Vertex LCD Inc.

TENTATIVE PRODUCT INFORMATION

(All information in this technical data sheet is tentative and subject to change without notice.)

Updated: 4/23/2007

15.0” XGA Very High Bright TFT-LCD

LVM150XSB-L

(Based on SHARP : LQ150X1LGN2A)

(PRELIMINIRY)

COLOR LIQUID CRYSTAL DISPLAY

CONTENTS

Revision History

Rev	ECN No.	Description of changes	Date	Prepared
P0		Preliminary	4/23/07	Eric Kim

1. General Description

LVM150XSB-L is 15.0" Color Active Matrix Liquid Crystal Display with an integral 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 15.0 inch diagonally measured active display area with XGA resolution (1024 horizontal by 768 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 LVM150XSB-L is intended to support applications where high brightness, broad viewing angle are critical factors. In combination with the vertical arrangement of the sub-pixels, the LVM150XSB-L 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	15.0 inches(38 Cm) diagonal 240.60(H) X 184.5(V) mm
Outline dimensions	326.0(H) × 252.0(V) × 11.5(D) mm
Pixel pitch	0.297(H) mm × 0.297(V) mm
Pixel format	1024(H) X 768(V) pixels
Color Pixel Arrangement	RGB stripe arrangement
Color depth	6-bit, 262,144 colors
Brightness	1,500 cd/m^2
Power Consumption	Total 24.7 Watt, typ (1.4 Watt @Vcc, 23.3 Watt @LED)
Weight	1,100g (typ.)
Display operating mode	transmissive mode, normally white
Surface treatments	hard coating(2H), Anti-glare
Backlight Unit	White LED

2. Absolute Maximum Rating

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage					
+5V supply voltage	V_{cc}	0	+4.0	Vdc	at 25^{o}C.
Operating Temperature	T_{OP}	0	+50	^{o}C	Note 1
Storage Temperature	T_{ST}	-25	+60	^{o}C	Note 1

Note 1. Humidity Less than 95% RH at Ta ≤ 40 ^{o}C. No condensation.

3. Electrical Characteristics

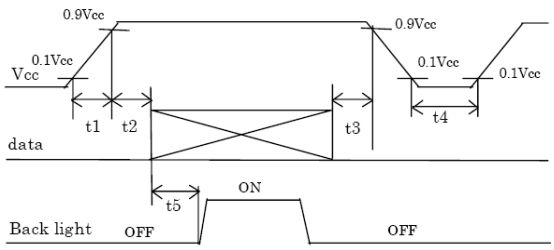
The LVM150XSB-L requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input, which powers the LED, is typically generated by a LED driver. The LED Driver is an external unit to the LCD.

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE:						
Power Supply Input Voltage	V_{CC}	+3.0	+3.3	+3.6	Vdc	1
Power Supply Input Current	I_{CC}	-	0.425	0.700	A	2
Power Consumption	P_C	-	1.40	-	Watts	
LED BACKLIGHT:						
Operating Voltage	V_{BL}	-	-	18.2	Vdc	4
Operating Current	I_{BL}	-	-	1.28	A	4
Power Consumption		-	-	23.30	Watts	3
Life Time		20,000	30,000	-	Hrs	

Notes: 1

1) On-Off sequences of Vcc and data

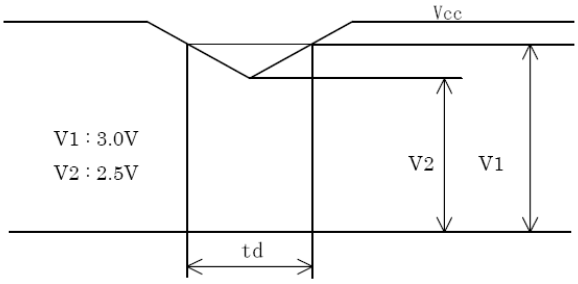
$0 < t1 \le 10$ ms
$0 < t2 \le 10$ ms
$0 < t3 \le 1$s
$1s < t4$
$200ms \le t5$



Power sequence for Backlight is not especially specified, however it is recommended to consider some timing difference between LVDS input and Backlight input as shown above.
If the Backlight lights on before LCD starting, or if the Backlight is kept on after LCD stopping, the screen may look white for a moment or abnormal image may be displayed.
This is caused by variation in output signal from timing generator at LVDS input on or off. It does not cause the damage to the LCD module.

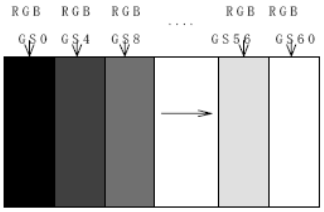
2) Dip condition for supply voltage

1) $V2 < Vcc \le V1$
$td \le 10$ ms
2) $Vcc < V2$
Vcc-dip conditions should also Follow the on-off conditions.



