FINAL PRODUCT INFORMATION

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

Updated: 12/5/2007

5.61” Wide SVGA High Bright TFT-LCD

LVM056WSD-LA

(Based on TOSHIBA: LTD056ET0S)

COLOR LIQUID CRYSTAL DISPLAY

CONTENTS

Revision History

Rev	ECN No.	Description of changes	Date	Prepared
0		Initial Release	12/05/07	Eric Kim

1. General Description

LVM056WSD-LA is 5.61" 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 5.61 inch diagonally measured active display area with WSVGA resolution (1024horizontal by 600 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 LVM056WSD-LA 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 LVM056WSD-LA 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	5.61 inches(14cm) diagonal 122.88(H) X 72.00(V) mm
Outline dimensions	141.8(H) × 84.4(V) × 7.5(D) mm
Pixel pitch	0.120(H) mm × 0.120(V) mm
Pixel format	1024(H) X 600(V) pixels
Color Pixel Arrangement	RGB stripe arrangement
Color depth	6-bit, 262,144 colors
Brightness	600 cd/m^2
Power Consumption	Total 3.48 Watt, typ (0.66 Watt @Vcc, 2.82 Watt @LED)
Weight	95g (typ)
Display operating mode	transmissive mode, normally white
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	V_{cc}	-0.3	+4.0	Vdc	at 25^{o}C.
Operating Temperature	T_{OP}	0	+50	^{o}C	Note 1
Storage Temperature	T_{ST}	-20	+60	^{o}C	Note 1

Note 1. Humidity Less than 90% RH at Ta ≤ 40 ^{o}C. No condensation.

3. Electrical Characteristics

The LVM056WSD-LA 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.

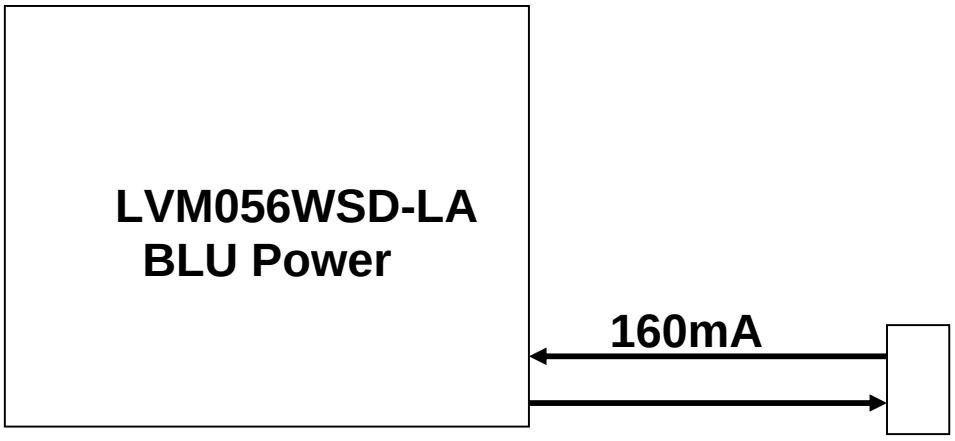
Parameter	Symbol	Values			Units	Notes
		Min.	Typ.	Max.		
MODULE:						
Power Supply Input Voltage	V_{CC}	+3.0	+3.3	+3.6	Vdc	Vcc = 3.3V
Power Supply Input Current	I_{CC}	-	0.200		A	1,2, Vcc = 3.3V
	I_{CC}		-	-	-	
Power Consumption	P_c	-	0.66	-	Watts	1,2
LED BACKLIGHT:						
Operating Voltage	V_{BL}	-	-	17.6	Vdc	4
Operating Current	I_{BL}		-	0.16	A	4
Power Consumption		-	-	2.82	Watts	3
Life Time		20,000	30,000	-	Hrs	

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 Vcc 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. LVM056WSD-LA load voltage should be about 17.6V at 160mA max current.



