



APPROVAL SHEET 承认书

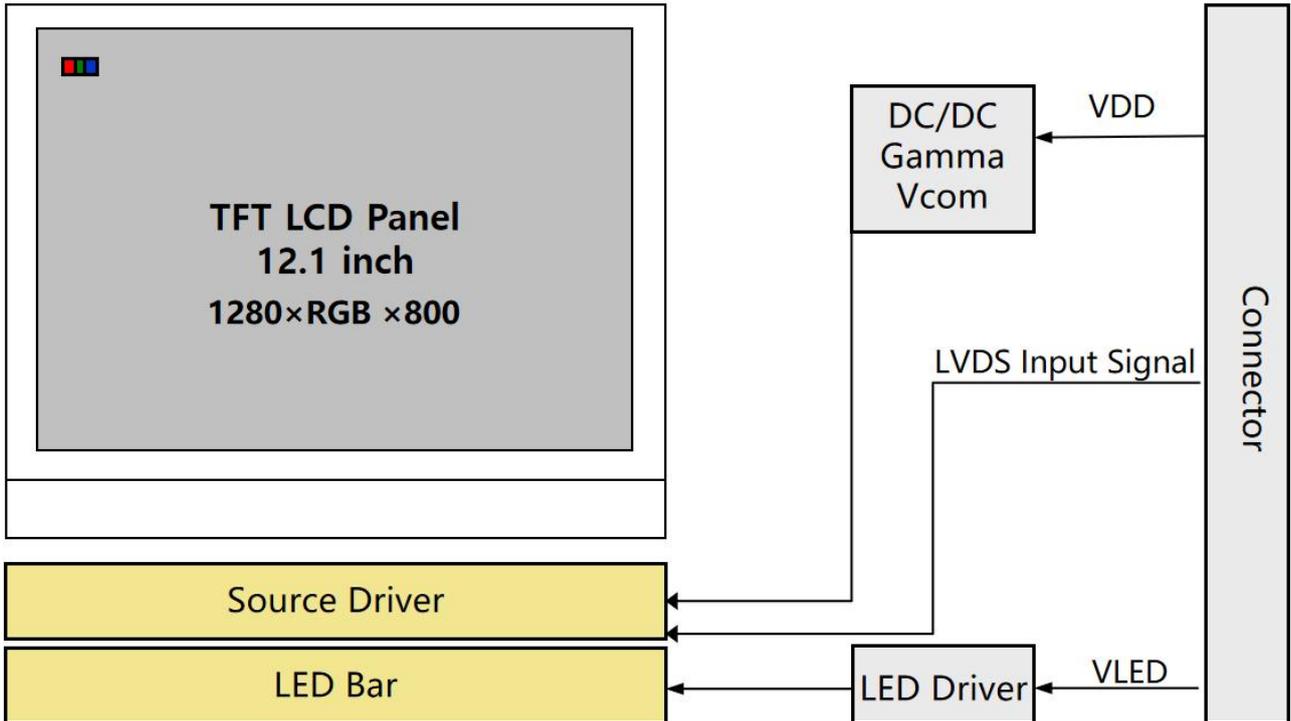
客户名称 Customer		
产品型号 Part NO.	HBM121WX10A	
产品内容 Product type	Mode:TFT LCD Module	
备注栏 Remarks	<input type="checkbox"/> APPROVAL FOR SEPCIFICATIONS ONLY <input checked="" type="checkbox"/> APPROVAL FOR SEPCIFICATIONS AND SAMPLE	
客户确认签章 Signature by Customer:		
备注/ Notes:		
PREPARED BY	CHECKED BY	APPROVED BY



1. GENERAL DESCRIPTION

1.1. Introduction

HBM121WX10A is a color active matrix TFT LCD panel using amorphous silicon TFT's (Thin Film Transistors) as an active switching devices. This panel has a 12.1 inch diagonally measured active area with XGA resolutions (1280 horizontal by 800 vertical pixel array). Each pixel is divided into RED, GREEN, BLUE dots which are arranged in vertical stripe and this module can display 16.7M(8bits) colors. The TFT-LCD panel used for this module is adapted for a low reflection and higher color type.



1.2. Features

- 8-bit color depth, display 16.7M colors
- LVDS Interface with 1pixel / clock
- DE (Data Enable) only
- Reverse Type
- Thin and light weight
- High luminance and contrast ratio, low reflection and wide viewing angle
- RoHS Compliant
- 7*24hrs usage support with dynamic video 或者 7*18hrs
- Landscape and Portrait usage support

1.3. Application

- For industrial control white Treadmill
- Portable display white refrigerator
- Washing machine and coffee-machine etc. white goods



1.4. Gechanical specifications.

<Table 1. General Specifications>

Parameter	Specification	Unit	Note
Display size	12.1" (Diagonal)	inch	
Active area	261.120 (H) × 163.2(V)	mm	
Pixel Format	1280(H) ×800(V) (1pixel = R + G + B dot)	pixel	
Pixel pitch	0.204(H) x 0.204 (V)	mm	
Pixel configuration	R, G, B vertical stripe		
Display mode	Normally black		
Surface Treatment	AG42		
Contrast Ratio	1200 typ		
Color Gamut	NTSC 72%typ		
Luminance	1800 typ	cd/m ²	

Outline dimensions

Parameter		Min	Typ	Max	Unit	Remark
Unit outline dimensions	Width	282.7	283.0	283.3	mm	
	Height	184.8	185.1	185.4	mm	
	Depth	6.85	7.15	7.45	mm	w/o PWB.[Note3-2]
Mass		-	-	-	g	

[Note 3-1]Outline dimensions is shown in page 22

[Note 3-2]Without war page and deflection.



