Version : ***1.0***

TECHNICAL SPECIFICATION

MODEL NO. : PM102WX1

☐Customer's Confirmation

Customer _____

By _____

☐PVI's Confirmation

Dep	FAE	Panel Design	Electronic Design	Mechanical Design	Product Verification	Prepared by
Sign						

TECHNICAL SPECIFICATION

CONTENTS

1. Application

This data sheet applies to a color TFT LCD module, PM102WX1.

PM102WX1 module applies to OA product, 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 PVI's reliability test conditions.

If you use PM102WX1, Prime View advises your systems use PVI's timing controller IC (PVI-2002A) which will generate proper timing signals to control PM102WX1.

2. Features

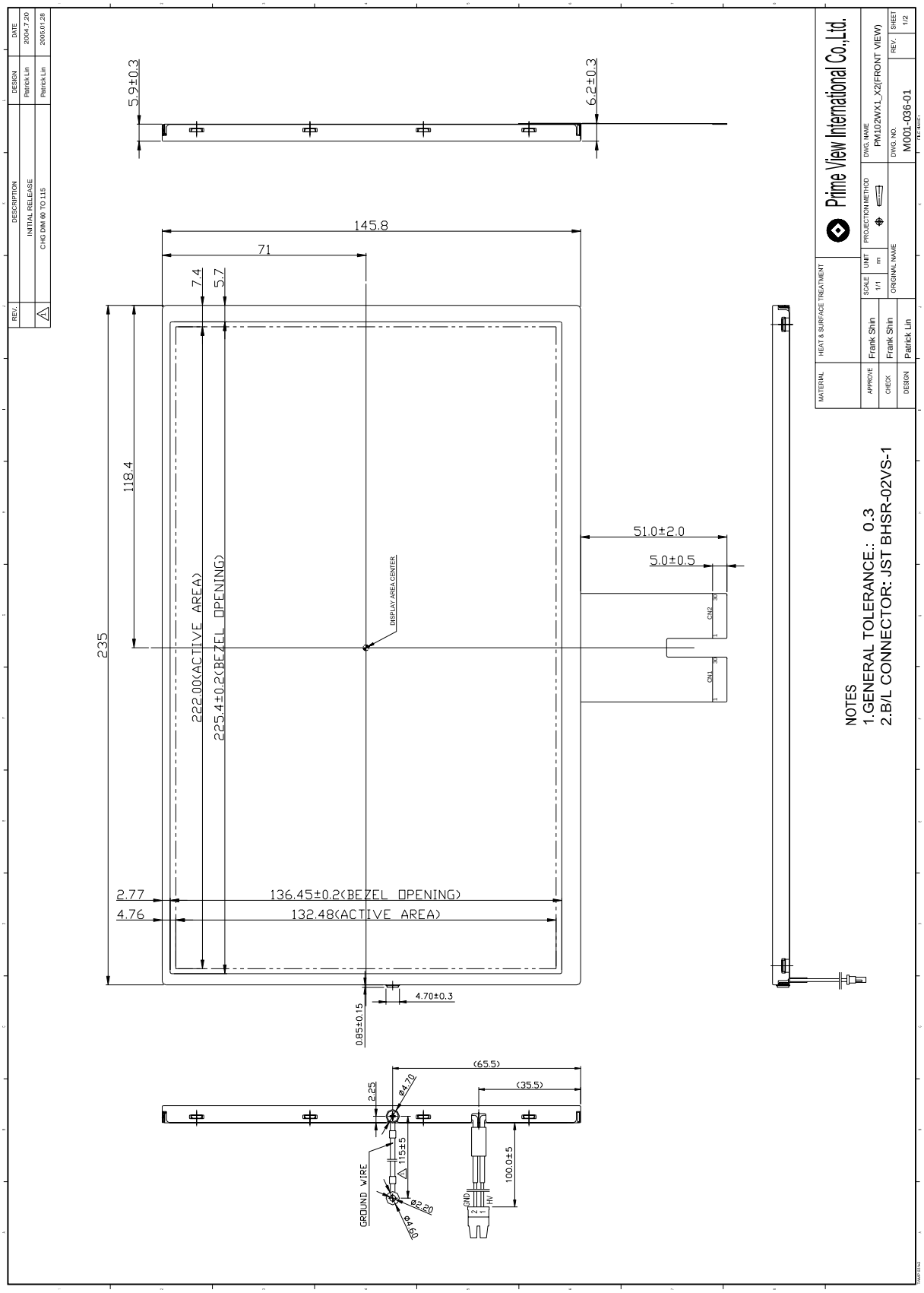
. Wide VGA (800*480 pixels) resolution
. Amorphous silicon TFT LCD panel with back-light unit
. Pixel in stripe configuration
. Thin and light weight
. Display Colors：262,144 colors
. Optimum Viewing Direction：6 o'clock
. TTL interface
. Wide viewing angle

3.Mechanical Specifications

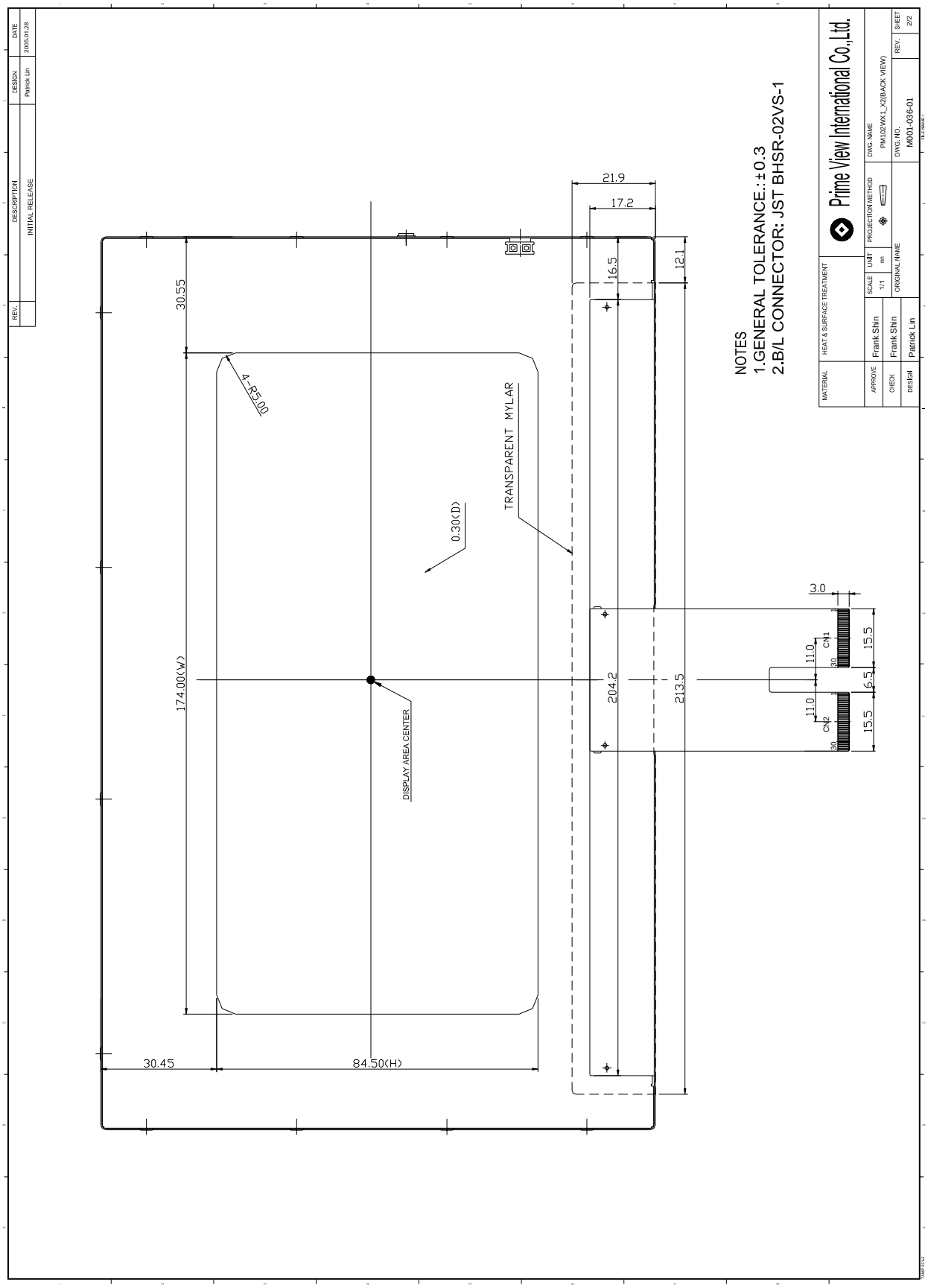
Parameter	Specifications	Unit
Screen Size	10.2 (diagonal)	inch
Display Format	800X(R, G, B)X480	dot
Display Colors	262,144	
Active Area	222.0(H)X132.48(V)	mm
Pixel Pitch	0.2775(H)X0.276(V)	mm
Pixel Configuration	Stripe	
Outline Dimension	235.0(W)X145.8 (H)X5.9 (D) (typ.)	mm
Weight	312±15	g
Back-light	CCFL, 1 tube	
Surface treatment	Anti-glare and Wide View Film	
Display mode	Normally white	

