

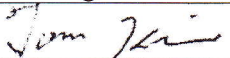

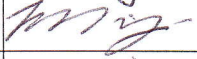

FINAL PRODUCT INFORMATION

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

Updated: 3/04/2010

15.0" XGA Very High Bright TFT-LCD

LVM150XSB-01-L01

PRODUCT ENGINEERING DEPT. Vertex LCD Inc.			
	Name	Signature	Date
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Revision History

Rev	ECN No.	Description of changes	Date	Prepared
A		Initial release	3/04/10	Tom Kim

1. General Description

LVM150XSB-01-L01 is 15.0" Color Active Matrix Liquid Crystal Display with LED backlight system. The matrix employs amorphous silicon Thin Film Transistor as the active element. It is a DE type display operating in the normally White mode. This TFT-LCD has a 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 8-bit gray scale signal for each dot, thus presenting a palette of more than 16,194,277 colors.

The LVM150XSB-01-L01 is intended to support applications where high brightness is a critical factor. In combination with the vertical arrangement of the sub-pixels, the LVM150XSB-01-L01 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(38cm) diagonal 304.128(H) X 228.096(V) mm
Outline dimensions	326.5(H) × 253.5(V) × 13.85(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	8-bit, 16,194,277 colors
Brightness	1,000 cd/m ² Typ.
Power Consumption (LCD & Backlight only)	Total 17.04 Watt,typ (2.48Watt @Vcc, 14.56 Watt @Lamp)
Weight	1100g (typ.)
Display operating mode	DE mode, normally White
Surface treatments	Haze 25, Anti-glare & hard-coating(3H)
Backlight Unit	White LED

2. Absolute Maximum Rating

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	V _{CC}	-0.3	+4.0	Vdc	at 25°C
Operating Temperature	T _{OP}	-30	+70	°C	1,2,3
Storage Temperature	T _{ST}	-40	+80	°C	1

Note 1: Humidity ≤ 90% RH Max (T_a ≤ 40°C) No condensation.

Note 2: The temperature of panel surface should be -30°C Min. and 70 °C Max.

Note 3: Panel at -30°C ~ 70 °C operating ambient temperature should guarantee function work.

3. Electrical Characteristics

The LVM150XSB-01-L01 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.

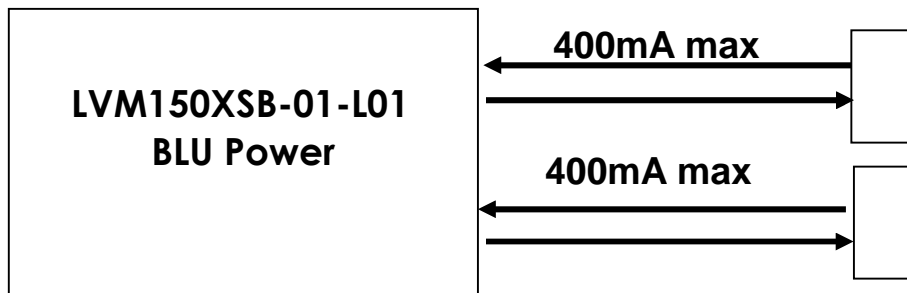
Parameter	Symbol	Condition	Values			Units	Notes
			Min.	Typ.	Max.		
MODULE: Power Supply Input Voltage	V _{CC}		3.0	3.3	3.6	Vdc	V _{CC} = 3.3 V
Power Supply Input Current	I _{CC}		-	0.75	-	A	1,2
Power Consumption	P _c		-	2.48	-	Watts	1,2
LED Backlight:							
Operating Voltage	V _{BL}	(I _{BL} = 0.80A)	17.7	18.2	18.7	Vdc	4
Power Consumption	P _{BL}			14.56		Watts	4
Life Time				30,000		Hrs	3

Notes: 1. The current draw and power consumption specified is for 3.3 Vdc at 25°C and fv at 60Hz.(at Black pattern displayed)

2. Logic level are specified for V_{CC} of 3.3 Vdc at 25°C. The values specified apply to all logic inputs; Hsync, Vsync, Clock, data signals, etc.

