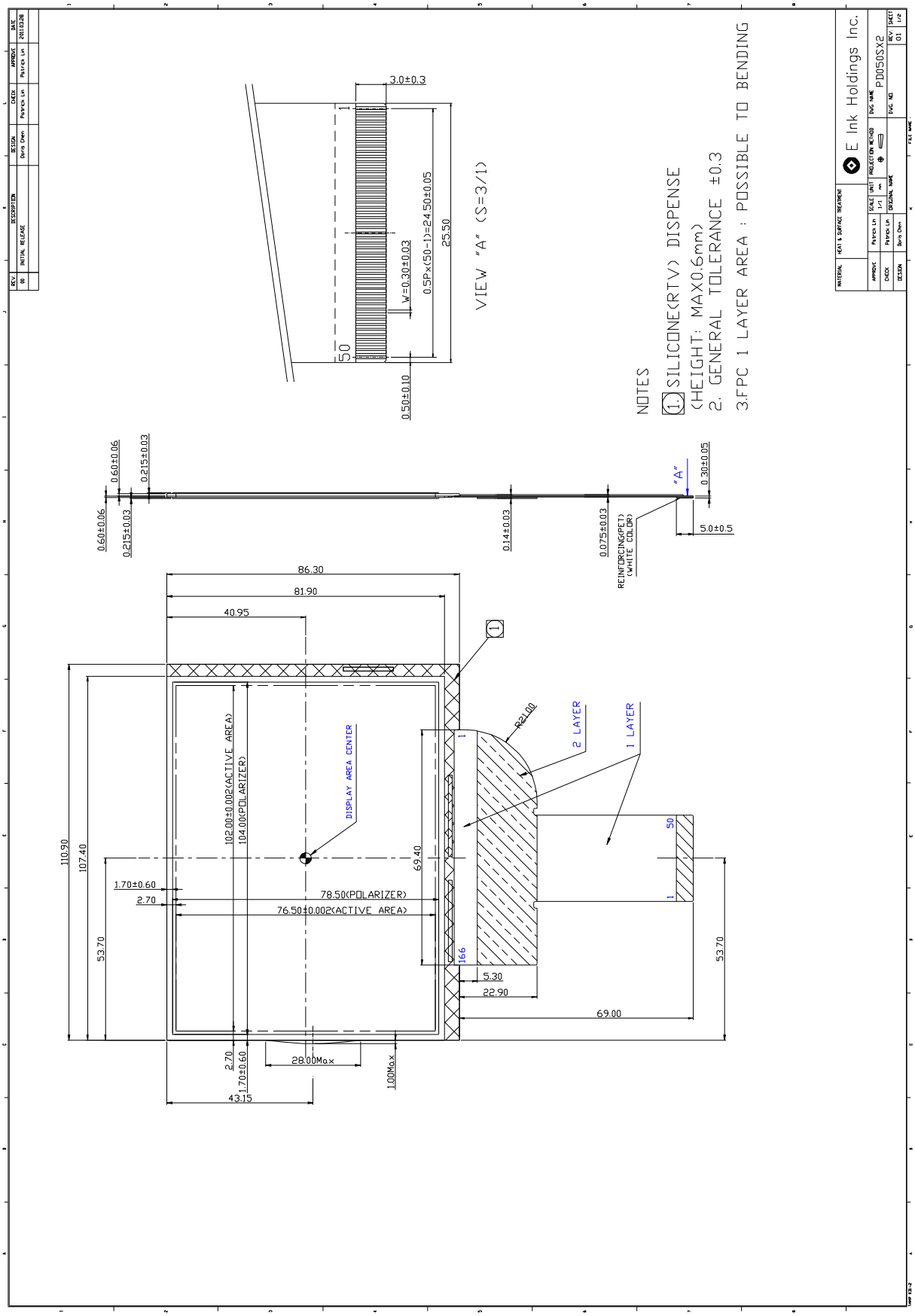
2. Features

. Pixel in stripe configuration
. Slim and compact, designed for O/A application
. Support TTL interface
. Display Colors：262,144 colors

3. Mechanical Specifications

Parameter	Specifications	Unit
Screen Size	5.0" (diagonal)	inch
Display Format	800×(RGB)×600	dot
Display Colors	262K	
Active Area	102.0(H)×76.50(V)	mm
Pixel Pitch	0.1275(H)×0.1275 (V)	mm
Pixel Configuration	Stripe	
Outline Dimension	110.90(W)× 86.30(H)× 1.63(D) (typ.)	mm
Weight	33.4±3	g
Surface treatment	No coating	
Display mode	Normally white	
Gray scale inversion direction	6 (ref to Note 13-1)	o'clock

4. Mechanical Drawing of TFT-LCD Module



5. Input / Output Terminals

5-1) TFT-LCD Panel Driving

Pin No.	Symbol	I/O	Function	Remark
1	DIO1	I/O	Horizontal Start Pulse Signal Input or Output 1	Note5-3
2	VSS2	I	Ground	
3	VDD1	I	Power Supply	
4	CLK	I	Horizontal Shift Clock	
5	R/L	I	Left/Right Selection	Note 5-3
6	R0	I	Red Data (LSB)	
7	R1	I	Red Data	
8	R2	I	Red Data	
9	R3	I	Red Data	
10	R4	I	Red Data	
11	R5	I	Red Data (MSB)	
12	VSS2	I	Ground	
13	G0	I	Green Data (LSB)	
14	G1	I	Green Data	
15	G2	I	Green Data	
16	G3	I	Green Data	
17	G4	I	Green Data	
18	G5	I	Green Data (MSB)	
19	B0	I	Blue Data (LSB)	
20	B1	I	Blue Data	
21	B2	I	Blue Data	
22	B3	I	Blue Data	
23	B4	I	Blue Data	
24	B5	I	Blue Data (MSB)	
25	LD	I	Load output signal	Note5-7
26	REV	I	Data invert control	Note5-8
27	POL	I	Polarity selection	Note5-9
28	DIO2	I/O	Horizontal Start Pulse Signal Input or Output	Note5-3
29	VSS2	I	Ground	
30	V3	I	Gamma Voltage 3	Note5-10
31	V5	I	Gamma Voltage 5	Note5-10
32	V7	I	Gamma Voltage 7	Note5-10
33	V8	I	Gamma Voltage 8	Note5-10
34	V10	I	Gamma Voltage 10	Note5-10
35	V12	I	Gamma Voltage 12	Note5-10
36	VSS2	I	Ground	
37	VDD2	I	Voltage for analog circuit	Note5-10
38	VCOM	I	Common Voltage	
39	OE	I	Output Enable	Note5-5
40	U/D	I	Up/Down Selection	Note5-6
41	CKV	I	Vertical Shift Clock	Note5-4
42	STVU	I/O	Vertical Shift Pulse Signal Input or Output	Note5-6
43	STVD	I/O	Vertical Shift Pulse Signal Input or Output	Note5-6
44	VGG	I	Gate On Voltage	Note5-1
45	VSS1	I	Ground	
46	VCC	I	Voltage for logic circuit	
47	VEE	I	Gate Off Voltage	Note5-2
48	DUMMY	-	NC	
49	DUMMY	-	NC	
50	DUMMY	-	NC	

