AZ DISPLAYS, INC.

COMPLETE LCD SOLUTIONS

3.5” VGA Very High Brightness TFT-LCD

ATM6448B-NLW-FBH Revision C

(based on PVI : PD035VX2)

COLOR LIQUID CRYSTAL DISPLAY

CONTENTS

Revision History

Rev	ECN No.	Description of changes	Date	Prepared
0		Initial release		
1		Update backlight specifications	9/12/08	
2		Update backlight, contrast, and temperature specifications	12/9/08	

1. General Description

ATM6448B-NLW-FBH is 3.5" Color Active Matrix Liquid Crystal Display with an LED backlight system. The matrix employs amorphous silicon Thin Film Transistor as the active element. It is a transmissive type display operating in the normally white mode. This TFT-LCD has a 3.5" inch diagonally measured active display area with VGA resolution (640 horizontal by 480 vertical pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 6-bit gray scale signal for each dot, thus presenting a palette of more than 262,144 colors.

The ATM6448B-NLW-FBH is intended to support applications where high brightness is a critical factor. In combination with the vertical arrangement of the sub-pixels, the ATM6448B-NLW-FBH characteristics provide an excellent flat panel display for office or industrial automation products or daylight applications.

General Specification

General specifications are summarized in the following table:

ITEM	SPECIFICATION
Active screen size	3.5 inches(8.9cm) diagonal 72.0(H) X 52.56(V) mm
Outline dimensions	84.25(H) × 65.40(V) × 5.80(D) mm Typ.
Pixel pitch	0.1125(H) mm × 0.1095(V) mm
Pixel format	640(H) X 480(V) pixels
Color Pixel Arrangement	RGB stripe arrangement
Color depth	6-bit, 262,144 colors
Brightness	1,000 cd/m^2 Min.
Power Consumption (LCD & Backlight only)	Total 1.58Watt,typ (0.18Watt @Vcc, 1.4Watt @Lamp)
Weight	60 g (Max.)
Display operating mode	transmissive mode, normally White
Surface treatments	Anti Glare
Backlight Unit	White LED

2. Absolute Maximum Rating

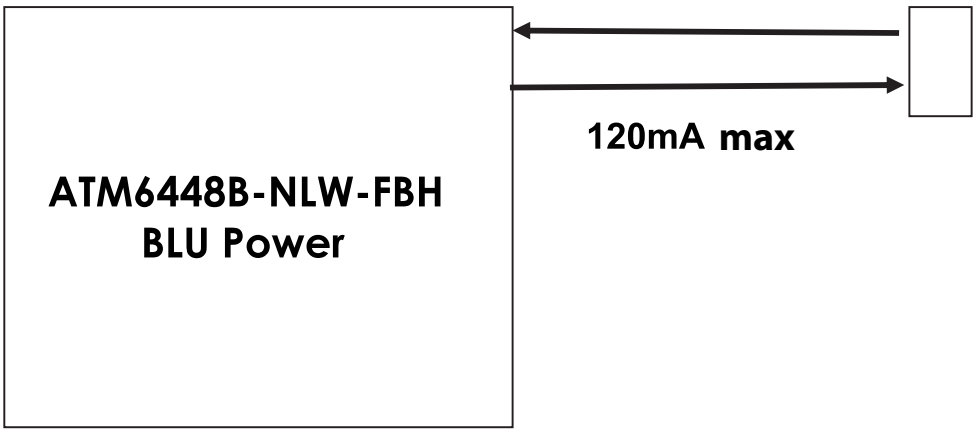
Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	V_{DD1}	-0.3	2	V	at 25°C
	V_{CC}	-0.3	5	V	
	V_{DD2}	-0.5	12.0	V	
	V_{GG}	-0.3	40.0	V	
	$V_{GG} – V_{EE}$	-	40.0	V	
	V_{EE}	-20	0.3	V	
Operating Temperature	T_{OP}	-20	+70	°C	1
Storage Temperature	T_{ST}	-30	+70	°C	1

3. Electrical Characteristics

The ATM6448B-NLW-FBH requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input which powers the LED backlight, is typically generated by LED driver board. The LED driver board is an external unit to the LCD.

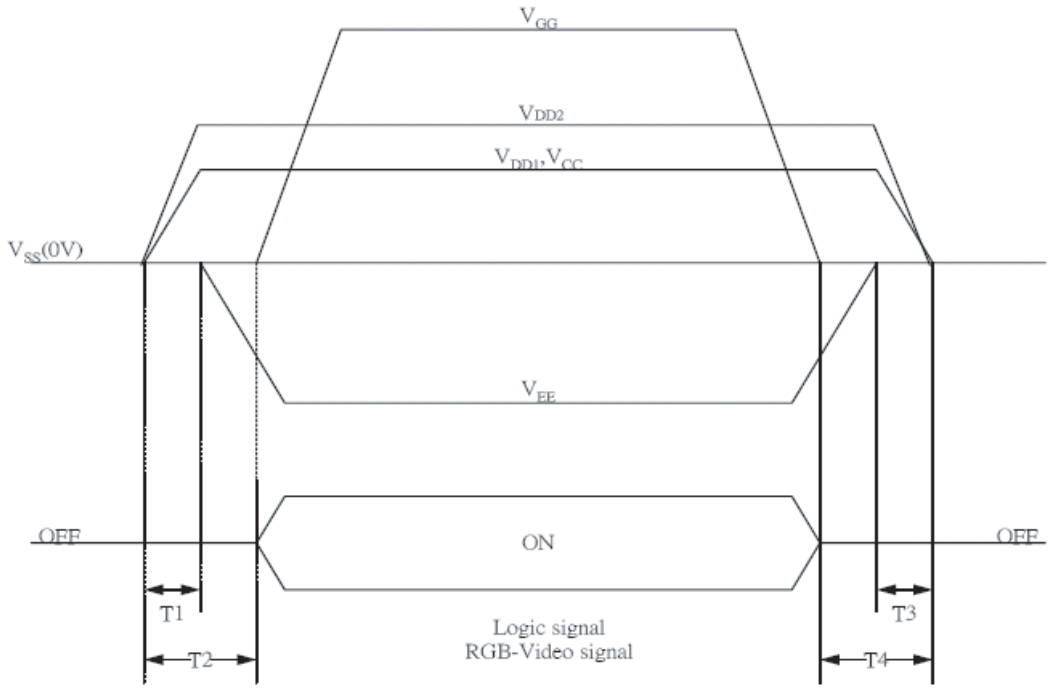
Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE:						
Supply Input Voltage	V_{DD1}	3.0	3.3	3.6	V	
(For Source Driver)	V_{DD2}	9.5	10	10.5		
Supply Input Voltage	V_{GG}	-	17		V	
(For Gate Driver)	V_{EE}	-	-10		V	
	V_{CC}	3.0	3.3	3.6	V	
Digital Input Voltage	V_{IH}	0.8 V_{DD1}	-	V_{DD1}	V	
	V_{IL}	0	-	0.2V_{DD1}	V	
Supply Current for Gate Driver (Hi level)	I_{GG}		0.12	0.15	mA	V_{GG} = +17V
Supply Current for Gate Driver (Low level)	I_{EE}		0.15	0.19	mA	V_{EE} = -10V
Supply Current for Source Driver (Digital)	I_{DD1}	-	4.8	8.0	mA	V_{DD1} = +3.3V
Supply Current for Source Driver (Analog)	I_{DD2}		16.0	30.0	mA	V_{DD2} = +10V
Supply Current for Gate Driver (Digital)	I_{CC}		0.17	0.21	mA	V_{CC} = +3.3V
Power Consumption	P_C		0.18	0.332	Watts	
LED Backlight:						
Operating Voltage	V_{BL}			11.7	Vdc	1
Operating Current	I_{BL}			0.12	Adc	1
Power Consumption	P_{BL}			1.4	Watts	
Life Time			30,000			

Notes: 1. ATM6448B-NLW-FBH load voltage should be about 11.7V at 120mA max current per top and bottom sides.



