

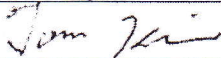



## FINAL PRODUCT INFORMATION

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

Updated: 3/04/2010

# 8.4" XGA High Bright NVIS TFT-LCD

## LVM084XD-L01-NVG

PRODUCT ENGINEERING DEPT. Vertex LCD Inc.			
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## 1. General Description

LVM084XD-L01-NVG is 8.4" 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 8.4"inch diagonally measured active display area with VGA 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 LVM084XD-L01-NVG 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 LVM084XD-L01-NVG characteristics provide an excellent flat panel display for industrial automation products or daylight applications or military airborne surveillance applications.

### General Specification

General specifications are summarized in the following table:

ITEM	SPECIFICATION
Active screen size	8.4 inches(21.3cm) diagonal 170.496(H) X 127.872(V) mm
Outline dimensions	200.0(H) × 152.0(V) × 17.0(D) mm
Pixel pitch	0.1665(H) mm × 0.1665(V) mm
Pixel format	1024(H) X 768(V) pixels
Color Pixel Arrangement	RGB stripe arrangement
Color depth	6-bit, 262,144 colors
Brightness (Day Mode)	1,000 cd/m <sup>2</sup> Typ.
Brightness (Night Mode) (W/T.S.)	10 cd/m <sup>2</sup> Typ.
Power Consumption (LCD & Backlight only)-Day Mode	Total 14.2 Watt, typ (0.7Watt @Vcc, 13.5 Watt @Lamp)
Power Consumption (LCD & Backlight only)-Night Mode	Total 1.78 Watt, typ (0.7Watt @Vcc, 1.08 Watt @Lamp)
Weight	550g (typ)
Display operating mode	transmissive mode, normally black
Surface treatments	hard coating(3H), Antiglare
Backlight Unit	White LED
NVG Compatibility	MIL-L-85762A/MIL-STD-3009, Class B, Type I multicolor display

## 2. Absolute Maximum Rating

Parameter	Symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage	V <sub>CC</sub>	-0.3	+4.0	V <sub>dc</sub>	at 25°C.
Operating Temperature	T <sub>OP</sub>	0	+55	°C	Note 1
Storage Temperature	T <sub>ST</sub>	-20	+60	°C	Note 1

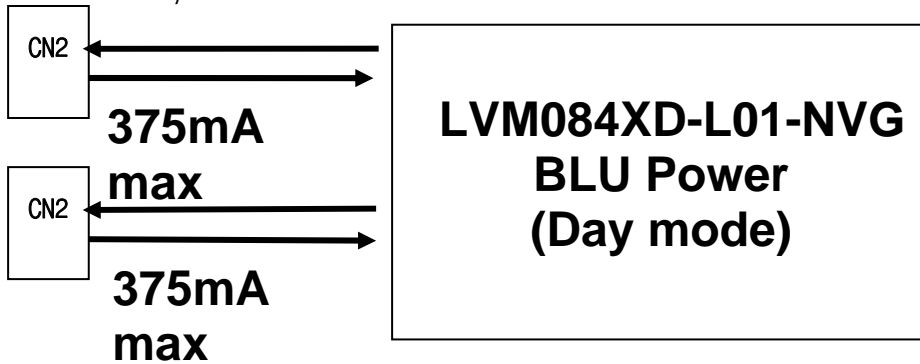
Note: Humidity ≤80% RH. No condensation.