Note 5-1 V_{GG}= +15V.

Note 5-2 V_{EE}= -7.5V.

Note 5-3: 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 5-4: Gate driver shift clock

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

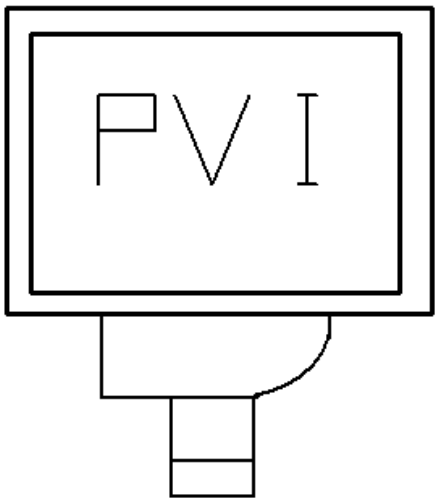
U/D	STVU	STVD	Shift
1	Hi-Z	Input	Down to Up
0	Input	Hi-Z	Up to Down

Note 5-7 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.

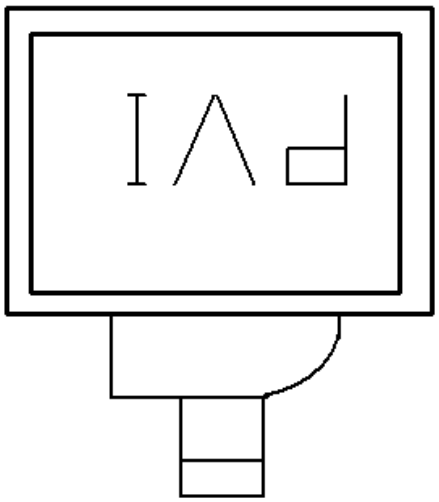
Note 5-8 Control whether the Data R0~G5 are inverted or not. (E Ink suggests connecting to GND)
When “REV=1”, these data will be inverted.
EX: “00”→”3F”, “07”→”38”, “15”→”2A”

Note 5-9: 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.

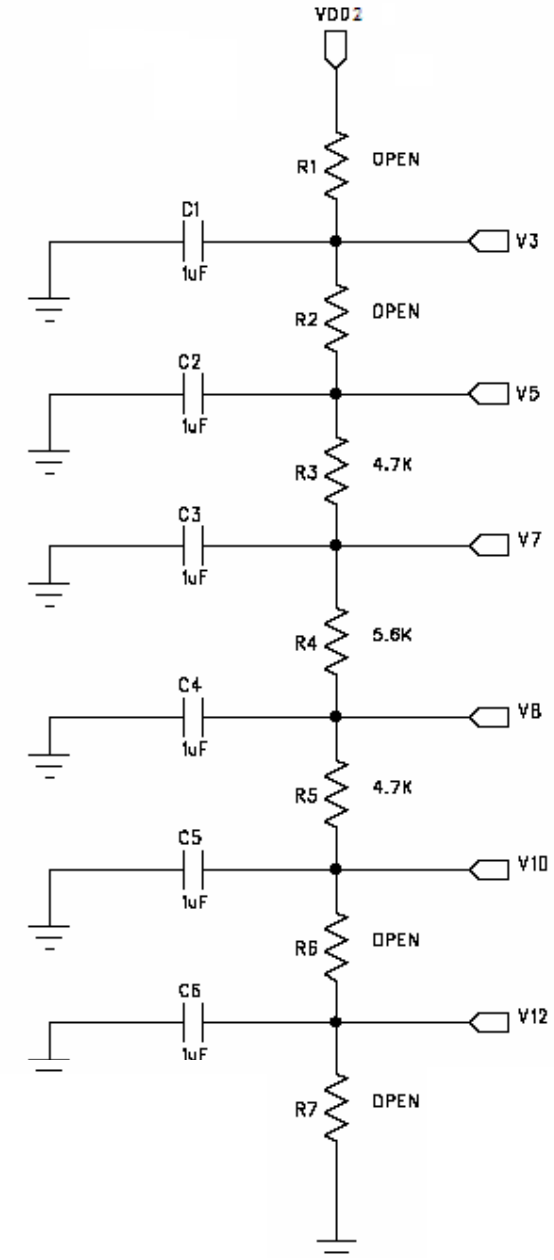
U/D(PIN 40)=Low R/L(PIN 5)=High



U/D(PIN 40)=High R/L(PIN 5)=Low



Note 5-10: Typical Application Circuit



6. Absolute Maximum Ratings:

AVSS(S) =GND=0V,Ta=25℃

Parameters	Symbol	MIN.	MAX.	Unit	Remark
Supply Voltage	V_{DD1}	-0.3	5.0	V	
	V_{CC}	-0.3	7.0	V	
	V_{DD2}	-0.5	15.0	V	
	V_{GG}	-0.3	42.0	V	
	V_{GG} V_{EE}	-0.3	40.0	V	
	V_{EE}	-20	0.3	V	

7. Electrical Characteristics

7-1) Recommended Operating Conditions:

AVSS(S)=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}	--	9.7	--	V	
Supply Voltage for Gate Driver	V_{GG}	--	15	--	V	
	V_{EE}	--	-7.5	--	V	
	V_{CC}	3.0	3.3	3.6	V	
VCOM Voltage	V_{com}	--	3.32	--	V	
Digital Input Voltage	V_{IH}	$0.8V_{DD1}$	-	V_{DD1}	V	
	V_{IL}	0	-	$0.2V_{DD1}$	V	