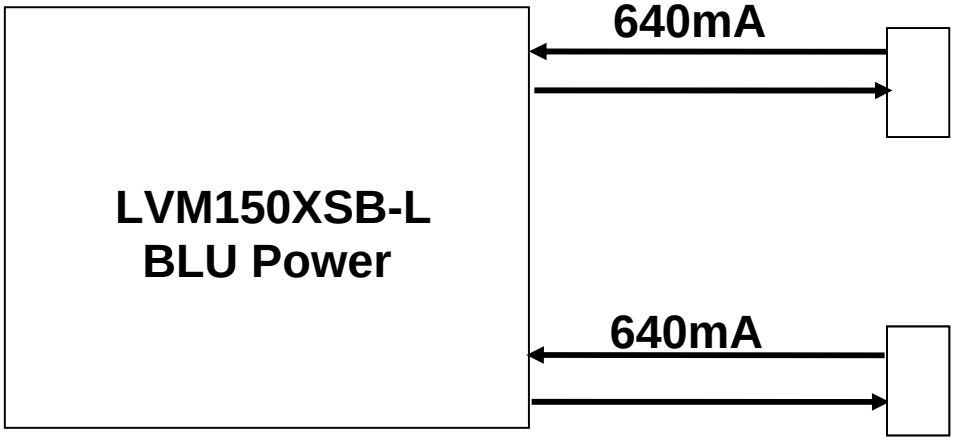
Notes: 2

Typical current situation : 16-gray-bar pattern
Vcc=+3.3V, CK=65MHz
Horizontal period =20.7 us
Gray scale : GS(4n)
n=0～15



The explanation of each gray scale, GS(4n), is described below section 8-2.

3. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical LED current & at ambient temperature of 25°C.
4. LVM150XSB-L load voltage should be about 18.2V at 640mA max current per top and bottom sides.



4-1. Interface Connections

CN 1(interface signal): LVM150XSB-L uses 20-pin connector for module electronics.
Used connector : DF14H-20P-1.25H (Hirose Electric Co., Ltd.)
Matching side: DF14-20S-1.25C(HIROSE Electric Co., Ltd.)

Pin	Symbol	Function	Remark
1	Vcc	+3.3V Power supply	-
2	Vcc	+3.3V Power supply	-
3	GND		-
4	GND		-
5	RXIN0-	Receiver signal (-)	LVDS
6	RXIN0+	Receiver signal (+)	LVDS
7	GND		-
8	RXIN1-	Receiver signal (-)	LVDS
9	RXIN1+	Receiver signal (+)	LVDS
10	GND		-
11	RXIN2-	Receiver signal (-)	LVDS
12	RXIN2+	Receiver signal (+)	LVDS
13	GND		-
14	RXCKIN-	Clock signal (-)	LVDS
15	RXCKIN+	Clock signal (+)	LVDS
16	GND		
17	RXIN3-	Receiver signal (-)	LVDS
18	RXIN3+	Receiver signal (+)	LVDS
19	GND		
20	LVDS_SET	LVDS_SET	

CN 2(backlight): LVM150XSB-L employs Molex 51004-0200 or equivalent connectors for the LED backlight.

Pin	Symbol	Description	Notes
1	V	Lamp power input	PINK (or Red)
2	Ground	Ground	WHITE (or Black)