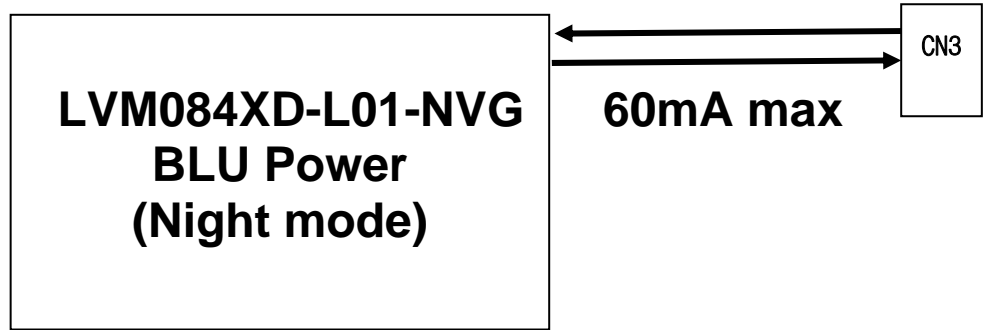
### 3. Electrical Characteristics

The LVM084XD-L01-NVG 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 (Day mode), is typically generated by LED driver board. The third input which powers the LED backlight (Night mode), 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 <sub>CC</sub>		+3.0	+3.3	+3.6	Vdc	V <sub>CC</sub> = 3.3V
Power Supply Input Current	I <sub>CC</sub>		-	0.300	0.450	A	1,2
Power Consumption	P <sub>C</sub>		-	0.66	-	Watts	1,2
LED BACKLIGHT: (Day Mode)							
Operating Voltage	V <sub>BL</sub>	(I <sub>BL</sub> =0.75A)	17.0	18.0	19.0	Vdc	4
Power Consumption	P <sub>BL</sub>		-	13.5	-	Watts	4
(Day Mode)							
Operating Voltage	V <sub>BL</sub>	(I <sub>BL</sub> =0.06A)	17.0	18.0	19.0	Vdc	5
Power Consumption	P <sub>BL</sub>		-	1.08	-	Watts	5
Life Time				30,000		Hrs	3

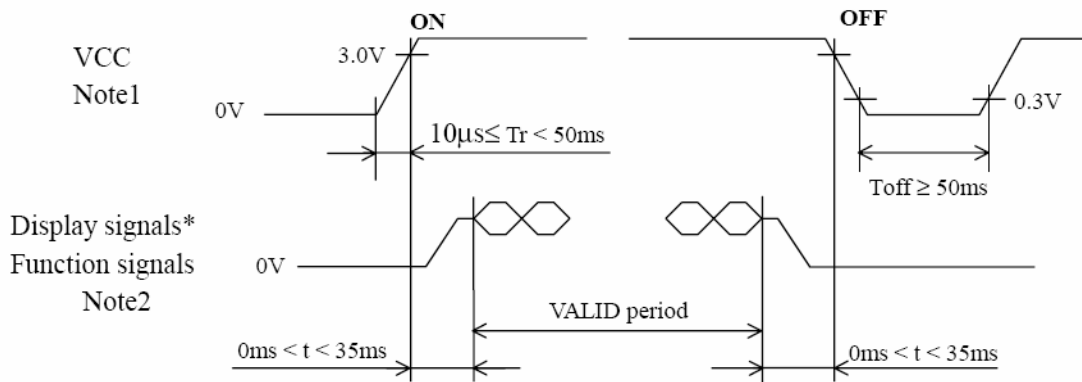
- Notes: 1. The current draw and power consumption specified is for 3.3 Vdc at 25 °C and fv at 60Hz.(at Black pattern displayed)
2. Logic level are specified for V<sub>CC</sub> of 3.3 Vdc at 25°C. The values specified apply to all logic inputs; Hsync, Vsync, Clock, data signals, etc.
3. The life time is determined as the time at which brightness of lamp is 50% compare to that of initial value at the typical LED current & at ambient temperature of 25°C.
4. LVM084XD-L01-NVG load voltage should be about 18.0V at 750mA max current per left sides.(Day Mode)
5. LVM084XD-L01-NVG load voltage should be about 18.0V at 60mA max current per right side.(Night Mode)





#### 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.



\* These signals should be measured at the terminal of 100 resistance.

Note1: In terms of voltage variation (voltage drop) while VCC rising edge is below 3.0V, a protection circuit may work, and then this product may not work.

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) and function signals (DPS and FRC) signals must be Low or High-impedance, exclude the VALID period (See above sequence diagram), in order to avoid that internal circuits is damaged. If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display and function signals, they should be cut VCC.

**5. Interface Connections**

CN 1(interface signal): LVM084XD-L01-NVG uses 20-pin connector for module electronics.

Used connector: FI-SE20P-HF (JAE) Matching side: FI-S20S (JAE)

Pin	Symbol	Description	Remark
1A	D3+	Pixel Data	Note 1, Note 3
1B	GND	Ground	
2A	D3-	Pixel Data	
2B	GND	Ground	
3	DPS	Selection of scan direction	High : Reverse scan, Low or Open : Normal scan Note 2
4	FRC	Selection signal of frame rate control	High: Frame rate control ON Low or Open: Frame rate control OFF Note 1
5	GND	Red data	
6	CK+	Pixel Clock	Note 3
7	CK-	Pixel Clock	
8	GND	Ground	
9	D2+	Pixel Data	Note 3
10	D2-	Pixel Data	
11	GND	Ground	
12	D1+	Pixel Data	Note 3
13	D1-	Pixel Data	
14	GND	Ground	
15	D0+	Pixel Data	Note 3
16	D0-	Pixel Data	
17	GND	Ground	
18	GND	Ground	
19	Vcc	Power supply	
20	Vcc	Power supply	

Note 1

Combination	Input data signals	CN1-Pin No.1 and 2	FRC signal	Display colors
1	8bit	D3+/-	High	16,777,216
2	6bit	GND	Low or Open	262,144

Note 2

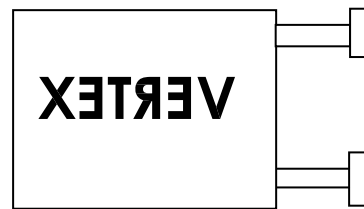


Figure 1. Normal scan (DPS: Low or Open)

Figure 2. Reverse scan (DPS: High)

Note 3: Twist pair wires with 100 (Characteristic impedance) should be connected between LCD panel signal processing board and LVDS transmitter.

