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Vertex LCD Inc.
600 S. Jefferson St. Unit K Placentia, CA 92870
TEL: 714-223-7111 FAX: 714-223-7711

FINAL PRODUCT INFORMATION

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

Updated: 2/05/2009

6.4” VGA Very High Bright TFT-LCD

LVM064VD-L01

COLOR LIQUID CRYSTAL DISPLAY

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Revision History

Rev	ECN No.	Description of changes	Date	Prepared
0		Initial Release	3/10/06	Hanna Lee
A		Typo correction	2/14/07	Eric Kim
B		-Change 1. Absolute Maximum Rating(P4) Operating Temperature 0~55°C → -30~80°C 2. Optical Specification(P11) Contrast Ratio 150 → 400 3. Reliability Condition(P15) : High temperature Storage test Ta = 80°C, 240hr → Ta = 80°C, 72hr : Low temperature storage test Ta = -30°C, 240hr → Ta = -30°C, 72hr : High temperature & high humidity operation test Ta = 40°C 90-95%RH 240hr → Ta = 40°C 90-95%RH 72hr : High temperature operation test Ta = 55°C, 240hr → Ta = 80°C, 72hr : Low temperature operation test Ta = 0°C, 240hr → Ta = -30°C, 72hr	5/30/07	Eric Kim
C		-Addition 5. Interface Connection(P7) Note 3: When opening it, it becomes set of High because the pull-up resistor is built into the module. 6.1 Timing Characteristics(P8) Note : Please use this module in more than 50Hz.(1/Tv) -Change 1. Response Time(P11) Tr(Typ)30→8ms, (max)60→20ms Td(typ)50→21ms, (max)100→40ms	9/10/07	Eric Kim
D		: - Based on deleted (P1) : -LED Backlight: Operating Voltage Max.= 17.7V deleted. (P5) : -LED Backlight: Operating Voltage Typ.= 17.7V added. (P5) : -LED Backlight: Operating Current Max.= .16A deleted. (P5) : -Condition (I_{BL} =0.16A) added. (P5) : -LED Backlight: Power Consumption Max.= 2.83W deleted. (P5) : -LED Backlight: Power Consumption Typ.= 2.83W added. (P5) : -CN 2(backlight): Pin 2 & Note NC deleted. (P7) : -CN 2(backlight): Pin 3 changed. (P7) Pin3→ Pin2 : -Color: Basic Colors: Red(63), Green(63), Blue(63) changed. (P10) Red(63), Green(63), Blue(63) → Red, Green, Blue : -approximately 30 minutes deleted. (P11) : -ON/OFF Cycle deleted (P15) : -Mean Time between Failure deleted (P15)	2/05/09	Tom Kim

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1. General Description

LVM064VD-L01 is 6.4" 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 6.4 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 LVM064VD-L01 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 LVM064VD-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	6.4 inches(16.32cm) diagonal 130.56(H) X 97.92(V) mm
Outline dimensions	161.3(H) × 117(V) × 12(D) mm
Pixel pitch	0.204(H) mm × 0.204(V) mm
Pixel format	640(H) X 480(V) pixels
Color Pixel Arrangement	RGB stripe arrangement
Color depth	6-bit, 262,144 colors
Brightness	950 cd/m^2
Power Consumption	Total 3.8 Watt, typ (1 Watt @Vcc, 2.8 Watt @Lamp)
Weight	300g (typ)
Display operating mode	transmissive mode, normally white / twisted nematic
Surface treatments	hard coating(3H), anti-glare treatment
Backlight Unit	White LED

2. Absolute Maximum Rating

Parameter	symbol	Values		Units	Notes
		Min.	Max.		
Power Input Voltage					
+5V supply voltage	V_{cc}	-0.3	+6	Vdc	at 25°C.
Operating Temperature	T_{OP}	-30	+80	°C	Note 1
Storage Temperature	T_{ST}	-30	+80	°C	Note 1

Note 1. Humidity Less than 95% RH at Ta ≤ 40 °C. No condensation.