4. Power On/Off Sequences

To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as shown below.



1) 10ms ≦ T1 < T2
2) 0ms < T3 ≦ T4 ≦ 10ms

5 Input/Output Terminals

TFT-LCD Panel Driving

Pin	Symbol		Description	
1	DIO1	I/O	Horizontal Start Pulse Signal Input or Output 1	Note5-1
2	VSS2	I	Ground	
3	VDD1	I	Power Supply	
4	CLK	I	Horizontal Shift Clock	
5	R/L	I	Left/Right Selection	Note5-1
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	G0	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	Note5-2
26	REV	I	Data invert control	Note5-3
27	POL	I	Polarity selection	Note5-4
28	DIO2	I/O	Horizontal Start Pulse Signal Input or Output	Note5-1
29	VSS2	I	Ground	
30	V3	I	Gamma Voltage 3	Note5-5
31	V5	I	Gamma Voltage 5	Note5-5
32	V7	I	Gamma Voltage 7	Note5-5
33	V8	I	Gamma Voltage 8	Note5-5
34	V10	I	Gamma Voltage 10	Note5-5
35	V12	I	Gamma Voltage 12	Note 5-5
36	VSS2	I	Ground	
37	VDD2	I	Voltage for analog circuit	Note5-5
38	VCOM	I	Common Voltage	
39	OE	I	Output Enable	Note5-6
40	U/D	I	Up/Down Selection	Note5-7
41	CKV	I	Vertical Shift Clock	Note5-8
42	STVU	I/O	Vertical Shift Pulse Signal Input or Output	Note5-7
43	STVD	I/O	Vertical Shift Pulse Signal Input or Output	Note5-7
44	VGG	I	Gate On Voltage	Note5-9
45	VSS1	I	Ground	
46	VCC	I	Voltage for logic circuit	
47	VEE	I	Gate Off Voltage	Note5-10
48	VLED	-	Supply voltage for LED backlight	Note5-11
49	GLED2	-	Ground for LED backlight	
50	GLED1	-	Ground for LED backlight	

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

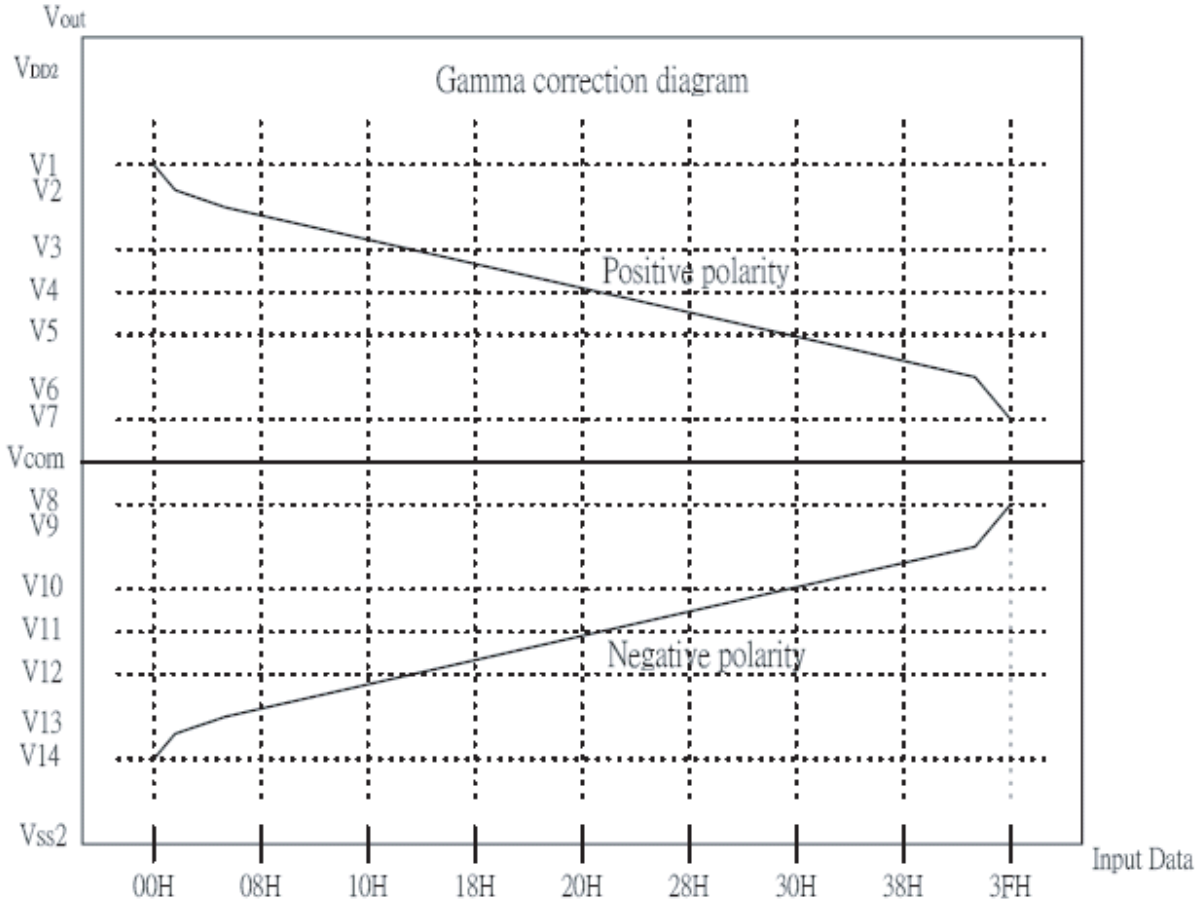
Note 5-2: Latch the polarity of outputs and switch the new data to outputs
At the rising edge (LD), latch the "POL" signal to control the polarity of the outputs.

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

1) Relationship between input data and output voltage
The figure below shows the relationship between the input data and the output voltage with the polarity. The range of V1~V7 is for positive polarity, and V8~V14 for negative polarity. Please refer to the following pages to get the related resister values and voltage calculation method.



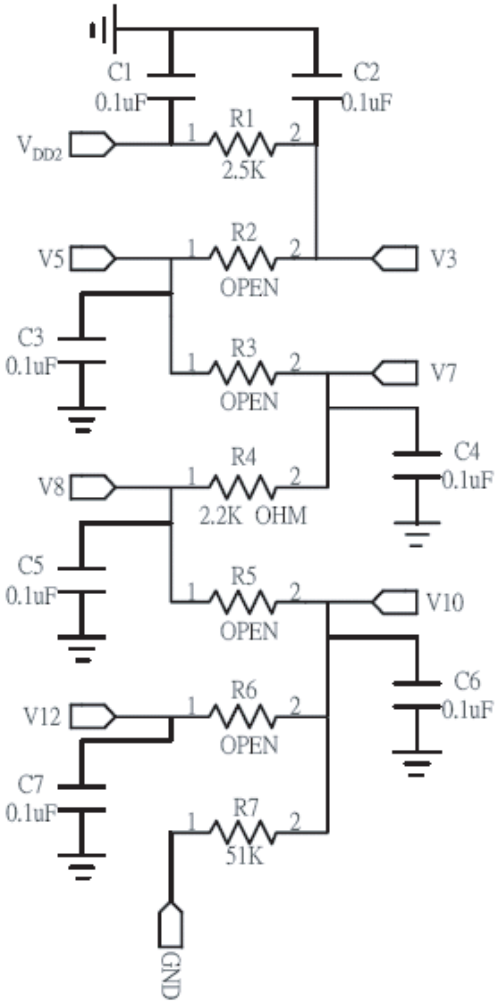
2) Output voltage and input data
Output Voltage to Panel VS Input Data