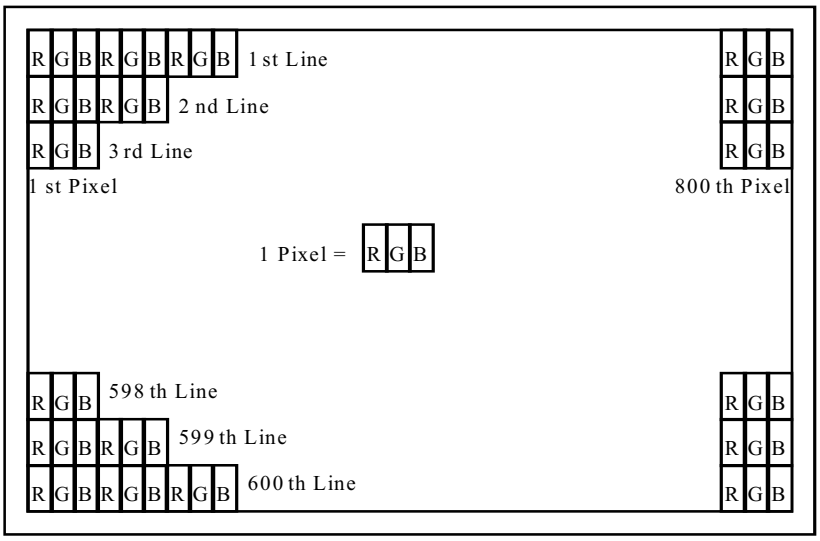
7-2) Power Consumption

Parameter	Symbol	Condition	Typ.	Max.	Unit	Remark
Supply Current for Gate Driver (Hi level)	I_{GG}	V_{GG} =15V	0.12	0.36	mA	
Supply Current for Gate Driver (Low level)	I_{EE}	V_{EE} =-7.5V	0.13	0.39	mA	
Supply Current for Source Driver (Digital)	I_{DD1}	V_{DD1}=3.3V	3.32	6.64	mA	
Supply Current for Source Driver (Analog)	I_{DD2}	V_{DD2}=9.7V	59.45	118.9	mA	
Supply Current for Gate Driver (Digital)	I_{CC}	V_{CC}=3.3V	0.01	0.03	mA	
LCD Panel Power Consumption	-	-	590.6	1184.1	mW	Note 7-1

Note 7-1: The power consumption for back light is not included.

8. Pixel Arrangement

The LCD module pixel arrangement is the stripe.

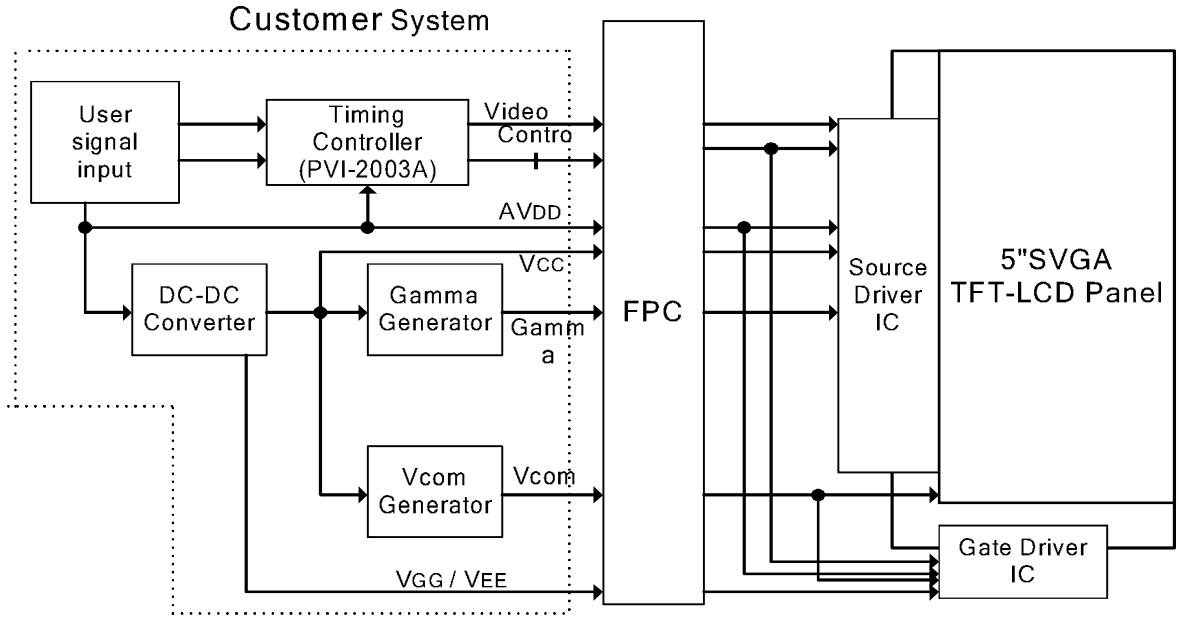


9. Display Color and Gray Scale Reference

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 PD050SX2, you can apply PVI-2003A (Timing controller) which will genera timing signals to support PD050SX2.

11. Interface Timing

11-1) Timing Parameters

AC Electrical Characteristics (V_{CC}=V_{DD1}=3.3V, V_{DD2}=9.7V, GND=V_{SS1}=V_{SS2}=0V, Ta=25℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK Frequency	Fclk	-	40	45	MHz
CLK Pulse Width	Tcw	22	-	-	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	800	800	Tcw
Horizontal Period Timing Range	T_{HP}	920	1056	1064	Tcw
Horizontal Lines Per Field	T_V	604	628	800	T_{HP}
Vertical Display Timing Range	T_{DV}	600	600	600	T_{HP}