2. ABSOLUTE MAXIMUM RATINGS

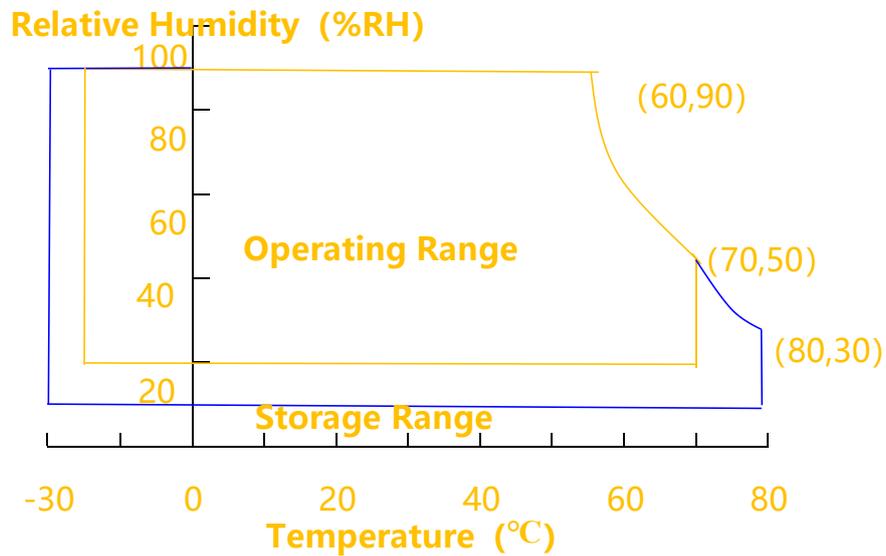
The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. Environment Absolute Maximum Ratings > [Ta =25±2 °C]

Parameter	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	VDD	3.0	3.6	V	Ta = 25 °C
Operating Temperature	TOP	-20	+70	°C	Note 1
Storage Temperature	TST	-30	+80	°C	
Operating Ambient Humidity	Hop	10	90	%RH	
Storage Humidity	Hst	10	90	%RH	

Note 1: Temperature and relative humidity range are shown in the figure below.

Wet bulb temperature should be 39 °C max. and no condensation of water.





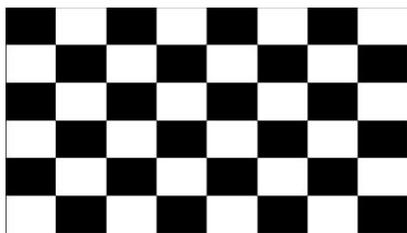
3. ELECTRICAL SPECIFICATIONS

3.1 TFT LCD Module

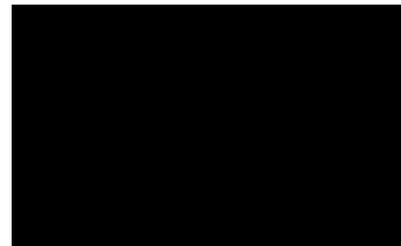
Parameter	Symbol				Unit	Notes	
		Min.	Typ.	Max.			
Power Supply Voltage	VDD	3.0	3.3	3.6	V		
Power Supply Ripple Voltage	VRP	-	-	100	mV	Note 1	
Power Supply Current	IDD	100	130	160	mA		
Rush current	IRUSH	-	-	1	A	Note 2	
LVDS Interface	Main link swing voltage	VID	200	-	600	mV	
	Common mode voltage	Vcm	1	1.2	1.4	V	
Power Consumption	PD	0.33	0.429	0.528	W	Note 1	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for VBAT=3.3V, Frame rate fV=60Hz
and Clock frequency = 72.4MHz. Test Pattern of power supply current

a) Typ : Mosaic 8 x 6 Pattern(L0/L255)



b) Max : Black



2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)



3.2 Back-light Unit

< Table 3. LED Driving guideline specifications > [Ta =25±2 °C]

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	VBL	5	12.0	24	V	
Power supply Current for Back light	ILED	6	-	25	mA	
Power supply for Back light	PLED	-	15.2	-	W	
Modulated light signal voltage	VPWM H	2.6	3.3	5.0	V	
	VPWM L	0	-	0.7	V	
Brightness Control Duty Ratio	Duty	1	-	100	%	
Brightness Control frequency	fPWM	600	-	1,000	Hz	
LED-BL ON/OFF High voltage	VCNTH	2.6	3.3	5.0	V	
LED-BL ON/OFF low voltage	VCNTL	0	-	0.7	V	
LED lifetime	-	20,000	30,000	-	h	LED

Notes : 1. Calculator Value for reference $I_{LED} \times V_{LED} = P_{LED}$

2. The LED Life-time define as the estimated time to 50% degradation of initial luminous under the condition of the ambient temperature of 25°C.