Data	Positive polarity Output Voltage	Negative polarity Output Voltage
00H	V1	V14
01H	V2=V3+(V1-V3) × 58 / 64.4	V13=V14+(V12-V14) × 6.4 / 64.4
02H	V3+(V1-V3) × 52 / 64.4	V14+(V12-V14) × 12.4 / 64.4
03H	V3+(V1-V3) × 46.4 / 64.4	V14+(V12-V14) × 18 / 64.4
04H	V3+(V1-V3) × 41.2 / 64.4	V14+(V12-V14) × 23.2 / 64.4
05H	V3+(V1-V3) × 36.4 / 64.4	V14+(V12-V14) × 28 / 64.4
06H	V3+(V1-V3) × 32 / 64.4	V14+(V12-V14) × 32.4 / 64.4
07H	V3+(V1-V3) × 27.6 / 64.4	V14+(V12-V14) × 36.8 / 64.4
08H	V3+(V1-V3) × 23.6 / 64.4	V14+(V12-V14) × 40.8 / 64.4
09H	V3+(V1-V3) × 19.6 / 64.4	V14+(V12-V14) × 44.8 / 64.4
0AH	V3+(V1-V3) × 16.4 / 64.4	V14+(V12-V14) × 48 / 64.4
0BH	V3+(V1-V3) × 13.2 / 64.4	V14+(V12-V14) × 51.2 / 64.4
0CH	V3+(V1-V3) × 10.4 / 64.4	V14+(V12-V14) × 54 / 64.4
0DH	V3+(V1-V3) × 7.6 / 64.4	V14+(V12-V14) × 56.8 / 64.4
0EH	V3+(V1-V3) × 4.8 / 64.4	V14+(V12-V14) × 59.6 / 64.4
0FH	V3+(V1-V3) × 2.4 / 64.4	V14+(V12-V14) × 62 / 64.4
10H	V3	V12
11H	V4+(V3-V4) × 19.6 / 22	V12+(V11-V12) × 2.4 / 22
12H	V4+(V3-V4) × 17.6 / 22	V12+(V11-V12) × 4.4 / 22
13H	V4+(V3-V4) × 15.6 / 22	V12+(V11-V12) × 6.4 / 22
14H	V4+(V3-V4) × 13.6 / 22	V12+(V11-V12) × 8.4 / 22
15H	V4+(V3-V4) × 12 / 22	V12+(V11-V12) × 10 / 22
16H	V4+(V3-V4) × 10.4 / 22	V12+(V11-V12) × 11.6 / 22
17H	V4+(V3-V4) × 8.8 / 22	V12+(V11-V12) × 13.2 / 22
18H	V4+(V3-V4) × 7.6 / 22	V12+(V11-V12) × 14.4 / 22
19H	V4+(V3-V4) × 6.4 / 22	V12+(V11-V12) × 15.6 / 22
1AH	V4+(V3-V4) × 5.2 / 22 V	12+(V11-V12) × 16.8 / 22
1BH	V4+(V3-V4) × 4 / 22	V12+(V11-V12) × 18 / 22
1CH	V4+(V3-V4) × 3.2 / 22	V12+(V11-V12) × 18.8 / 22
1DH	V4+(V3-V4) × 2.4 / 22	V12+(V11-V12) × 19.6 / 22
1EH	V4+(V3-V4) × 1.6 / 22	V12+(V11-V12) × 20.4 / 22
1FH	V4+(V3-V4) × 0.8 / 22	V12+(V11-V12) × 21.2 / 22

Output Voltage to Panel VS Input Data(continued)

Data	Positive polarity Output Voltage	Negative polarity Output Voltage
20H	V4	V11
21H	V5+(V4-V5) × 12 / 12.8	V11+(V10-V11) × 0.8 / 12.8
22H	V5+(V4-V5) × 11.2 / 12.8	V11+(V10-V11) × 1.6 / 12.8
23H	V5+(V4-V5) × 10.4 / 12.8	V11+(V10-V11) × 2.4 / 12.8
24H	V5+(V4-V5) × 9.6 / 12.8	V11+(V10-V11) × 3.2 / 12.8
25H	V5+(V4-V5) × 8.8 / 12.8	V11+(V10-V11) × 4 / 12.8
26H	V5+(V4-V5) × 8 / 12.8	V11+(V10-V11) × 4.8 / 12.8
27H	V5+(V4-V5) × 7.2 / 12.8	V11+(V10-V11) × 5.6 / 12.8
28H	V5+(V4-V5) × 6.4 / 12.8	V11+(V10-V11) × 6.4 / 12.8
29H	V5+(V4-V5) × 5.6 / 12.8	V11+(V10-V11) × 7.2 / 12.8
2AH	V5+(V4-V5) × 4.8 / 12.8	V11+(V10-V11) × 8 / 12.8
2BH	V5+(V4-V5) × 4 / 12.8	V11+(V10-V11) × 8.8 / 12.8
2CH	V5+(V4-V5) × 3.2 / 12.8	V11+(V10-V11) × 9.6 / 12.8
2DH	V5+(V4-V5) × 2.4 / 12.8	V11+(V10-V11) × 10.4 / 12.8
2EH	V5+(V4-V5) × 1.6 / 12.8	V11+(V10-V11) × 11.2 / 12.8
2FH	V5+(V4-V5) × 0.8 / 12.8	V11+(V10-V11) × 12 / 12.8
30H	V5	V10
31H	V7+(V5-V7) × 26.8 / 27.6	V10+(V8-V10) × 0.8 / 27.6
32H	V7+(V5-V7) × 26 / 27.6	V10+(V8-V10) × 1.6 / 27.6
33H	V7+(V5-V7) × 25.2 / 27.6	V10+(V8-V10) × 2.4 / 27.6
34H	V7+(V5-V7) × 24.4 / 27.6	V10+(V8-V10) × 3.2 / 27.6
35H	V7+(V5-V7) × 23.6 / 27.6	V10+(V8-V10) × 4 / 27.6
36H	V7+(V5-V7) × 22.4 / 27.6	V10+(V8-V10) × 5.2 / 27.6
37H	V7+(V5-V7) × 21.2 / 27.6	V10+(V8-V10) × 6.4 / 27.6
38H	V7+(V5-V7) × 20 / 27.6	V10+(V8-V10) × 7.6 / 27.6
39H	V7+(V5-V7) × 18.4 / 27.6	V10+(V8-V10) × 9.2 / 27.6
3AH	V7+(V5-V7) × 16.8 / 27.6	V10+(V8-V10) × 10.8 / 27.6
3BH	V7+(V5-V7) × 14.8 / 27.6	V10+(V8-V10) × 12.8 / 27.6
3CH	V7+(V5-V7) × 12.8 / 27.6	V10+(V8-V10) × 14.8 / 27.6
3DH	V7+(V5-V7) × 10.4 / 27.6	V10+(V8-V10) × 17.2 / 27.6
3EH	V7+(V5-V7) × 6.4 / 27.6	V10+(V8-V10) × 21.2 /27.6
3FH	V7	V8

3) Typical Application Circuit



Note 5-6: When OE is connected to high "1", the driver outputs are disabled (Gate output = VEE). Under this condition, the operation of registers will not be affected.

Note 5-7: Select up or down shift

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

Note 5-8: Gate driver shift clock

Note 5-9: Gate on voltage, VGG= +17V.

Note 5-10: Gate off voltage, VEE= -10V.

Note 5-11: ILED TYP.=20mA.

CN 2, (backlight): ATM6448B-NLW-FBH employs Molex 51004-0200 or equivalent connectors for the LED backlight.