4.Mechanical Drawing of TFT-LCD Module

Outline Drawing : Front View (unit : mm)



Outline Drawing : Rear View (unit : mm)



5.Input / Output Terminals

5-1) TFT-LCD Panel Driving

Connector type: ELCO, 6210-30PIN, PIN No 30 pins, pitch=0.5mm

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	I	NC	
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 (CLK), latch the “POL” signal to control the polarity of the outputs.

Note 5-3: Control whether the Data R0~G5 are inverted or not. (PVI 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

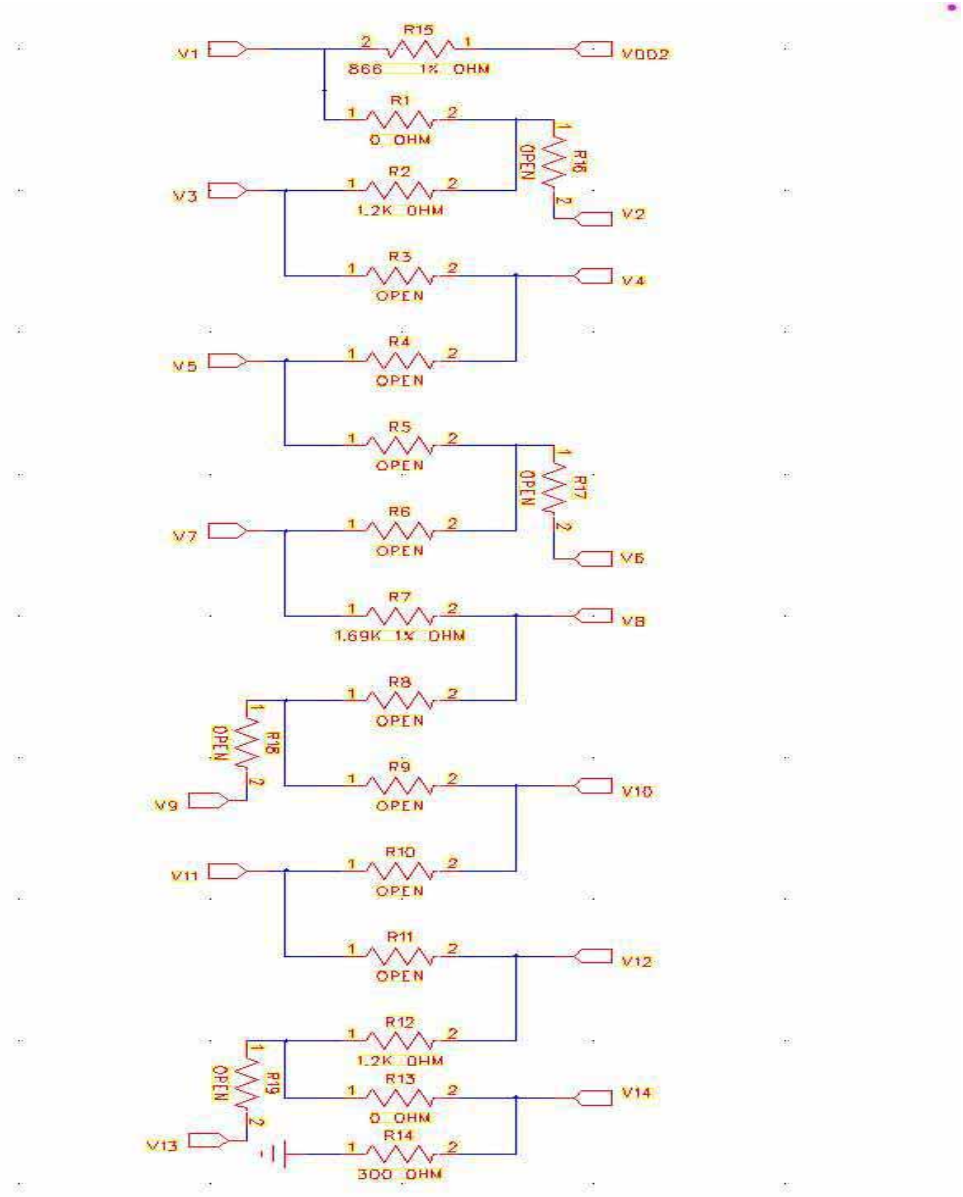
U/D	STVU	STVD	Shift
1	Hi-Z	Input	Down to Up
0	Input	Hi-Z	Up to Down

Note 5-7: Gate driver shift clock

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

Note 5-9: Gate off voltage, V_{EE}=-10V.

Note 5-10: Typical Application Circuit (When V_{DD2} = +8.8V)



5-2) Backlight driving

Connector type: JST BHSR-02VS-1, PIN No 2 pins, pitch=3.5mm

Pin No	Symbol	Description	Remark
1	VL1	Input terminal (Hi voltage side)	Wire color : Pink
2	VL2	Input terminal (Low voltage side)	Wire color : White Note 5-11

Note 5-11: Low voltage side of backlight inverter connects with ground of inverter circuits.