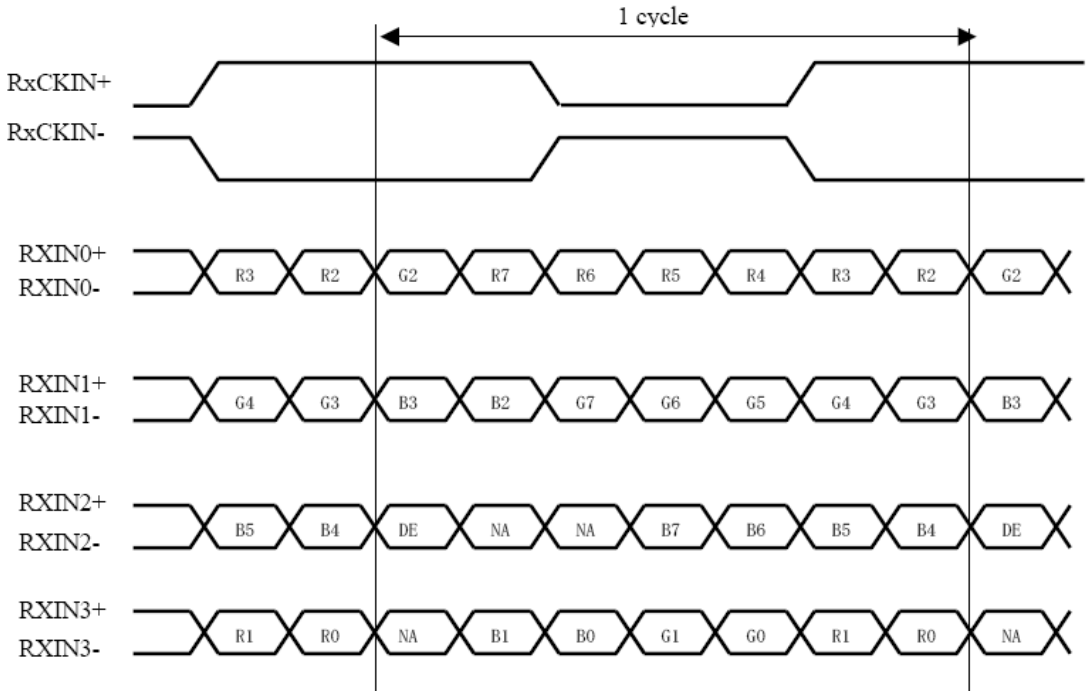
4-2. Data Maping

1) 8bit input

【note1】 pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

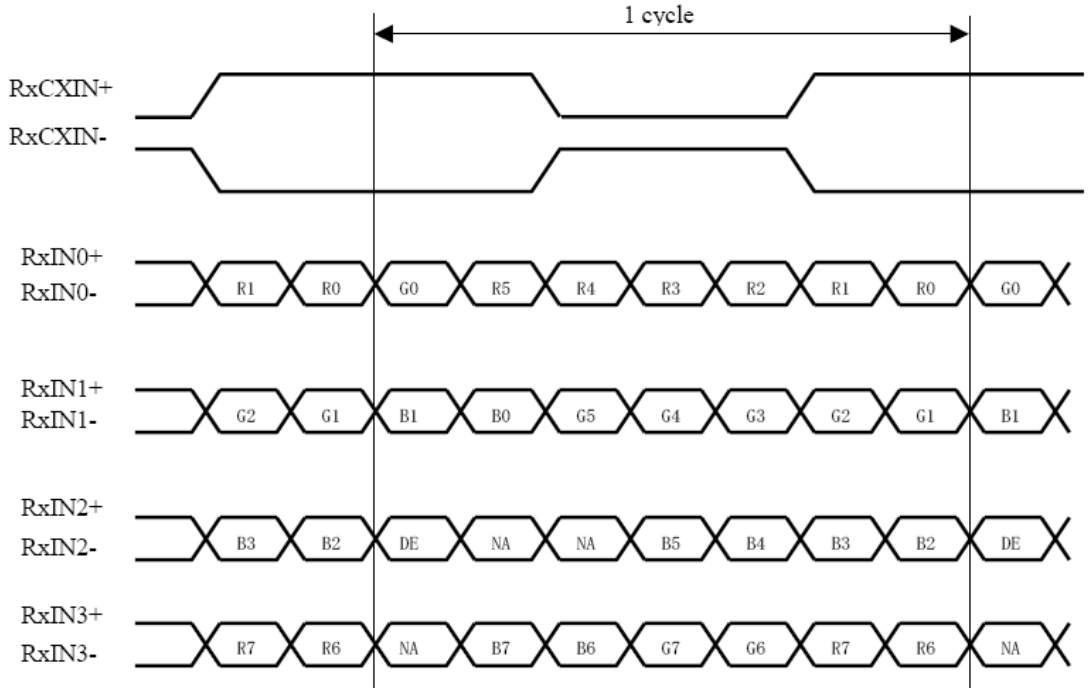
Transmitter		20pin LVDS_SET	
Data	Pin No.	=H(3.3V)	=L (GND) or Open
TA0	51	R0(LSB)	R2
TA1	52	R1	R3
TA2	54	R2	R4
TA3	55	R3	R5
TA4	56	R4	R6
TA5	3	R5	R7(MSB)
TA6	4	G0(LSB)	G2
TB0	6	G1	G3
TB1	7	G2	G4
TB2	11	G3	G5
TB3	12	G4	G6
TB4	14	G5	G7(MSB)
TB5	15	B0(LSB)	B2
TB6	19	B1	B3
TC0	20	B2	B4
TC1	22	B3	B5
TC2	23	B4	B6
TC3	24	B5	B7 (MSB)
TC4	27	(NA)	(NA)
TC5	28	(NA)	(NA)
TC6	30	DE	DE
TD0	50	R6	R0(LSB)
TD1	2	R7(MSB)	R1
TD2	8	G6	G0(LSB)
TD3	10	R7(MSB)	G1
TD4	16	B6	B0(LSB)
TD5	18	R7(MSB)	B1
TD6	25	(NA)	(NA)

<LVDS SET=L or Open>



DE : Display Enable
NA : Not Available

<LVDS SET =H>

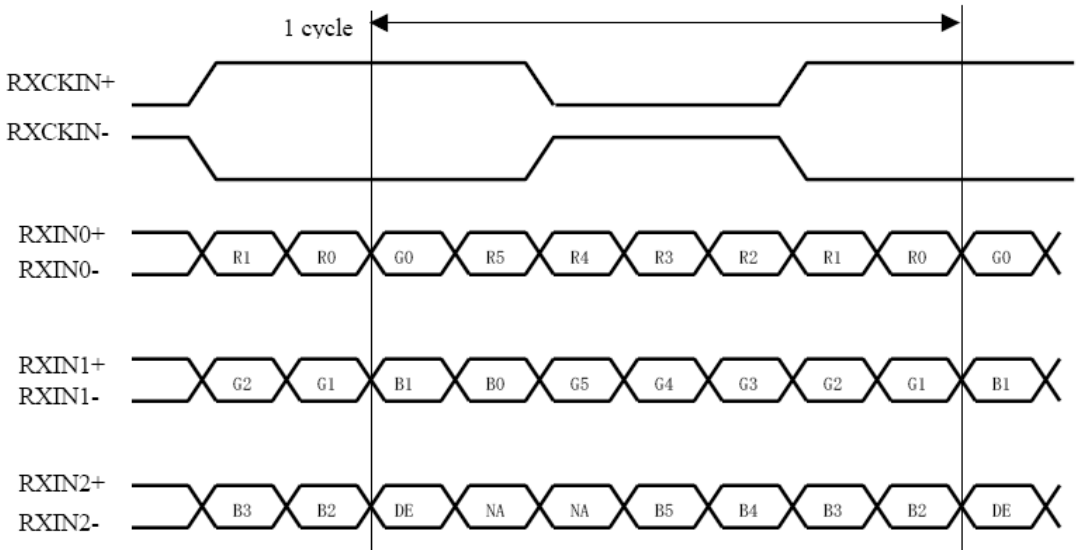


DE : Display Enable
NA : Not Available

2) 6bit input

【note1】pin assignment with LVDS_SET pin (Thine:THC63LVDM83R)