4. INTERFACE CONNECTION

4.1 Electrical Interface Connection

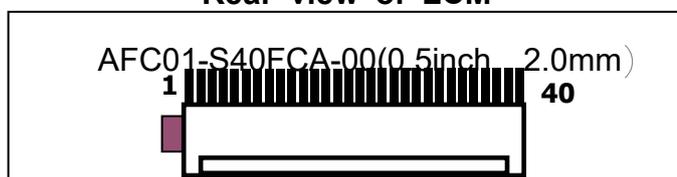
The connector interface pin assignments are listed in Table 4

<Table 4 Pin Assignments for the Interface Connector>

Terminal	Symbol	Functions
1	NC	No Connection.
2-4	VDD	Power Supply For LCD,VDD=3.3V.
5	NC	No Connection.
6-7	GND	Ground.
8	RIN0-	LVDSData differential signal input pins.
9	RIN0+	LVDS Data differential signal input pins.
10	GND	Ground.
11	RIN1-	LVDS Data differential signal input pins.
12	RIN1+	LVDS Data differential signal input pins.
13	GND	Ground.
14	RIN2-	LVDS Data differential signal input pins.
15	RIN2+	LVDS Data differential signal input pins.
16	GND	Ground.
17	LVDS_CLK-	LVDS CLOCK differential signal input pins.
18	LVDS_CLK+	LVDS CLOCK differential signal input pins.
19	GND	Ground.
20	RIN3-	LVDSData differential signal input pins.
21	RIN3+	LVDS Data differential signal input pins.
22	GND	Ground.
23-24	NC	No Connection.
25	GND	Ground.
26	SDA	Serial data input/output for I2C Interface.
27	SCL	Clock Input for I2C interface.
28	GND	Ground.
29-30	NC	No Connection.
31-33	GND	Ground.
34	NC	No Connection.
35	PWM	PWM dimming control input.
36	LED_EN	Chip enable (active high).
37	NC	No Connection.
38-40	VLED	LED Power supply input,VLED=5V-24V,12V TYP.

*1 P: POWER I: Input O: Output

Rear view of LCM



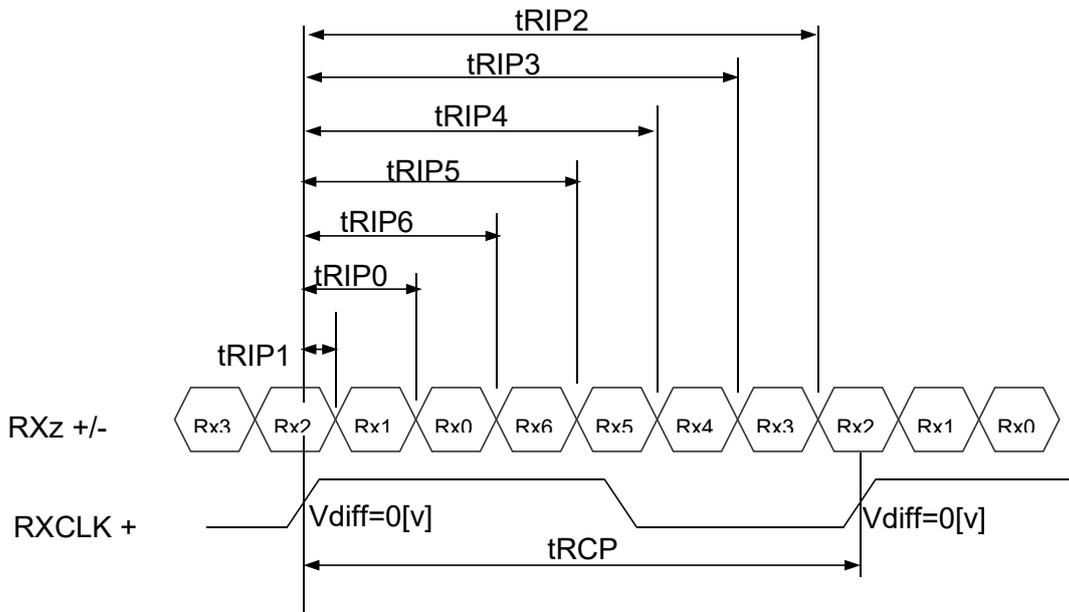


4.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 5.

<Table 5. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCP	10	T	40	nsec	
Receiver Data Input Margin	tRMG	-0.45	-	+0.45	nsec	fCLKIN=80.9MHz
		-0.60	-	+0.60	nsec	fCLKIN=75MHz
Input Data 0	tRIP1	- tRMG	0.0	tRMG	Clock	
Input Data 1	tRIP0	T/7- tRMG	T/7	T/7+ tRMG	Clock	
Input Data 2	tRIP6	2 T/7- tRMG	2T/7	2T/7+ tRMG	Clock	
Input Data 3	tRIP5	3T/7- tRMG	3T/7	3T/7+ tRMG	Clock	
Input Data 4	tRIP4	4T/7- tRMG	4T/7	4T/7+ tRMG	Clock	
Input Data 5	tRIP3	5T/7- tRMG	5T/7	5T/7+ tRMG	Clock	
Input Data 6	tRIP2	6T/7- tRMG	6T/7	6T/7+ tRMG	Clock	



* Vdiff = (RXz+)-(RXz-),..... ,(RXCLK+)-(RXCLK-)