6.Absolute Maximum Ratings:

$V_{SS1}=V_{SS2}$=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}	-	33	V	
	V_{EE}	-20	0.3	V	
Digital Input	V_{IN}	-0.5	V_{CC}+0.5	V	
Backlight Driving Voltage	V_L	-	2000	V	
Backlight Driving Frequency	F_L	0	100	KHz	
Storage Temperature	T_{ST}	-30	80	℃	
Operating Temperature	T_{OP}	-20	80	℃	

7.Electrical Characteristics

7-1) Recommended Operating Conditions: $V_{SS1}=V_{SS2}$=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}	8.2	8.8	9.2	V	
Supply Voltage for Gate Driver	V_{GG}	-	17	-	V	
	V_{EE}	-	-10	-	V	
	V_{CC}	3.0	3.3	3.6	V	
Vcom Voltage	Vcom	-	(3.1)	-		
Digital Input Voltage	V_{IH}	$0.8V_{DD1}$	-	V_{DD1}	V	
	V_{IL}	0	-	$0.2V_{DD1}$	V	

7-2) Recommended Driving Condition for Back Light Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Lamp Voltage	V_L	770	700	630	V	I_L=6mA
Lamp Current	I_L	4	6	8	mA	Note 7-1
Lamp Frequency	P_L	30	60	80	KHz	Note 7-2
Starting Voltage (25℃) (Reference Value)	Vs	-	-	1270	Vrms	Note 7-3
Starting Voltage (0℃) (Reference Value)	Vs	-	-	1650	Vrms	Note 7-3

Note 7-1: In order to have proper operation of the B/L, no matter what kind of inverters, the output lamp current must be between Min. and Max. values to avoid the abnormal display image caused by B/L.

Note 7-2: The waveform of lamp driving voltage should be as close to a perfect sine wave as possible.

Note 7-3: The "Max of kick off voltage" means the minimum voltage of inverter to turn on the CCFL. and it should be applied to the lamp for more than 1 second to start up. Otherwise the lamp may not be turned on.

7-3) Power Consumption

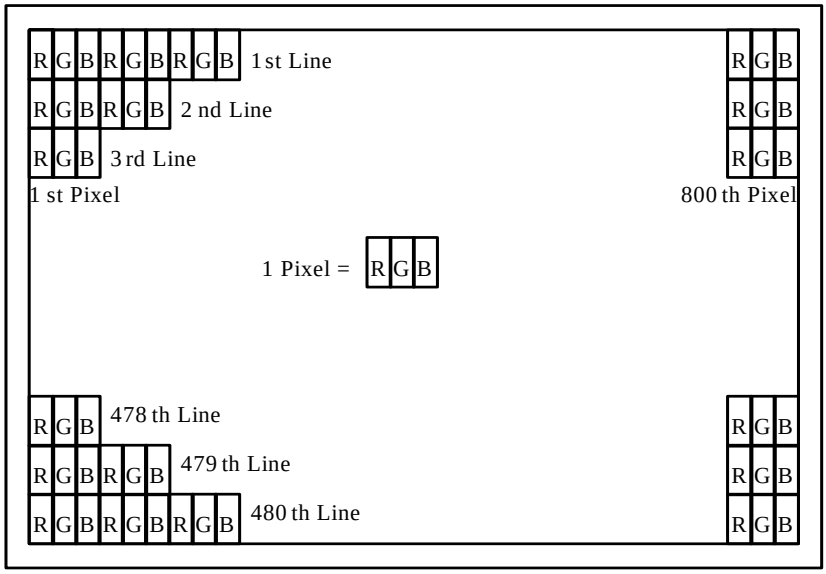
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply Current for Gate Driver (Hi level)	I_{GG}	V_{GG}=+17V	0.240	0.300	mA	
Supply Current for Gate Driver (Low level)	I_{EE}	V_{EE}=-10V	0.235	0.295	mA	
Supply Current for Source Driver (Digital)	I_{DD1}	V_{DD1}=+3.3V	6	10	mA	
Supply Current for Source Driver (Analog)	I_{DD2}	V_{DD2}=+8.8V	20	27.5	mA	
Supply Current for Gate Driver (Digital)	I_{CC}	V_{CC}=+3.3V	0.007	0.009	mA	
LCD Panel Power Consumption			202.3	283.1	mW	Note 7-4
Back Light Lamp Power Consumption			4.2	5.04	W	Note 7-5

Note 7-4: The power consumption for back light is not included.

Note 7-5: Back light lamp power consumption is calculated by I_L X V_L.

8. Pixel Arrangement

The LCD module pixel arrangement is stripe configuration.

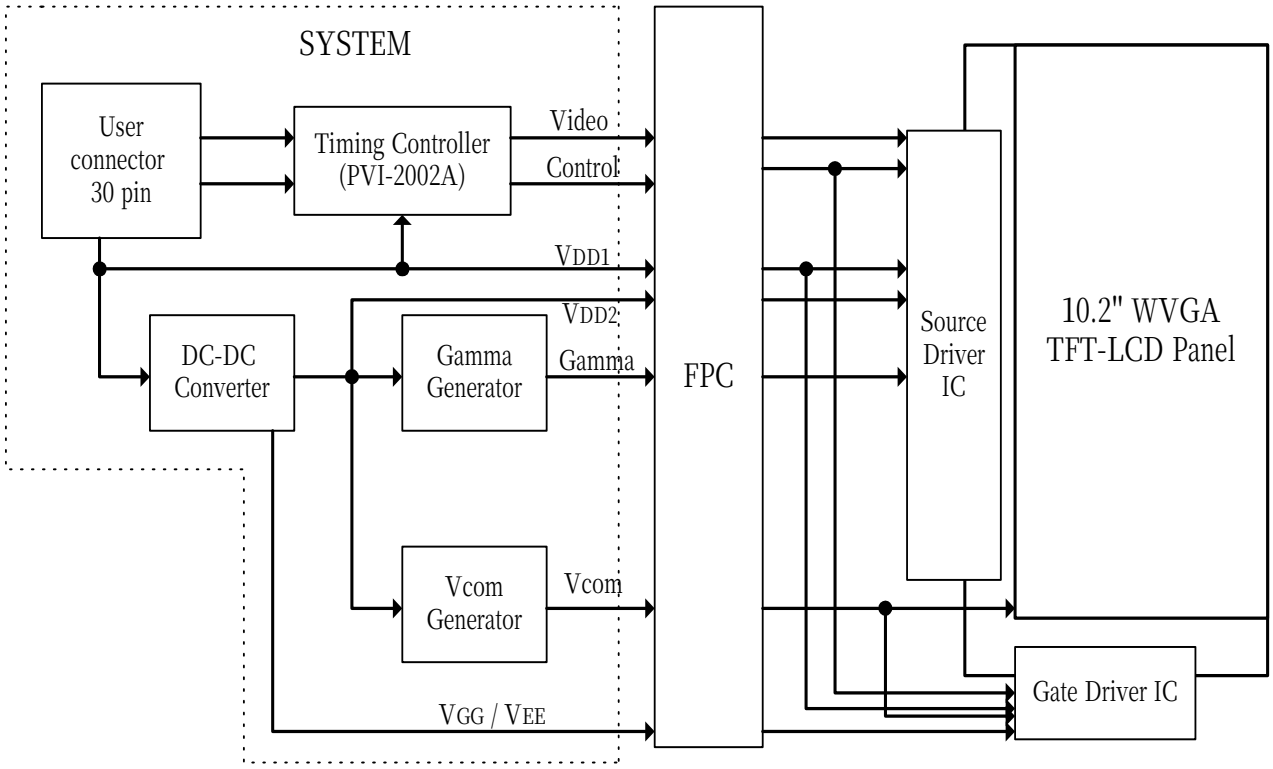


9. Display Color and Gray Scale Reference

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 PM102WX1, you can apply PVI-2002A(Timing controller) which will gernerate timing signals to support PM102WX1.