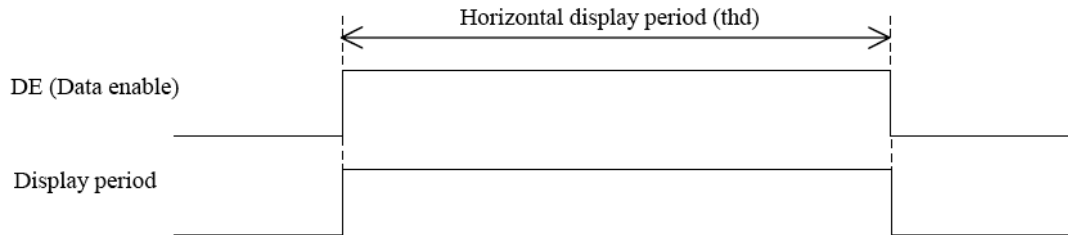
CN 2(backlight): LVM084XD-L01-NVG employs Molex 51004-0200 or equivalent connectors for the LED backlight.

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

### 6.1 Outline of input signal Timings

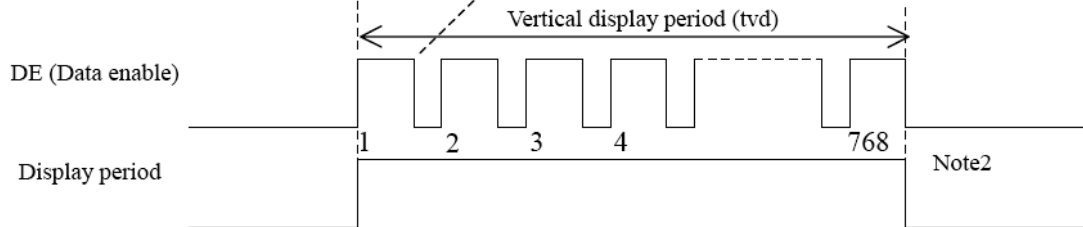
- Horizontal signal

Note1



- Vertical signal

Note1



### 6.2 Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remarks	
Clock	Frequency	1/Tc	60.0	65.0	68.0	MHz	15.385 ns (typ.)	
	Duty	-	-			-	Note2	
	Rise time, Fall time	-	-			ns		
Data	CLK-DATA	Setup time	-			ns	Note2	
		Hold time	-			ns		
	Rise time, Fall time	-	-			ns		
DE	Horizontal	Cycle	Th	19.67	20.676	22.4	$\mu$ s	48,363 kHz (typ.) Note1, Note2, Note3
		Display period	Thd	1024			CLK	
	Vertical (One frame)	Cycle	Tv	13.3	16.666	18.5	Ms	
		Display period	Tvd	768			H	
	CLK-DE	Setup time	-	-			ns	60.0 Hz (typ.) Note1
		Hold time	-	-			ns	
		Rise time, Fall time	-	-			clock	

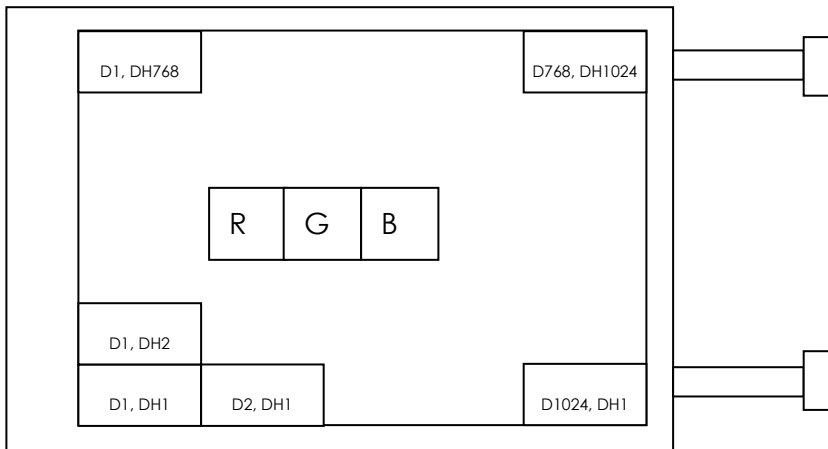
Note1: Definition of parameters is as follows.