4. Interface Connections

CN 1(interface signal): LVM056WSD-LA uses 25-pin connector for module electronics.
Used connector: FH23-25S-0.3SHW(05) (HIROSE)

Pin	Symbol	Description
1	VDD	Power supply Voltage : 3.3V
2	VDD	Power supply Voltage : 3.3V
3	VDD	Power supply Voltage : 3.3V
4	VDD	Power supply Voltage : 3.3V
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	RXCLK+	Positive LVDS Differential clock input
10	GND	Ground
11	RXCLK-	Negative LVDS Differential clock input
12	GND	Ground
13	RXIN2+	Positive LVDS Differential clock input,[B2-B5,V,H-sync,DE]
14	GND	Ground
15	RXIN2-	Negative LVDS Differential clock input, [B2-B5,V,H-sync,DE]
16	GND	Ground
17	RXIN1+	Positive LVDS Differential clock input,[G1-G5, B0-B1]
18	GND	Ground
19	RXIN1-	Negative LVDS Differential clock input, [G1-G5, B0-B1]
20	GND	Ground
21	RXIN0+	Positive LVDS Differential clock input,[R0-R5, G0]
22	GND	Ground
23	RXIN0-	Negative LVDS Differential clock input, [R0-R5, G0]
24	GND	Ground
25	GND	Ground

CN 2(backlight): LVM065VD-LA employs Molex 51004-0200 or equivalent connectors for the LED backlight.

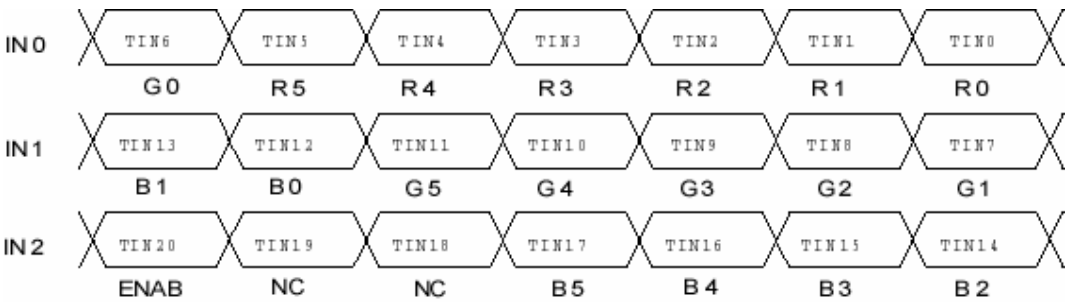
Pin	Symbol	Description	Notes
1	V	Lamp power input	PINK (or Gray)
2	Ground	Ground	WHITE