Transmitter		20pin LVDS_SET	
Data	Pin No.	=L (GND) or Open	=H(3.3V)
TA0	51	R0(LSB)	-
TA1	52	R1	-
TA2	54	R2	-
TA3	55	R3	-
TA4	56	R4	-
TA5	3	R5(MSB)	-
TA6	4	G0(LSB)	-
TB0	6	G1	-
TB1	7	G2	-
TB2	11	G3	-
TB3	12	G4	-
TB4	14	G5(MSB)	-
TB5	15	B0(LSB)	-
TB6	19	B1	-
TC0	20	B2	-
TC1	22	B3	-
TC2	23	B4	-
TC3	24	B5(MSB)	-
TC4	27	(NA)	-
TC5	28	(NA)	-
TC6	30	DE	-
TD0	50	GND	-
TD1	2	GND	-
TD2	8	GND	-
TD3	10	GND	-
TD4	16	GND	-
TD5	18	GND	-
TD6	25	(NA)	-



DE : Display Enable
NA : Not Available

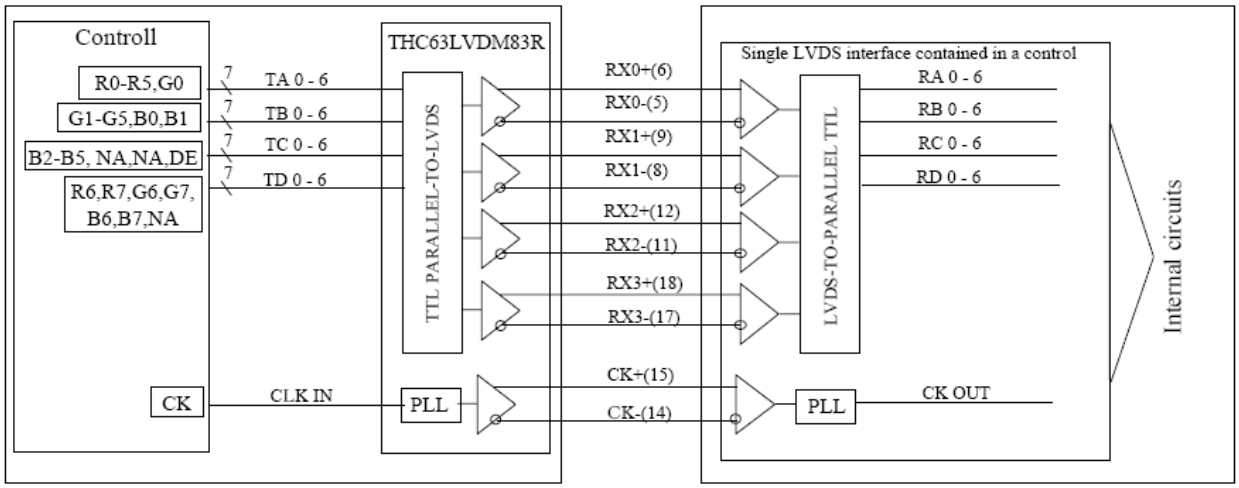
※In case of supplying 6 bit signal, it is recommended to connect pin No.17(Rx3-) with VCC(3.3V), and No.18(Rx3+) with GND(0V).

3) Interface block diagram

(Computer Side) (TFT-LCD side)

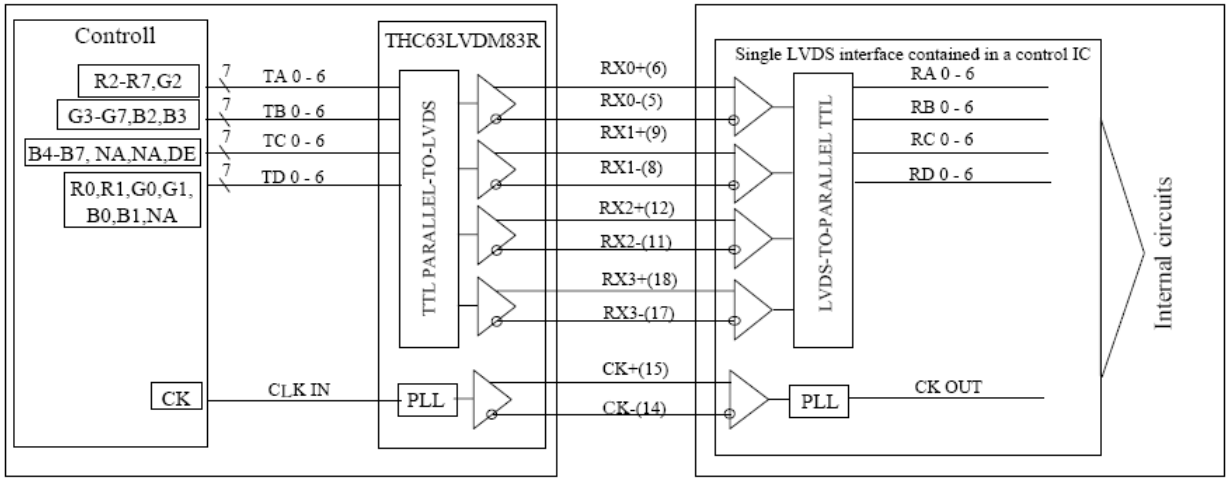
①8Bit Mode

LVDS_SET=H (20 pin=3.3[V])