Tc = 1CLK, Th = 1H

Note2: See the data sheet of LVDS transmitter.

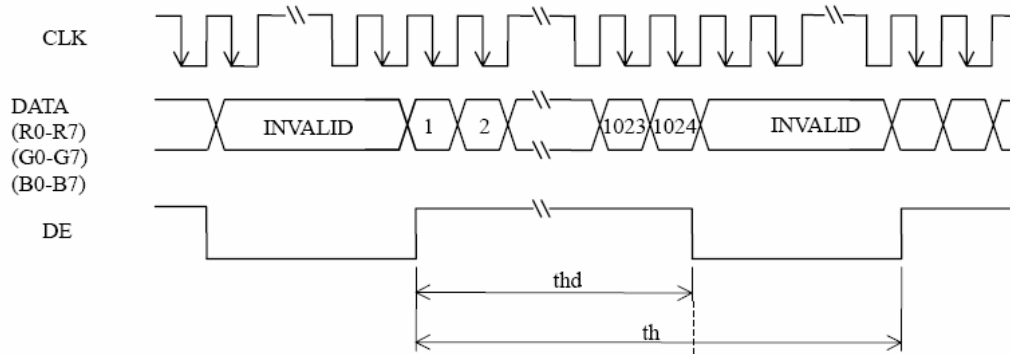
Note3: "Th" must keep the fluctuation within  $\pm 1$  CLK, because of avoidance of image sticking.