11-2) Timing Diagram

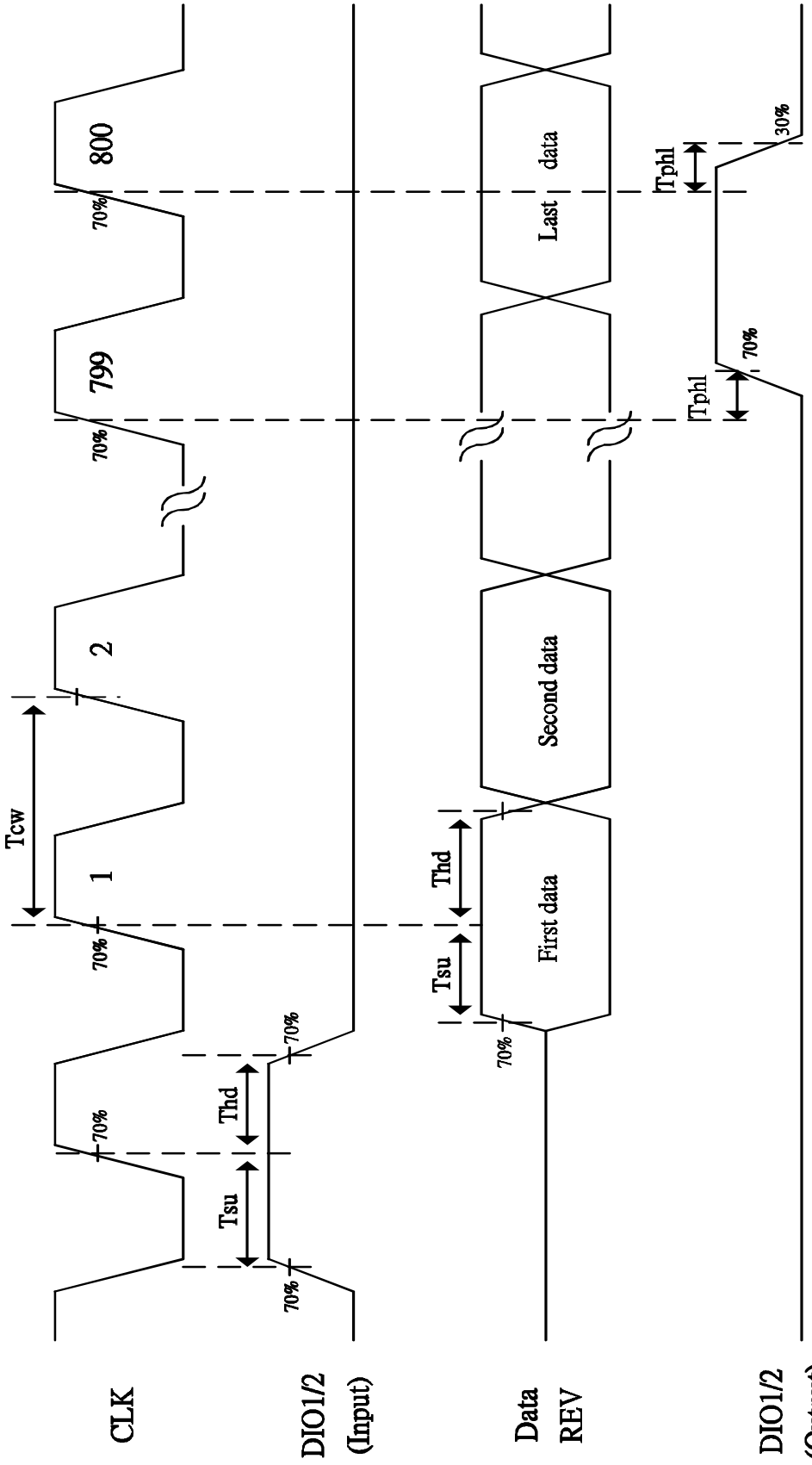


Fig. 11-1 Horizontal timing (1)