Pin	Symbol	Description	Color
1	V	Lamp power input	Pink or Red
2	Ground	Ground	White

6. Signal Timing Specification

AC Electrical Characteristics (VCC=VDD1=3.3V, VDD2=10V, GND=VSS1=VSS2=0V, Ta=25℃)

Item	Symbols	Min	Typ	Max	Units
CLK Frequency	Fclk	-	25	40	MHz
CLK Pulse Width	T_{CPH}	25	-	-	ns
Data Set-up Time	T_{SU}	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	-	-	T_{CPH}
Pulse width of LD	Twld	2	-	-	T_{CPH}
Time That LD to DIO1/2	Tlds	5	-	-	T_{CPH}
POL Set-up Time	Tpsu	6	-	-	ns
POL Hold Time	Tphd	6	-	-	ns
OE Pulse Width	T_{OEV}	1	-	-	μs
CKV Pulse Width	T_{CKU}	500	-	-	ns
STV Set-up Time	T_{SUV}	400	-	-	ns
STV Hold Time	T_{HDV}	400	-	-	ns
Horizontal Display Period	T_{HDP}	-	640	-	T_{CPH}
Horizontal Period Timing Range	T_{HP}	-	800	-	T_{CPH}
Horizontal Lines Per Field	T_V	520	525	640	T_{HP}
Vertical Display Timing Range	T_{DV}	-	480	-	T_{HP}

7. Timing Wave Form

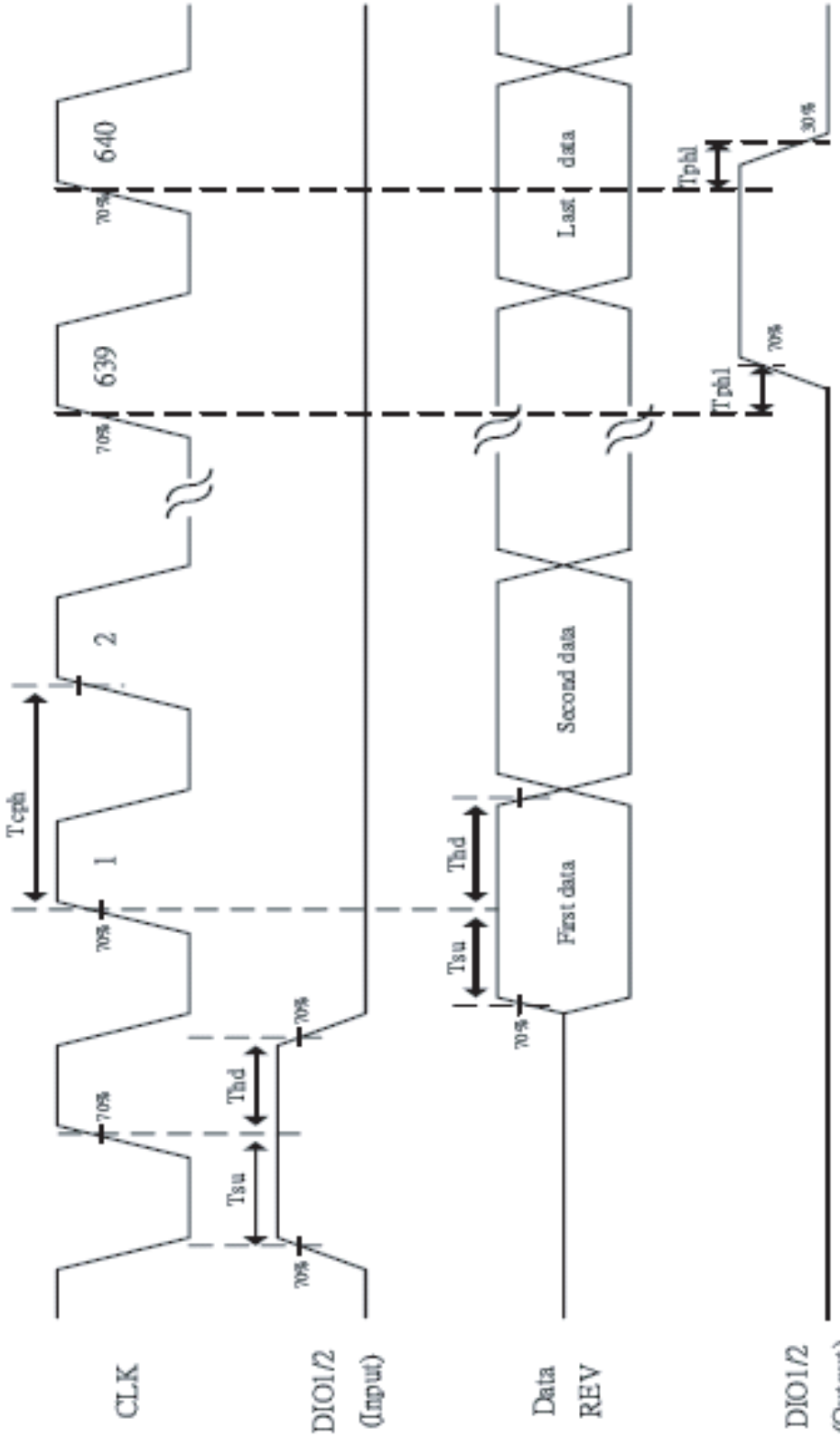
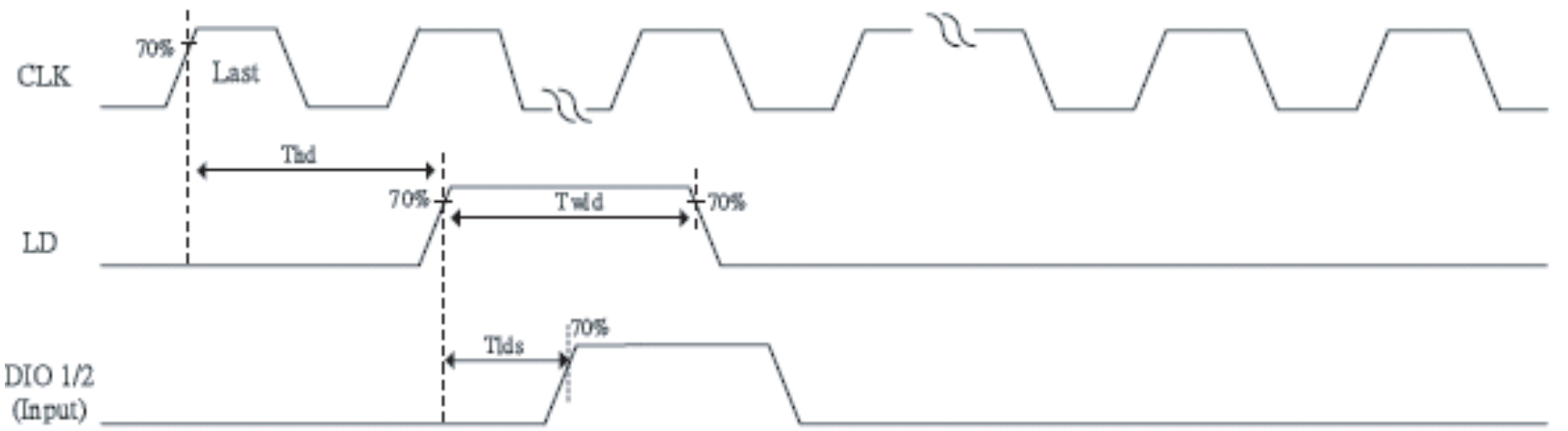


Fig. 11-1 Horizontal timing(1)