### 6.3 Input data signals and display position on the screen

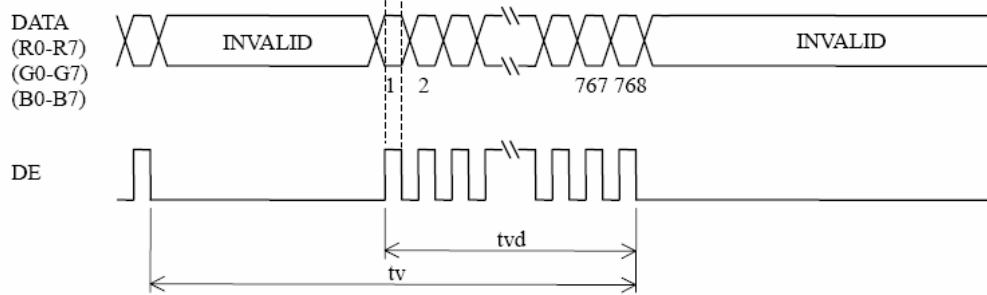


## 6.4 Input signal timing chart

Horizontal timing



Vertical timing

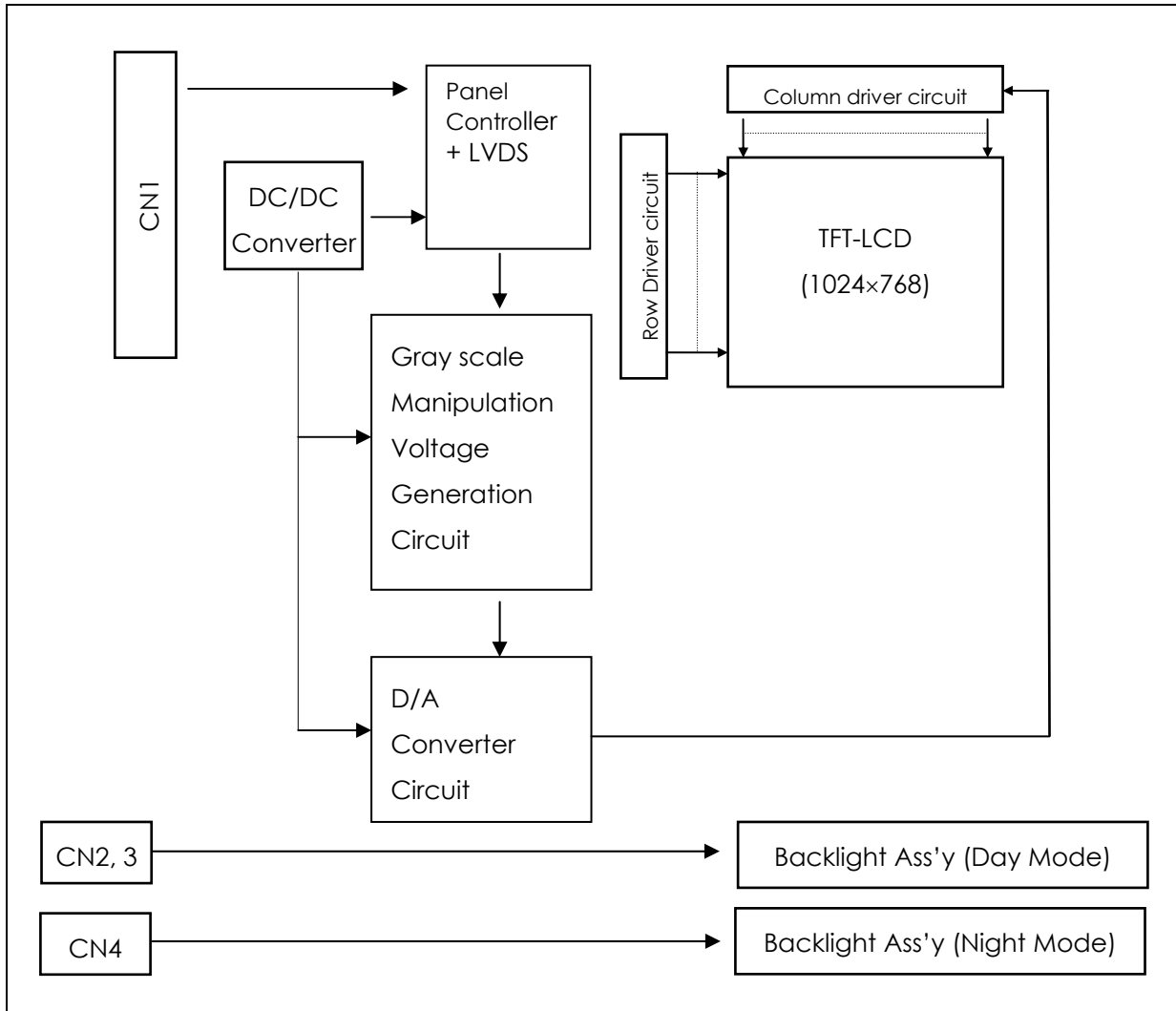


## 7. Color Input Data Reference

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
	Blue	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Magenta	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	1	1	1	1	1	1
	Cyan	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	1	0	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

**8. Block Diagram**



## 9. 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  $\Phi$  and  $\theta$  equal to 0°.

Appendix A presents additional information concerning the measurement equipment and method.

Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
<u>Day Mode</u>						
Contrast Ratio	CR	300	400	-	cd/m <sup>2</sup>	1
Surface Luminance, white	L <sub>WH</sub>	900	1000	-		2
Luminance Variation	$\delta$ WHITE	75%	80%	-		3
<u>Night Mode</u>						
Contrast Ratio	CR	-	400	-	msec	1
Surface Luminance, white	L <sub>WH</sub>	-	10	-		2
Luminance Variation	$\delta$ WHITE	65%	70%	-		3
Response Time Total (Tr + Td)		-	40	-	msec	4
		-				
<u>Day Mode</u>						
CIE Color Coordinates					degree	5
Red	X <sub>R</sub>	0.547	0.590	0.647		
	Y <sub>R</sub>	0.285	0.350	0.385		
Green	X <sub>G</sub>	0.234	0.320	0.334		
	Y <sub>G</sub>	0.500	0.590	0.600		
Blue	X <sub>B</sub>	0.095	0.160	0.195		
	Y <sub>B</sub>	0.120	0.120	0.220		
White	X <sub>W</sub>	0.259	0.340	0.359		
	Y <sub>W</sub>	0.297	0.390	0.397		
Night Mode						
CIE Color Coordinates						
White	U' <sub>W</sub>		0.190			
	V' <sub>W</sub>		0.490			
Viewing Angle						
x axis, right ( $\theta=0^\circ$ )	$\theta$ X	-	85	-		
x axis, left ( $\theta=180^\circ$ )	$\theta$ X	-	85	-		
y axis, up ( $\theta=90^\circ$ )	$\theta$ Y	-	85	-		
y axis, down ( $\theta=270^\circ$ )	$\theta$ Y	-	85	-		

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,  $\delta$  WHITE is determined by measuring L<sub>ON</sub> at each test position 1 through 9, and then dividing the minimum L<sub>ON</sub> of 9 points luminance by maximum L<sub>ON</sub> of 9 points luminance and multiply by 100 for percentage value. For more information see Appendix B.  
 $\delta$  WHITE = **Minimum (L<sub>ON1</sub>, L<sub>ON2</sub>, ..., L<sub>ON9</sub>) \* 100 / Maximum (L<sub>ON1</sub>, L<sub>ON2</sub>, ..., L<sub>ON9</sub>)**
- Response time is the time required for the display to transition from white to black (Rise Time, Tr<sub>R</sub>) and from black to white (Decay Time, Tr<sub>D</sub>). 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.