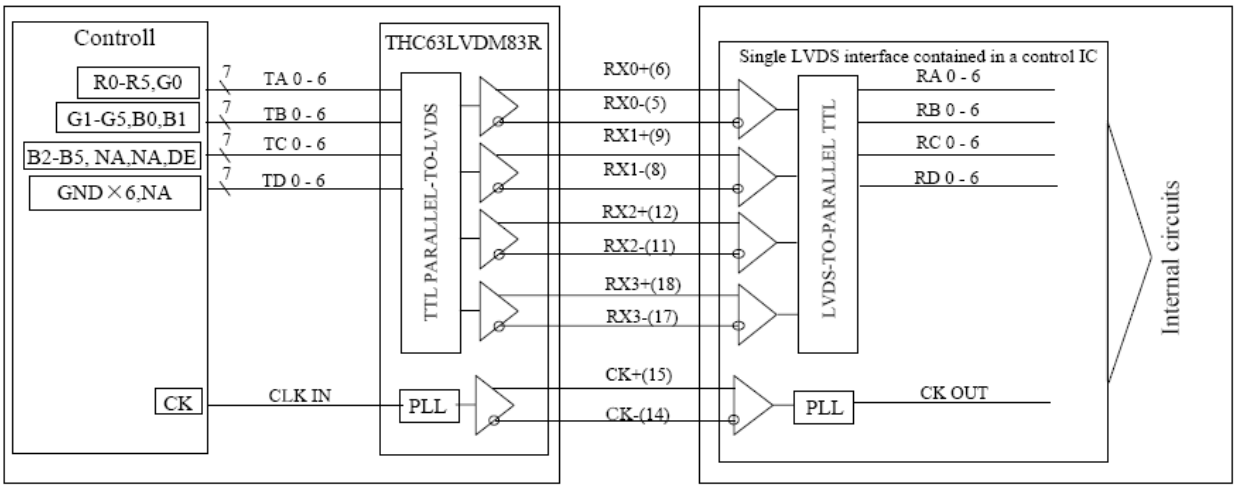
②8Bit Mode

LVDS_SET=L (20 pin=GND or OPEN)

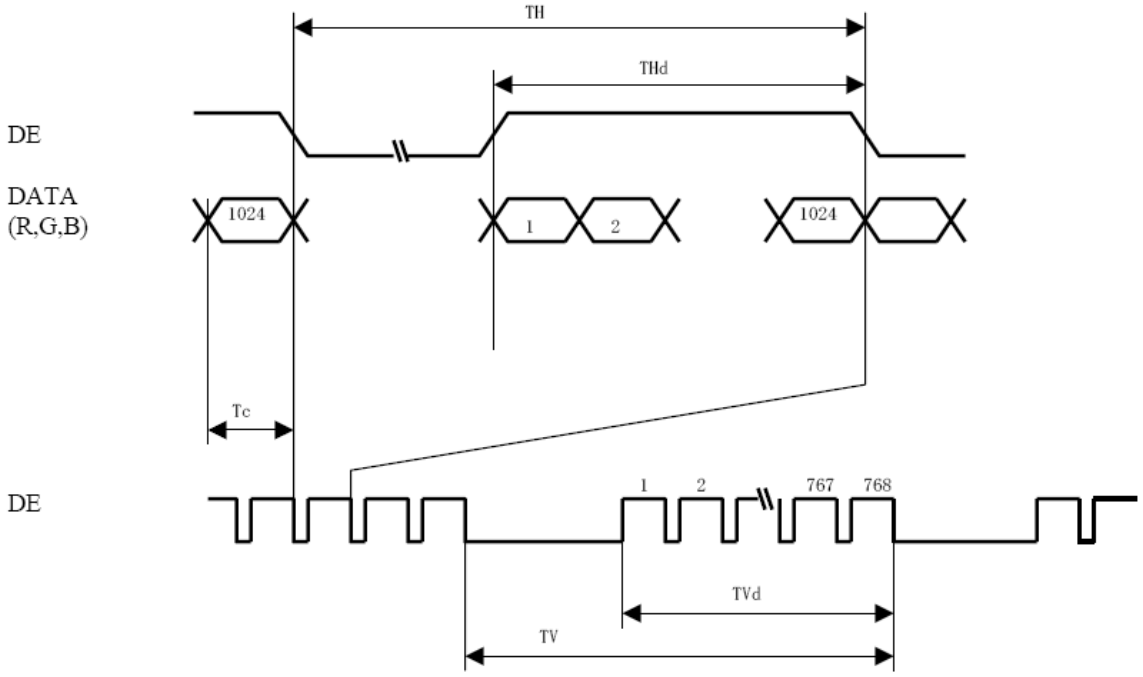


③6Bit Mode

LVDS_SET=L (20 pin=GND or OPEN)



5.1 Outline of input signal Timings

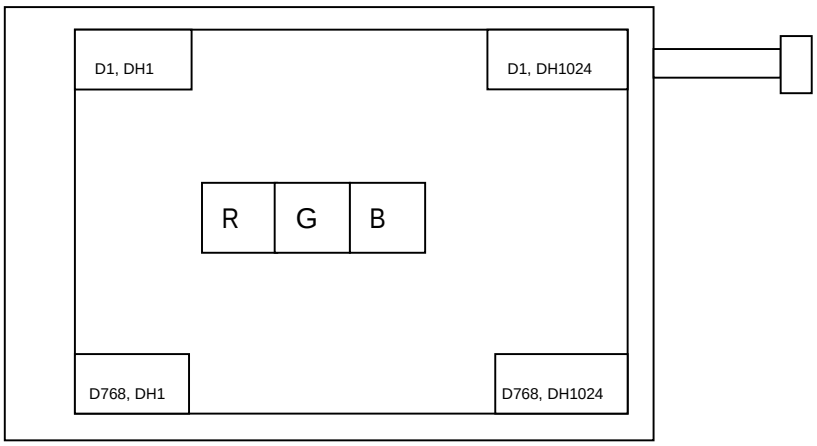


5.2 Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock	Frequency	1/Tc	50.0	65.0	80.0	MHz
ENAB signal	Horizontal period	TH	1056	1344	1720	clock
			16.0	20.7	23.4	μs
	Horizontal period(High)	THd	1024	1024	1024	clock
	Vertical period	TV	773	806	990	line
	Vertical period(High)	TVd	768	768	768	line

【Note】 In case of using the long vertical period, the deterioration of display quality, flicker etc. may occur.