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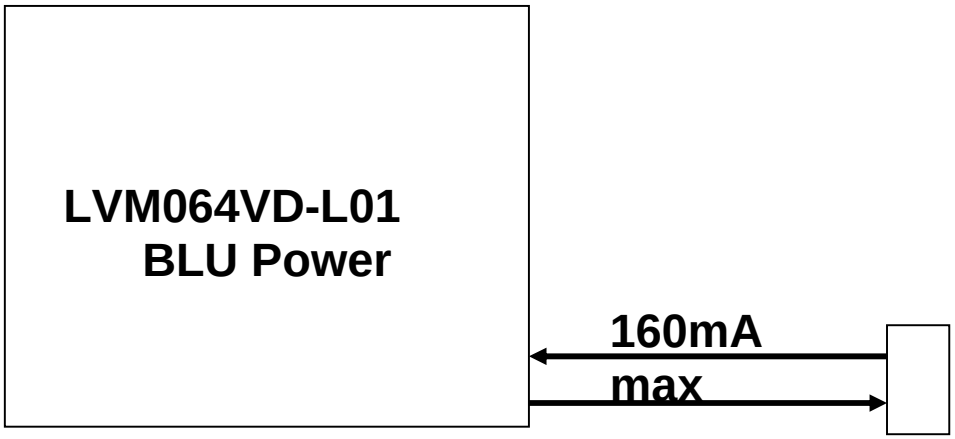
3. Electrical Characteristics

The LVM064VD-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, is typically generated by a LED driver. The LED Driver 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	Vcc = 3.3V
	V_{CC}		+4.5	+5.0	+5.5	Vdc	Vcc = 5.0V
Power Supply Input Current	I_{CC}		-	0.290	0.580	A	1,2, Vcc = 3.3V
	I_{CC}		-	0.200	0.400	A	1,2, Vcc = 5.0V
Power Consumption	P_C		-	1	-	Watts	1,2
LED BACKLIGHT:							
Operating Voltage	V_{BL}	(I_{BL} =0.16A)	-	17.7	-	Vdc	4
Power Consumption			-	2.83	-	Watts	
Life Time			-	50,000	-	Hrs	3

Notes: 1. The current draw and power consumption specified is for 3.3 / 5.0 Vdc at 25°C and fv at 60Hz.(at Black pattern displayed)

2. Logic level are specified for Vcc of 3.3 / 5.0 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. LVM064VD-L01 load voltage should be about 17.7V at 160mA max current.



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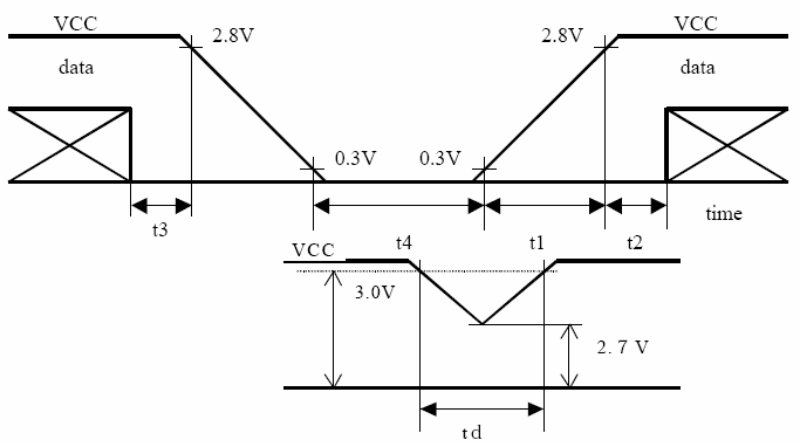
4. Power On/Off Sequences

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

Vcc-turn on/off conditions.
0 < t1 ≤ 15ms
0 < t2 ≤ 20ms
0 < t3 ≤ 1s
1s < t4

Vcc-dip conditions.
1) At 2.7V = Vcc < 3.0V
td ≤ 10ms
2) At Vcc < 2.7V
Vcc dip conditions
Should also follow the
Vcc turn-on/off conditions



Note: 1. Please avoid floating state of interface signal at invalid period.
2. When the interface signal is invalid, be sure to pull down the power supply for LCD Vcc to 0 Vdc.
3. Backlight power must be turn on after power supply for LCD and interface signal is valid.

