SPECIFICATION
FOR
LCD MODULE

Customer : _____

Product Model: BI097XG-1

Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

☐ LCM Machinery OK **Checked By** _____ ☐ LCM Display OK **Checked By** _____	☐ LCM OK ☐ NG，Problem survey: **Approved By** _____

※**The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.**

Revision History

Version	Contents	Date	Note
	Original	2017.02.12	

Contents

2. Scope

This specification applies to the TFT LCD module which is designed and manufactured by LCM Factory.

3. Normative Reference

GB/T4619-1996 《 Liquid Crystal Display Test Method》

GB/T2424 《Basic environmental Testing Procedures for Electric and Electronic Products.》

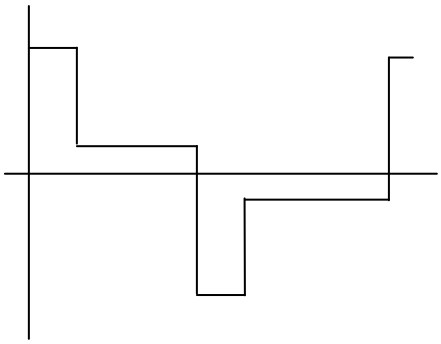
GB/T2423 《Basic Testing Procedures for Electric and Electronic Products》

IEC61747-1 《SIXTH PARTGB2828`2829-87《National Standard of PRC》

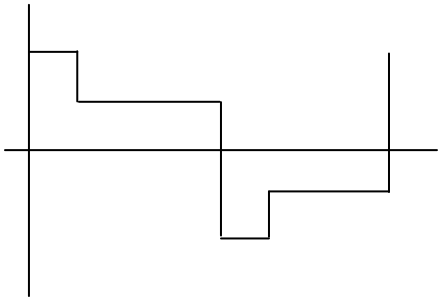
4. Definitions

4.1 Definitions of Vop

The definitions of threshold voltage Vth,1 Vth2 the following typical waveforms are applied on liquidc rystal by the methodo f equalized voltage for each duty andb ias.



【 selected waveform 】



【 non-selected waveform 】

① Vth1: The voltage which the brightness of segment indicates 50% of saturated value on the conditions of selected waveform

(f_f=80Hz, Φ=10° θ=270° at 25℃)

② Vth2: The voltage which the brightness of segment indicates 50% of saturated value on the conditionso f non-selected waveform

(f_f=80Hz, Φ=10° θ=270° at 25℃)

③ Vop: (Vth1(50%)+Vth2(50%))/2 (f_f=80Hz, Φ=10° θ=270° at 25℃)

4.2 Definition of Response Time Tr, Td

①Tr: The time required which the brightness of segment becomes 10% from 100% when waveform is switched to selected one from non-selected one. (f_f=80Hz, Φ=10°θ=270°at 25℃)

②Td: The time required which the brightness of segment becomes 90% from 10% when waveform is switched to selected one from selected one. (f_f=80Hz, Φ=10°θ=270°at 25℃)