## 10. NVIS (NIGHT VISION IMAGING SYSTEM) SPECIFICATION

NVIS Type	TYPE I
NVIS CLASS	CLASS B
Military Standard	MIL-STD-3009 (NVG interface and performance requirements derived from MIL-L-85762A)

## 11. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LVM084XD-L01-NVG. 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	200.0 ± 0.5 mm
Vertical	152.0 ± 0.5 mm
Depth	17.0 ± 0.5 mm

Bezel area :

Horizontal	173.6 ± 0.5 mm
Vertical	131.1 ± 0.5 mm

Active Display area :

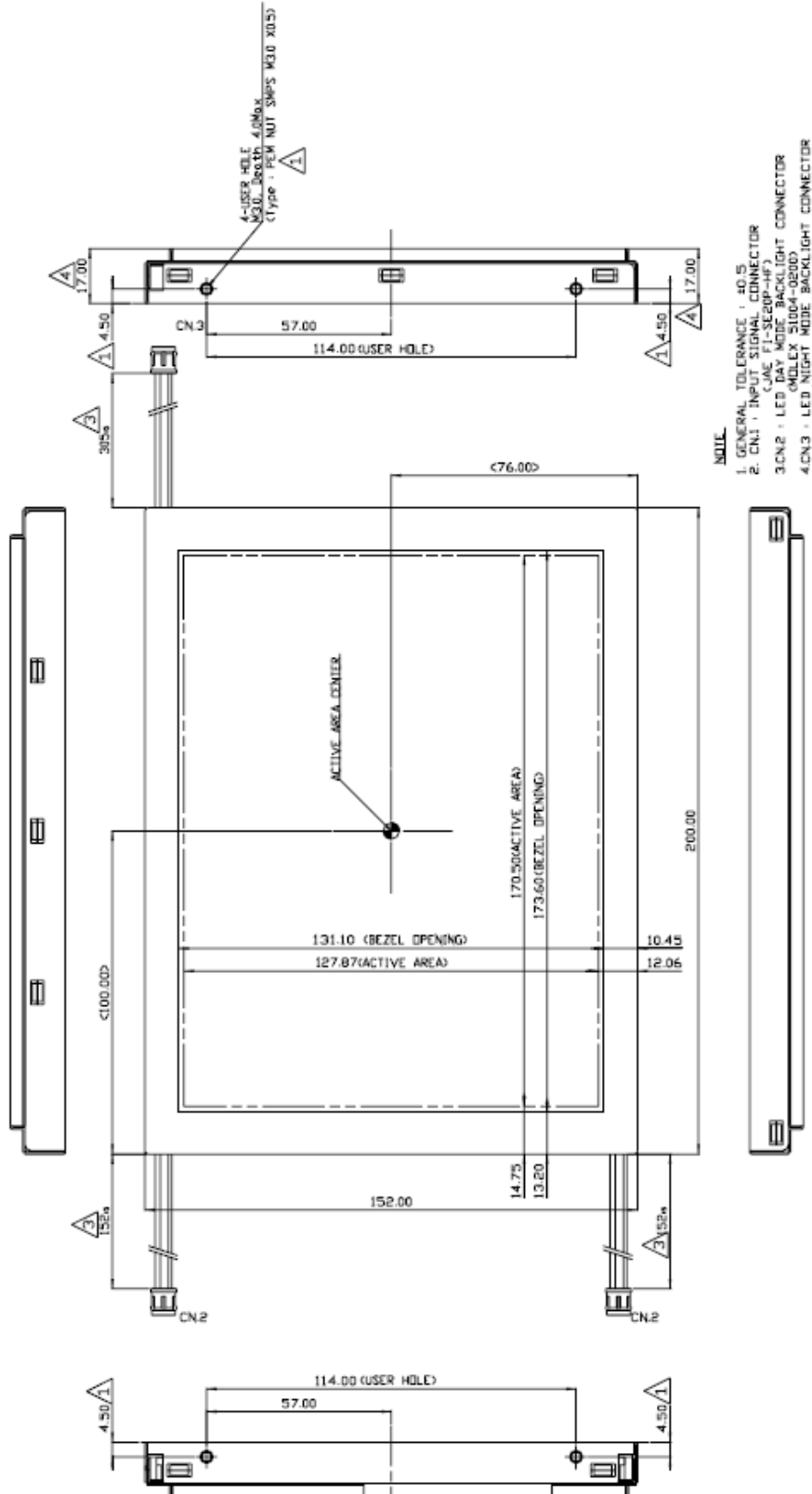
Horizontal	170.496 mm
Vertical	127.872 mm

Weight (approximate) : 550g Typ. (590g Max.)

