MODEL :ENT070FWS-001S

ENTINC			
WRITTEN	APPROVED		APPROVED

CUSTOMER			
APPROVED			

DATE: 2014.5.20

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REV. NO.	REV. DATE	PAGE	REVISION DESCRIPTION	BEFORE	AFTER
00	14/05/20	23	Initial release	-	-

CONTENTS

1. FEATURES

LCD Module

Item	LCD Module
LCD Type	7.0’’TFT / FFS / Transmissive / Normally black
Display Resolution	1024x (RGB)×600
Number of Color	16M color
RGB Interface	LVDS Interface
Color Pixel Arrangement	RGB vertical stripe
Back Light	21 White LED In Parallel
Viewing Direction	ALL
Touch Panel Type	With Out Touch

2. ELECTRIC ABSOLUTE MAXIMUM RATINGS

Item	Symbol	MIN	TYP	MAX	UNIT
Digital Power Supply Voltage For LCD	DVDD	+3.0	+3.3	+3.6	V
Analog Power Supply Voltage	AVDD	+9.4	+9.6	+9.8	V
Logic input Voltage (LVDS:IN+, IN-)	NIND, PIND, NIND0, PIND0, NIND1, PIND1, NIND2, PIND2, NIND3, PIND3	[VIN] ……. 2	-	[VIN] 2.4 . … …. 2	V

3. MECHANICAL SPECIFICATIONS

3.1 Entire Dimension

Item	Specification	Unit
External dimension (W x H x T)	164.90(W)×100.00(H)×2.80(T)	mm
Total Weight (Typical)	T.B.D	g

3.2 LCD Panel Dimension

Item		Specification	Unit
LCD Panel	External dimension (W x H x T)	164.90(W)×100.00(H)×2.80(T)	mm
	Active Area (W x H)	154.2144(W)×85.92(H)	mm
	Dot pitch	0.1506 (W)×0.1432 (H)	mm
	Viewing Direction	ALL	-
	Resolution (W x H)	1024x(RGB)×600	-

4. ENVIRONMENTAL CONDITION

Item		Min	Max	Remark
Storage Temperature	Main	-30℃	+80℃	Condensation not allowed
Operating Temperature	Main	-20℃	+70℃	

5. ABSOLUTE MAXIMUM RATINGS.

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

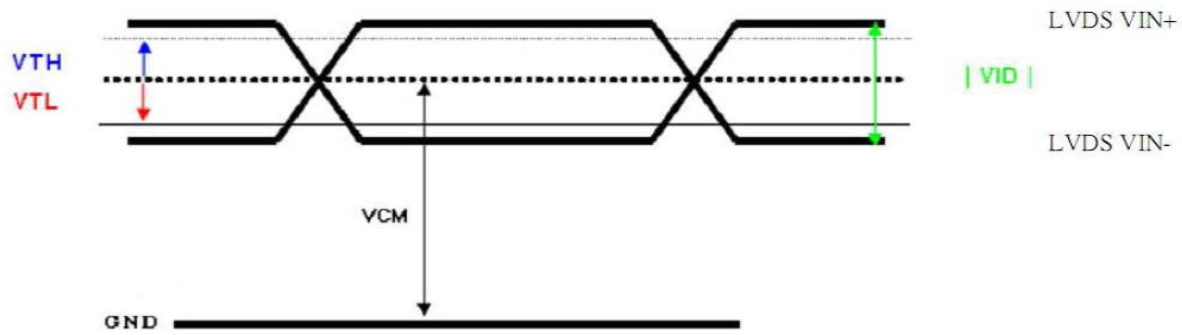
Item	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	DVDD	-0.3	5	V	
Analog Supply Voltage	AVDD	-0.5	15	V	
Gate On Voltage	VGH	-0.3	40	V	
Gate Off Voltage	VGL	-20	0.3	V	
Gate On-Gate Off Voltage	VGH-VGL	-0.3	40	V	
Signal Input Voltage	NIND0 ~ NIND3 PIND0 ~ PIND3 NINC,PINC	-0.5	5	V	
Operating Temperature	Topa	-20	70	℃	Note1
Storage Temperature	Tstg	-30	80	℃	Note1

Note1 : if users use the product out of the environmental operation range (temperature and humidity, it will have visual quality concerns.