11. Interface Timing

11.1) Timing Parameters

AC Electrical Characteristics (V_{CC}=V_{DD1}=3.3V, V_{DD2}=8.8V, 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

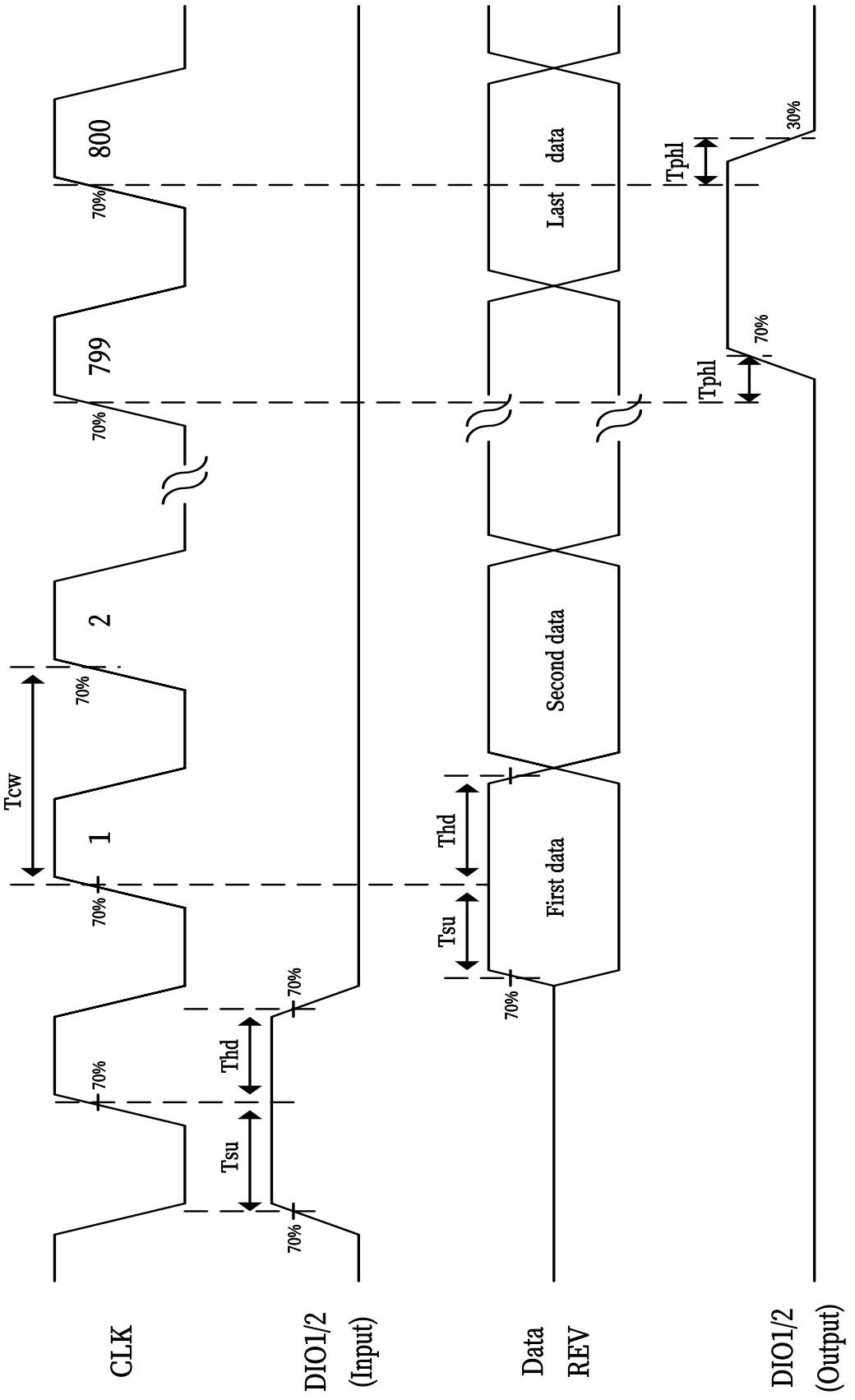


Fig. 11-1 Harizontal Timing(1)

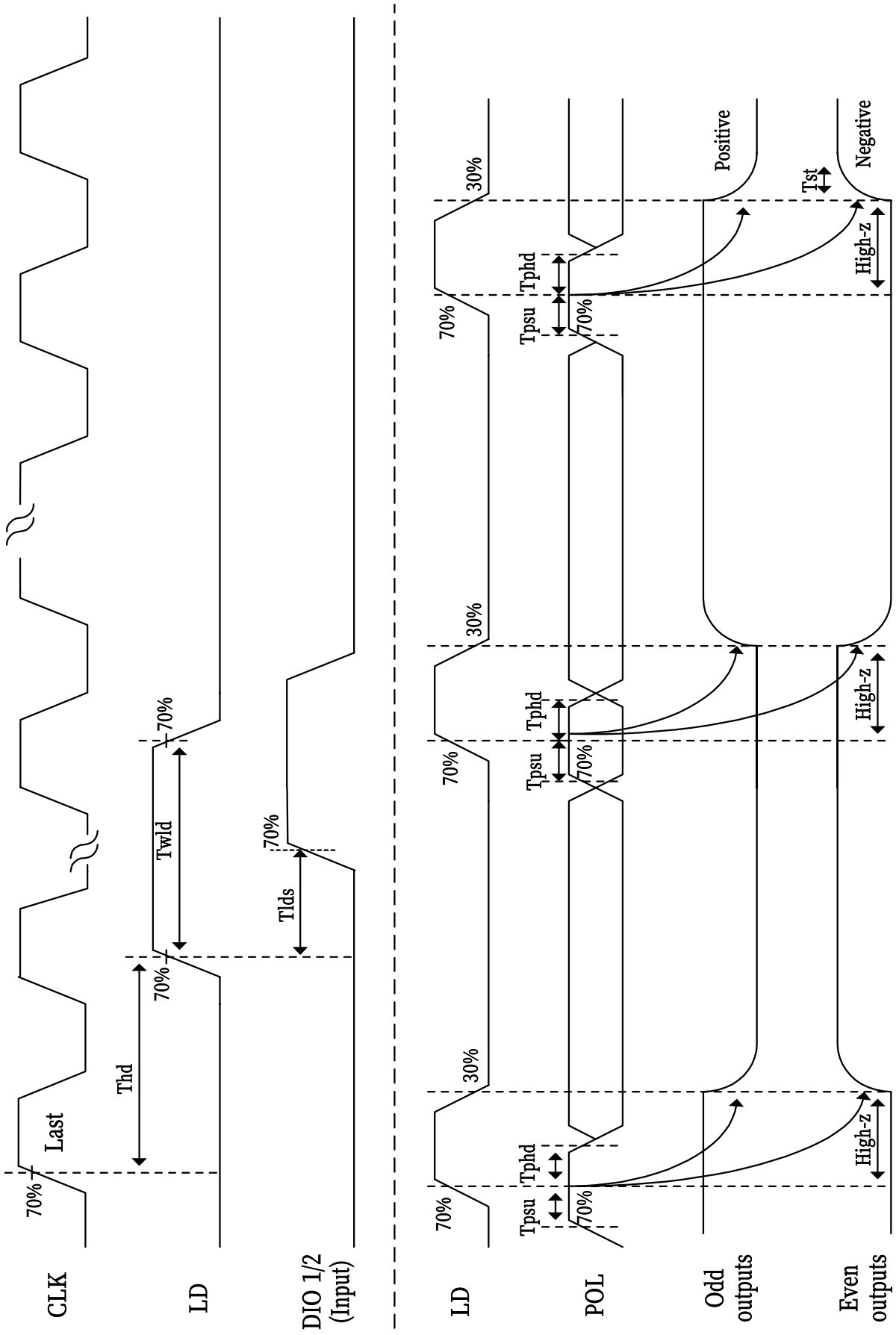


Fig. 11-2 Horizontal timing(2)