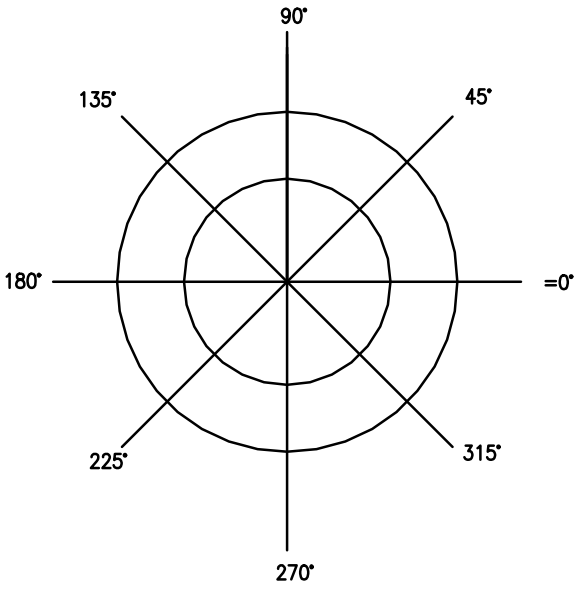
4.3 Definition of Contrast Ratio Cr

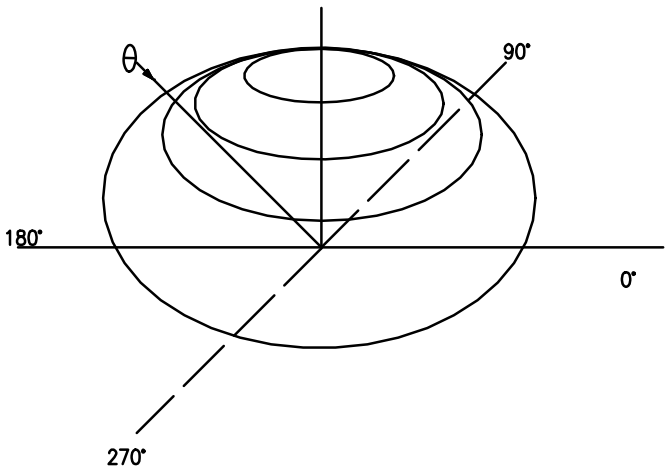
Cr=A/B

① A: Segments brightness in case of non-selected waveform

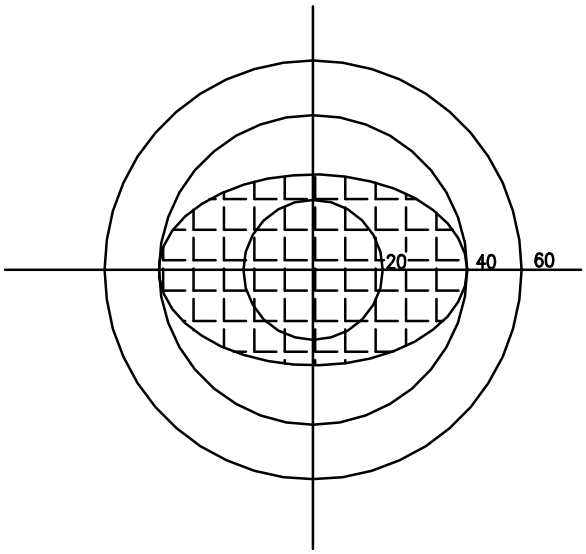
② B: Segments brightness in case of selected waveform

4.4 Definition of Angle and Viewing Range





Angular Graph: Constrast Ratio



Such as:
Viewing Angle Range:
80(Cr>2) Horizontal
70(Cr>2) Vertical

5. Technology Specifications

5.1 Features

This single-display module is suitable for use in Net Book products.

The LCD adopts one backlight with High brightness 36-lamps white LED.

1) Construction: 9.7″ a-Si color TFT-LCD ,White LED backlight.
2) LCD:
   2.1 TFT 9.7”-inch display, transmissive, normally white type.
   2.2 1024(RGB)×768 dots Matrix.
   2.3 Narrow-contact edge technique.
3) Low cross talk by frame rate modulation.
4) LVDS interface.

5.2 General Specifications

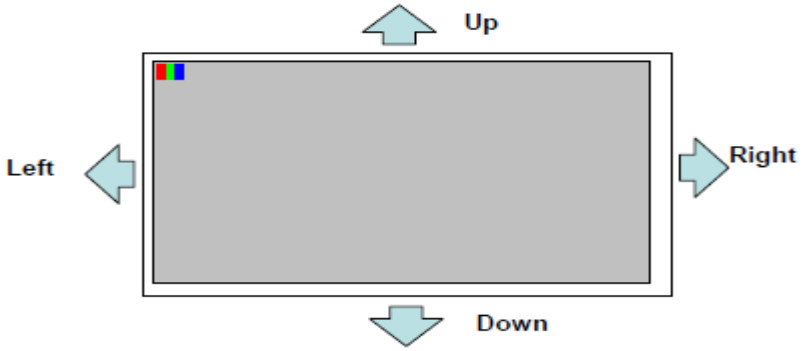
No.	Item	Specification
1	LCD size	9.7 inch
2	Panel Type	a-Si TFT active matrix
3	Resolution	1024 (RGB)X768
4	Display mode	Normally Black
5	Display Number of Colors	16.7M
6	Pixel pitch	0.192(W) X 0.192 (H) mm
7	Module size	210.2(H) X 164.2(W) X 5.0
8	Active area	196.608(H) X 147.456 (V) mm
9	Pixel arrangement	RGB-stripe
10	Interface	LVDS
11	Luminance	450 cd/m2(type)
12	Viewing Direction	All
13	Weight	TBD