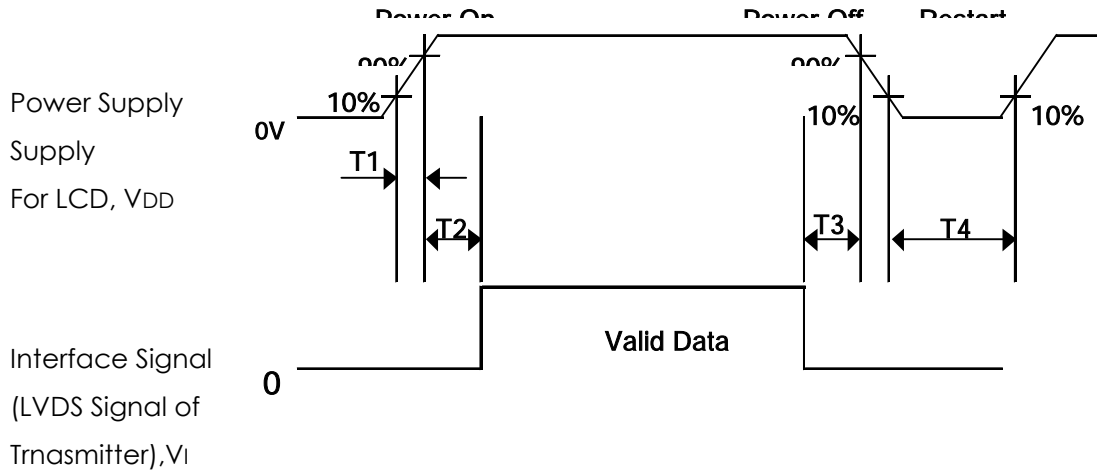
3. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical LED voltage 18.2V (condition : current 0.80A) & at ambient temperature of 25°C.

4. LVM150XSB-01-L01 load voltage should be about 18.2V at each 400mA max current per top & 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.



- $0.5 < T1 \leq 10 \text{ ms}$
- $0 < T2 \leq 50 \text{ ms}$
- $0 < T3 \leq 50 \text{ ms}$
- $0 < T4 \leq 500 \text{ ms}$

Note 1: Please avoid floating state of interface signal at invalid period.

Note 2: When the interface signal is invalid, be sure to pull down the power supply for LCD VDD to 0V.

Note 3: Lamp power must be turn on after power supply for LCD and interface signal is valid.

5. Interface Connections

CN 1 (interface signal): LVM150XSB-01-L01 uses 20 pin connector for module electronics.

Used connector: DF14L-20P-1.25H (HIROSE Electric Co. LTD) Matching side: DF14-20S-1.25C (HIROSE)

Pin	Symbol	Description
1	V _{DD}	Power supply +3.3V
2	V _{DD}	Power supply +3.3V
3	V _{SS}	Ground
4	V _{SS}	Ground
5	RX0-	LVDS Differential Data Input (-)
6	RX0+	LVDS Differential Data Input (+)
7	GND	Ground
8	RX1-	LVDS Differential Data Input (-)
9	RX1+	LVDS Differential Data Input (+)
10	GND	Ground
11	RX2-	LVDS Differential Data Input (-)
12	RX2+	LVDS Differential Data Input (+)
13	GND	Ground
14	RXCLK -	LVDS Differential Data Input (-)
15	RXCLK +	LVDS Differential Data Input (+)
16	GND	Ground
17	RX3-	LVDS Differential Data Input (-)
18	RX3+	LVDS Differential Data Input (+)
19	GND	Ground
20	NC	Tied to ground

CN 2 (backlight): LVM150XSB-01-L01 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