6. D C CHARACTERISTICS

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Digital Power Supply Voltage For LCD	DVDD	3	3.3	3.6	V	
Logic Input Voltage (LVDS:IN+,IN-)	VCM	$\frVert VID\frVert/2$	-	$2.4-\frVert VID\frVert/2$	V	Note1
	$\frVert VID\frVert$	200	-	600	mV	Note1
	VTH	-	-	100	mV	VCM=1.2V Note1
	VTL	-100	-	-	mV	
Analog Power Supply Voltage	AVDD	9.4	9.6	9.8	V	
Gate On Power Supply Voltage	VGH	17	18	19	V	
Gate Off Power Supply Voltage	VGL	-6.6	-6	-5.4	V	
Common Power Supply Voltage	VCOM		(3.15)		V	Note2
Logic Input Voltage	VIH	0.7*DVDD	-	DVDD	V	
	VIL	GND	-	0.3*DVDD	V	

【Note1】 LVDS Signal

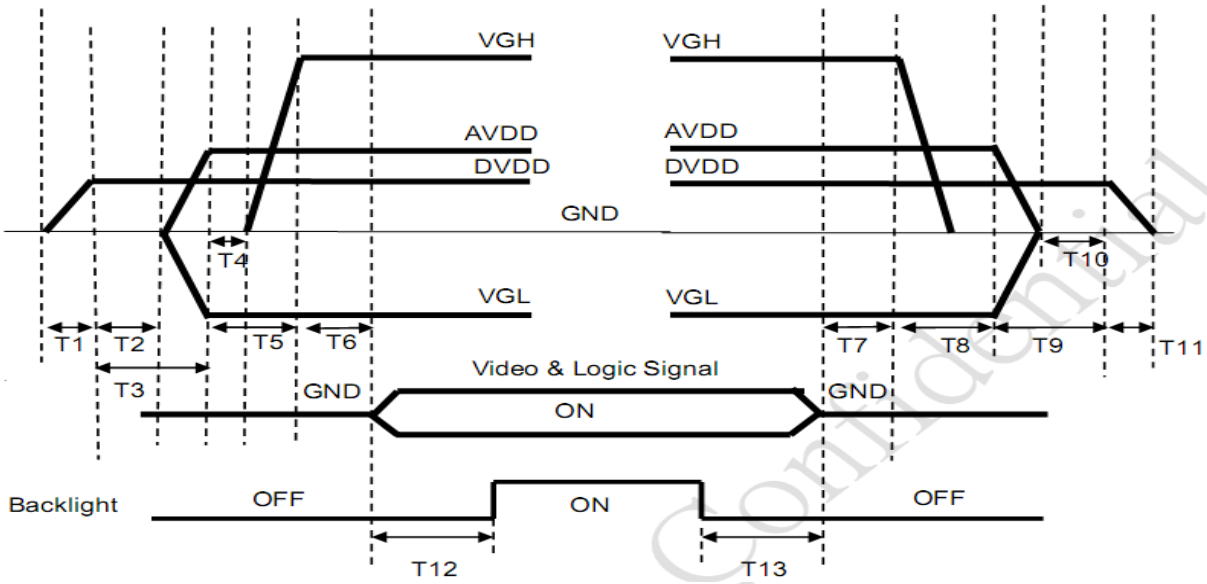


【Note2】 Please adjust VCOM to make the flicker level be minimum.

7. TIMING CHARACTERISTICS.

7.1 Power , Signal Sequence.

Power On : DVDD→AVDD/VGL →VGH →Video &Logic Signal→Backlight
Power Off : Backlight→Video &Logic Signal→ VGH→AVDD/VGL→DVDD