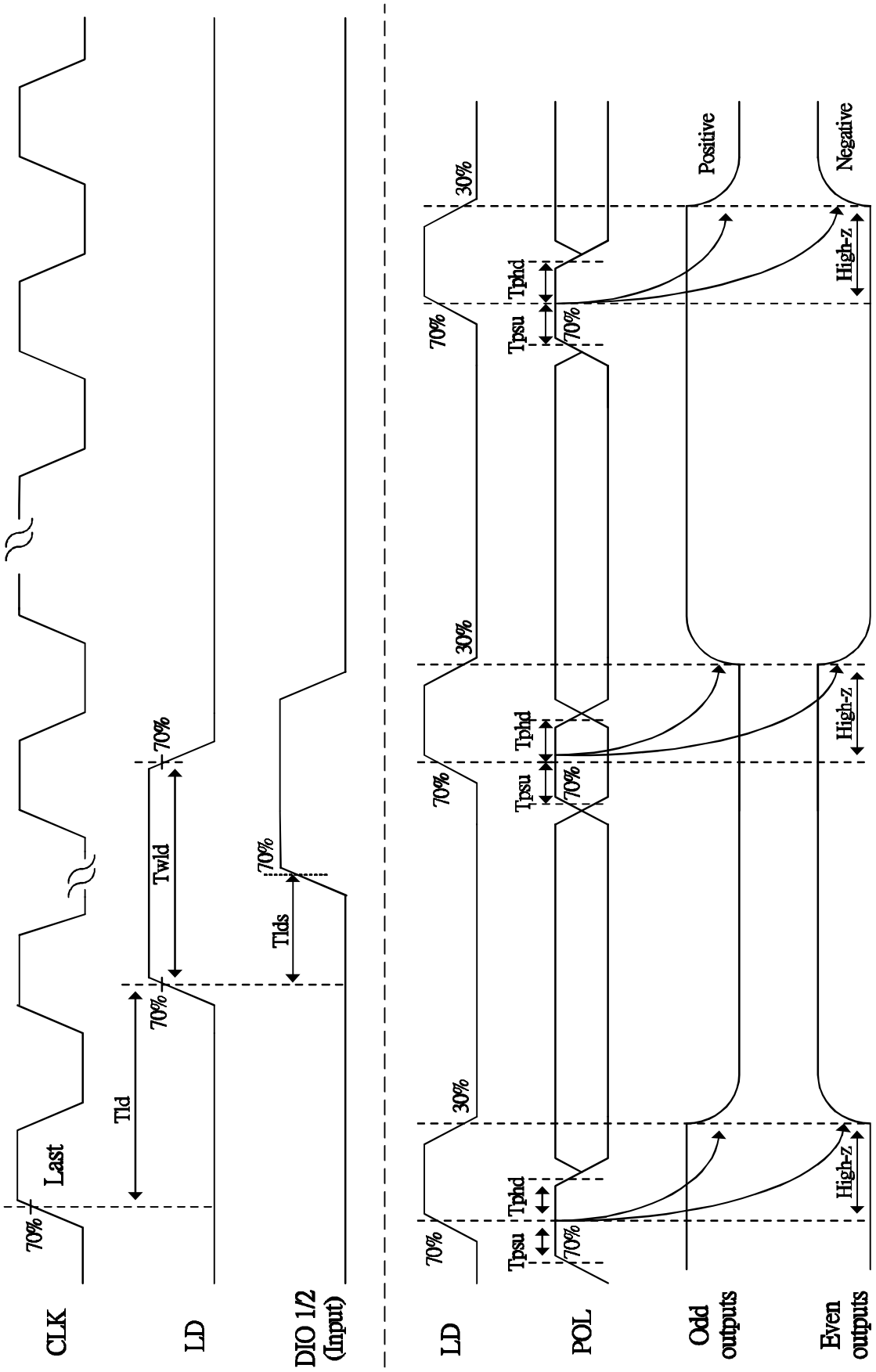


Fig. 11-2 Horizontal timing(2)