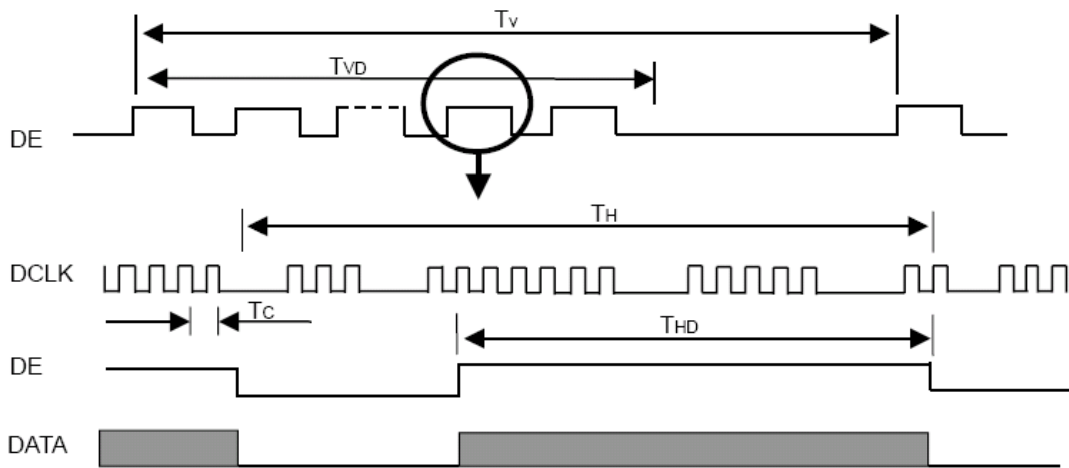
6. Signal Timing Specification

The input signal timing specifications are shown as the following table and timing diagram.

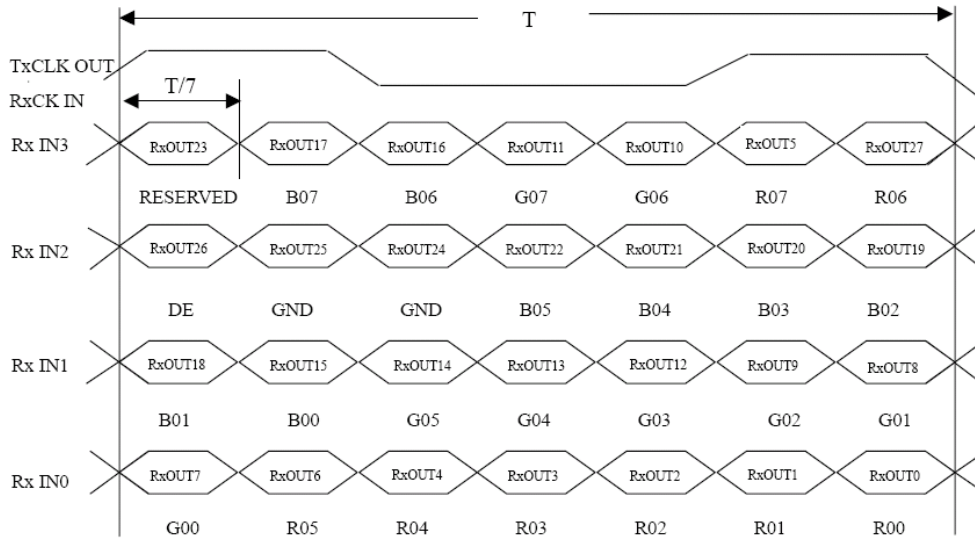
Signal	Item	Symbols	Min	Typ	Max	Units	Note
DLCK	Pixel Clock	1/Tc	-	65	80	MHz	-
DE	Vertical Total Time	Tv	780	806	1200	TH	-
	Vertical Address Time	TvD	768	768	768	TH	-
	Horizontal Total Time	TH	1140	1344	1600	Tc	-
	Horizontal Address Time	THD	1024	1024	1024	Tc	-

Note 1: Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

7. Timing Wave Form Input Signal Timing Diagram



Timing Diagram of LVDS



8. Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8-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.