0<T1≦10ms
T2>0ms
T3>20ms
T4>0ms
T5>10ms
0<T6≦10ms
T12≧200ms

T7>0ms
T8>0ms
T9>0ms
T10>0ms
0<T11≦10ms
T13≧200ms

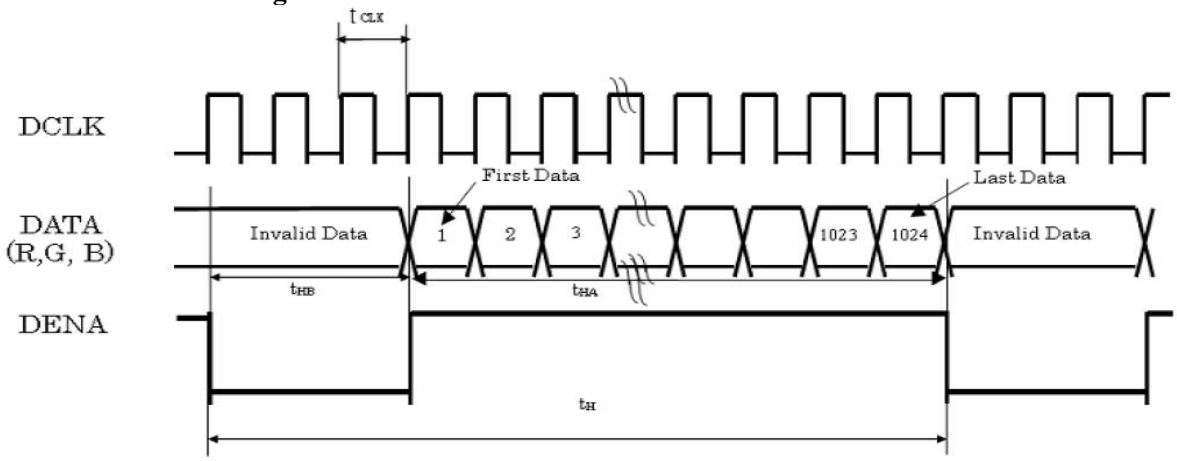
7.2 Timing characteristics

7.2. Timing characteristics of input signals

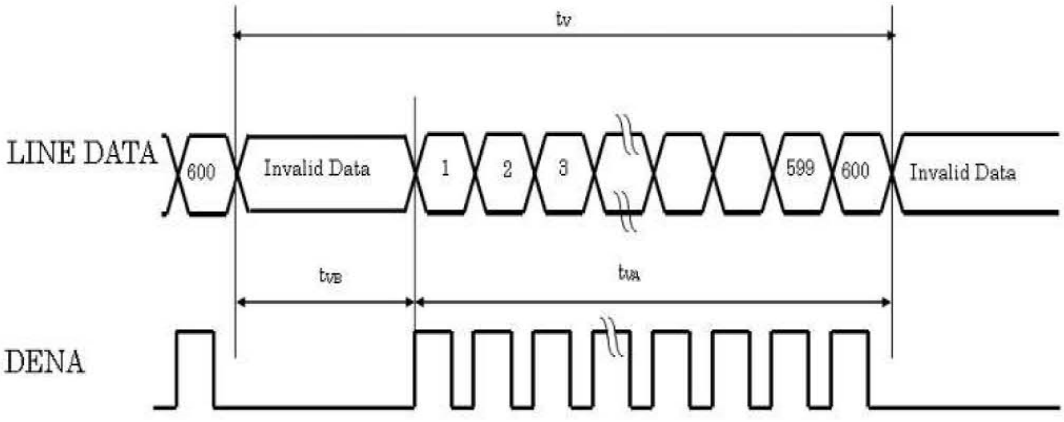
ITEM				SYMBOL	MIN	TYP	MAX	UNIT
LVDS Input Signal Sequence	CLK Frequency			tclk	45	51.2	57	MHz
LCD Input Signal Sequence （Input LVDS Transmitter）	DENA	Horizontal	Horizontal Total Time	t_H	1324	1344	1364	tCLK
			Horizontal Effective Time	t_{HA}		1024		tCLK
			Horizontal Blank Time	t_{HB}	300	320	340	tCLK
		Vertical	Vertical Total Time	t_V	625	635	645	t_H
			Vertical Effective Time	t_{VA}		600		t_H
			Vertical Blank Time	t_{VB}	25	35	45	t_H