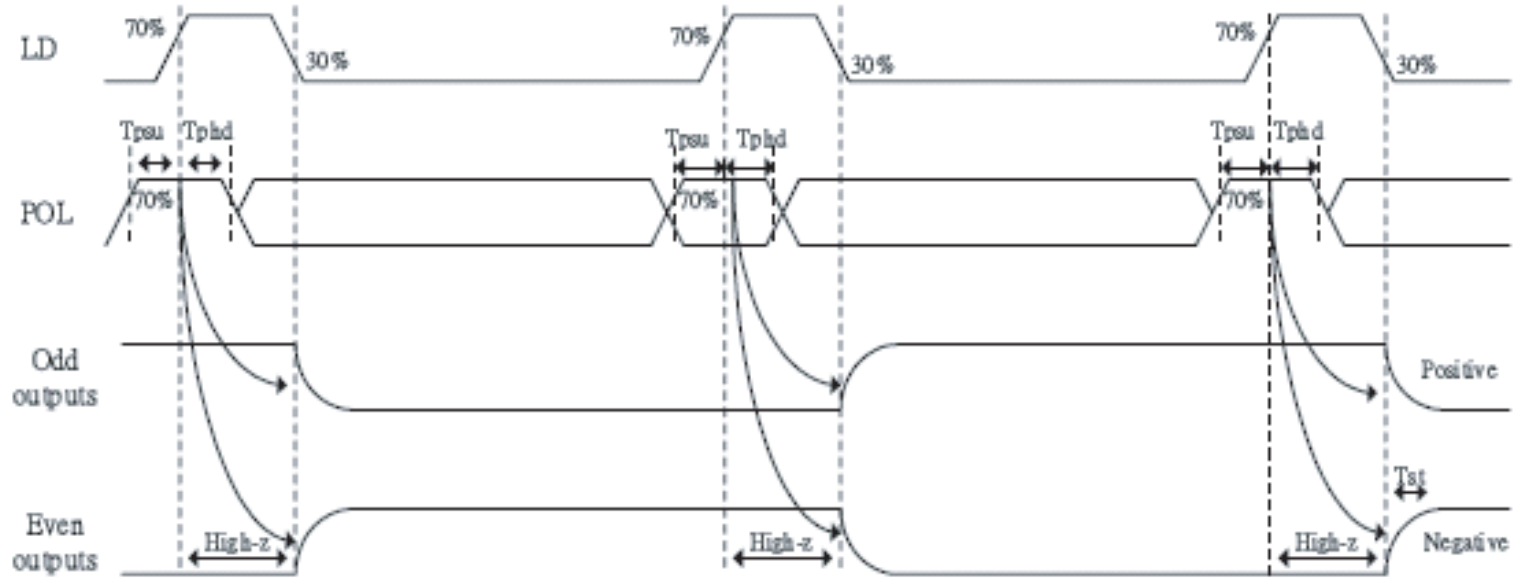


Fig. 11-2 Horizontal timing(2)