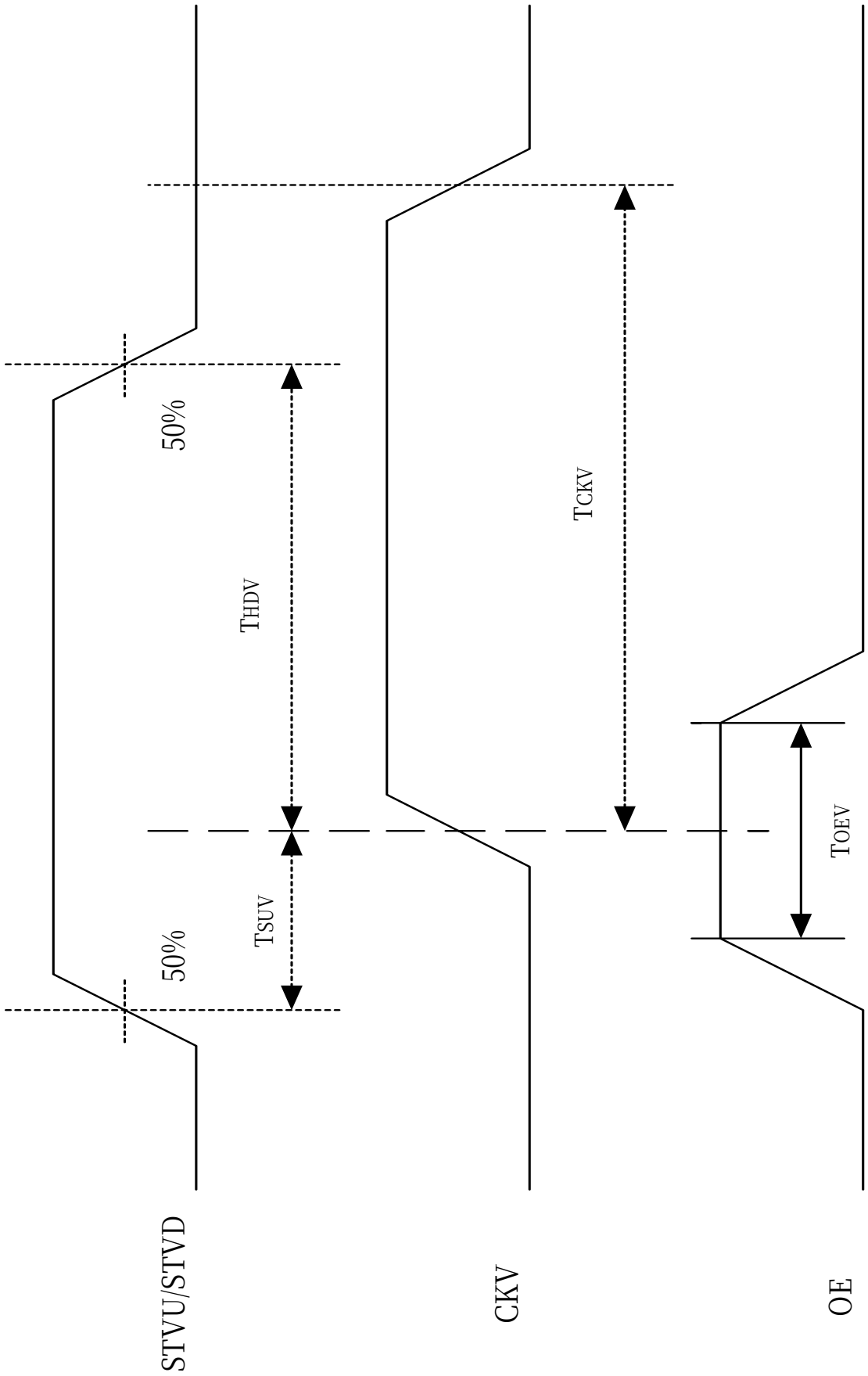


Fig. 11-3 Vertical shift clock timing

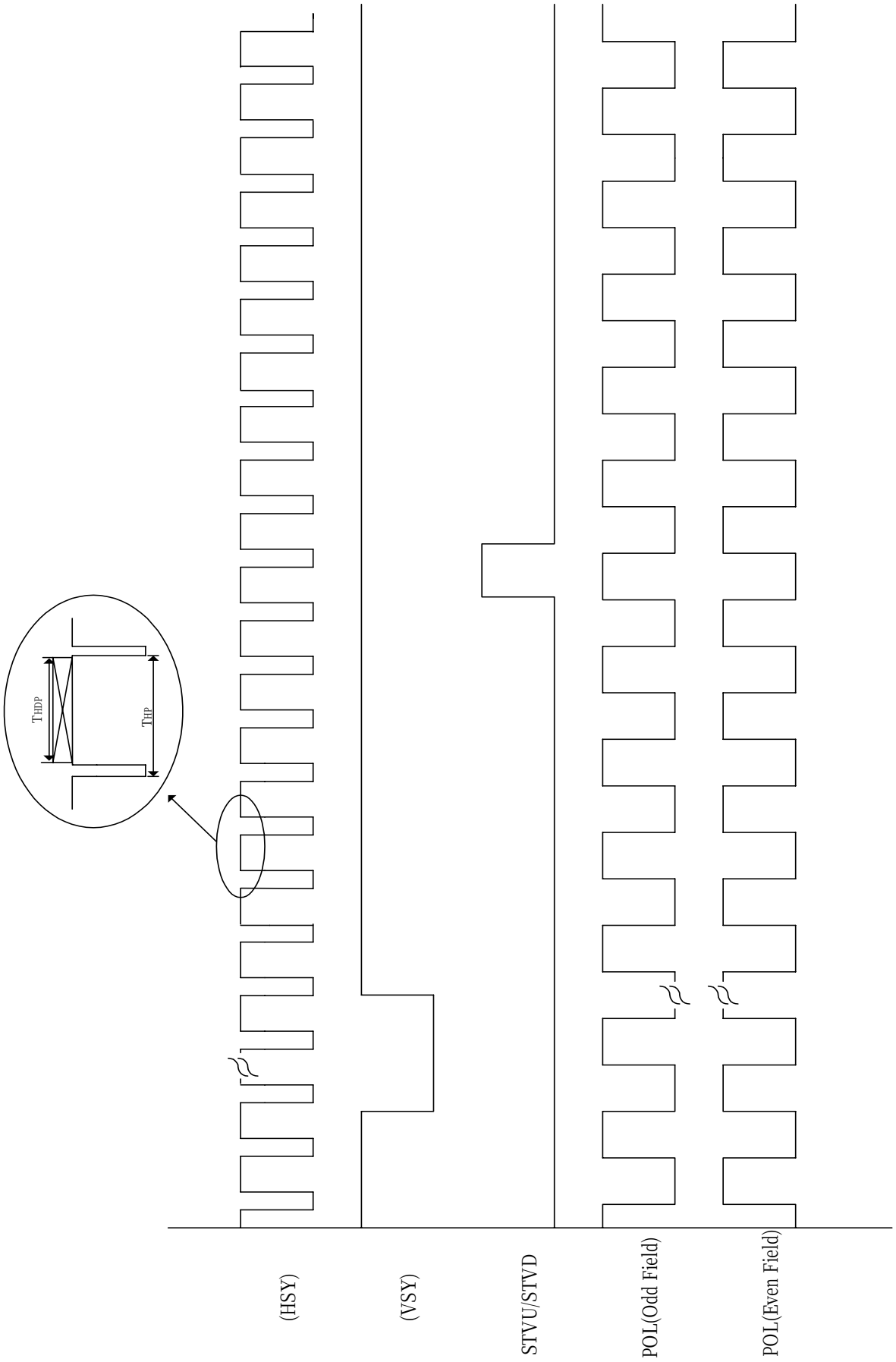
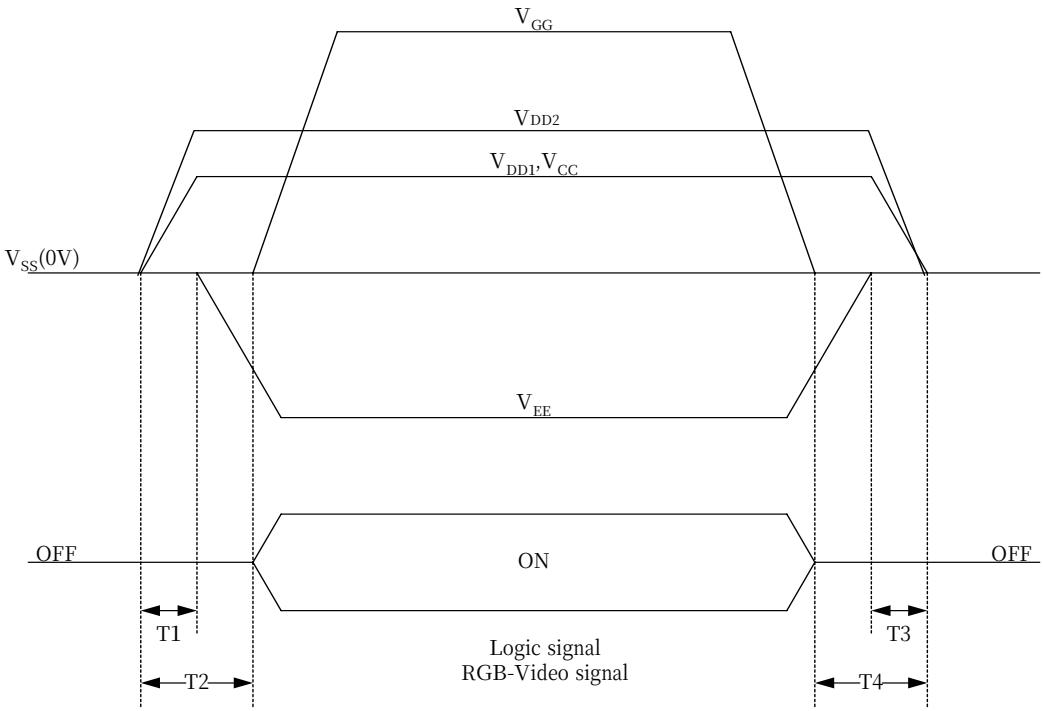