Recommended Transmitter to LVM056WSD-LA

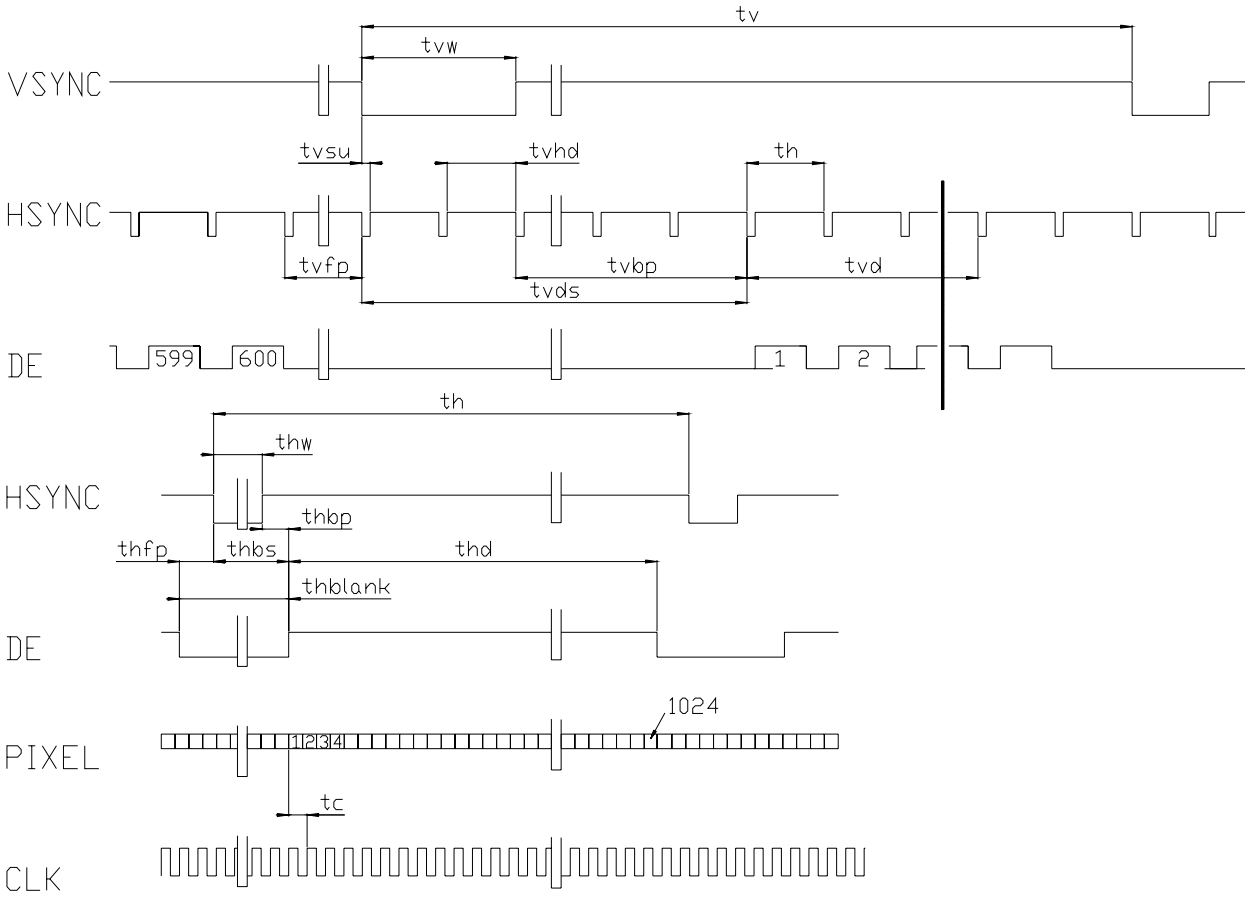
6 Bit Transmitter

Input Terminal No.		Input Signal (Graphic controller output signal)		Output Signal Symbol	LVM056WSD-LA Interface (CN1)	
Symbol	DS90CF363	Symbol	Function		Terminal	Symbol
TIN0	44	R0	Red Pixels Display Data (LSB)			
TIN1	45	R1	Red Pixels Display Data			
TIN2	47	R2	Red Pixels Display Data			
TIN3	48	R3	Red Pixels Display Data			
TIN4	1	R4	Red Pixels Display Data	TOUT0+	No. 21	IN0+
TIN5	3	R5	Red Pixels Display Data (MSB)	TOUT0-	No. 23	IN0 -
TIN6	4	G0	Green Pixels Display Data (LSB)			
TIN7	6	G1	Green Pixels Display Data			
TIN8	7	G2	Green Pixels Display Data			
TIN9	9	G3	Green Pixels Display Data			
TIN10	10	G4	Green Pixels Display Data			
TIN11	12	G5	Green Pixels Display Data (MSB)	TOUT1 +	No. 17	IN1 +
TIN12	13	B0	Blue Pixels Display Data (LSB)	TOUT1 -	No. 19	IN1 -
TIN13	15	B1	Blue Pixels Display Data			
TIN14	16	B2	Blue Pixels Display Data			
TIN15	18	B3	Blue Pixels Display Data			
TIN16	19	B4	Blue Pixels Display Data			
TIN17	20	B5	Blue Pixels Display Data (MSB)			
TIN18	22	NC	Non Connection (open)	TOUT2 +	No. 13	IN2 +
TIN19	23	NC	Non Connection (open)	TOUT2 -	No. 15	IN2 -
TIN20	25	ENAB	Compound Synchronization Signal			
CLK IN	26	NCLK	Data Sampling Clock	TCLK OUT +	No. 9	CLK IN +
				TCLK OUT -	No.11	CLK IN -