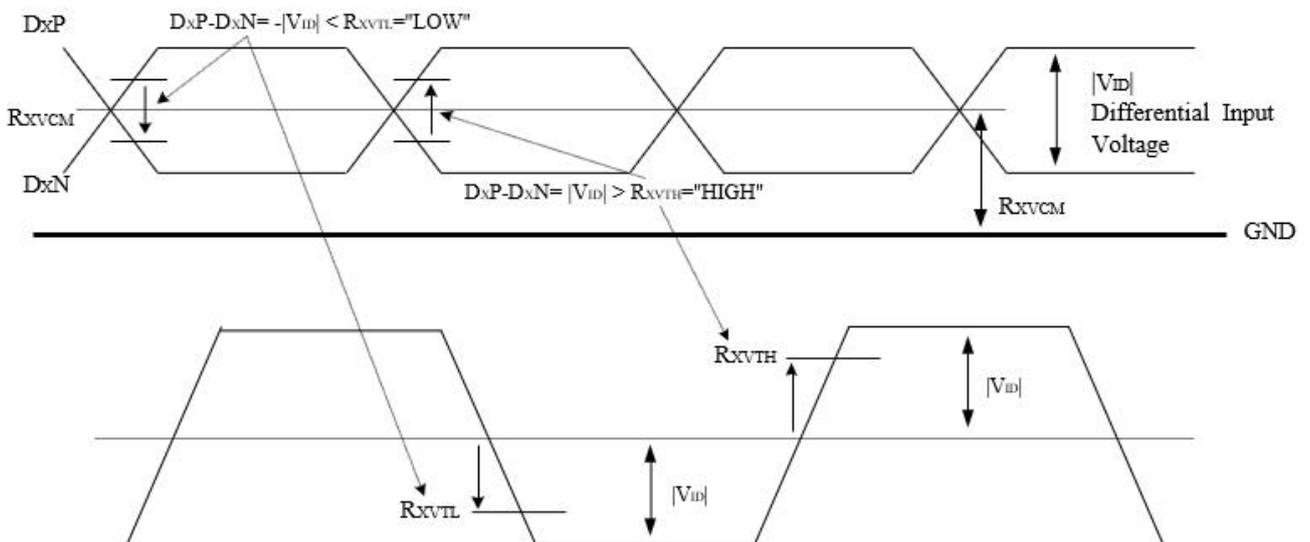
4.3 DC Specification

- LVDS Receiver Differential Input (DC Characteristics)

< Table 6. LVDS Rx DC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Differential Input High Threshold Voltage	V_{TH}	-	-	+100	mV	VCM=1.2V
Differential Input Low Threshold Voltage	V_{TL}	-100	-	-	mV	
Differential Input Common Mode Voltage	VCM	1	1.2	1.4	V	
Differential Input Voltage	$ VID $	200	-	600	mV	

Single-end Signals



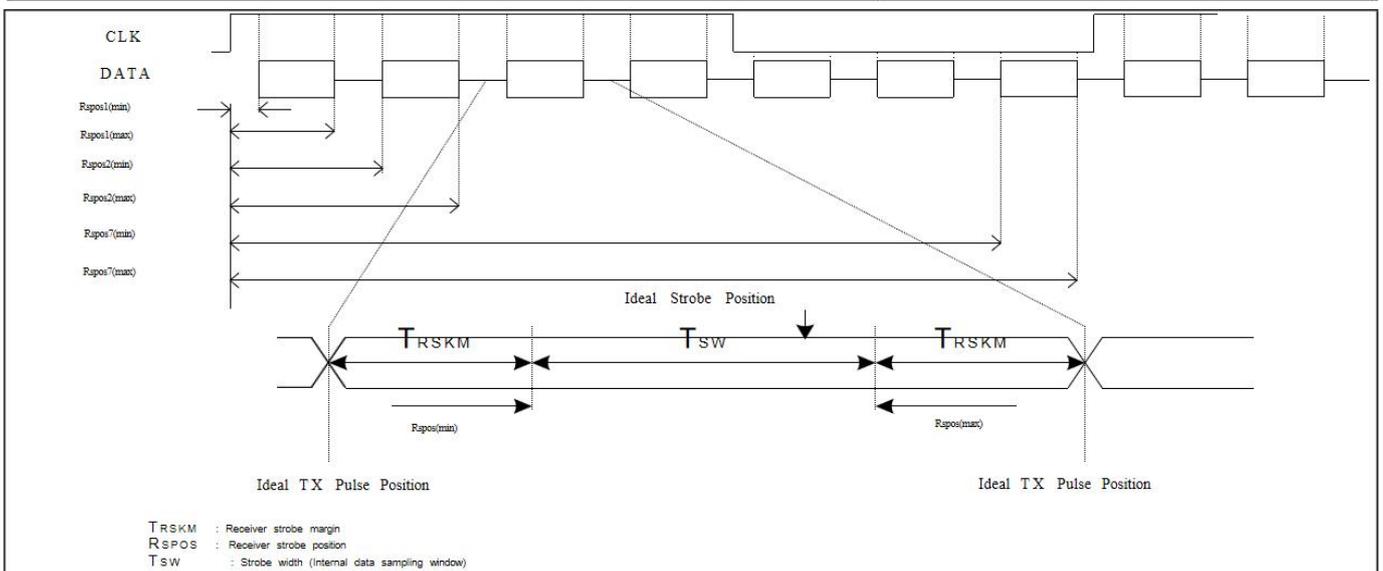
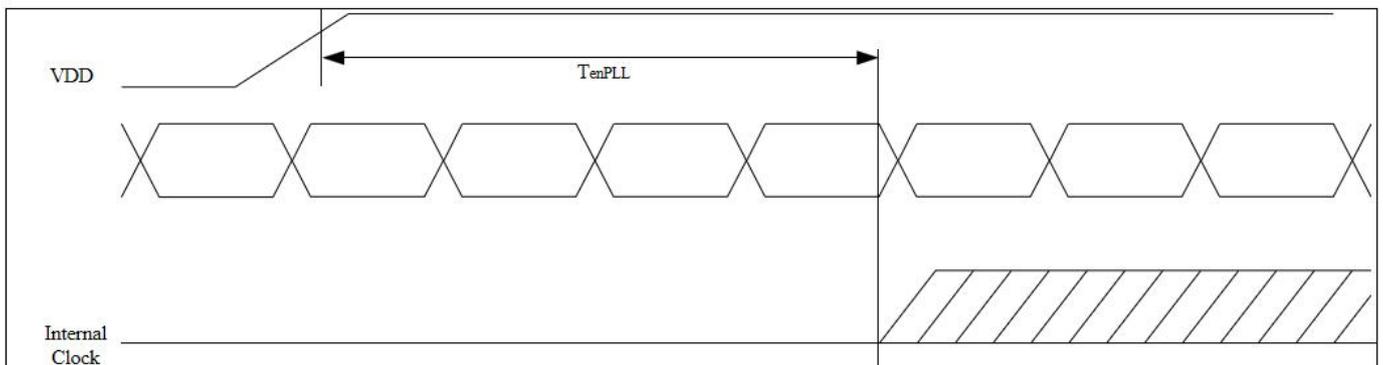
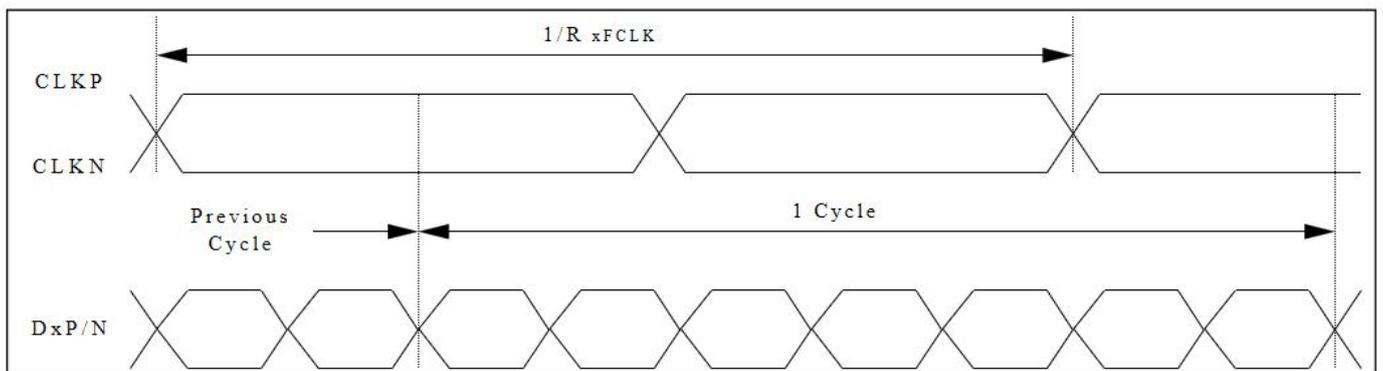