Fig. 11-4 Vertical timing

12. Power On Sequence



1. 10ms≦T1＜T2
2. 0ms＜T3≦T4≦10ms

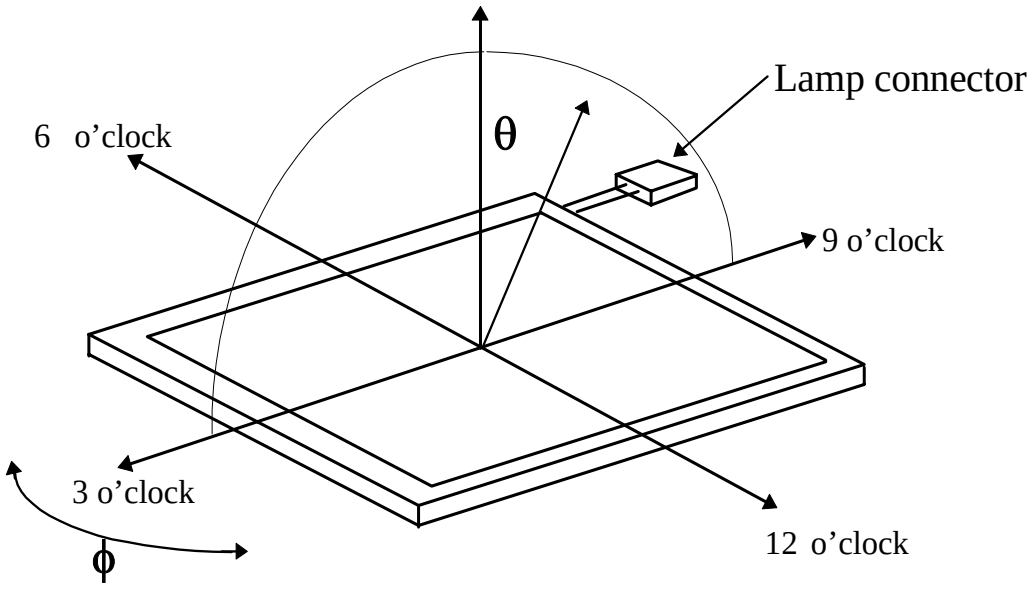
13. Optical Characteristics

13-1) Specification:

Ta=25℃

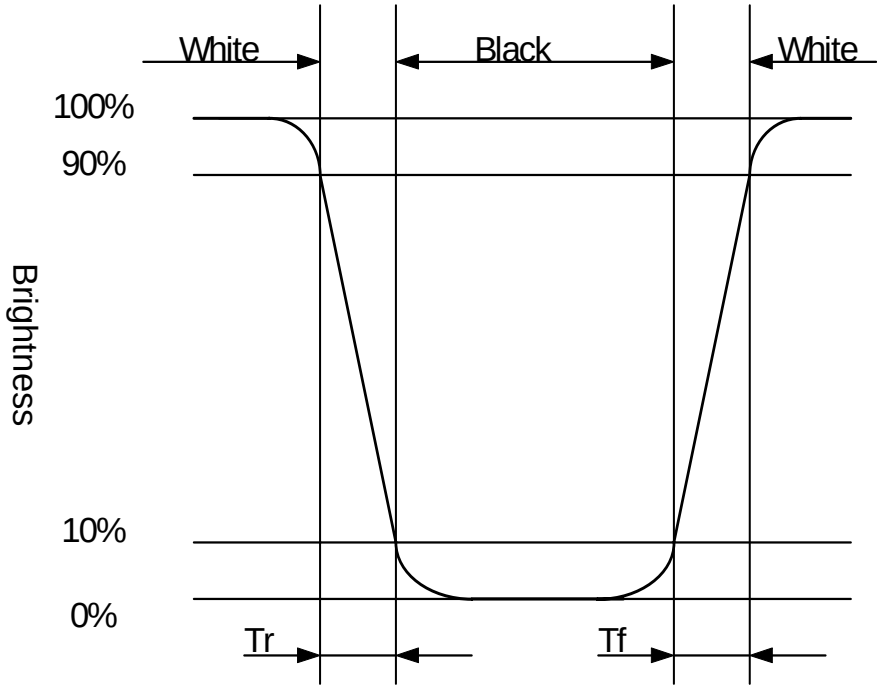
Parameter		Symbol	Condition	MIN.	TYP.	MAX.	Unit	Remarks
Viewing Angle	Horizontal	θ	CR＞10	±55	±60	-	deg	Note 13-1
	Vertical	θ (to 6 o'clock)		50	55	-	deg	
		θ (to 12 o'clock)		35	40	-	deg	
Contrast Ratio		CR	At optimized viewing angle	200	400	-	-	Note 13-2
Response time	Rise	Tr	θ=0°	-	15	30	ms	Note 13-3
	Fall	Tf		-	25	50	ms	
Brightness			θ=0°/ϕ=0	350	400	-	cd/m²	Note 13-4
Luminance Uniformity		U		75	80	-	%	Note 13-5
White Chromaticity		x		0.28	0.31	0.34	-	
		y		0.31	0.34	0.37	-	
Cross Talk			θ=0°	-	-	3.5	%	Note 13-6
Lamp Life				-	30000	-	hr	At=6mA

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

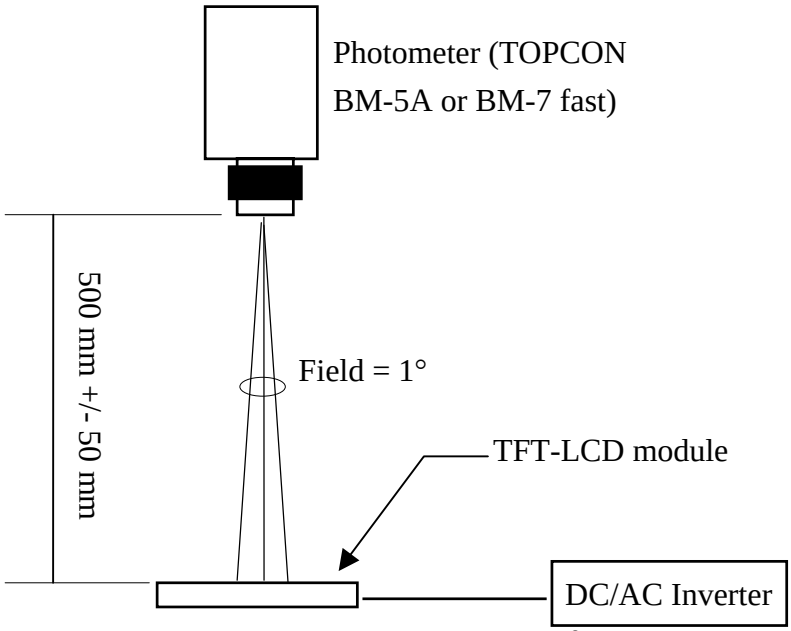


Note 13-2: The definition of contrast ratio $CR = \frac{\text{Luminance at gray level 63}}{\text{Luminance at gray level 0}}$

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



Note 13-4: All optical measurements shall be performed after backlight being turned-on for 30 mins. 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.



Optical characteristics measuring configuration

Note 13-5: The uniformity of LCD is defined as

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

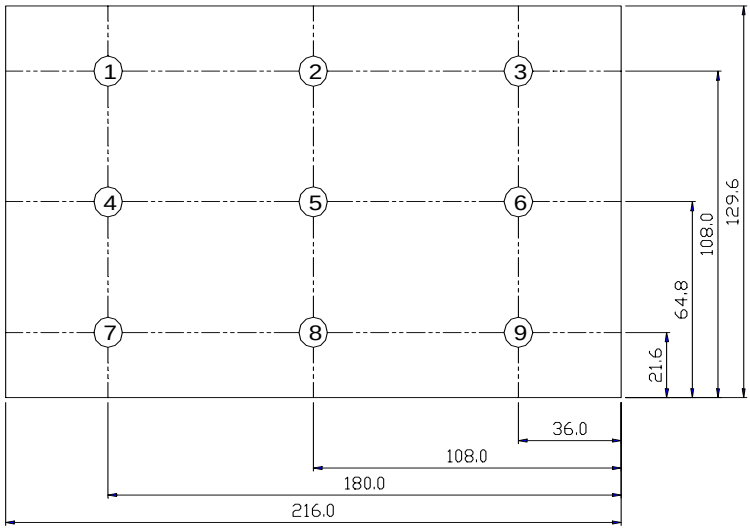
Luminance meter: BM-5A or BM-7 fast (TOPCON)

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 13-6: 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)

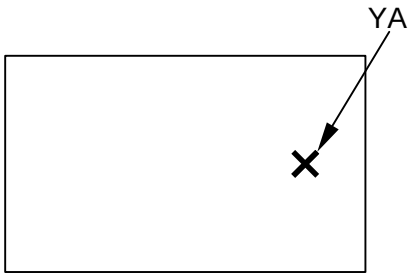
Measurement distance: 500 mm +/- 50 mm

Ambient illumination: < 1 Lux

Measuring direction: Perpendicular to the surface of module

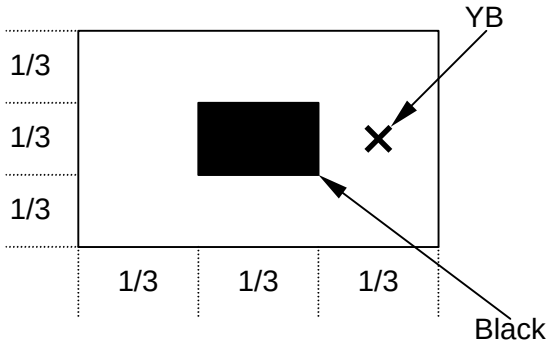
Pattern A

(Gray Level 31)



Pattern B

(Gray Level 31, except the black box in the center)



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

(Gray Level 0)

Note 13-7: Topcon BM-5A or BM-7 fast luminance meter 1° field of view is used in the testing (after 30 minutes' B/L power-on). The typical luminance value is measured at lamp current 6 mA.

14. Handling Cautions

14-1) Mounting of module

0. Please power off the module when you connect the input/output connector.

b) Please connect the ground pattern of the inverter circuit surely. If the connection is not perfect, some following problems may happen possibly.

0. The noise from the backlight unit will increase.
0. The output from inverter circuit will be unstable.
0. In some cases a part of module will heat.

c) Polarizer which is made of soft material and susceptible to flaw must be handled carefully.

d) Protective film (Laminator) is applied on surface to protect it against scratches and dirts. It is recommended to peel off the laminator before use and taking care of static electricity.