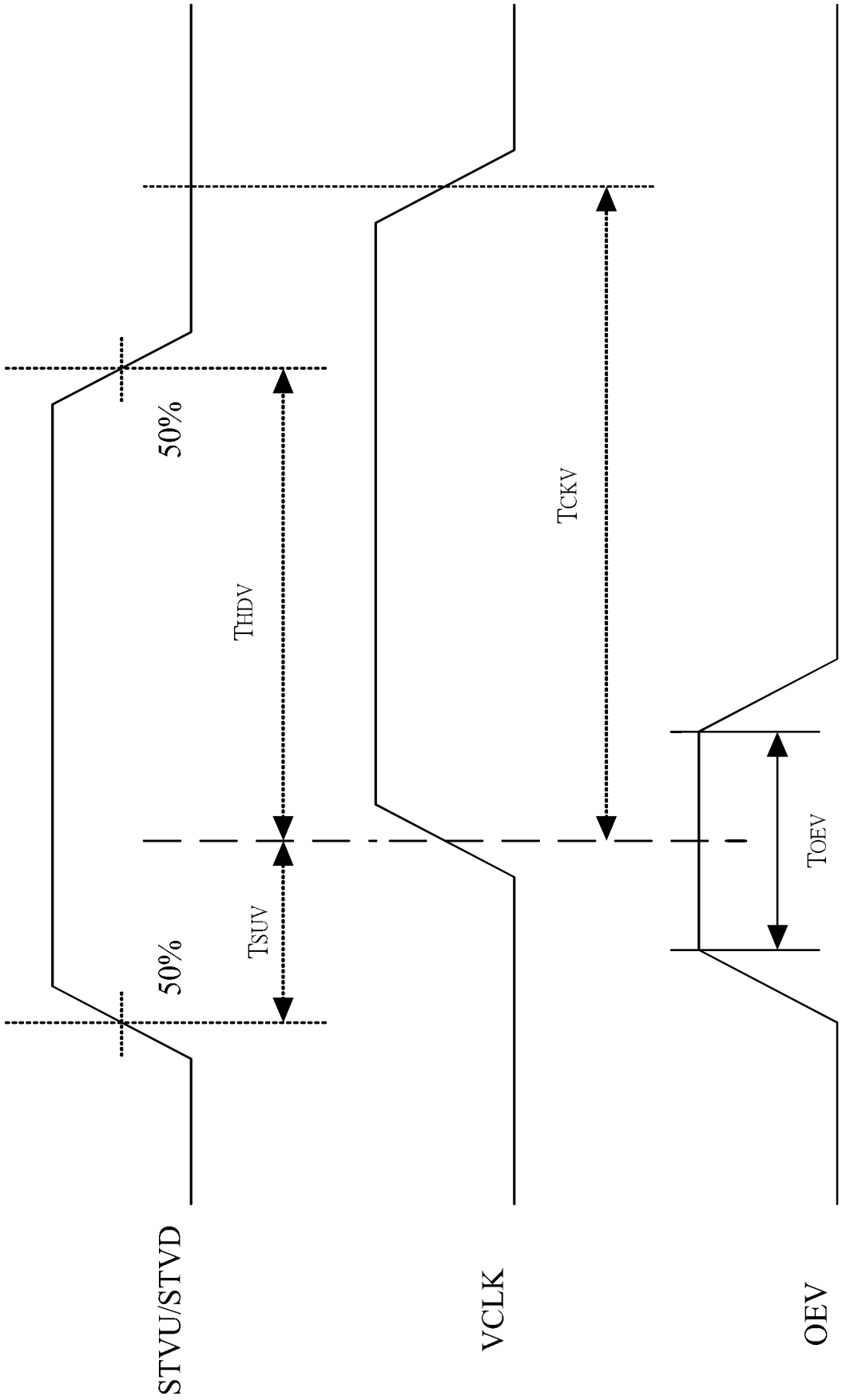


Fig. 11-3 Vertical shift clock timing

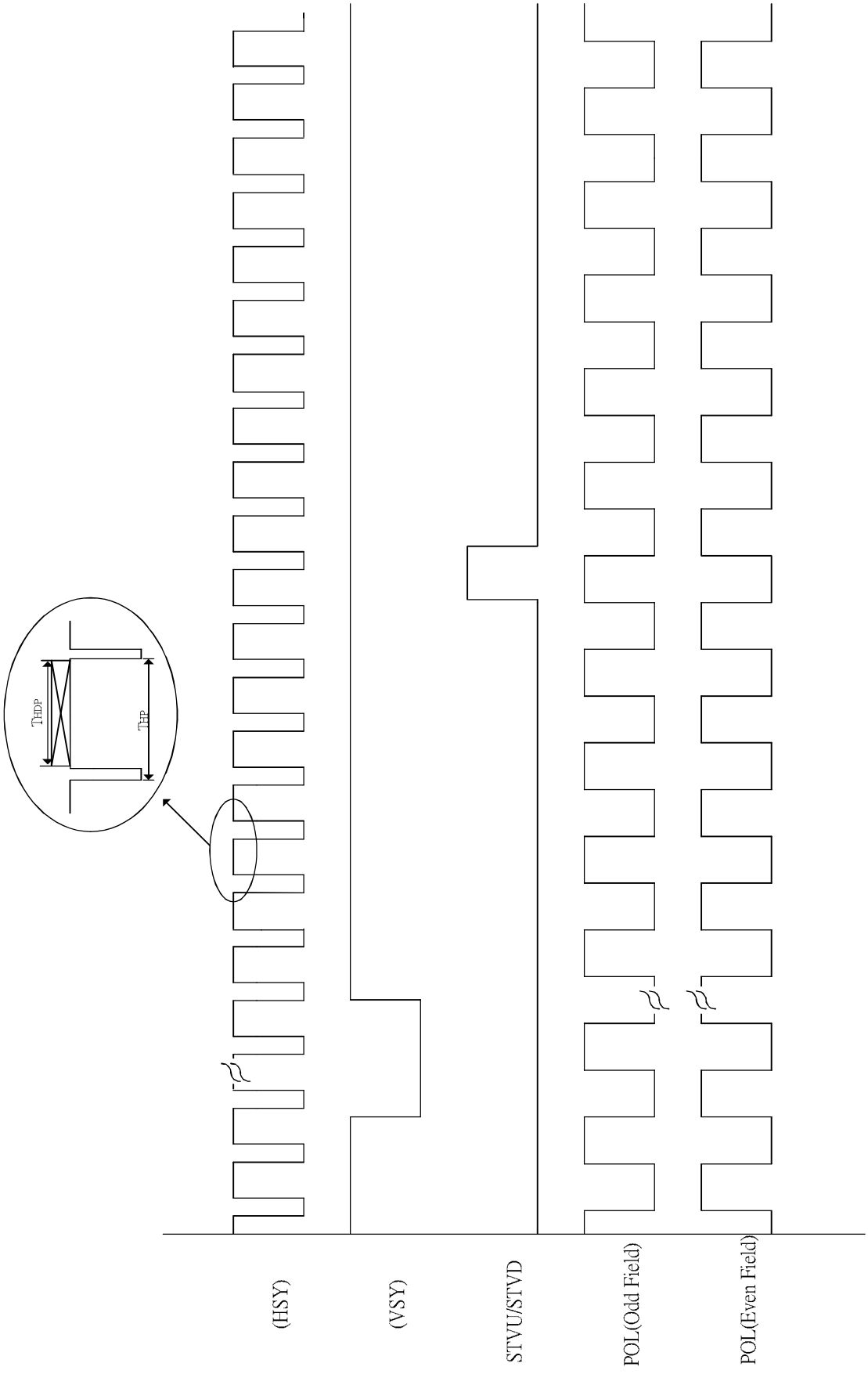
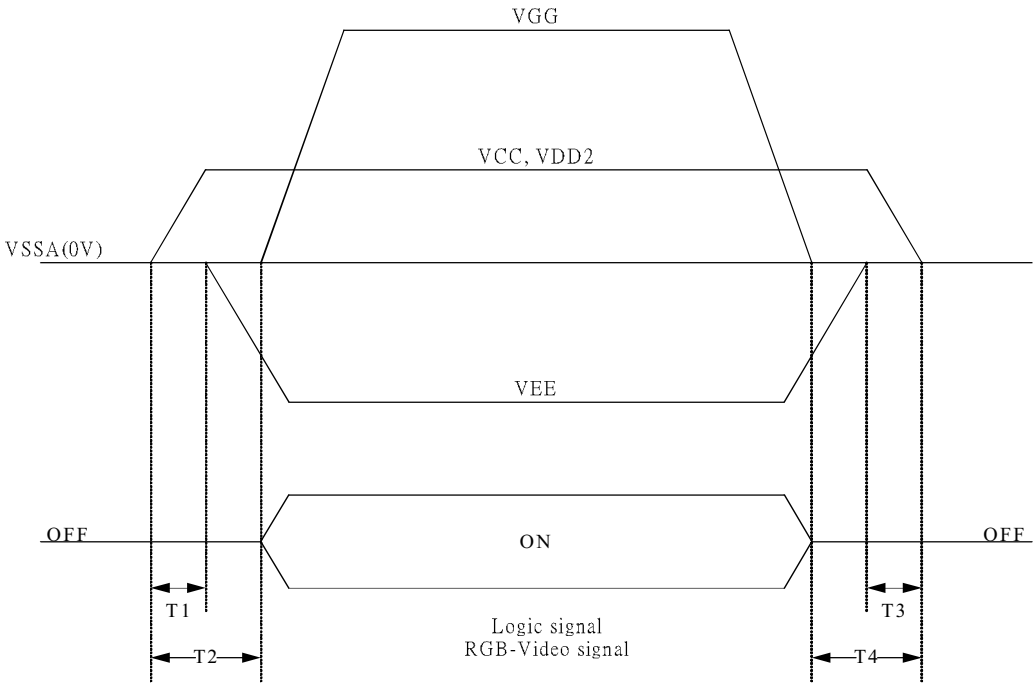


Fig. 11-4 Vertical timing

12. Power On Sequence

The Power on Sequence only effect by VCC, VGG, VDD2, VSS and VEE, the others do not care.