5.3 Input data signals and display position on the screen



Display Position of Data (V,H)

6. 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.

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) 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

7. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 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	250	350	-		1
Surface Luminance, white	L_{WH}	-	1,500	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	75				3
Response Time						
Rise Time	Tr_R	-	5	20	msec	4
Fall Time	Tr_D	-	25	40		
CIE Color Coordinates				-		
Red	x_G	0.547	0.597	0.647		
	y_G	0.285	0.335	0.385		
Green	x_B	0.234	0.284	0.334		
	y_B	0.500	0.550	0.600		
Blue	x_W	0.095	0.145	0.195		
	y_W	0.120	0.170	0.220		
	x_W	0.250	0.300	0.350		
White	y_W	0.297	0.347	0.397		
Viewing Angle(CR≧10)						
x axis, right (ø=0°)	θ x	50	60		degree	5
x axis, left(ø=180°)	θ x	50	60			
y axis, up(ø=90°)	θ y	35	45			
y axis, down (ø=270°)	θ y	45	55			

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 variation in surface Luminance, δ_{WHITE} is determined by measuring L_{ON} at each test position 1 through 5, and then dividing the maximum L_{ON} of 5 points luminance by minimum L_{ON} of 5 points luminance. For more information see Appendix B.
   δ_{WHITE} = Maximum (L_{ON1}, L_{ON2}, ...L_{ON5}) ÷ Minimum (L_{ON1}, L_{ON2}, ...L_{ON5})
4. Response time is the time required for the display to transition from white to black (Rise Time, Tr_R) and from black to white (Decay Time, Tr_D). For additional information see Appendix C.
5. Viewing angle is the angle at which the contrast ratio is greater than 5. 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.

8. Mechanical Characteristics

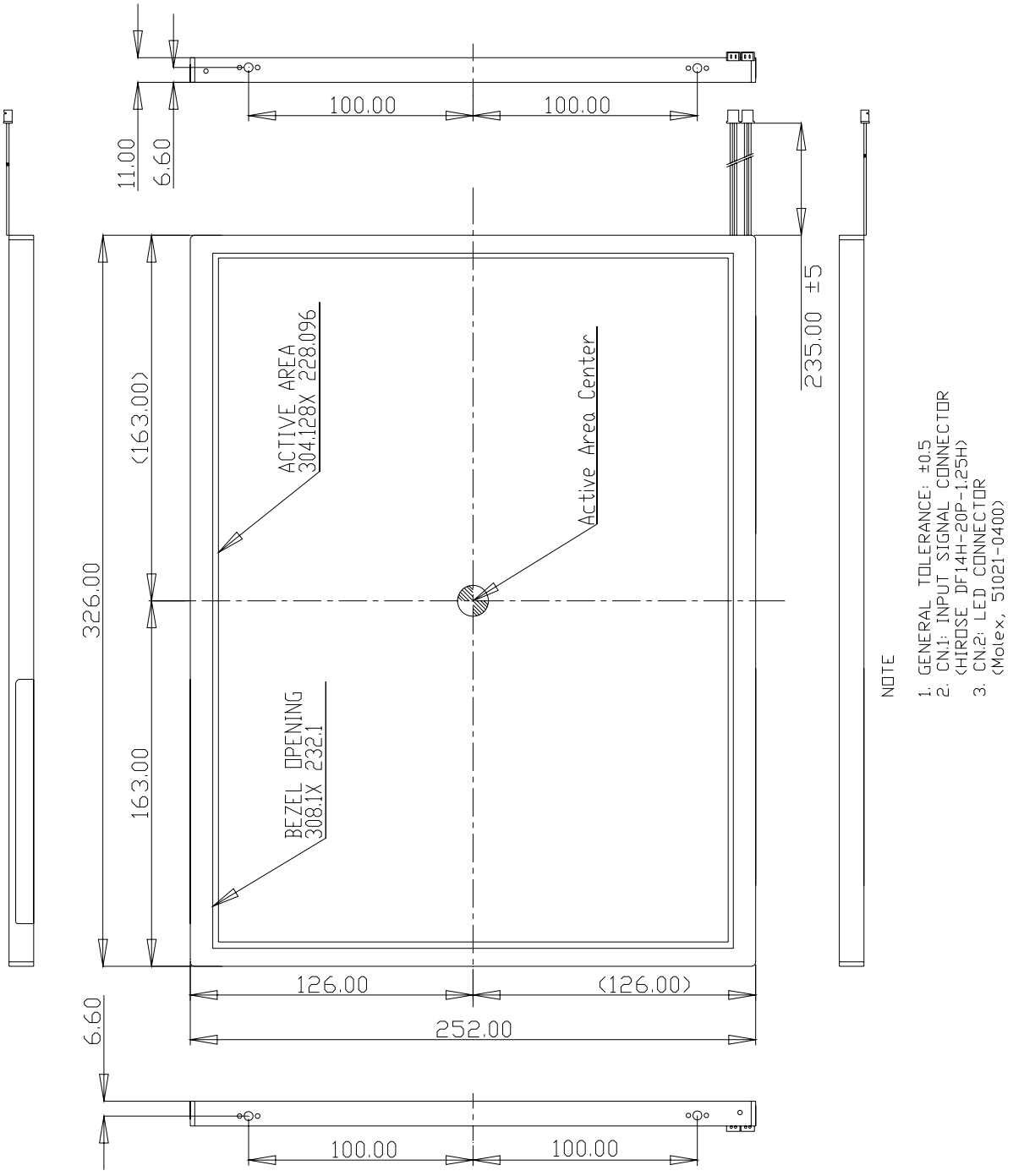
The chart below provides general mechanical characteristics for the model LVM150XSB-L. In addition, the figure below is a detailed mechanical drawing of the LCD. Note that dimensions are given for reference purposes only.