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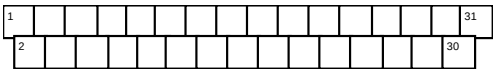
5. Interface Connections



CN 1(interface signal): LVM064VD-L01 uses 31-pin connector for module electronics.
Used connector: DF9BA31P-1V (HIROSE) Matching side: DF9-31S-1V (HIROSE)

Pin	Symbol	Description	Remark
1	GND	Ground	-
2	CK	Main clock	-
3	Hsync	Horizontal sync.	Negative
4	Vsync	Vertical sync.	Negative
5	GND	Ground	-
6	R0	Red data (LSB)	-
7	R1	Red data	-
8	R2	Red data	-
9	R3	Red data	-
10	R4	Red data	-
11	R5	Red data (MSB)	-
12	GND	Ground	-
13	G0	Green data (LSB)	-
14	G1	Green data	-
15	G2	Green data	-
16	G3	Green data	-
17	G4	Green data	-
18	G5	Green data (MSB)	-
19	GND	Ground	-
20	B0	Blue data (LSB)	-
21	B1	Blue data	-
22	B2	Blue data	-
23	B3	Blue data	-
24	B4	Blue data	-
25	B5	Blue data (MSB)	-
26	GND	Ground	-
27	ENAB	Data timing signal (Control signal for image location in horizontal direction)	Note 1
28	Vcc	Power supply	-
29	Vcc	Power supply	-
30	R/L	Horizontal scanning direction control signal (Rightwards/Leftwards)	Note 2
31	U/D	Vertical scanning direction control signal (Upwards/downwards)	Note 2

The back shield case is internally grounded to GND of the module.
The front shield case is not certainly grounded to GND of the module.

Note1: The horizontal display location is designated and controlled by rising timing of ENAB signal. However if ENAB signal is fixed to “Low”, display location is designated by the default setting in the module. (Don’t use the module by fixing ENAB o “High”
Note2: Typical setting is R/L = High, U/D = High as shown in 6.4
Note 3: When opening it, it becomes set of High because the pull-up resistor is built into the module.

CN 2(backlight): LVM064VD-L01 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

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6 Timing Characteristics of Input signals

6.1 Timing Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock	Frequency	1/Tc	-	25.18	28.33	MHz
	High time	Tch	5	-	-	ns
	Low time	Tcl	10	-	-	ns
Data	Setup time	Tds	5	-	-	ns
	Hold time	Tdh	10	-	-	ns
Hsync	Cycle	TH	30.00	31.78	-	μs
			770	800	900	clock
	Pulse width	THp	2	96	200	clock
Vsync	Period	TV	515	525	560	line
	Pulse width	TVp	1	-	34	line
Horizontal display period		THd	640	640	640	clock
Phase difference between Hsync and clock		THc	10	-	Tc-10	ns
Phase difference between Hsync and Vsync		TVh	0	-	TH-THp	Clock
Vertical display period		TVd	480	480	480	line

* In case of low frequency, the deterioration of display quality, flicker, etc. may occur. Please use this module in more than 50Hz.(1/Tv)

6.2 Horizontal Display Position

Display position in horizontal direction is designated by rising timing of ENAB signal.

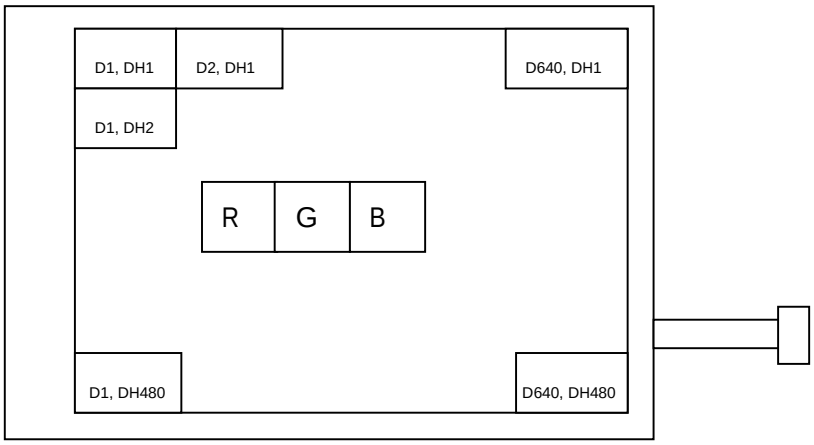
Parameter		symbol	Min.	Typ.	Max.	Unit	Remark
Enable signal	Setup time	Tes	5	-	Tc-10	ns	
	Pulse width	Tep	2	640	640	clock	
Phase difference between Hsync and ENAB signal		THe	44	-	TH-664	clock	

When ENAB is fixed “Low”, the horizontal display will starts from the clock of C100 (clock) as shown in 6.5. When the phase difference is not greater than 100 clock, hold ENAB terminal in “High” state for more than (100-THe), otherwise display will start from data of C100 (clock).