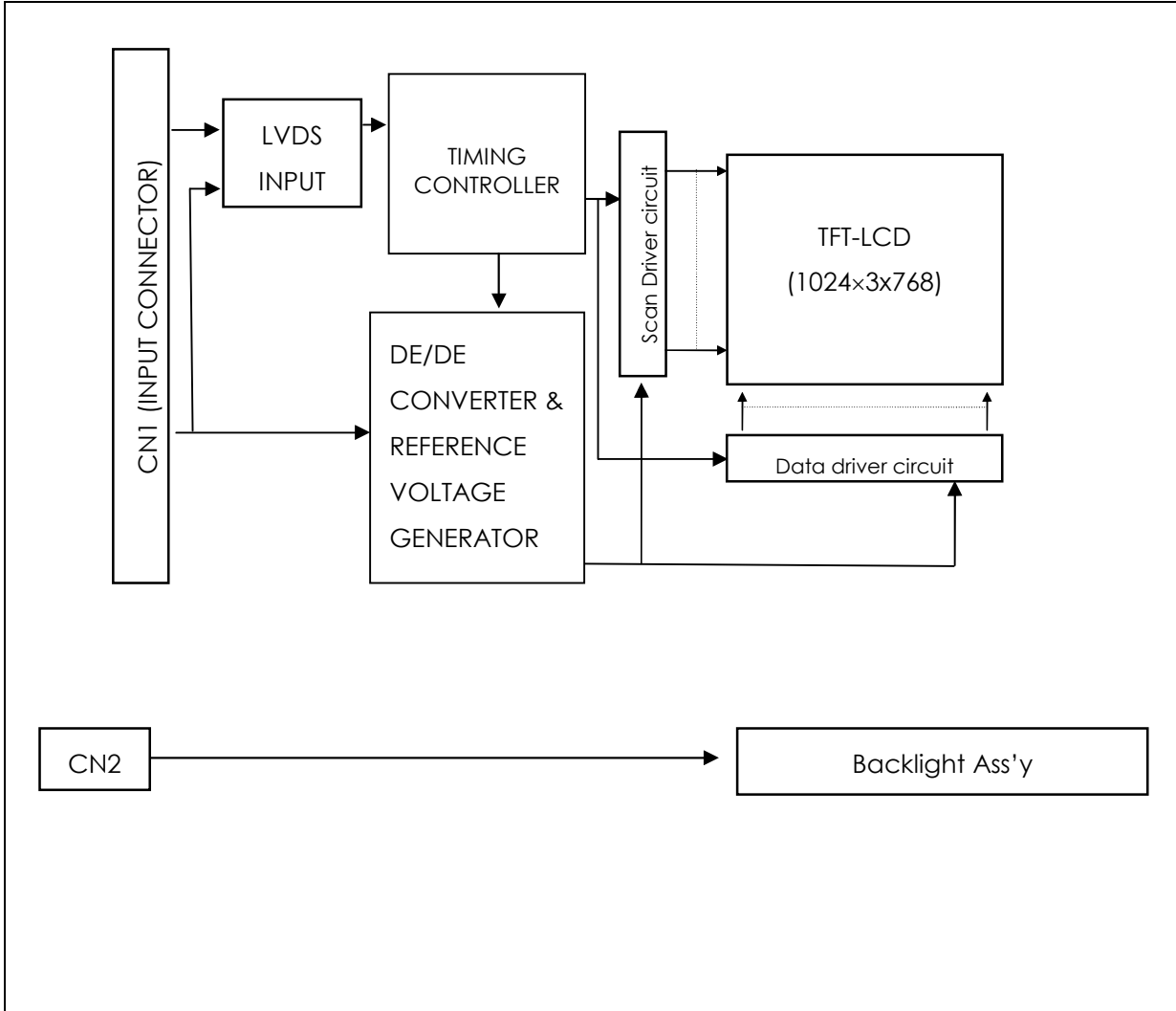
Color		Input Color Data																						
		Red								Green								Blue						
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	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	1	1	1	1	1
Red	Red(000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