6 bit Transmitter



5.1 Timing Chart



5.2 Timing Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Horizontal Scanning Term	th	1334 x tc	1334 x tc	-	clock
H-sync Pulse Width	thw	8 x tc	136 x tc	-	clock
Horizontal Front Porch	thfp	4 x tc	24 x tc	-	clock
Horizontal Back Porch	Thbp	24 x tc	160 x tc	-	clock
Horizontal Data Sync Period	Thds	32 x tc	296 x tc	-	clock
Horizontal Display Term	Thd	1024 x tc	1024 x tc	1024 x tc	clock
Frame Period	Tv	778 x th	806 x th	860 x th	line
V-sync Pulse Width	Tvw	2 x th	6 x th	-	line
V-sync Set-up Time (to H-sync)	Tvsu	8 x tc	-	-	clock
V-sync Hold Time	Tvhd	8 x tc	-	-	clock
Vertical Front Porch	Tvfp	1 x th	3 x th	-	line
Vertical Back Porch	Tvbp	2 x th	29 x th	-	line
Vertical Data Sync Period	Tvds	8 x th	35 x th	-	line
Vertical Display Term	Tvd	600 x th	600 x th	600 x th	line
Clock Period	Tc	15.0	15.38	-	ns

Note 1) Refer to "Timing Chart" and LVDS (DS90CF364,DS90CF384) specifications by National semiconductor corporation.

Note 2) If DE is fixed to "H" or "L" level for certain period while CLK is supplied, the panel displays black with some flicker.

Note 3) IF CLK is fixed to "H" or "L" level for certain period while DE is supplied, the panel may be damaged.

Note 4) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality. There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving condition (especially driving frequency), even if condition satisfies above timing specifications and recommended operating conditions shown in 3.

Note 5) Do not make ty,th,thbp and tvds fluctuate.
if tv, th, thbp and tvds are fluctuate, the panel display black.

Note 6) In case of using the long frame period, the deterioration of display quality, noise etc. may be occurred.

Note 7) CLK count of each Horizontal Scanning Time should be always the same.
V-Blanking period should "n" X "Horizontal Scanning Time". (n: integer)
Frame period should be always the same.

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					
		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(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)Brigh t	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	100	250	-		1
Surface Luminance, white	L_{WH}	-	600	-	cd/m^2	2
Luminance Variation	δ_{WHITE}	70				3
Response Time Rise Time	Tr_R Tr_D	- -	- -	50 -	msec	4
CIE Color Coordinates White	x_W y_W	- -	0.300 0.325	- -		
Viewing Angle x axis, right (ø=0°) x axis, left(ø=180°) y axis, up(ø=90°) y axis, down (ø=270°)	 θ x θ x θ y θ y	 - - - -	 TBD TBD TBD TBD	 -	degree	5

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 LVM056WSD-LA. In addition, the figure below is a detailed mechanical drawing of the LCD. Note that dimensions are given for reference purposes only.