1) 10ms≦T1<T2
2) 0ms<T3≦T4≦10ms

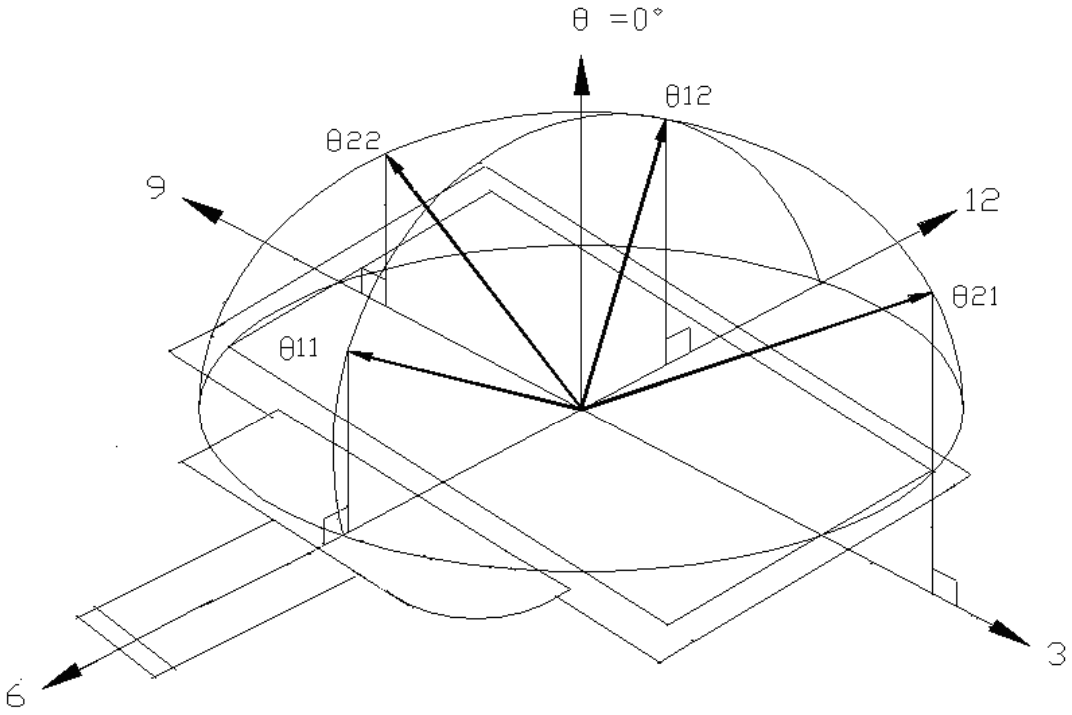
13. Optical Characteristics

13-1) Specification:

The back-light which E Ink used is 5 inch for optical measuring and the specification of average brightness is 6980 (cd/m^2). Ta=25℃

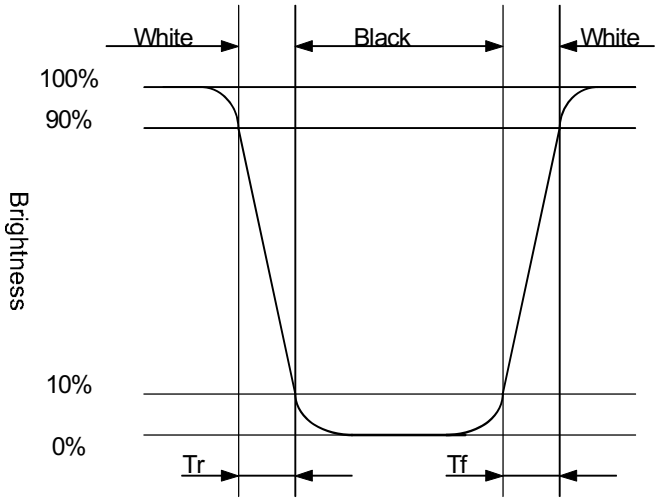
Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ 21.22	CR≥10	45	50	-	deg	Note 13-1
	Vertical	θ 12		10	15	-	deg	
		θ 11		30	35	-	deg	
Contrast Ratio		CR	Optimum direction	500	600	-	-	Note 13-2
Transmission Ratio		T	θ =0°	6.5	7.0	-	%	
Response time	Rise	Tr	θ =0°	-	15	30	ms	Note 13-3
	Fall	Tf	φ =0°	-	25	50	ms	
Cross Talk Ratio		CTK	-	-	-	3.5	%	Note 13-4

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



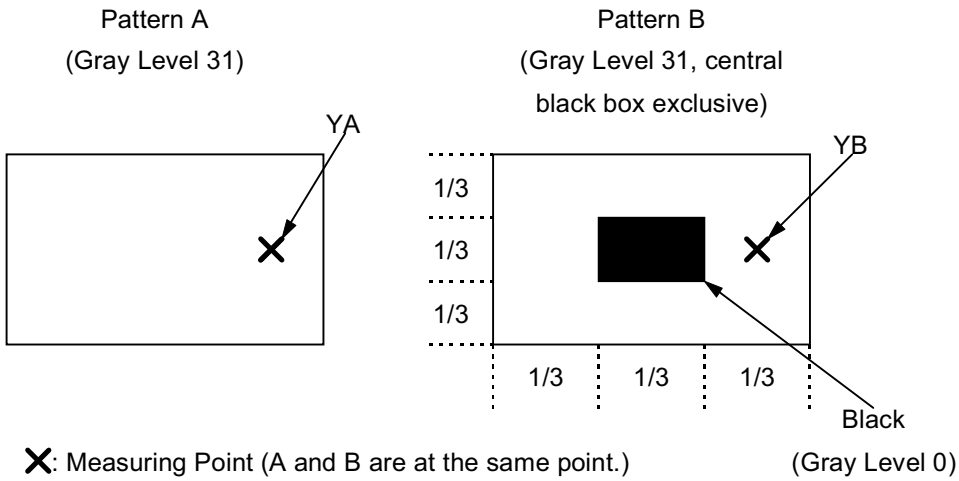
Note 13-2: The definition of contrast ratio $CR = \frac{\text{Luminance at gray level 63}}{\text{Luminance at gray level 0}}$

Note 13-3: Definition of Response Time Tr and Tf



Note 13-4: 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



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 figure14-1 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.