	Red(252)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(252)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Red(252) Bright	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green	Green(000)Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Green(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	

	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	
	Green(252)Bright	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Blue	Blue(000) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Blue(001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	

	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	
	Blue(252) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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 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		700			1
Surface Luminance, white	L _{WH}	900	1,000		cd/m ²	2
Luminance Uniformity	δ_{WHITE}	70%	75%			3
Response Time Total (Tr + Td)			25		msec	4
CIE Color Coordinates						
Red	X _R	0.549	0.599	0.649		
	Y _R	0.322	0.372	0.422		
Green	X _G	0.273	0.323	0.373		
	Y _G	0.521	0.571	0.621		
Blue	X _B	0.089	0.139	0.189		
	Y _B	0.064	0.114	0.164		
White	X _W	0.268	0.318	0.368		
	Y _W	0.303	0.353	0.403		
Viewing Angle						
x axis, right ($\theta=0^\circ$)	θ_x		80	-	degree	5
x axis, left ($\theta=180^\circ$)	θ_x		80	-		
y axis, up ($\theta=90^\circ$)	θ_y		80	-		
y axis, down ($\theta=270^\circ$)	θ_y		50	-		

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

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

- 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.
- The uniformity in surface Luminance, δ_{WHITE} is determined by measuring L_{ON} at each test position 1 through 9, and then dividing the minimum L_{ON} of 9 points luminance by maximum L_{ON} of 9 points luminance and multiply by 100 for percentage value. For more information see Appendix B.
 $\delta_{\text{WHITE}} = \text{Minimum (L}_{\text{ON1}}, \text{L}_{\text{ON2}}, \dots, \text{L}_{\text{ON9}}) * 100 / \text{Maximum (L}_{\text{ON1}}, \text{L}_{\text{ON2}}, \dots, \text{L}_{\text{ON9}})$
- 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.
- 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 LVM150XSB-01-L01. 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	326.5 ± 0.5 mm
Vertical	253.5 ± 0.5 mm
Depth	13.85 ± 0.5 mm

Bezel Opening Area:

Horizontal	307.4 ± 0.5 mm
Vertical	231.3 ± 0.5 mm

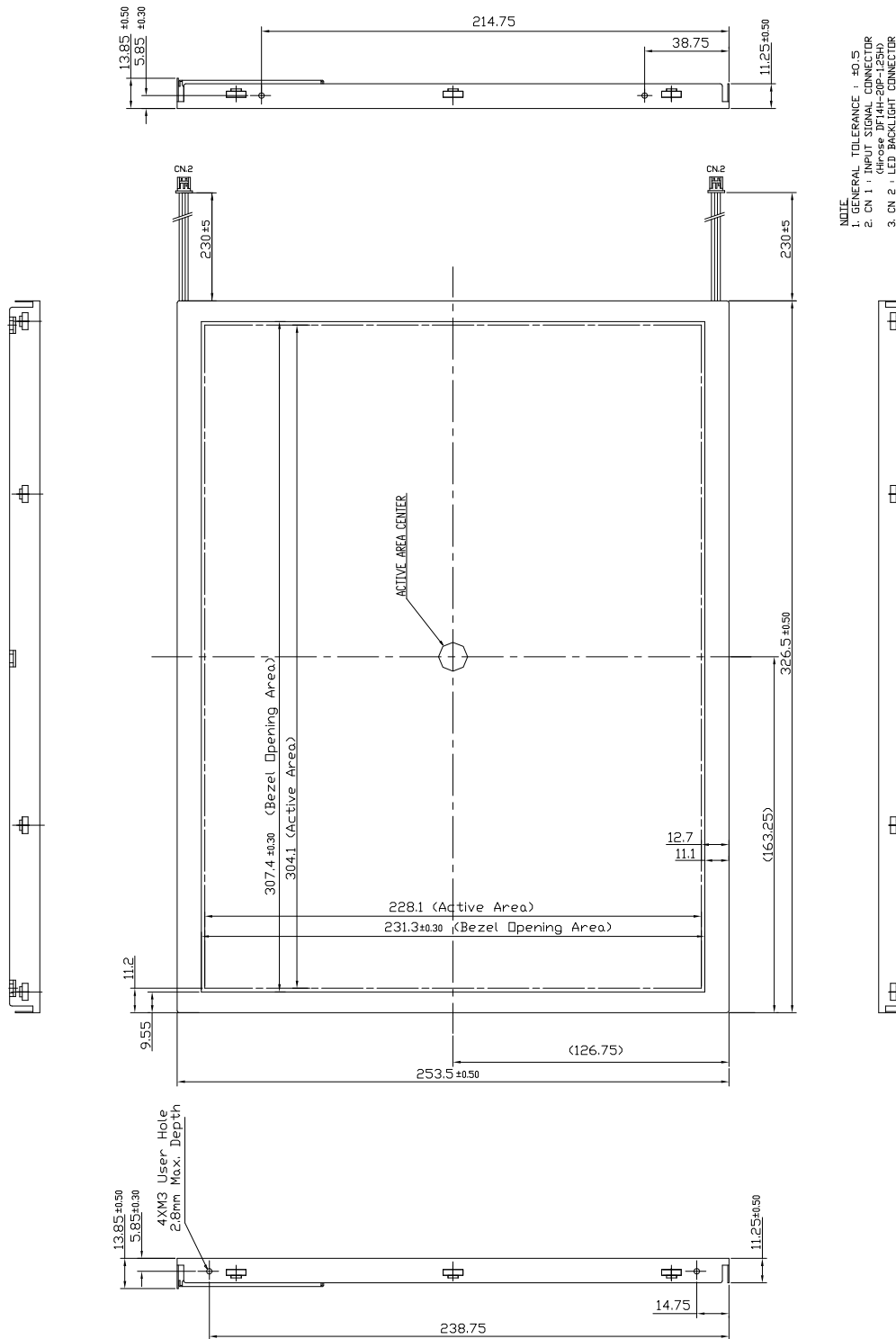
Active Display Area:

Horizontal	304.128 mm
Vertical	228.096 mm

Weight (approximate): 1100 g

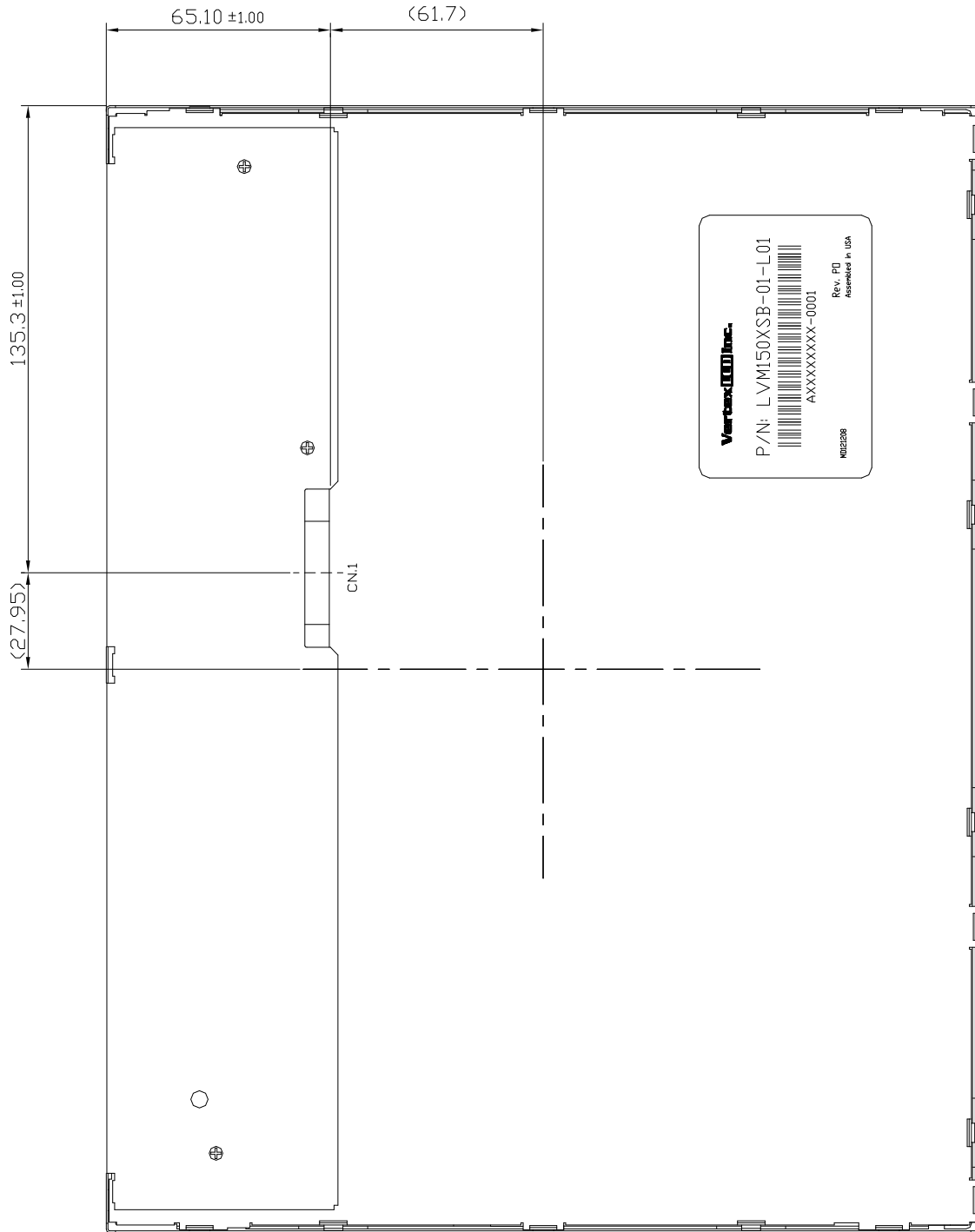
Surface treatment: Anti-glare treatment of the front polarizer.

12. Mechanical Specification
< FRONT VIEW >



NOTE
 1. GENERAL TOLERANCE : ±0.5
 2. CN 1 : INPUT SIGNAL CONNECTOR
 Hirose JFH-20P-12SH)
 3. CN 2 : LED BACKLIGHT CONNECTOR
 Hirose S1004-0200)

< REAR VIEW >



13. Reliability

- Environment test condition.

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 80 °C, 72hr
2	Low temperature storage test	Ta = -40 °C, 72hr
3	High temperature & high humidity operation test	Ta = 40 °C, 90%RH 72hrs (no condensation)
4	High temperature operation test	Ta = 70 °C, 72h
5	Low temperature operation test	Ta = -30 °C, 72h
6	Thermal Shock(non-operating)	Ta = -30 °C(2 Hours) ~ 80 °C (2 Hours), 6cycles
7	Shock test (non-operating)	Gravity : 120G Pulse width: 2ms, half sine wave for X, Y, Z once each direction
8	Vibration test (non-operating)	Frequency 10 ~ 300 ~10 Hz Gravity/AMP: 1.5G Period: X, Y, Z 30 min., 1Cycle

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. Packing Form

- a) Package quantity in one box : TBD
- b) Box Size : TBD

15. PRECAUTIONS

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

15.1 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.

15.2 OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage : $V = \pm 200\text{mV}$ (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.

15.3 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.