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 match up with the rubbing direction.

15. Reliability Test

No	Test Item	Test Condition	Remark
1	High Temperature Storage Test	Ta = +80℃, 240 hrs	
2	Low Temperature Storage Test	Ta = -30℃, 240 hrs	
3	High Temperature Operation Test	Ta = +80℃, 240 hrs	
4	Low Temperature Operation Test	Ta = -20℃, 240 hrs	
5	High Temperature & High Humidity Operation Test	Ta = +50℃, 80%RH, 240 hrs (No Condensation)	
6	Thermal Cycling Test (non-operating)	0℃→+60℃, 50 Cycles 1Hr 1Hr	
7	Vibration Test (non-operating)	Frequency：10 ~ 57 H_Z, Amplitude：0.5 mm 58~500Hz, 1G Sweep time: 11 min Test Period: 3 hrs (1 hr for each direction of X, Y, Z)	
8	Shock Test (non-operating)	80G, 6ms, X,Y, Z 1 times for each direction	
9	Electrostatic Discharge Test (non-operating)	200Pf, 0Ω ±200V 1 time / each terminal	

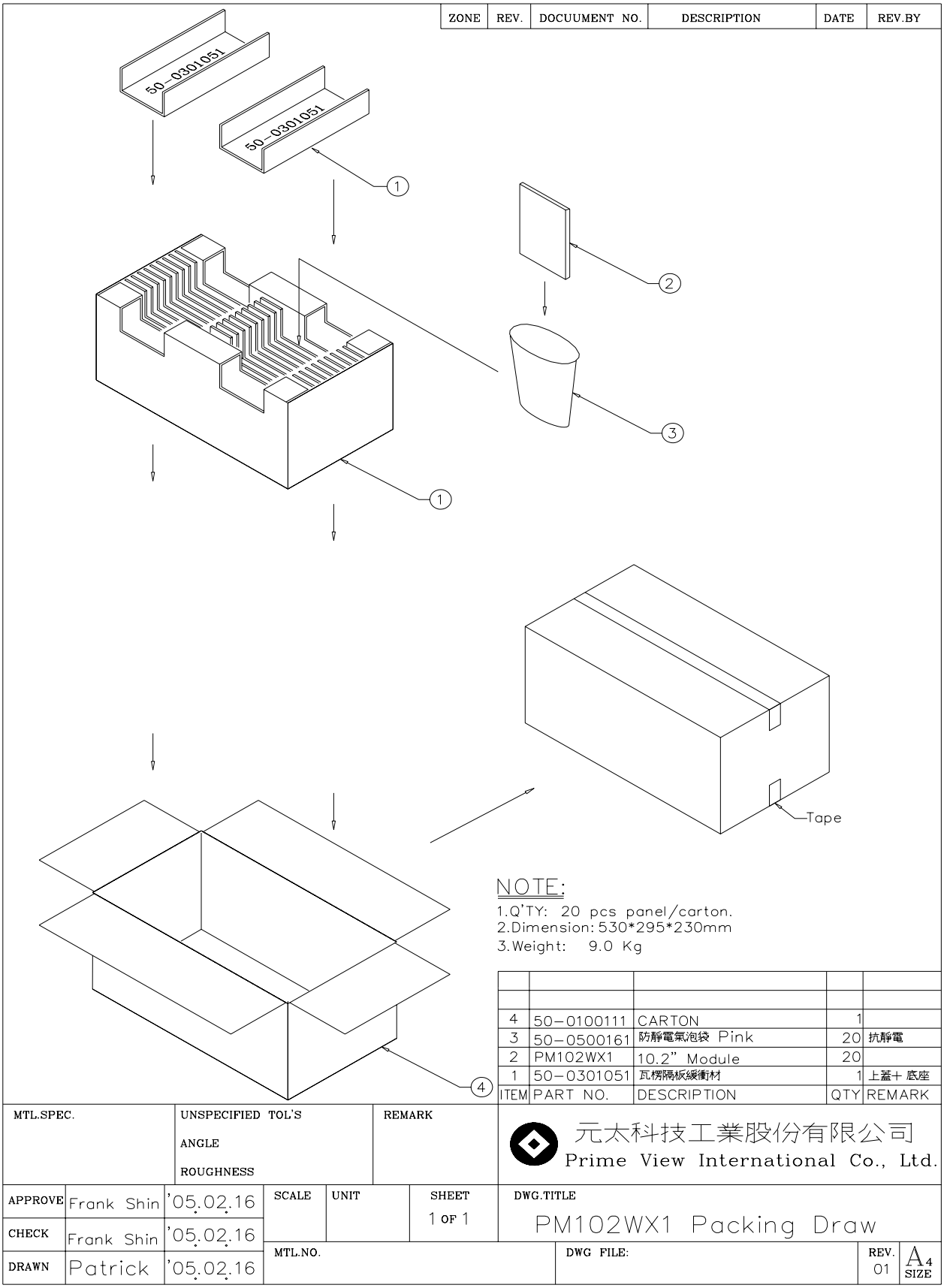
Ta: ambient temperature

Note: The protective film must be removed before temperature test

[Judgement Criteria]

Under the display quality test conditions with normal operation state, there should be no change which may affect practical display function.

16. Packing Diagram



Revision History

Rev.	Issued Da	Revised Contents
0.1	Jul. 21,2004	New
0.2	Aug.13, 200	Page 16: Modify Interface Timing
0.3	Dec.28,2004	Updata Page12: 7-2) Recommended Driving Condition for Back Light Page 13:7-3) Power Consumption Page 22:13-1) Specification
0.4	Jun.31,2005	Page4: 4.Mechanical Drawing of TFT-LCD Module (Change ground line form 45mm increase length to 100mm)
0.5	Fab.16,2005	Updata Page 21: 13. Optical Characteristics Luminance Uniformity Page 27: 16. Packing Diagram
0.6	Apr.8,2005	Modify Page21: 13. Optical Characteristics 13-1) Specification→ Vertical view angle
0.7	Jul.14,2005	Modify Page12: 5-2) Backlight driving Connector number Form JST BHR-02VS-1 to JST BHSR-02VS-1
1.0	Aug.12,2005	Modify Page8: Note 5-8: Gate on voltage, V_{GG} from 16V change to 17V Note 5-9: Gate off voltage, V_{EE} from -9V change to -10V Page8: Typical Application Circuit (When VDD2 = +8.8V) Page9: 6.Absolute Maximum Ratings Supply Voltage V_{GG}-V_{EE} From 40 change to 33V(MAX) Page9: 7.Electrical Characteristics 7-1) Recommended Operating Conditions →Supply Voltage for Gate Driver V_{GG} from 16V change to 17V, V_{EE} from -9V change to -10V Add Vcom voltage 3.1V Page9: 7-2) Recommended Driving Condition for Back Light→Lamp voltage From 790V change to 700V(TYP) Page10: 7-3) Power Consumption→Update E/S data.(Novatec) Page18: 13. Optical Characteristics→13-1) Specification Add Lamp Life Page23: 15. Reliability Test→High Temperature & High Humidity Operation Test Test Condition→Ta from +60℃, 90%RH, 240 hrs change to +50℃, 80%RH, 240 hrs Delete Page8: 1)Relationship between input data and output voltage Page9: 2) Output voltage and input data