4.4 AC Specification

- LVDS Receiver Differential Input (AC Characteristics)

< Table 7. LVDS Rx AC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Strobe Width	t_{SW}	200	-	-	ps	V _{cm} =1.2V VID = 200mV @81MHz
LVDS Receiver Skew Margin	t_{RSKM}	500	-	-	ps	





5. Interface timing Parameter

5.1 Timing Parameters (DE only mode)

For 1280RGBx800

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz (LVDS)	F _{DCLK}	66.3	72.4	78.9	MHz
HSYNC period time	T _H	1380	1440	1500	DCLK
Horizontal display area	T _{HD}	1280			DCLK
HSYNC pulse width	T _{HPW}	Min.	2		
		Typ.	-		
		Max.	40		
HSYNC back porch(with pulse width)	T _{HBP}	88	88	88	DCLK
HSYNC front porch	T _{HFP}	12	72	132	DCLK
VSYNC period time	T _V	824	838	872	H
Vertical display area	T _{VD}	800			H
VSYNC pulse width	T _{VPW}	Min.	2		H
		Typ.	-		
		Max.	20		
VSYNC back porch(with pulse width)	T _{VBP}	23	23	23	H
VSYNC front porch	T _{VFP}	1	15	49	H

For 1280RGBx800 DE mode

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz (LVDS)	F _{DCLK}	69.7	75	80.9	MHz
Horizontal display area	T _{HD}	1280			DCLK
HSYNC period time	T _H	1380	1440	1500	DCLK
HSYNC blanking	T _{HBP+T_{HFP}}	100	160	220	DCLK
Vertical display area	T _{VD}	800			H
VSYNC period time	T _V	842	838	872	H
VSYNC blanking	T _{VBP+T_{VFP}}	24	38	72	H

Note

1. DE Only Mode, While operation, DE signal should be have the same cycle. The input of HSYNC & VSYNC signal does not have an effect on normal operation.