5.3 Interface Pin Connection

PIN NO.	Symbol	Description
1	VCOM	Common voltage
2	DVDD	Digital powe
3	DVDD	Digital Power
4	NC	Not connect
5	RESET	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability.
6	UPDN	Vertical inversion
7	SHLR	Horizontal inversion
8	STBYB	Standby mode, normally pull high STBYB=”1”, normal operation STBYB=”0”,timing control, source driver will turn off, all output are high-Z Data Enable signal
9	G N D	Ground
10	NINC	Negative LVDS differential clock input
11	PINC	Positive LVDS differential clock input
12	G N D	Ground
13	NIND0	Negative LVDS differential data input
14	PIND0	Positive LVDS differential data input
15	G N D	Ground
16	NIND1	Negative LVDS differential data input
17	PIND1	Positive LVDS differential data input
18	G N D	Ground
19	NIND2	Negative LVDS differential data input
20	PIND2	Positive LVDS differential data input
21	G N D	Ground
22	NC(NIND3)	NC(Negative LVDS differential data input)
23	NC(PIND3)	NC(Positive LVDS differential data input)
24	G N D	Ground
25	SELB	NC
26	G N D	Ground
27	AVDD	Power for Analog Circuit
28	G N D	Ground
29	VGH	Positive power for TFT
30	NC	Not connect
31	NC	Not connect
32	VGL	Negative power for TFT
33	G N D	Ground
34	NC	Not connect
35	NC(LED-)	Not connect （LED cathode）
36	NC(LED-)	Not connect （LED cathode）
37	NC	Negative Power for TFT
38	NC	Negative Power for TFT
39	NC(LED+)	Not connect （LED Anode）
40	NC(LED+)	Not connect （LED Anode）

Note 1 : UPDN and SHLR control function

UPDN	SHLR	FUNCTION
0	1	Normal display
0	0	Inverse Left and Right
1	1	Inverse Up and Down
1	0	Inverse Left and Right Inverse Up and Down



CN2 (LED backlight)

PIN NO	SYMBOL	FUNCTION
1	A	Anode
2	K	Cathode

Note :
Maker:JST
Input connector : BHSR-02VS-1(JST)
Outlet connector: SM02B-BHSS-1(JST)

5.4 POWER SUPPLY

5.5 Absolute Max. Rating

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. Absolute Maximum Ratings>

Parameter	Symbol	Min.	Max.	Unit	Remarks
LC operating Voltage [1]	V_{OP}		4.1	V	Ta=25+/-2°C
Operating Temperature (Humidity)	T_{OP}	-20	+70	℃	
	RH		90	%	At 60°C
Storage Temperature (Humidity)	T_{ST}	-30	+80	℃	
	RH		90	%	At 60°C

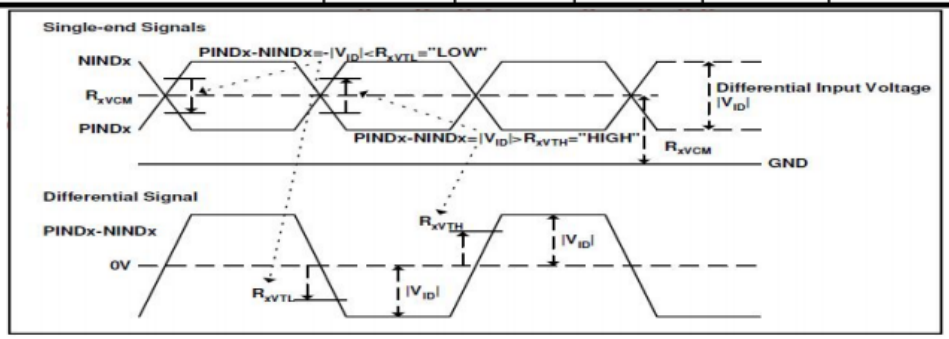
[1] Liquid Crystal driving voltage
Due to the characteristics of LC Material, this voltage varies with environmental temperature.