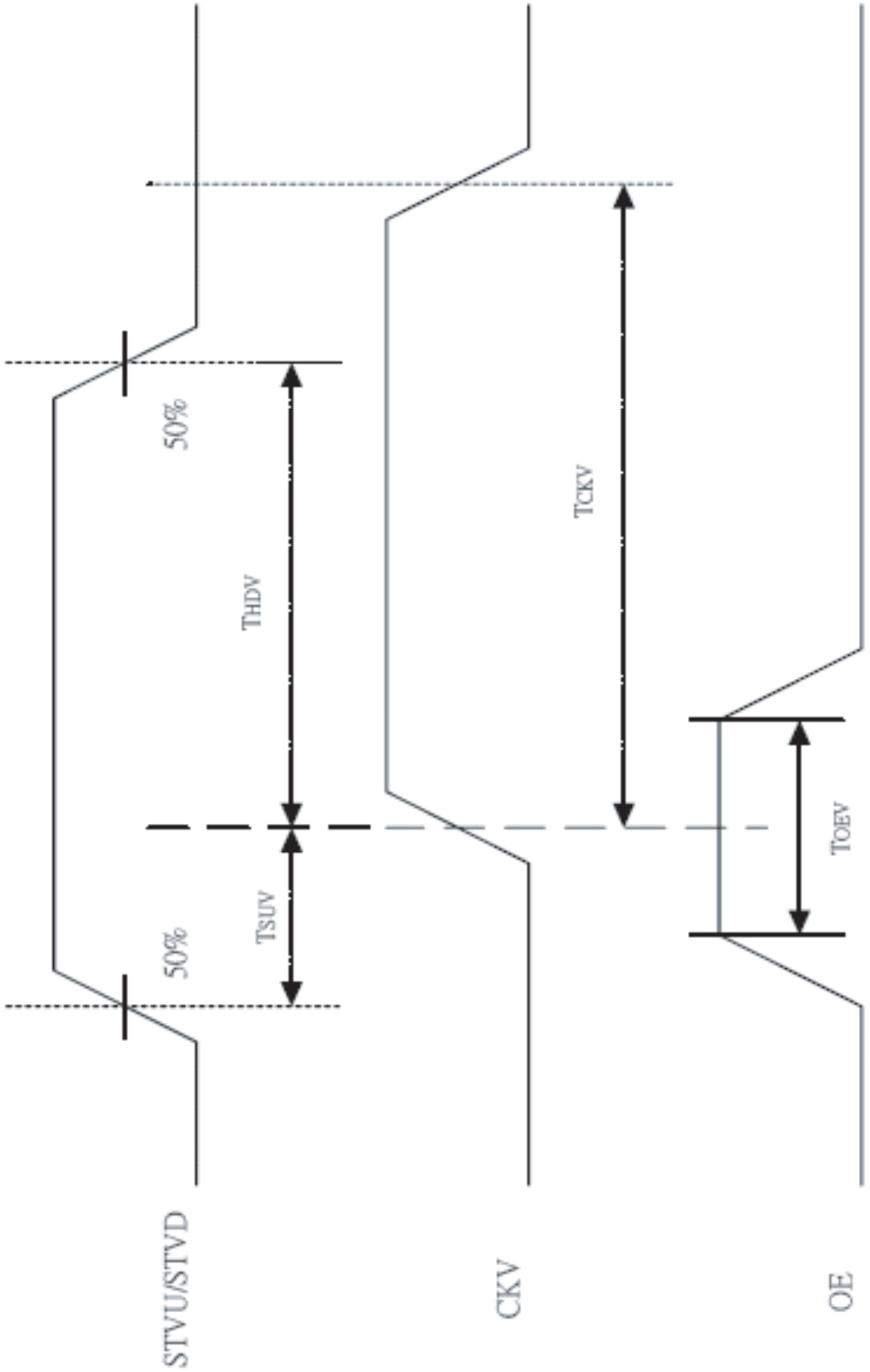


Fig. 11-3 Vertical shift clock timing

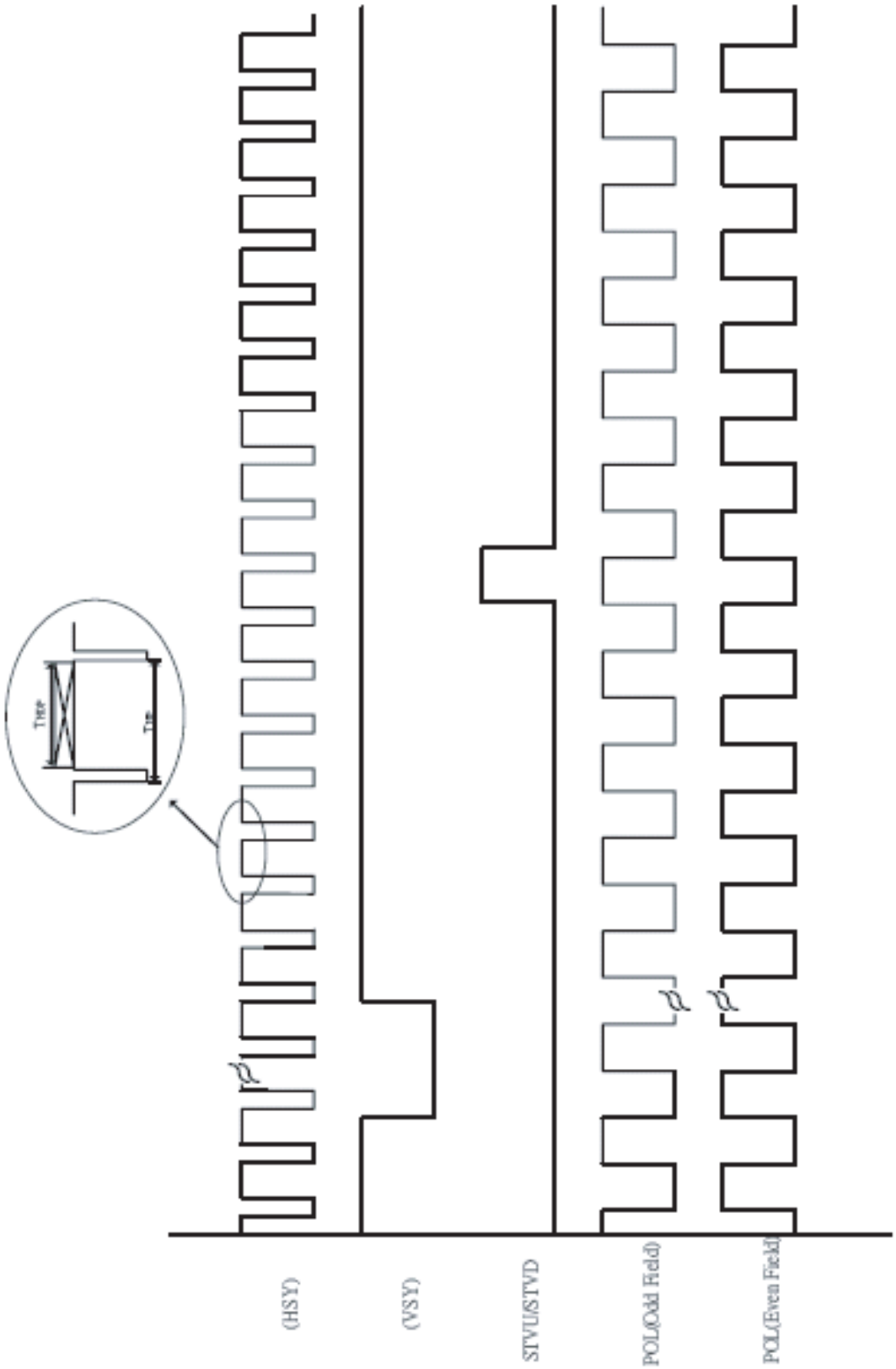


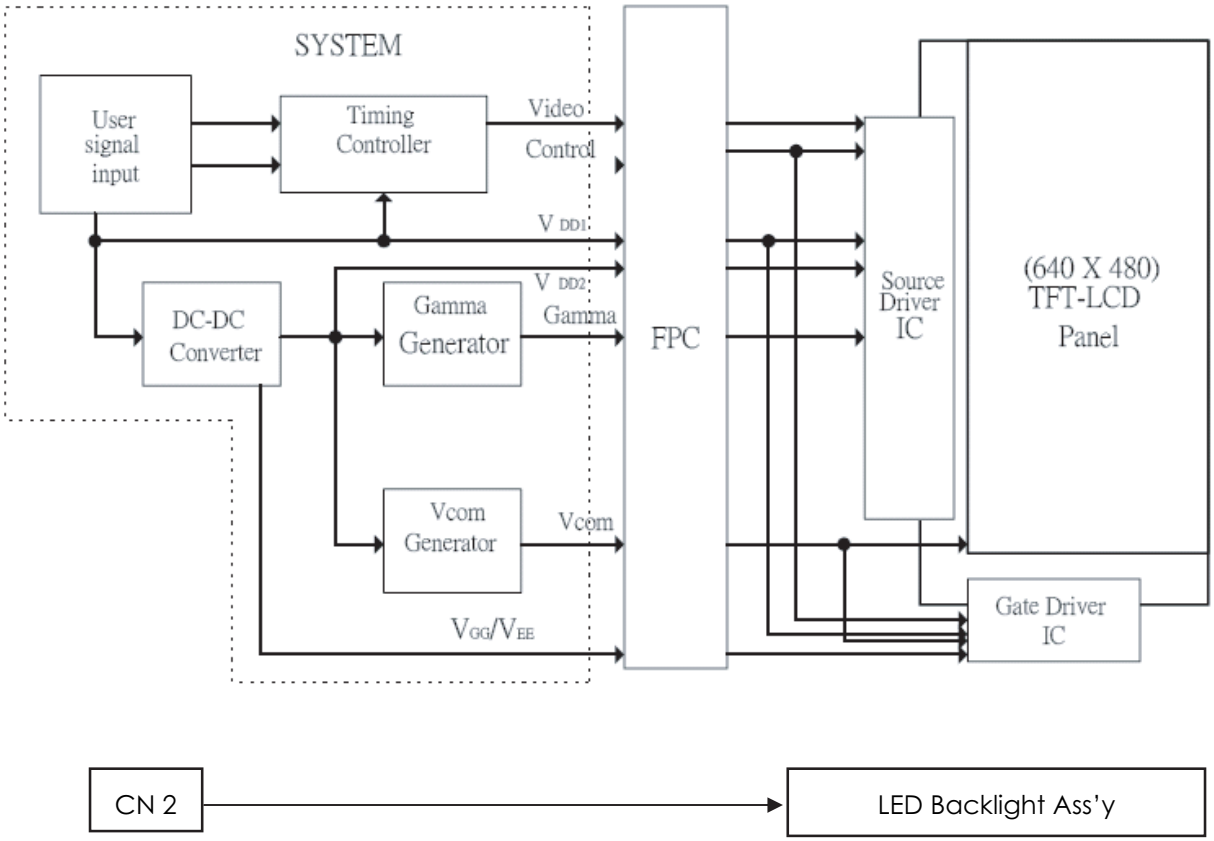
Fig. 11-4 Vertical timing

8. Color Input Data Reference

The brightness of each primary color(red, green and blue) is based on the 6-bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

	Display	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
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Light Blue	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Purple	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) Dark	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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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) Bright	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(00)Dark	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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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)Bright	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Blue(00) Dark	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
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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) Bright	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Whte & Black	Black(00) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	(01)	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
	(02)	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
		:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	(61)	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	1
	(62)	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0
	White(63) Bright	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

9. Block Diagram



10. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 10 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0°.
Appendix A presents additional information concerning the measurement equipment and method.

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
Contrast Ratio	CR		400			1
Surface Luminance, white	L_{WH}	1,000			cd/m^2	2
Luminance Uniformity	δ WHITE	70%	80%			3
Response Time						
Total(Tr + Td)			40	80	msec	4
CIE Color Coordinates						
Red	x_R	0.470	0.520	0.570		
	y_R	0.314	0.364	0.414		
Green	x_G	0.260	0.310	0.360		
	y_G	0.414	0.464	0.514		
Blue	x_B	0.100	0.150	0.200		
	y_B	0.120	0.170	0.220		
White	x_W	0.250	0.300	0.350		
	y_W	0.310	0.340	0.390		
Viewing Angle						
x axis, right (ø=0°)	θ x	45	50	-	degree	5
x axis, left(ø=180°)	θ x	30	40	-		
y axis, up(ø=90°)	θ y	10	15	-		
y axis, down (ø=270°)	θ y	30	35	-		

Notes 1. Contrast Ratio (CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

2. Surface luminance is the center point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see Appendix B.
3. The uniformity in surface Luminance, δ_{WHITE} is determined by measuring L_{ON} at each test position 1 through 5, and then dividing the minimum L_{ON} of 5 points luminance by maximum L_{ON} of 5 points luminance and multiply by 100 for percentage value. For more information see Appendix B.
   δ_{WHITE} = Minimum (L_{ON1}, L_{ON2}, ...L_{ON9}) * 100 / Maximum (L_{ON1}, L_{ON2}, ...L_{ON9})
4. Response time is the time required for the display to transition from white to black (Rise Time, T_R) and from black to white (Decay Time, T_{RD}). For additional information see Appendix C.
5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x-axis and the vertical or y-axis with respect to the z-axis which is normal to the LCD surface. For more information see Appendix D.

11. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model ATM6448B-NLW-FBH. In addition, the figure below is a detailed mechanical drawing of the LCD. Note that dimensions are given for reference purposes only.

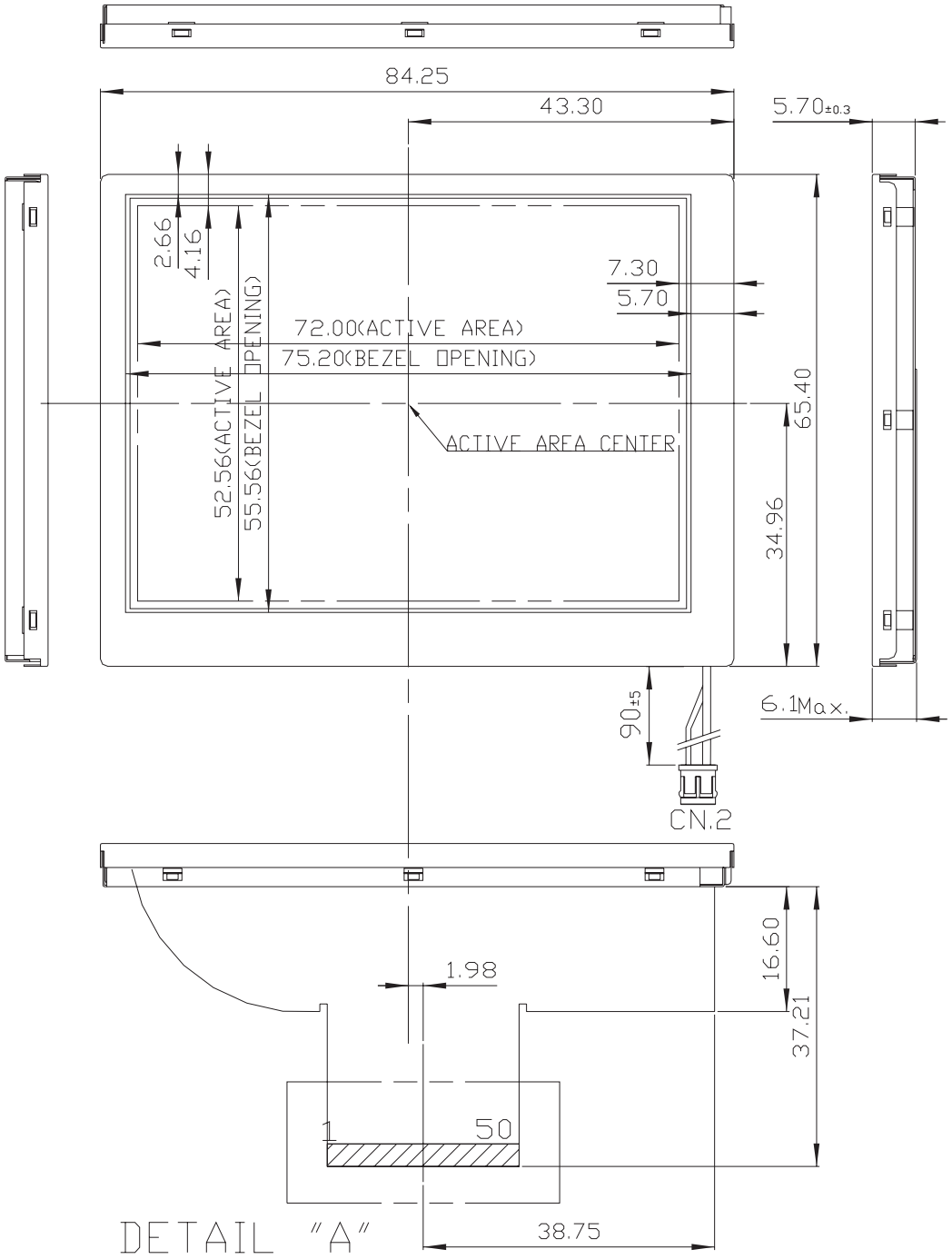
Outside dimensions:		
	Horizontal	84.25± 0.5 mm
	Vertical	65.40± 0.5 mm
	Depth	5.80 ± 0.3 mm
Bezel area:		
	Horizontal	55.20± 0.3 mm
	Vertical	55.56± 0.3 mm
Active Display area:		
	Horizontal	72.00 mm
	Vertical	52.56 mm

Weight (approximate): 60 g Max.

Surface Treatment: Anti glare treatment of the front polarizer.