6.3 Vertical Display Position

Display start position in vertical direction is fixed to the 34th line.
The ENAB signal does not related to Vertical display position.

6.4 Input data signals and display position on the screen



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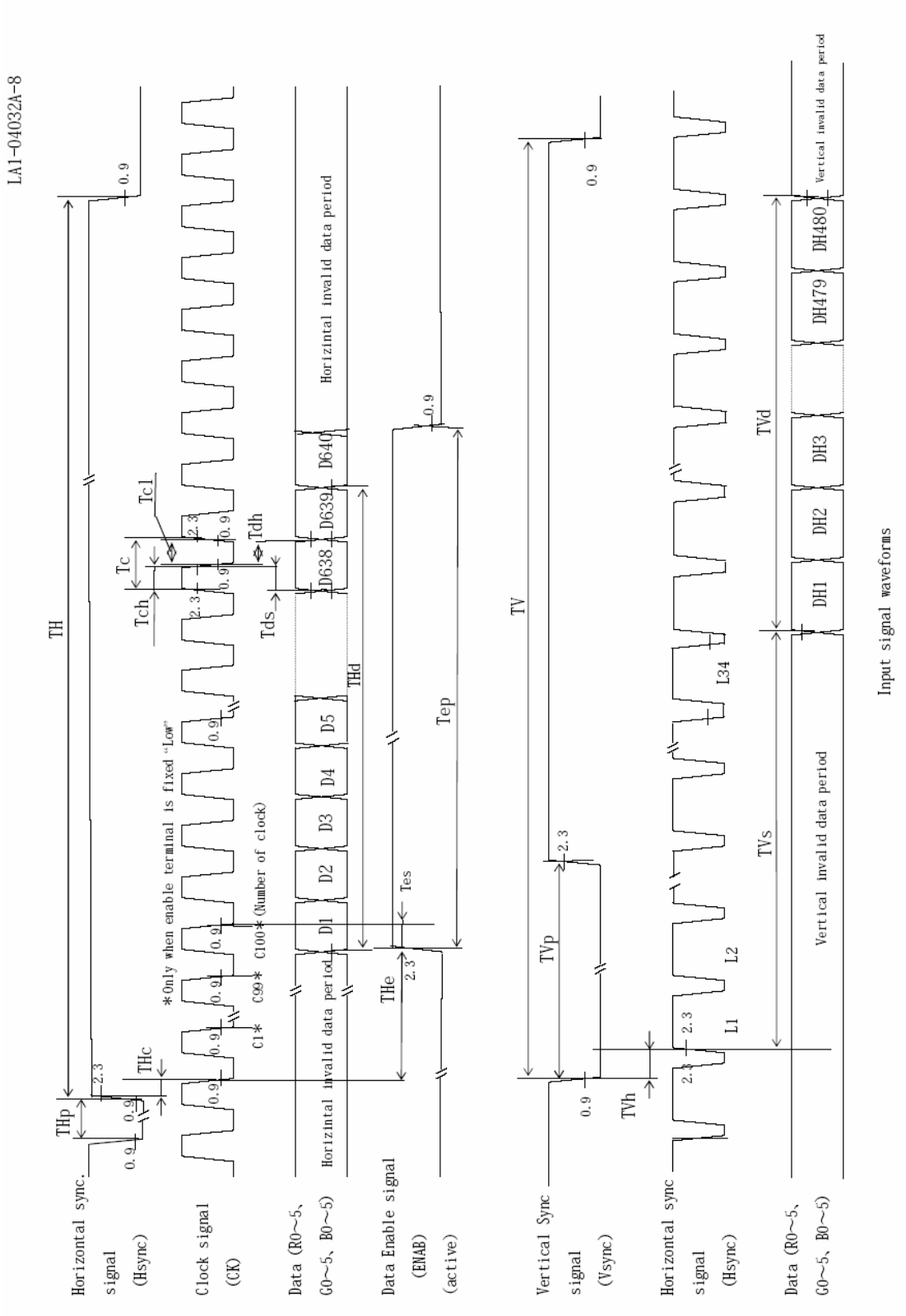
6.5 Timing Characteristics of Input Signals