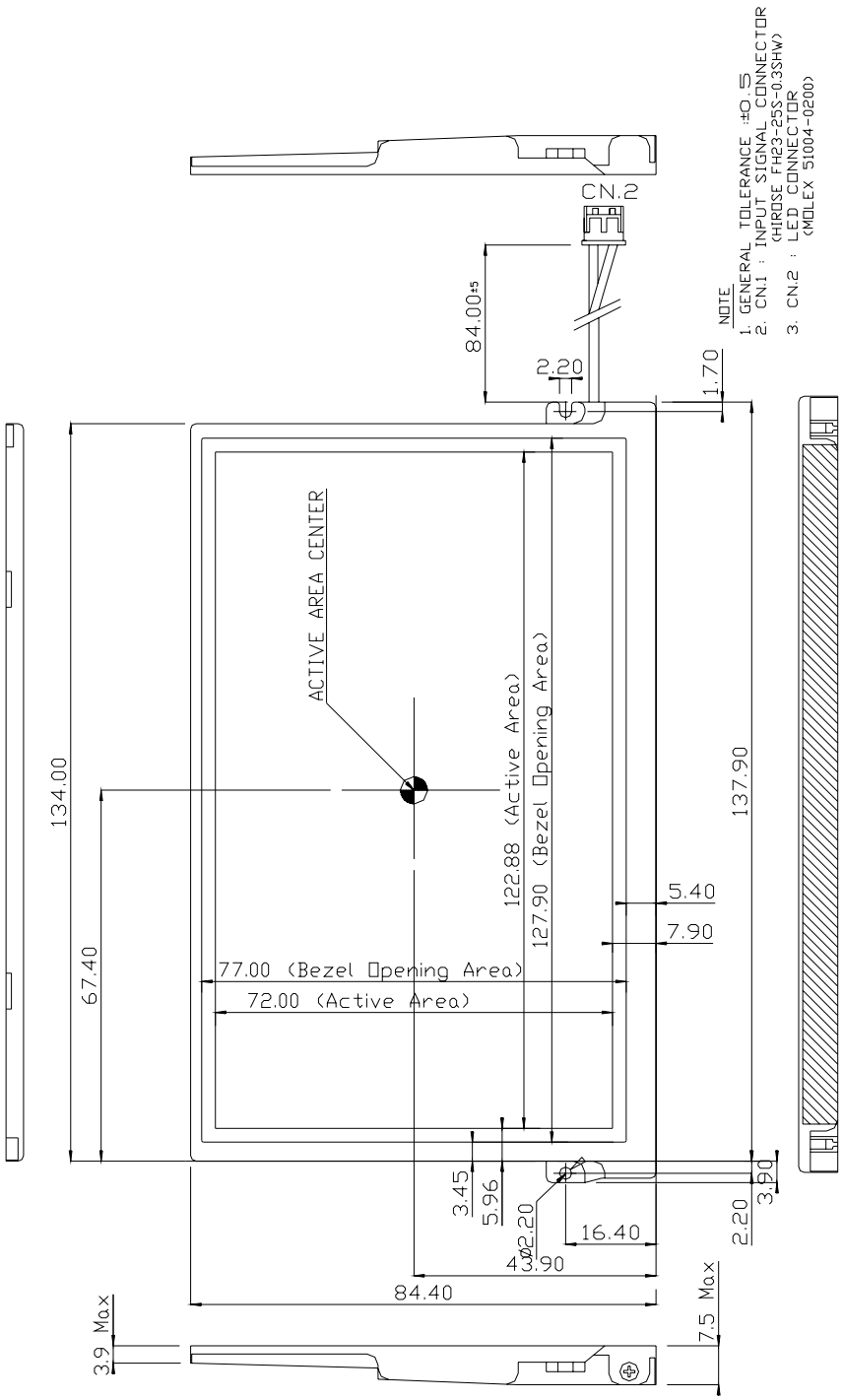
Outside dimensions :		
	Horizontal	141.8 ± 0.5 mm
	Vertical	84.4 ± 0.5 mm
	Depth	7.5 max mm
Bezel area :		
	Horizontal	127.9 ± 0.5 mm
	Vertical	77.0 ± 0.5 mm
Active Display area :		
	Horizontal	122.88 mm
	Vertical	72.00 mm