12. Mechanical Specification

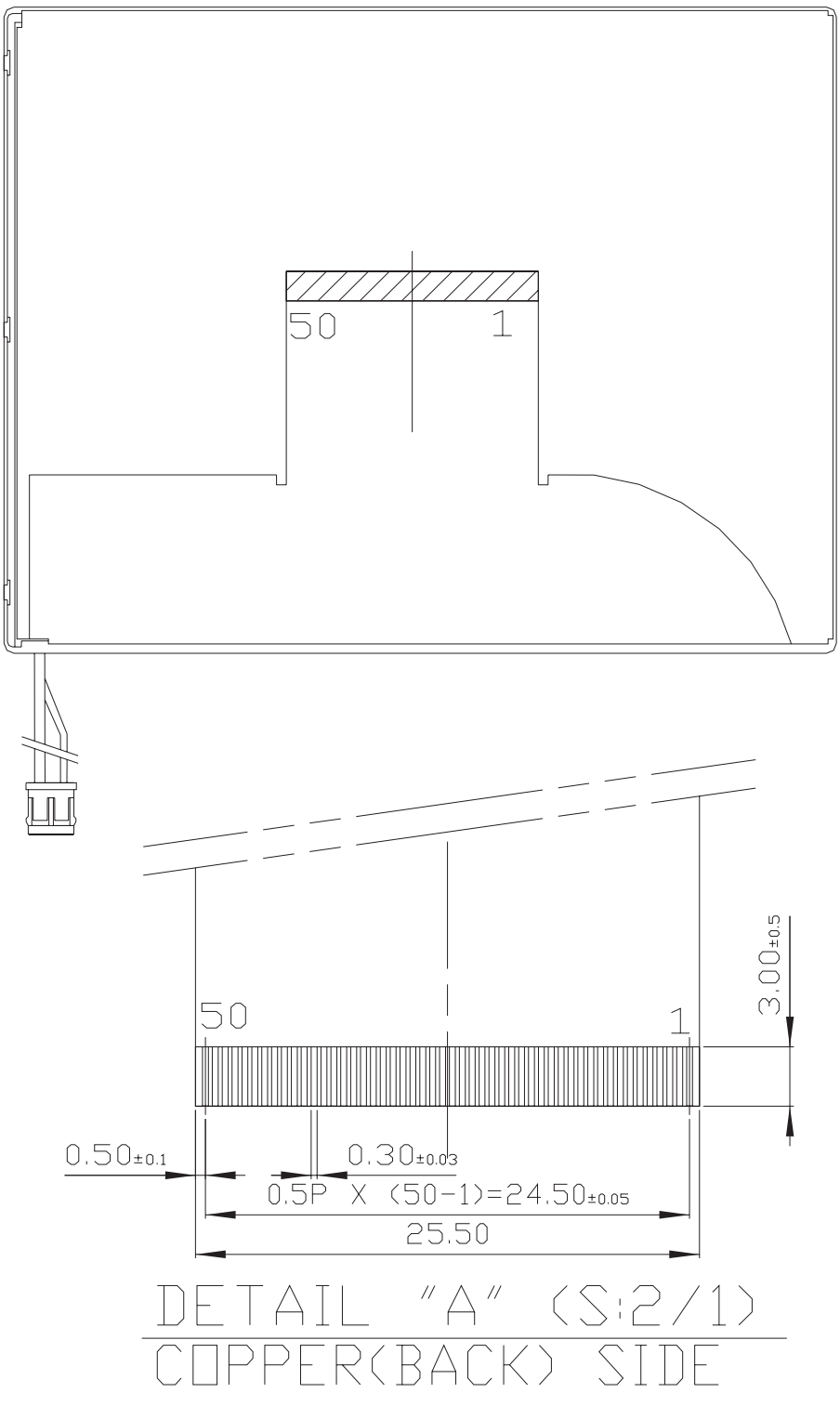
< FRONT VIEW >



NOTE

1. GENERAL TOLERANCE : ±0.5
2. CN2 : LED BACKLIGHT CONNECTOR
   MOLEX (51004-0200)

<Rear View>


50
1
50
1
3.00±0.5
0.50±0.1
0.30±0.03
0.5P X (50-1)=24.50±0.05
25.50
DETAIL "A" (S:2/1)
COPPER(BACK) SIDE

13. Reliability

- Environment test condition on backlight only.

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 70˚C, 240 hrs
2	Low temperature storage test	Ta = -30˚C, 240 hrs
3	High temperature operation test	Ta = 70˚C, 240 hrs
4	Low temperature operation test	Ta = -20˚C, 240 hrs
5	Thermal Shock(None Operation)	Ta = -20°C(2 Hour) ~ 70°C (2 Hour), 6cycles

Result Evaluation Criteria

There should be no change which might affect the practical display function when the display quality test is conducted under normal operating condition.

14. PRECAUTIONS

Please pay attention to the followings when you use this TFT/LCD module.

14.1 MOUNTING PRECAUTIONS

(1) You must mount a module using holes arranged in four corners.

(2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to the module.
And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) Please attach the surface with a transparent protective plate in order to protect the polarizer LC cell.
Transparent protective plate should have sufficient strength in order to resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter cause circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And Please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer with bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluen and alcohol because they cause chemical damage to the polarizer.

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

14.2 OPERATING PRECAUTIONS

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage : V = ± 200mV (Over and under shoot voltage).
(2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
(3) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
(4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
(6) A module has high frequency circuit. It might be necessary to shield the electromagnetic noise in your integrating system.
(7) When a Backlight unit is operating, it may make sounds. It might be necessary to shield your integrating system to cut down the noise.

14.3 ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc . . And don't touch I/F pin directly.

14.4 STORAGE

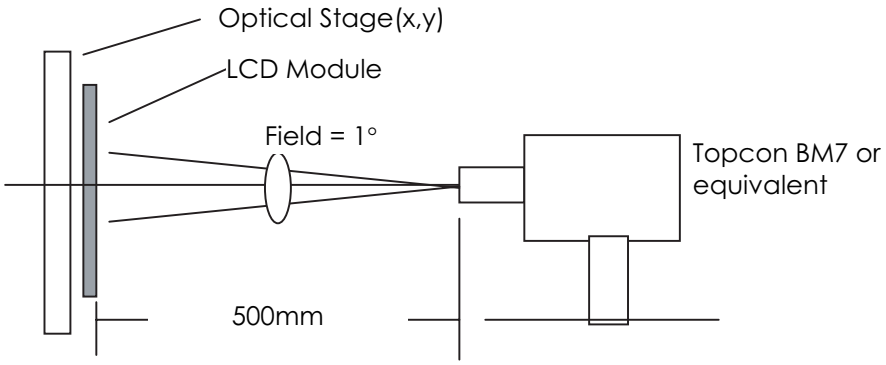
When storing modules for a long time, the following precautions should be followed.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
(2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

14.5 HANDLING PRECAUTIONS FOR PROTECTION FILM

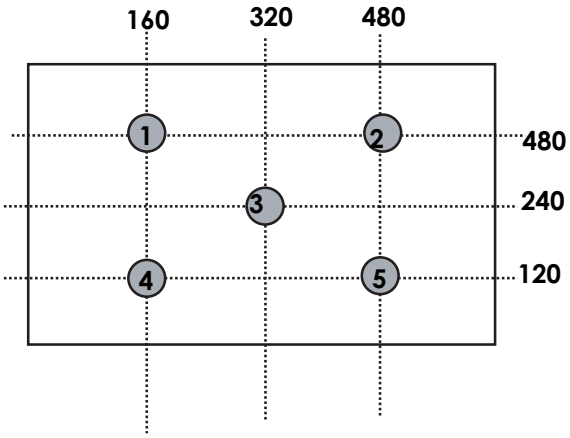
(1) When the protection film is peeled off, static electricity is generated between the film and polarizer.
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion- blown equipment or in such a condition, etc..
(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.
Please carefully peel off the protection film without rubbing it against the polarizer.
(3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal- hexane.

A. Optical Characteristic Measurement Equipment and Method

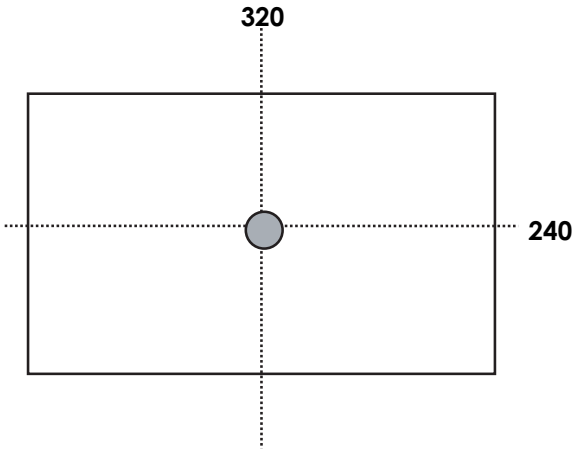


B. Luminance

<measuring point for luminance variation>

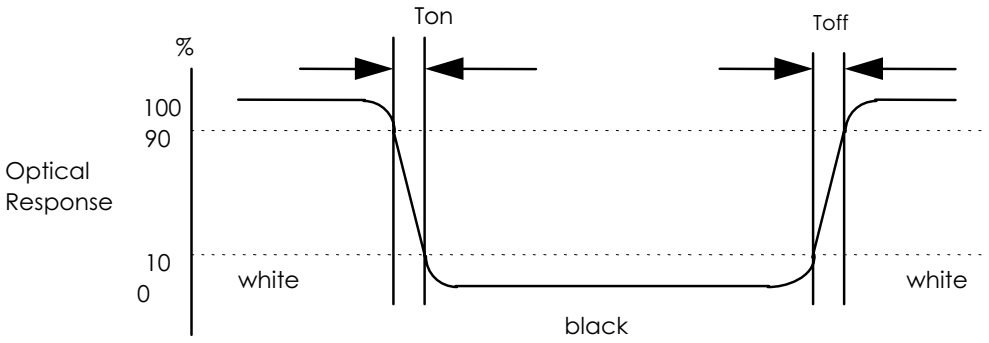


<measuring point for surface luminance >



C. Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



D. Viewing angle

<Definition of viewing angle range>