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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					
		MSB					LSB	MSB					LSB	MSB					LSB
		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	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	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
	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

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8. 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	400	-	-		1
Surface Luminance, white	L_{WH}	-	950	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	-	1.14	1.45		3
Response Time						4
Rise Time	Tr_R	-	8	20	msec	
Decay Time	Tr_D	-	20	40		
CIE Color Coordinates						
White						
	x_W	-	0.306	-		
	y_W	-	0.345	-		
Viewing Angle						
x axis, right (ø=0°)						5
x axis, left(ø=180°)	θ x	60	70	-	degree	
y axis, up(ø=90°)	θ x	60	70	-		
y axis, down (ø=270°)	θ y	55	70	-		
	θ y	35	40			

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.

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9. Mechanical Characteristics

The chart below provides general mechanical characteristics for the model LVM064VD-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	161.3 ± 0.5 mm
	Vertical	117.0 ± 0.5 mm
	Depth	12.0 ± 0.5 mm
Bezel area :		
	Horizontal	135.3 ± 0.5 mm
	Vertical	103.0 ± 0.5 mm
Active Display area :		
	Horizontal	130.56 mm
	Vertical	97.92 mm
Weight (approximate) :		300g

Surface Treatment : Hard coating 3H.
Anti-glare treatment of the front polarizer.

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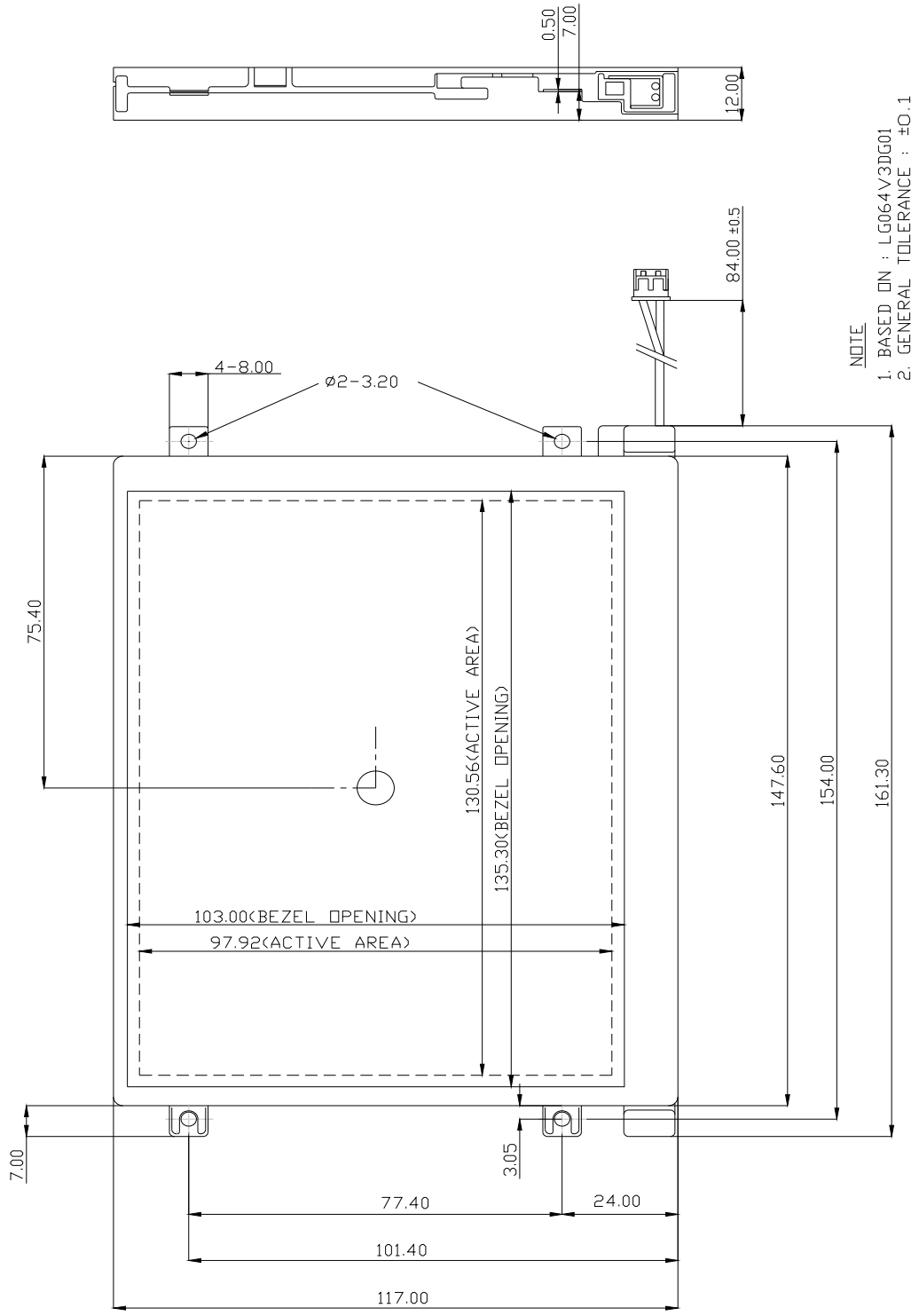
10. Mechanical Specification