5.6 Typical Operation Conditions

5.6.1 DC Characteristics

< Table 3. Electrical specifications > Ta=25+/-2°C

Parameter		Symbol	Values			Unit	Notes
			Min	Typ	Max		
Power Supply Input Voltage		VDD	3	3.3	3.6	Vdc	
Power Supply Ripple Voltage		VRP			300	mV	
Analog Voltage		AVDD	9.4	9.6	9.8	V	
TFT Gate ON Voltage		VGH	16	18	20	V	
TFT Gate OFF Voltage		VGL	-5	-6	-7	V	
TFT Common Electrode Voltage		VCOM	3.3	3.8	4.3	V	
Power Consumption		PDD		0.33	0.45	Watt	1
Rush current		IRUSH	-	-	1	A	
LVDS Interface	Differential Input High Threshold Voltage	VLVTH	100		300	mV	
	Differential Input Low Threshold Voltage	VLVTL	-300		-100	mV	
	Common Input Voltage	VLVC	|Vid|/2	1.2	VDD-1.2	V	
	Differential input voltage	|Vid|	0.2	-	0.6		
CMOS Interface	Input High Threshold Voltage	VIH	2.6	-	3.3	V	
	Input Low Threshold Voltage	VIL	0	-	0.8	V	
Power Consumption		PDD	-	0.33	0.45	W	1

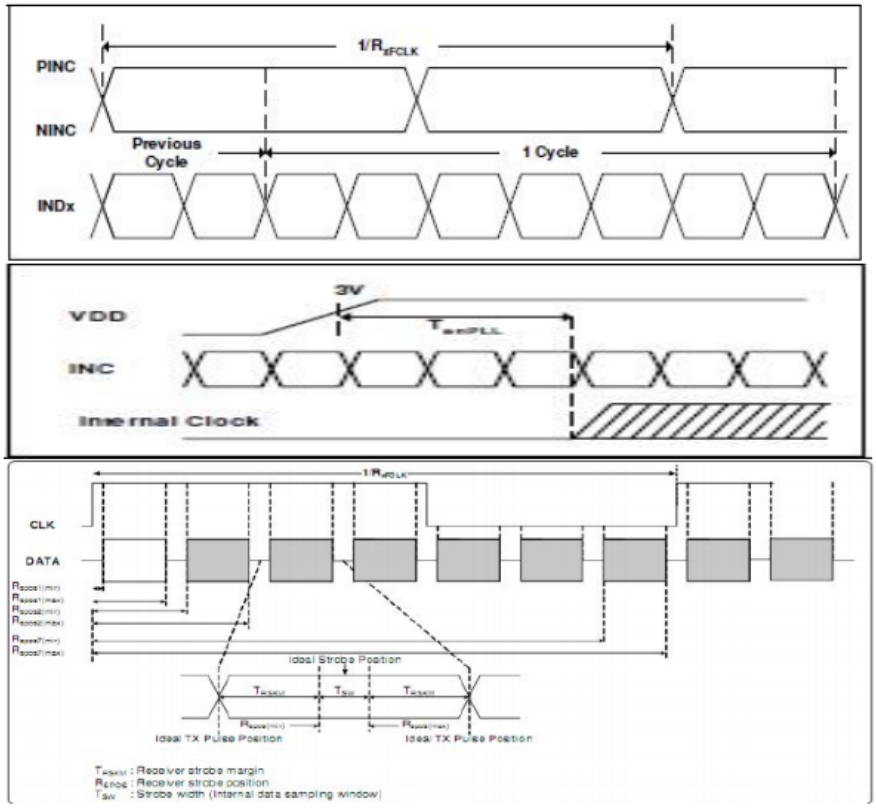


Notes : 1. The supply voltage is measured and specified at the interface connector of LCM. The current draw and power consumption specified is for VDD=3.3V, Frame rate 60Hz and Clock frequency = 51.2MHz. Test Pattern of power supply current
a) Typ : Check Flag b) Max : Black