Outside dimensions :		
	Horizontal	326.0 ± 0.5 mm
	Vertical	252.0 ± 0.5 mm
	Depth	11.5 ± 0.5 mm
Bezel area :		
	Horizontal	308.1 ± 0.5 mm
	Vertical	232.1 ± 0.5 mm
Active Display area :		
	Horizontal	304.128 mm
	Vertical	228.096 mm
Weight (approximate) :		1,100 g

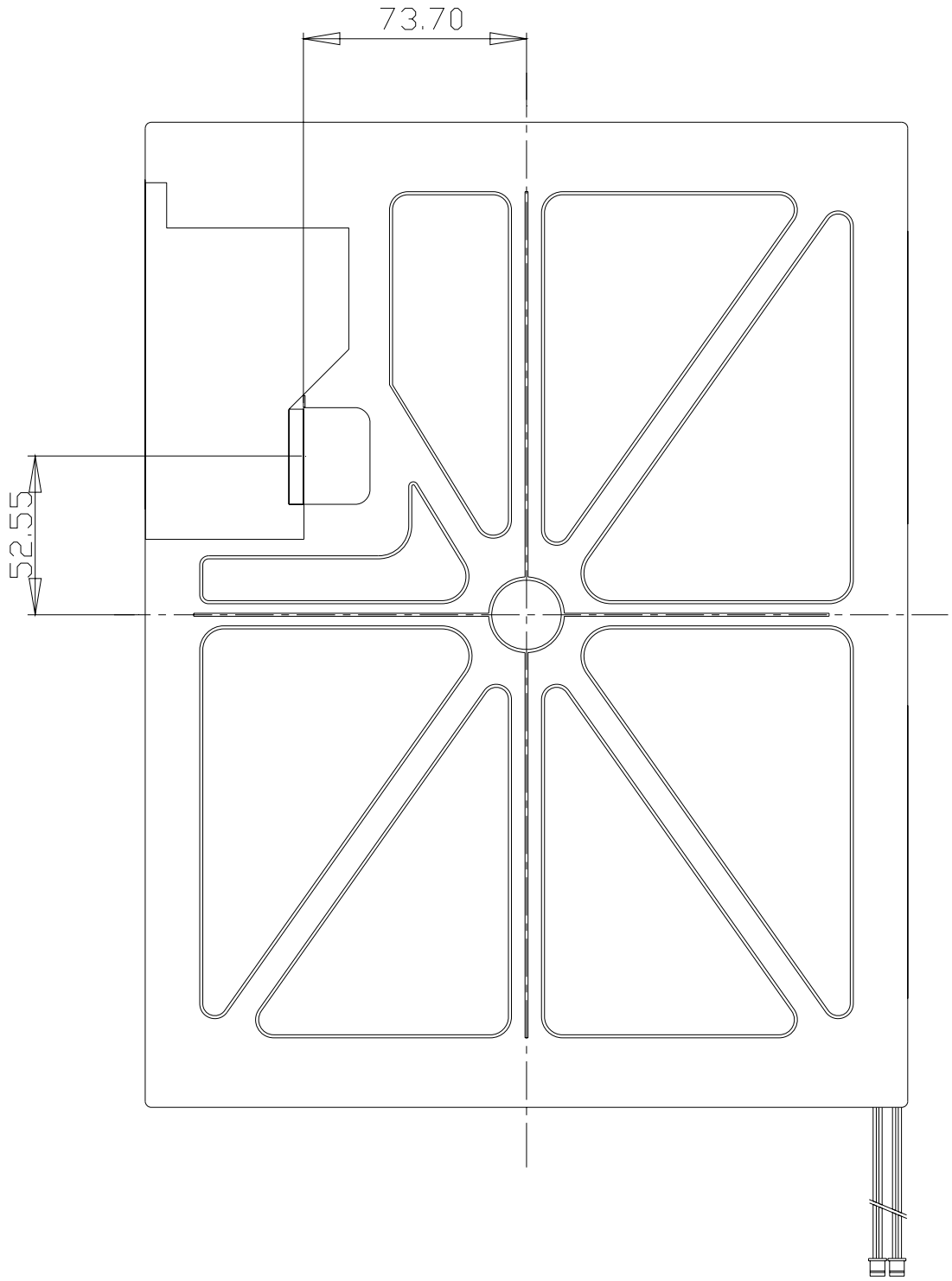
Surface Treatment: hard coating (2H), Anti-glare

9. Mechanical Specification

<FRONT VIEW>



<BACK VIEW>



10. Reliability

- Environment test condition

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 60 °C 72h
2	Low temperature storage test	Ta = -25 °C 72h
3	High temperature & high humidity operation test	Ta = 40 °C 95%RH 72h (no condensation)
4	High temperature operation test	Ta = 50 °C 72h
5	Low temperature operation test	Ta = 0 °C 72h
6	Vibration test (non-operating)	Frequency 10 ~ 300 Hz Gravity/AMP: 1.5G Period: X, Y, Z 30 min.
`7	Shock test (non-operating)	- Max. gravity: 220G - Pulse width: 11ms, half sine wave - Direction: ± X, ± Y, ± Z once for each direction

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.