<FRONT VIEW>



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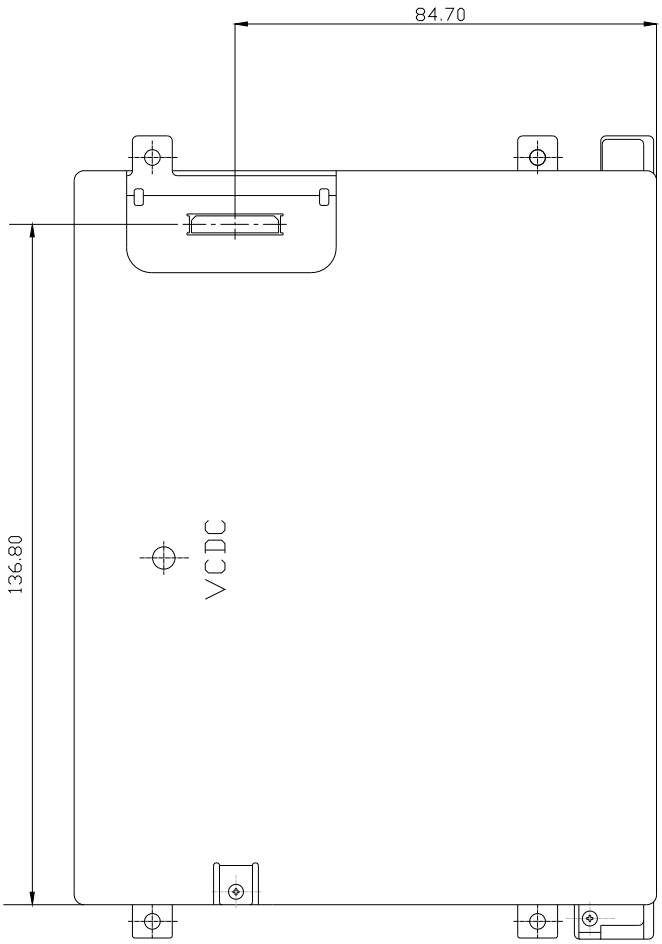
<BACK VIEW>



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11. Reliability

- Environment test condition

No.	Test ITEM	Conditions
1	High temperature storage test	Ta = 80 °C 72h
2	Low temperature storage test	Ta = -30 °C 72h
3	High temperature & high humidity operation test	Ta = 40 °C 90-95%RH 240hr (no condensation)
4	High temperature operation test	Ta = 80 °C 72h
5	Low temperature operation test	Ta = -30 °C 72h
6	Vibration test (non-operating)	- Frequency: 10 ~ 57 Hz/vibration width (one side): 0.075mm - 58 ~ 500 Hz/gravitity: 9.8m/s² - Sweep time: 11 minutes - Test period: 3 hours (1hour for each direction of X, Y,Z)
7	Shock test (non-operating)	- Max. gravity: 490 m/s² - Pulse width: 11ms, half sine wave - Direction: ± X, ± Y, ± Z once for each direction
8	Altitude (storage & shipment)	0 - 40,000 feet (12192m)

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.

12. Packing Form

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

13. 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 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.