Weight (approximate) : 95g

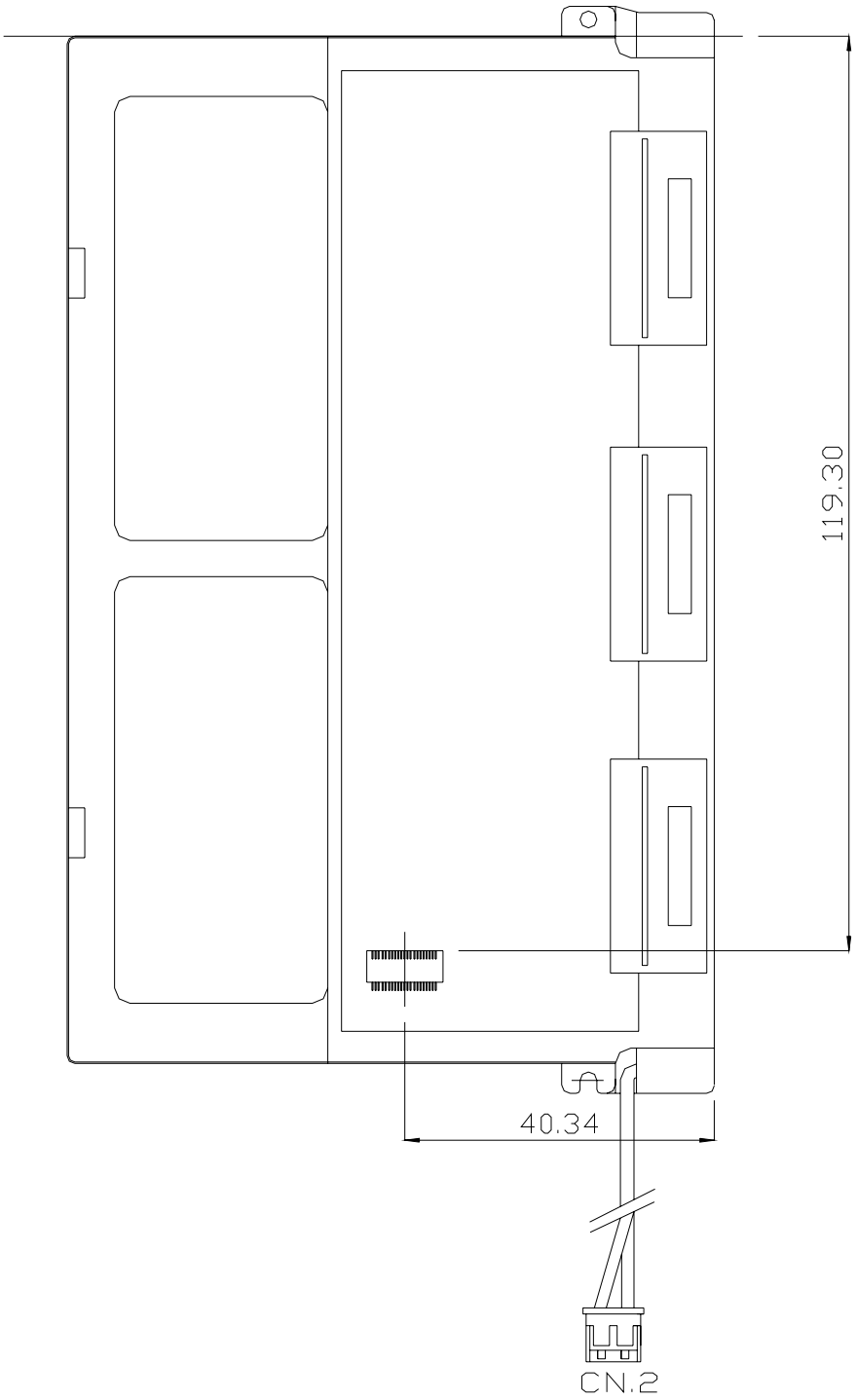
Surface Treatment : Hard coating 3H.
Anti-glare treatment

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 = -10 °C 72h
3	High temperature & high humidity operation test	Ta = 60 °C 90-95%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)	- Gravity : 120G - Pulse width: 2ms, half sine wave for X, Y, Z 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..