2. Best operation clock frequency is 75Mhz.

3. Frequency] = [H Total] * [V Total] * [vertical Frame rate]

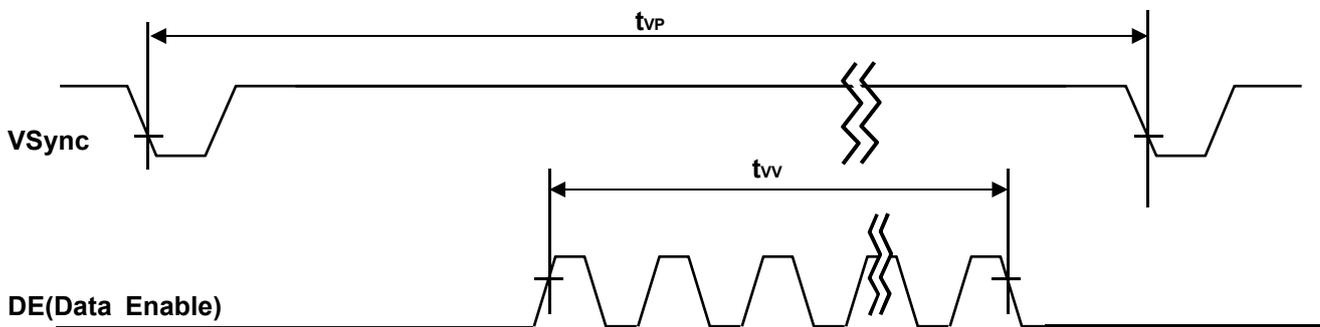
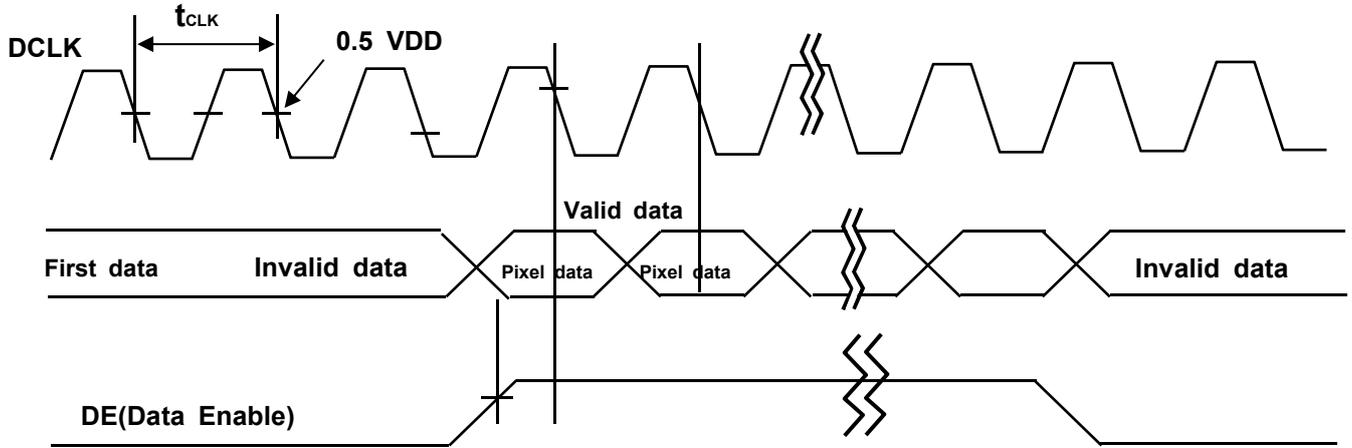
H Total, V Total and Frame rate]should operate within the range between Frequency_Min and Frequency_Max

4. Except Best operation clock frequency, FOS(Flicker & Brightness & Crosstalk, Etc.) are not guaranteed.

5. Main frequency Max is 80.9Mhz MHz without spread spectrum



5.2 Signal Timing Waveform





5.3 Input Signals, Basic Display Colors and Gray Scale of Colors

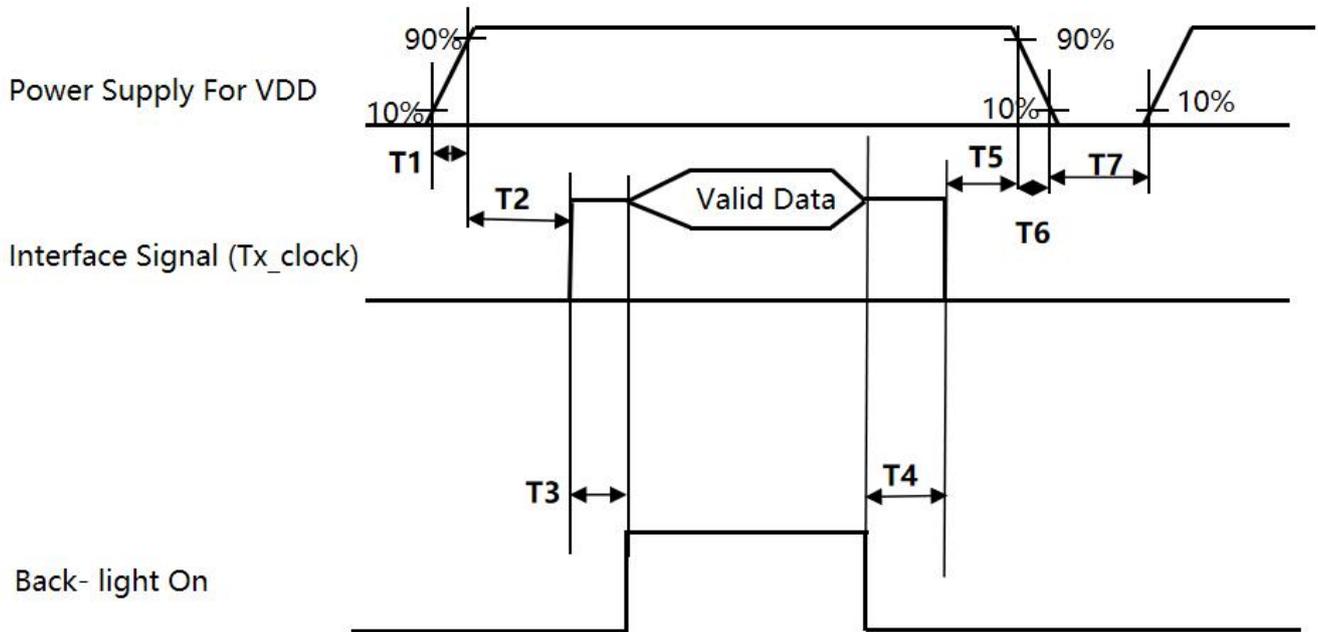
< Table 8. Input Signal and Display Color Table >