Surface Treatment : Hard coating 3H.  
Antiglare

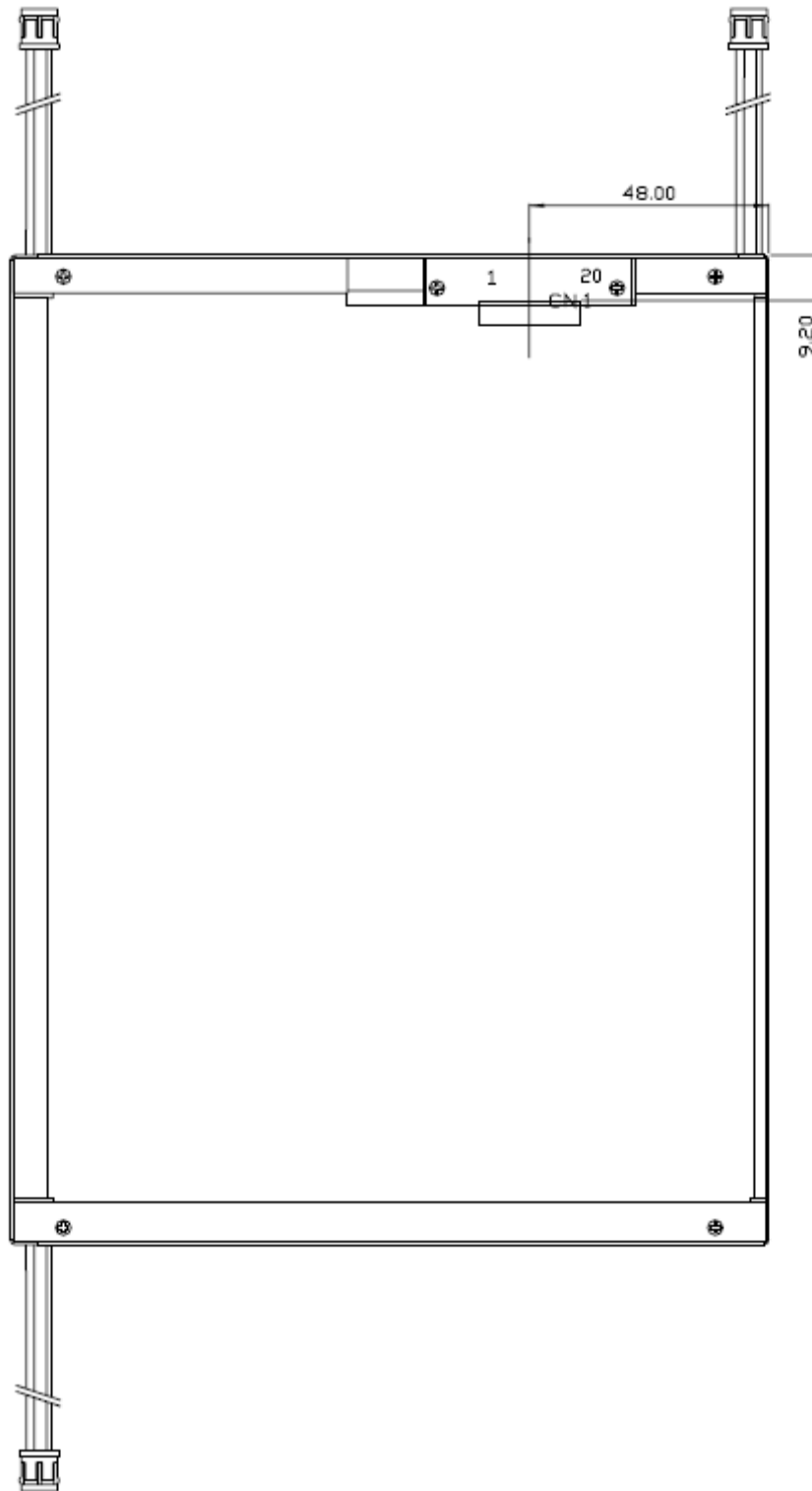
**12. Mechanical Specification**

<FRONT VIEW>



- NOTE**
1. GENERAL TOLERANCE : ±0.5
  2. CN.1 : INPUT SIGNAL CONNECTOR (JAE F1-SE20P-HF)
  3. CN.2 : LED DAY MODE BACKLIGHT CONNECTOR (OMLEX S1004-0200)
  4. CN.3 : LED NIGHT MODE BACKLIGHT CONNECTOR

<BACK VIEW>



**13. Reliability**

- Environment test condition

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 60 °C 72h
2	Low temperature storage test	Ta = -20 °C 72h
3	High temperature & high humidity operation test	Ta = 60 °C 60%RH 72h (no condensation)
4	High temperature operation test	Ta = 55 °C 72h
5	Low temperature operation test	Ta = 0 °C 72h
6	Vibration test (non-operating)	Frequency 10~50~10Hz Gravity/AMP: 1.5G Period: X, Y, Z 30 min. 1 Cycle
7	Shock test (non-operating)	Gravity : 50G Pulse width: 11ms, half sine wave for X, Y, Z once 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.