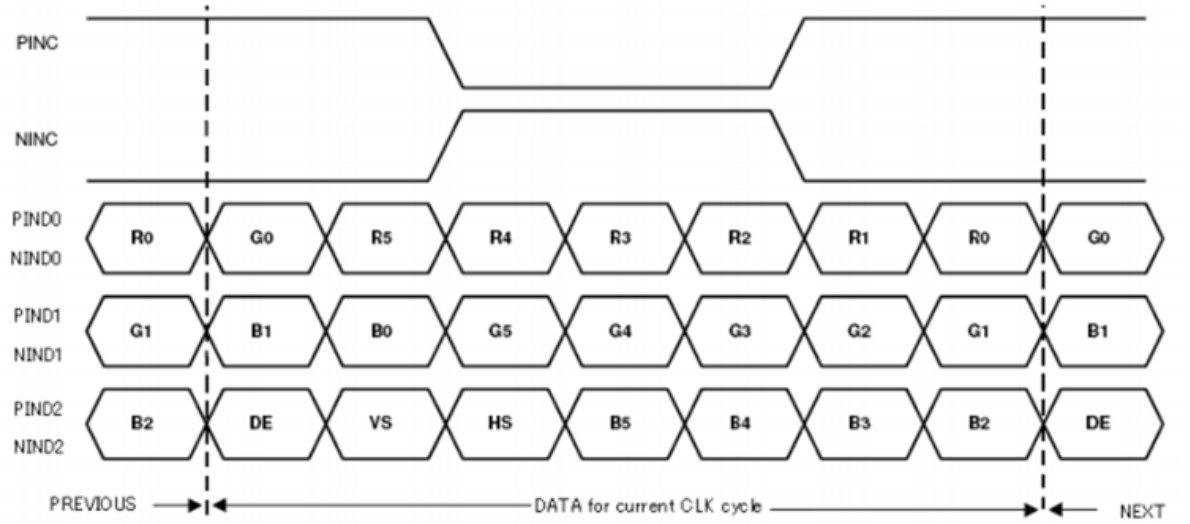
5.7 INPUT SIGNAL(DE ONLY MODE)

< Table 5. AC Electrical Characteristics>

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Clock frequency	RxFCLK	40.8	51.2	67.2	MHz	
Input data skew margin	TRSKM	500	-	-	ps	|VID|=400mV RxVCM=1.2V RxFCLK=71MHz
Clock high time	TLVCH	-	4/ (7*RxFCLK)		ns	
Clock low time	TLVCL		3/ (7*RxFCLK)		ns	
PLL wake-up time	TenPLL			150	us	

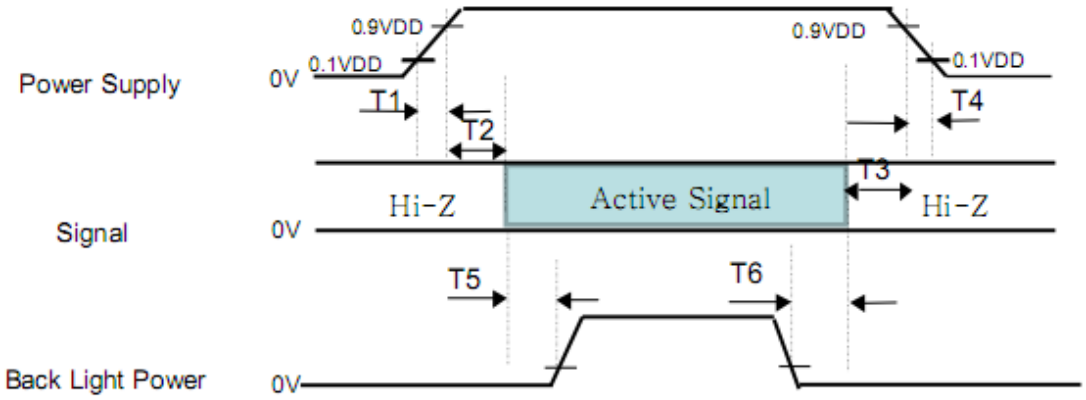


LVDS Input Data mapping
6 Bit LVDS input



5.8 Power Sequence

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



- 0.5ms ≤ T1 ≤ 10 ms
- 0 ms ≤ T2
- 0 ms ≤ T3
- 0 ms ≤ T4 ≤ 10ms
- 100ms ≤ T5 ≤ 300ms
- 100 ms ≤ T6 ≤ 300ms

Notes:

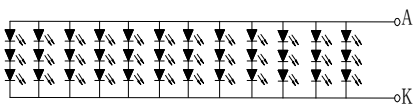
1. When the power supply VDD is 0V, keep the level of input signals on the low or keep high impedance.
2. Do not keep the interface signal high impedance when power is on. Back Light must be turn on after power for logic and interface signal are valid.