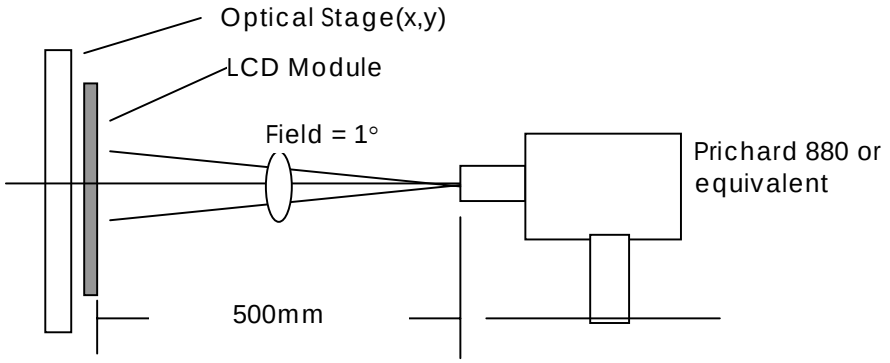
(2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing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

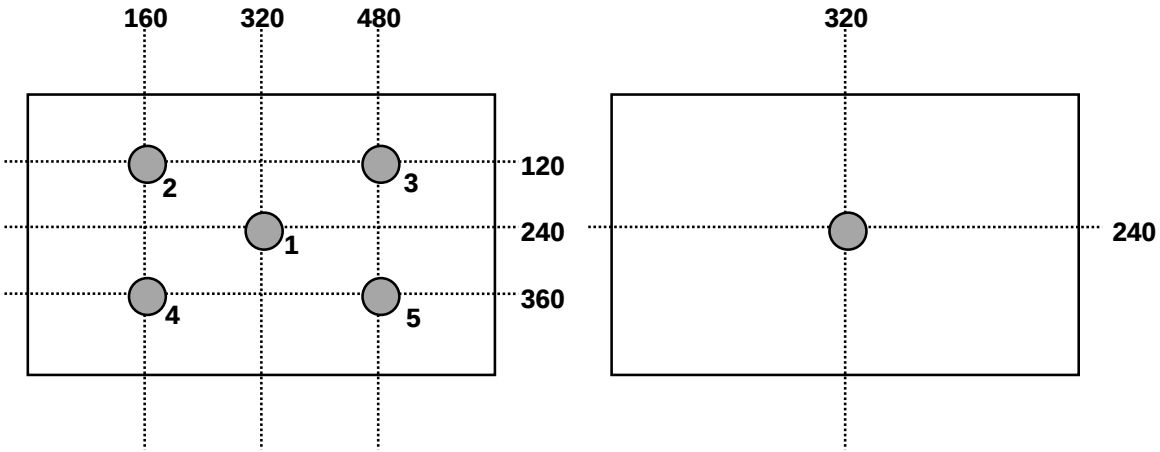
(4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal- hexane.

A. Optical Characteristic Measurement Equipment and Method



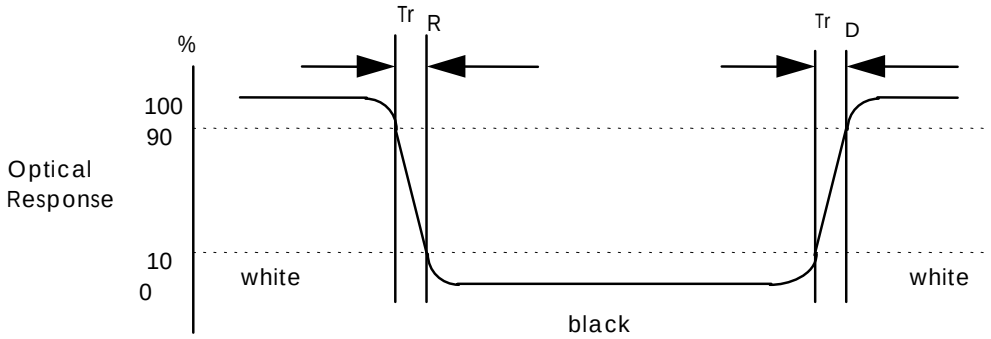
B. Luminance

<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>