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	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	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	
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	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	
Gray Scale of Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	△																								
	▽																								
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	▽	1	1	1	1	1	1	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		
Gray Scale of Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0		
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		
	△																								
	▽																								
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0		
	▽	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0		
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
Gray Scale of Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		
	△																								
	▽																								
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
	▽	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0		
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1		
Gray Scale of White	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1		
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1		
	△																								
	▽																								
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0		
	▽	1	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0		
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		



6. POWER SEQUENCE

To prevent a latch-up or DC operation of the Open Cell, the power on/off sequence shall be as shown in below



Parameter	Values			Units
	Min	Typ	Max	
T1	0.1	-	10	ms
T2	0.1	-	50	ms
T3	300	-	-	ms
T4	200	-	-	ms
T5	0.1	-	50	s
T6	0.1	-	10	ms
T7	500	-	-	ms

Note 1: Even though T1 is over the specified value, there is no problem if the rush current is within Spec.

Note 2: When the power supply VDD is 0V, keep the level of input signals on the low or high impedance;

※ Please avoid floating state of interface signal at invalid period.

※ When the power supply for LCD (VDD) is off, be sure to pull down the valid and invalid data to 0V.

Note 3: The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.

Note 4: T6: Voltage of VDD must decay smoothly after power-off, there should be none re-bounding voltage. (customer system decide this value)

Note 5: T7 should be measured after the Module has been fully discharged between power off and on period



7. Optical characteristics

7.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (Goniometer system and TOPCON CS2000/CA310) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0. We refer to $\theta = 0$ ($= \theta_3$) as the 3 o'clock direction (the "right"), $\theta = 90$ ($= \theta_{12}$) as the 12 o'clock direction ("upward"), $\theta = 180$ ($= \theta_9$) as the 9 o'clock direction ("left") and $\theta = 270$ ($= \theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by CS2000/CA310. The backlight should be operating for 10 minutes prior to measurement. VDD shall be $3.3 \pm 0.3\text{V}$ at 25°C . Optimum viewing angle direction is 6 o'clock

Parameter	Conditions	Min.	Typ.	Max.	Unit	Note	
Viewing Angle (CR>10)	Horizontal	θ_L	-	85	-	degree	Note1
		θ_R	-	85	-		
	Vertical	θ_T	-	85	-		
		θ_B	-	85	-		
Contrast Ratio	Center	1000	1200	-	-	Note2	
Response Time	Tr+Td	-	30	35	ms	Note 6	
CF Color Chromaticity (CIE1931)	Red x	Typ. -0.03	0.636	Typ. +0.03	-	Note 5	
	Red y		0.345		-		
	Green x		0.314		-		
	Green y		0.614		-		
	Blue x		0.134		-		
	Blue y		0.059		-		
	White x		0.319		-		
	White y		0.342		-		
NTSC ratio	%		(72)		-		
Center Luminance of white	YLI	1500	1800		cd/m ²		

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of $\theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$\text{CR} = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display. The luminance is measured by



CS2000/CA310 when the LED current is set at 60mA.

4. The color chromaticity coordinates specified in Table 5. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5. The electro-optical response time measurements shall be made as FIGURE 3 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_d .

8. RELIABILITY TEST

The Reliability test items and its conditions are shown in below.

No	Test Items	Conditions	Remark
1	High temperature storage test	$T_a = 80^\circ\text{C}$, 72 hrs	
2	Low temperature storage test	$T_a = -30^\circ\text{C}$, 72 hrs	
3	High temperature & high humidity operation test	$T_a = 50^\circ\text{C}$, 80%RH, 72 hrs	
4	High temperature operation test	$T_a = 70^\circ\text{C}$, 72 hrs	
5	Low temperature operation test	$T_a = -20^\circ\text{C}$, 72 hrs	
6	Thermal shock	$T_a = -20^\circ\text{C} \leftrightarrow 60^\circ\text{C}$ (0.5 hr), 60%±3%RH, 100 cycle	
7	Vibration test (non-operating)	$T_a = 25^\circ\text{C}$, 60%RH, 1.5G, 10~500Hz, Sine X,Y,Z / Sweep rate : 1 hour	Note 1
8	Shock test (non-operating)	$T_a = 25^\circ\text{C}$, 60%RH, 220G, Half Sine Wave 2msec±X,±Y,±Z Once for each direction	Note 1
9	Electro-static discharge test (operating)	Air : 150 pF, 330Ω, ±15 KV Contact : 150 pF, 330Ω, ±8 KV $T_a = 25^\circ\text{C}$, 60%RH,	Note 2

Notes :

1. The fixture must be hard enough , so that the module would not be twisted or bent.
2. Self- recovery and restart recovery is allowed. No hardware failures.

9. Precautions

Please pay attention to the followings when you use this LCM Panel.

9.1 Mounting Precautions

- (1) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (2) You must mount a module using specified mounting holes (Details refer to the drawings).
- (3) Please make sure to avoid external forces applied to the Source PCB or FPC and D-IC during the process of handling or assembling. If not, It causes panel damage or malfunction.
- (4) Note that polarizers are very fragile and could be easily damaged. 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.
- (5) Do not pull or fold the source D-IC which connect the source PCB or FPC and the panel. Do not pull or fold the LED wire.