**14. Packing Form**

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

**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

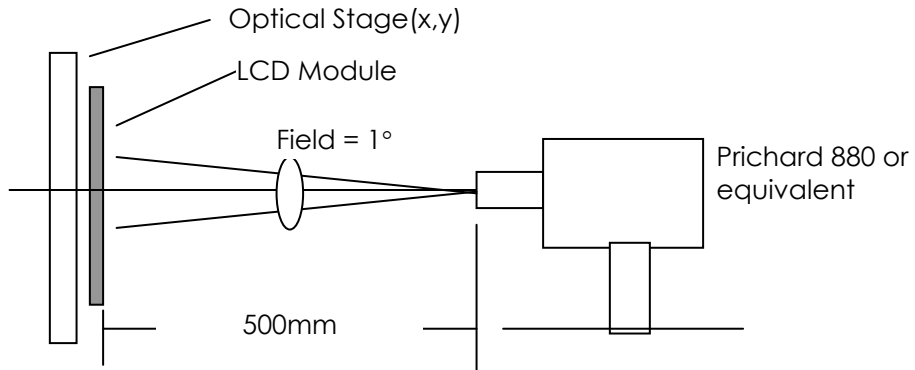
When storing modules for a long time, the following precautions should be followed.

- (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

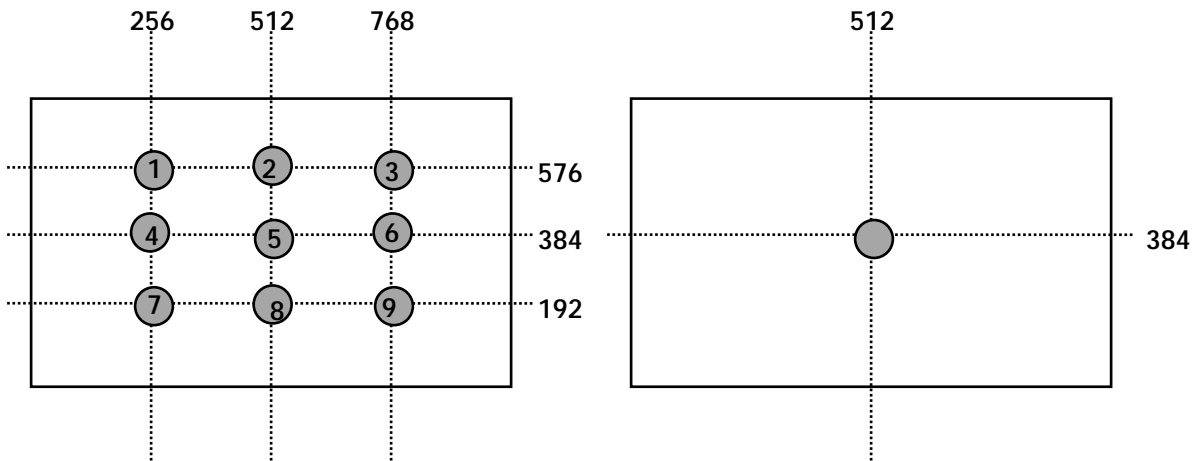
- (1) When the protection film is peeled off, static electricity is generated between the film and polarizer.  
This should be peeled off slowly and carefully by people who are electrically grounded and with well ion- blown equipment or in such a condition, etc..
- (2) The protection film is attached 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**



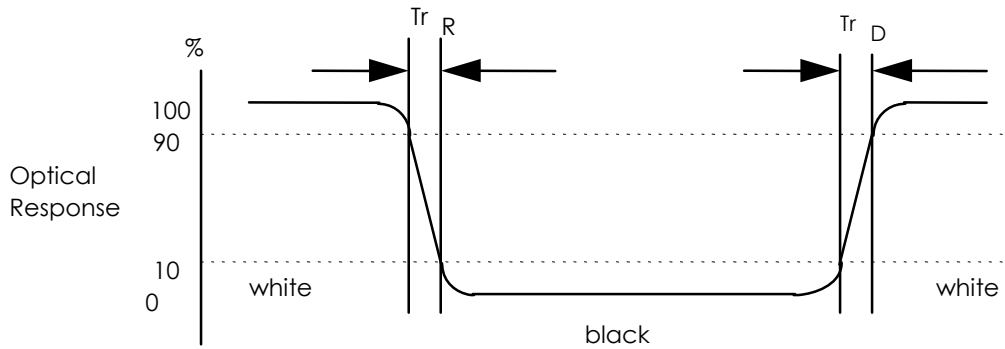
**B. Luminance**

<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>