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

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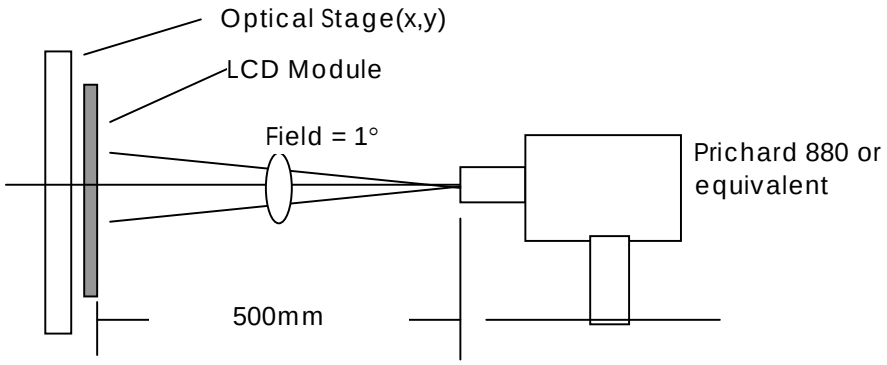
there remains a very small amount of glue still on the polarizer after the protection film is peeled off.

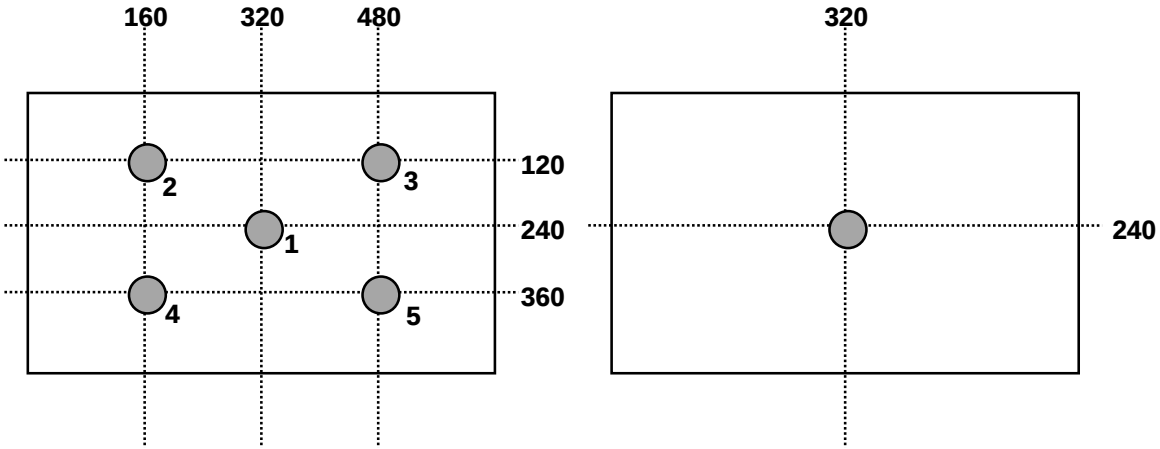
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal- hexane.

A. Optical Characteristic Measurement Equipment and Method



B. Luminance

<measuring point for luminance variation> <measuring point for surface luminance >



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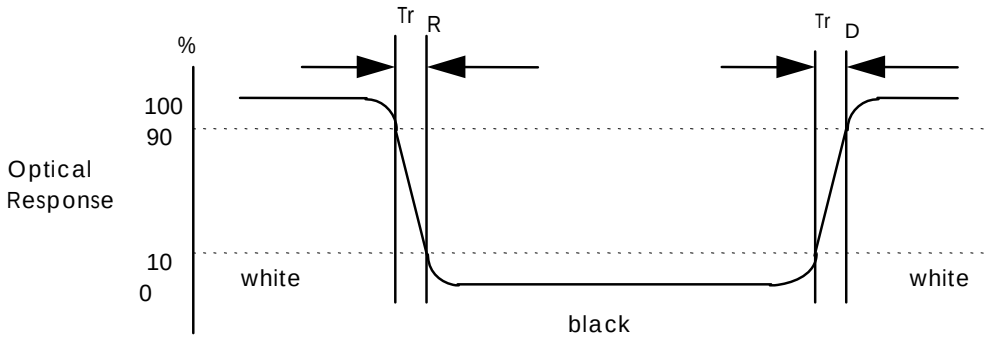
C. Response Time

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>