15.4 STORAGE

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

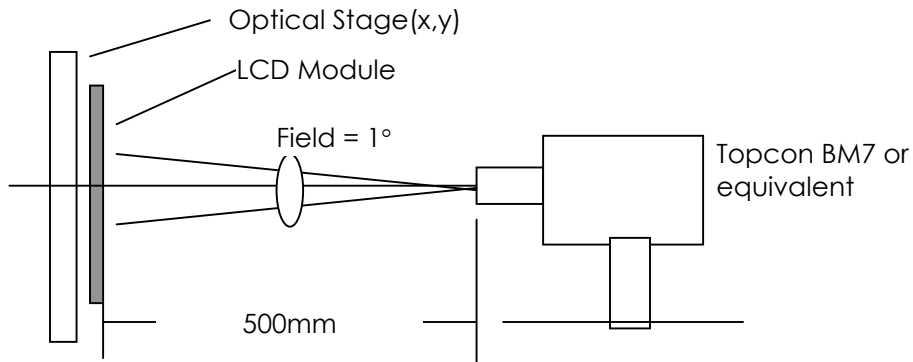
- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35 °C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they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

15.5 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.

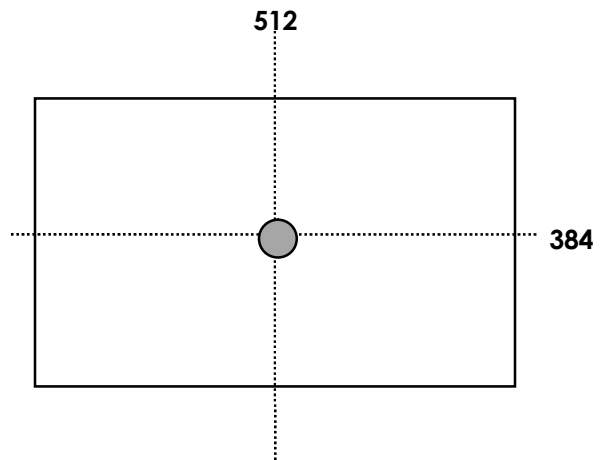
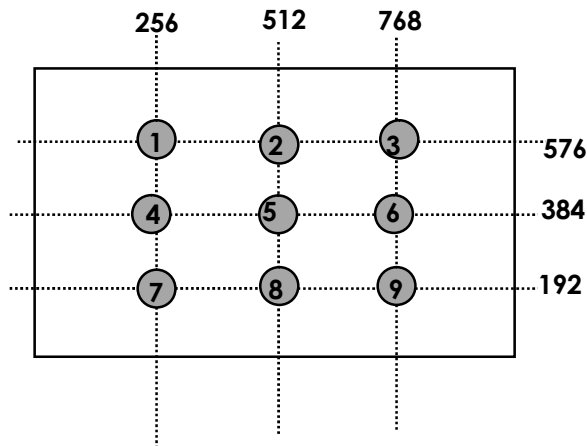
A. Optical Characteristic Measurement Equipment and Method



B. Luminance

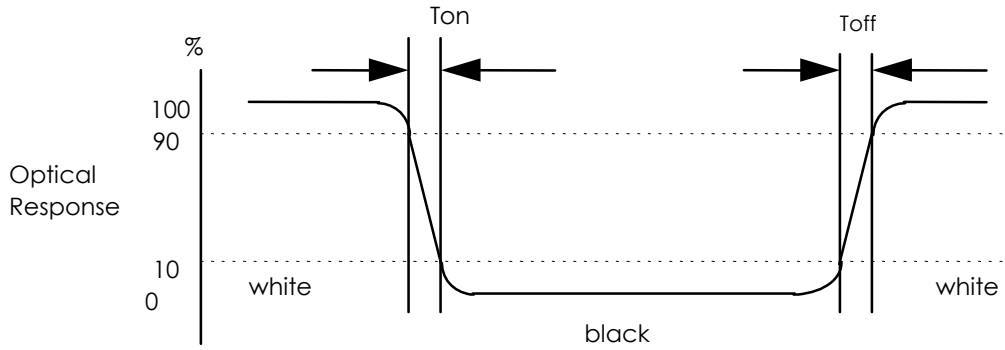
<measuring point for luminance variation>

<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>