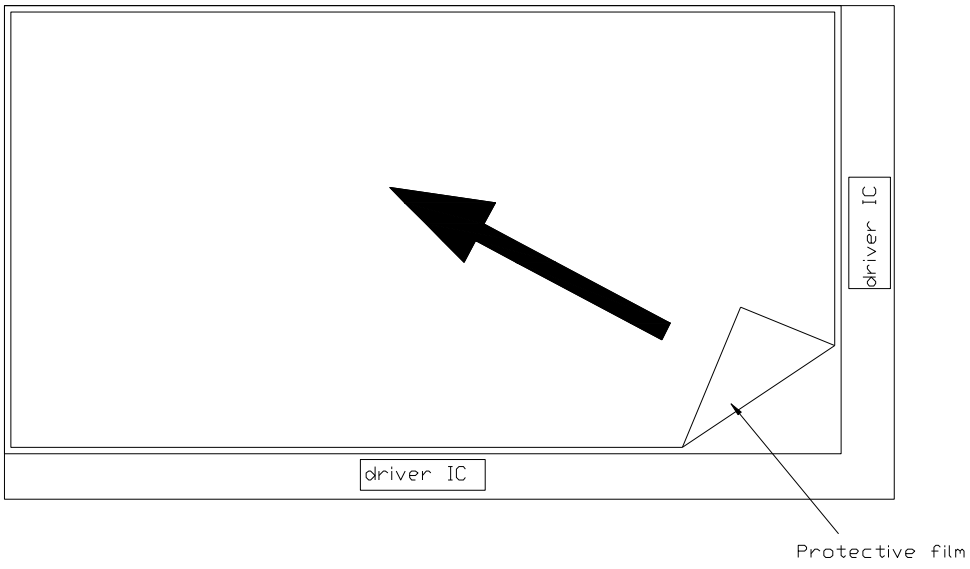


Figure 14-1 the way to peel off protective film

15. Reliability Test

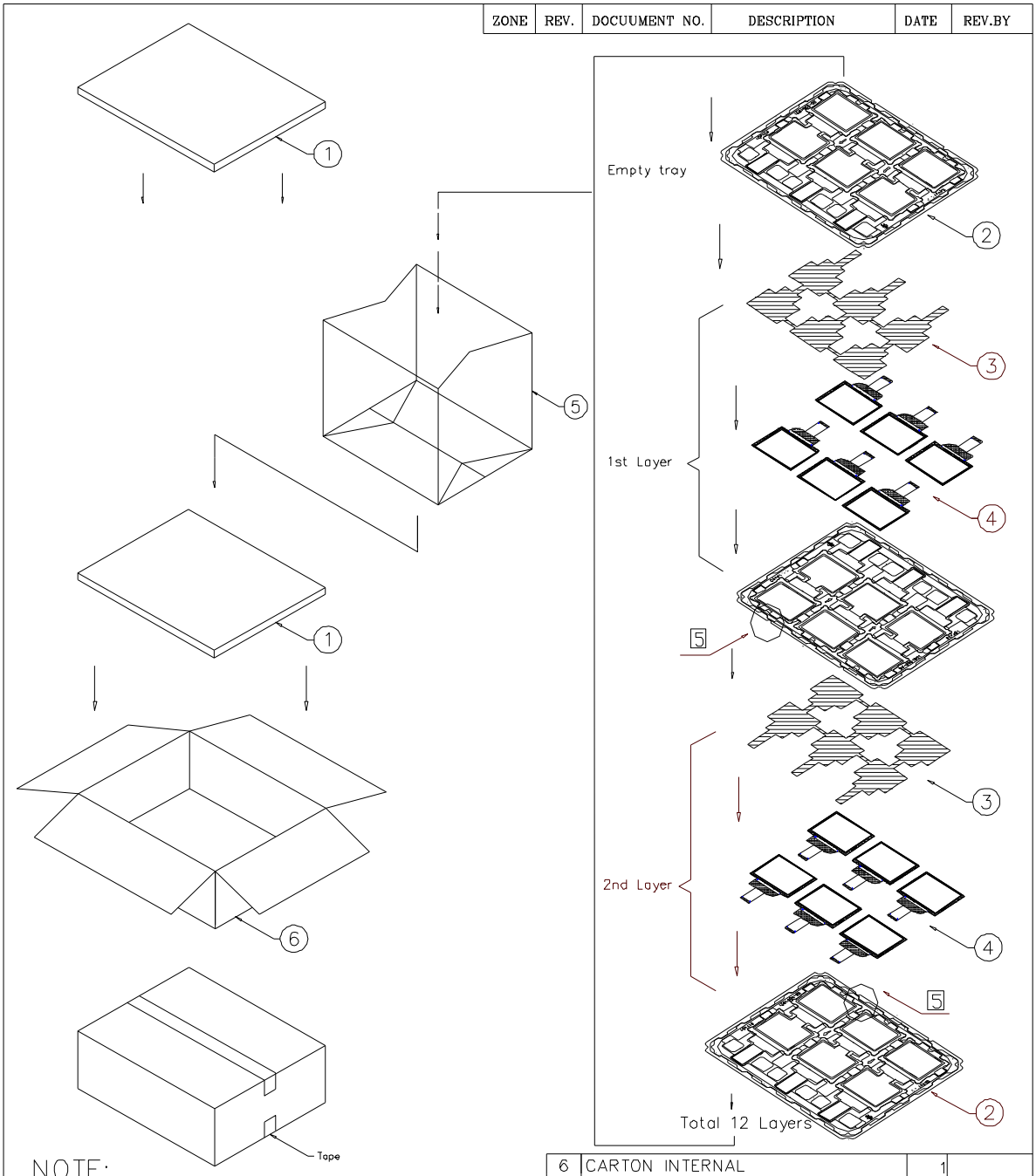
No	Test Item	Test Condition
1	High Temperature Storage Test	Ta = 70℃, 240 hrs
2	Low Temperature Storage Test	Ta = -20℃, 240 hrs
3	High Temperature Operation Test	Ta = 70℃, 240 hrs
4	Low Temperature Operation Test	Ta =-20℃, 240 hrs
5	High Temperature & High Humidity Operation Test	Ta = 60℃, 90%RH, 240 hrs (No Condensation)
6	Thermal Cycling Test (non-operating)	-20℃→70℃, 200 Cycles 30min 30min
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

ZONE	REV.	DOCUUMENT NO.	DESCRIPTION	DATE	REV.BY



NOTE:

1. One layer include: 1 piece of cushion sheet, 6pcs panel & 1 piece of tray.
2. Q'TY: 72 pcs panel/carton.
3. Dimension: 455*375*190mm
4. Weight: 5.9 KG

5. tray 需180°交叉堆疊，疊堆後可從側邊檢視圓弧防呆方向是否正確

ITEM	DESCRIPTION	QTY	REMARK
6	CARTON INTERNAL	1	
5	摺口袋450*380*700mm	1	抗靜電
4	PD050SX2 Panel	72	
3	EPE CUSHION SHEET	12	抗靜電
2	PS TRAY	13	抗靜電
1	EPE FOAM	2	

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

			SCALE	UNIT	SHEET	DWG.TITLE
APPROVE	Patrick Lin	'11.03.29	1:1	mm	1 OF 1	PD050SX2 PACKING Drawing
CHECK	Patrick Lin	'11.03.29				
DESIGN	Doris Chen	'11.03.29	MTL.NO.	DWG.NO.	REV. 01	A4 SIZE