5.9 BACKLIGHT SPECIFICATION

5.9.1 Backlight Circuit

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	Vf	If=260 mA	8	9.2	11	V
Uniformity (with L/G)	ΔB_p	If=260 mA	70	-	-	%
Luminance for BL	L_V	If=260 mA	tbd	450	-	cd/m^2

Backlight Circuit



5.10 Optical specifications

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = 25±2℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) 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 $\Theta_{Ø=0}$ (=Θ_3) as the 3 o'clock direction (the "right"), $\Theta_{Ø=90}$ (= Θ_{12}) as the 12 o'clock direction ("upward"), $\Theta_{Ø=180}$ (= Θ_9) as the 9 o'clock direction ("left") and $\Theta_{Ø=270}$(= Θ_6) as the 6 o'clock direction ("bottom"). While scanning Θ and/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The measurement shall be executed after 30 minutes warm-up period. VDD shall be 12.0V +/-10% at 25°C. Optimum viewing angle direction is 6 'clock.

Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	L	Φ=180°(9 o'clock)		80	-	degree	Note 1，2
	R	Φ=0°(3 o'clock)		80	-		
	T	Φ=90°(12 o'clock)		80	-		
	B	Φ=270°(6 o'clock)		80	-		
Response time Rise+Fall	T_{RT}	Normal θ=Φ=0°	-	20	40	msec	Note2，3
Contrast ratio	CR		400	800	-	-	Note 4
Color chromaticity (CIE1931)	W_X			0.303		-	Note 2 Note 6
	W_Y			0.329		-	
	Rx			0.596			
	Ry			0.336			
	Gx			0.342			
	Gy			0.584			
	Bx			0.144			
	BY			0.175			
Color Gamut	NTSC		-	50	-	%	
Flicker			Not visible				Note 8
Crosstalk			Not visible				Note 9

Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing 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.
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 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

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

3. Center Luminance of white is defined as 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.
4. The White luminance uniformity on LCD surface is then expressed as :
   $\Delta Y5$ = (Minimum Luminance of 5 points / Maximum Luminance of 5 points) * 100
   $\Delta Y13$= (Minimum Luminance of 13 points / Maximum Luminance of 13 points) * 100
   (See FIGURE 2 and FIGURE 3 shown in Appendix).
5. The color chromaticity coordinates specified in Table 4. 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.
6. The electro-optical response time measurements shall be made as FIGURE 4 shown in Appendix by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Td, and 90% to 10% is Tr.

6. Reliability Test Conditions And Methods

Item	Test Conditions	Remark
High Temperature Storage	Ta = 80℃ 96 hrs	
Low Temperature Storage	Ta =-30℃ 96hrs	
High Temperature Operation	Ts = 65℃ 96hrs	
Low Temperature Operation	Ta = -20℃ 96hrs	
Operate at High Temperature and Humidity	+60℃, 90%RH max. 96 hrs	Operation
Thermal Shock	-20℃~ +65℃ 100 cycles 2Hrs/cycle	Non-operation
Electrostatic Discharge	Contact=±4KV, class B Air=±8KV, class B	
Mechanical Shock	Half- sine wave,300m/s2,11ms	
Vibration(With Carton)	10Hz~150Hz, 100m/s2, 120min	
Drop(With Carton)	TBD	
Electro Static Discharge	TBD	

7. Handling Precautions

7.1 Mounting method

The LCD panel of DXS LCD module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

7.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Salfur (S)

If goods were sent without being sili8con coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (Cl), Salfur (S) from customer, Responsibility is on customer.

7.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended that you:

Connect any unused input terminal to Vdd or Vss, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

7.4 packing

- Module employ LCD elements and must be treated as such.

- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

7.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.Usage under the maximum operating temperature, 50%Rh or less is required.

7.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
  [It is recommended to store them as they have been contained in the inner container at the time of delivery from us

7.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

8. Precaution for use

8.1 A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

8.2 On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to DXS , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

9. Package Drawing

TBD

10. Outline Dimension