- ON/OFF Cycle

  : The display module will be capable of being operated over 24,000 ON/OFF cycles (LED power & Vcc ON/OFF)

- Mean Time between Failure

  : The LCD Panel and interface board assembly (excluding the LEDs) shall have a mean time between failures of 30,000 hours with a confidence level 90%.

11. Packing Form

a) Package quantity in one box : TBD pcs.
b) Box Size : TBD (mm)

12. PRECAUTIONS

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

13-1. 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 df polarizer for 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.

13-2. 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.

13-3. 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.

13-4. 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.

13-5. 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..

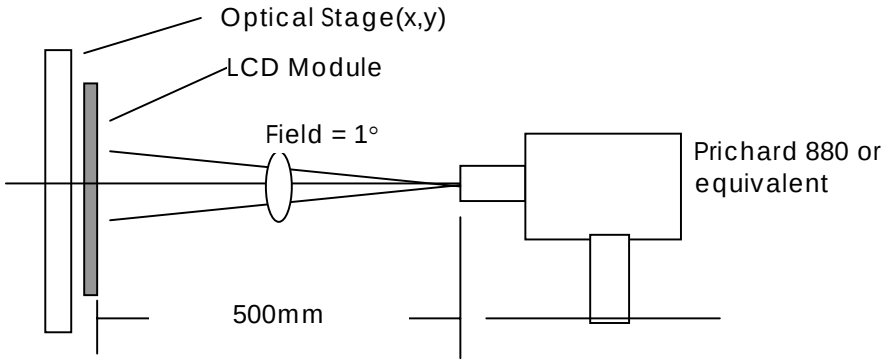
(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing 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.

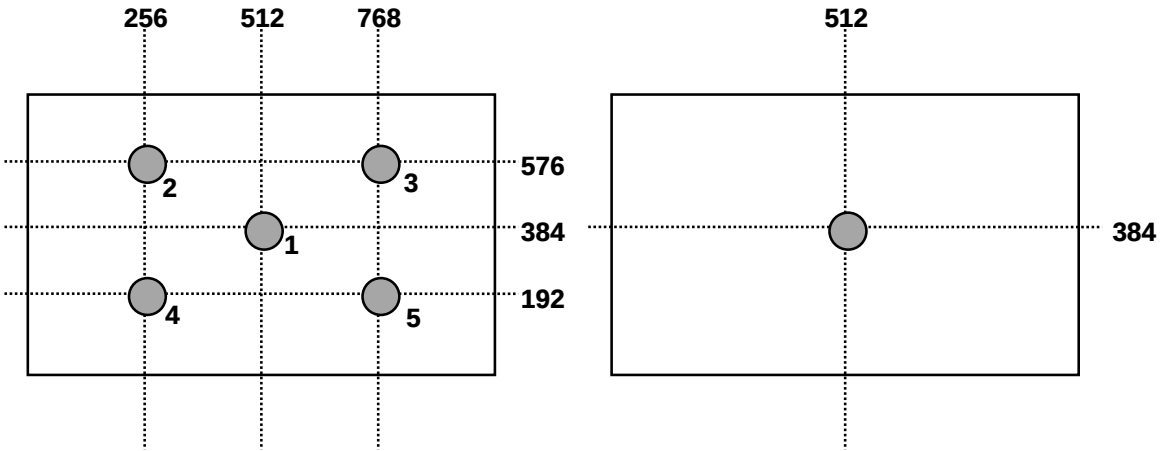
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal- hexane.

A. Optical Characteristic Measurement Equipment and Method



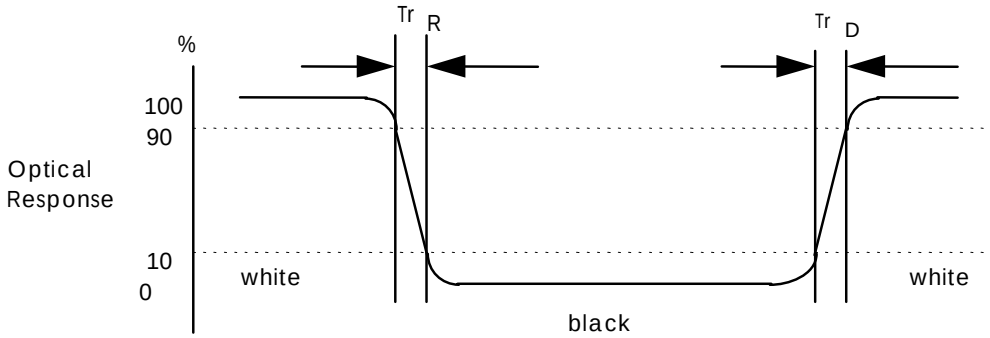
B. Luminance

<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>