- (6) After removing the protective film, when the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with alcohol or purified water. Do not strong polar solvent because they cause chemical damage to the polarizer.
- (7) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (8) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (9) Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass may be broken.
- (10) Do not disassemble the module.
- (11) To determine the optimum mounting angle, refer to the viewing angle range in the specification for each model.
- (12) If the customer's set presses the main parts of the LCM, the LCM may show the abnormal display. But this phenomenon does not mean the malfunction of the LCM and should be pressed by the way of mutual agreement.
- (13) Do not drop water or any chemicals onto the LCM's surface.

9.2 Operating Precautions

- (1) 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.
- (2) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimized the interference.
- (3) The electrochemical reaction caused by DC voltage will lead to LCM degradation, so DC drive should be avoided.
- (4) The LCM modules use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.
- (5) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.
- (6) Design the length of cable to connect between the connector for back-light and the converter as short as possible and the shorter cable shall be connected directly.
The longer cable between that of back-light and that of converter may cause the luminance of LED to lower and need a higher startup voltage(Vs).
- (7) Connectors are precise devices for connecting PCB and transmitting electrical signals. Operators should insert and unplug MDL in parallel when assembling MDL.
- (8) Do not connect or disconnect the cable to/ from the module at the "Power On" condition.
- (9) When the module is operating, do not lose CLK, ENAB signals. If any one these signals is lost, the LCM panel would be damaged.
- (10) Obey the supply voltage sequence. If wrong sequence is applied, the module would be damaged.
- (11) Do not re-adjust variable resistor or switch etc.
- (12) Long Side LED Bar design is recommended when using E-LED type Back Light.



9.3 Electrostatic Discharge Control

(1) 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 wrist band etc. And don't touch interface pin directly. Keep products as far away from static electricity as possible.

(2) Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

9.4 Precautions for Strong Light Exposure

It is not allowed to store or run directly in strong light or in high temperature and humidity for a long time; Strong light exposure causes degradation of polarizer and color filter.

9.5 Storage Precautions

When storing modules as spares for a long time, the following precautions are necessary.

(1) 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.

Temperature : 5 ~ 40 °C

(2) Humidity : 35 ~ 75 %RH

(3) Period : 6 months

(4) Control of ventilation and temperature is necessary.

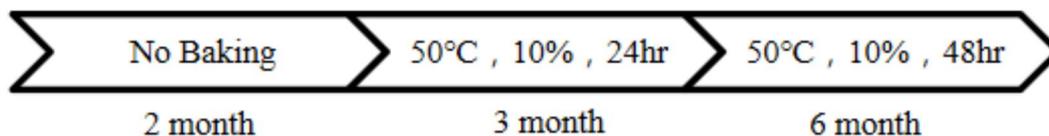
(5) Please make sure to protect the product from strong light exposure, water or moisture.

Be careful for condensation.

(6) Store in a polyethylene bag with sealed so as not to enter fresh air outside in it.

(7) Do not store the LCM near organic solvents or corrosive gasses.

(8) Please keep the Modules/OC/FOG at a circumstance shown below Fig.



9.6 Precautions for Protection Film

(1) Remove the protective film slowly, keeping the removing direction approximate

30-degree not vertical from panel surface, If possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

(2) In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary.

9.7 Appropriate Condition for Display

(1) Normal operating condition

- Temperature: 0 ~ 40°C

- Operating Ambient Humidity : 10 ~ 90 %

- Display pattern: dynamic pattern (Real display)

- Suitable operating time: under XX hours a day. (Please contract BOE in advance for 7*24hrs

or more than suggested Operating time)

-Long-term lighting products recommended regular shutdown

(2) Special operating condition

If the product will be used in extreme conditions such as high temperature, humidity, display patterns or 7*24hrs



operation time etc., It is strongly recommended to contact BOE for Application engineering advice. Otherwise, its reliability and function may not be guaranteed.

(3) Black image or moving image is strongly recommended as a screen save.

(4) Lifetime in this spec. is guaranteed only when commercial display is used according to operating usages.

(5) Please contact HSD in advance when you want to switch between portrait and landscape screen

(6) Please contact HSD in advance for outdoor operation.

(7) Please contact HSD in advance when you display the same pattern for a long time.

(8) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen. To avoid image sticking, it is recommended to use a screen saver.

(9) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the Module may be damaged.

(10) Dew drop atmosphere should be avoided.

(11) The storage room should be equipped with a good ventilation facility and avoid to expose to corrosive gas , which has a temperature controlling system.

(12) When expose to drastic fluctuation of temperature (hot to cold or cold to hot) ,the LCM may be affected; Specifically, drastic temperature fluctuation from cold to hot ,produces dew on the LCD's surface which may affect the operation of the polarizer and the LCM.

(13) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCM may turn black at temperature above its operational range. However those phenomena do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

9.8 Cleaning at the end user customer environment

IPA (Isopropyl Alcohol) wipes, Lysol wipes, Clorox wipes, and other general Hospital disinfectants (on a cloth, not sprayed directly on equipment) which may include ingredients such as IPA, Ammonium Chloride, or Accelerated Hydrogen Peroxide can be used on the LCM glass surface.

9.9 Others

A. LC Leak

If the liquid crystal material leaks from the panel, it is recommended to wash the LC with acetone or ethanol and then burn it.

In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

If LC in mouth, mouth need to be washed, drink plenty of water to induce vomiting and follow medical advice.

If LC touch eyes, eyes need to be washed with running water at least 15 minutes.

B. Rework

When returning the module for repair or etc., Please pack the module not to be broken. We recommend to use the original shipping packages.



10. Label (TBD)

- 1) Module Bar code label: TBD
- 2) Packing bar code label:TBD

11. PACKING INFORMATION

TBD

12. Mechanical Drawing