7.3 Timing Sequence(Timing Chart)

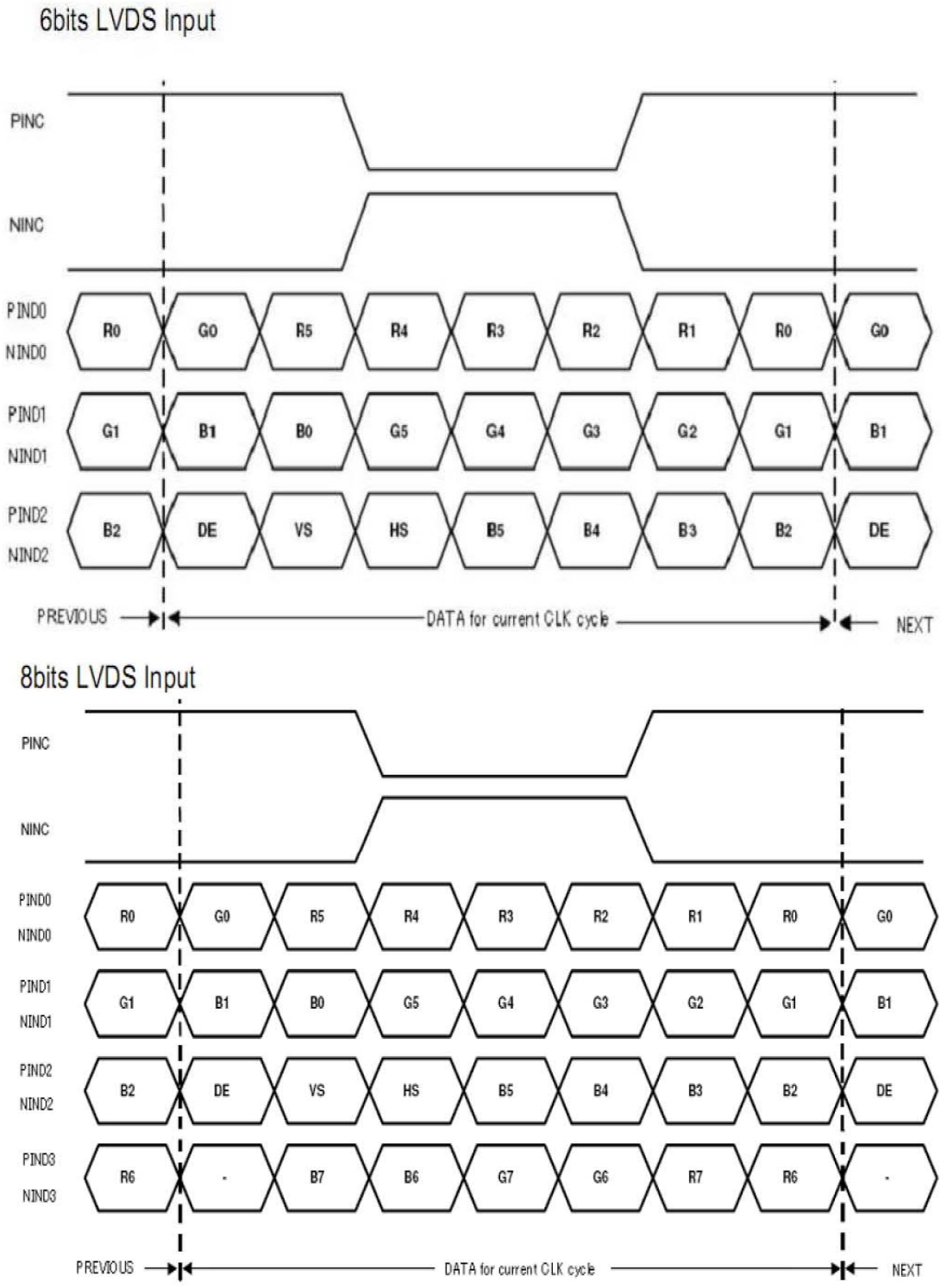
7.3.1 Horizontal timing:



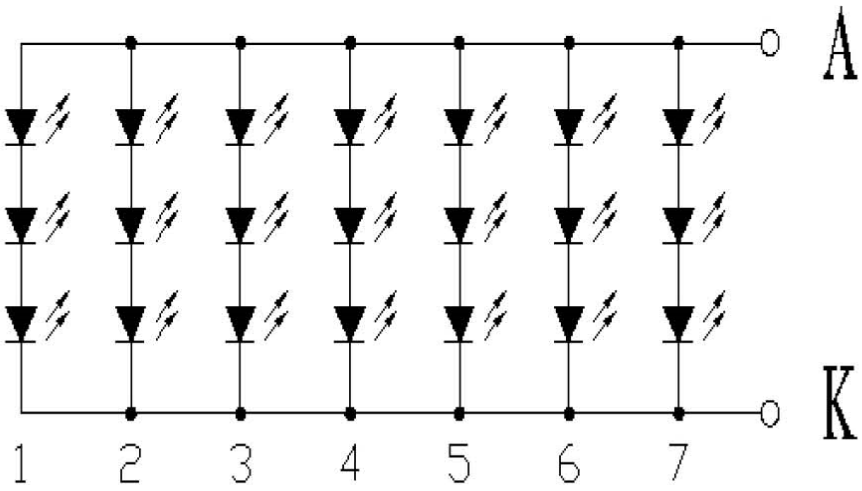
7.3.2 Vertical timing:



7.3.3. LVDS Input Data Mapping



8. BACKLIGHT LED CHARACTERISTICS.

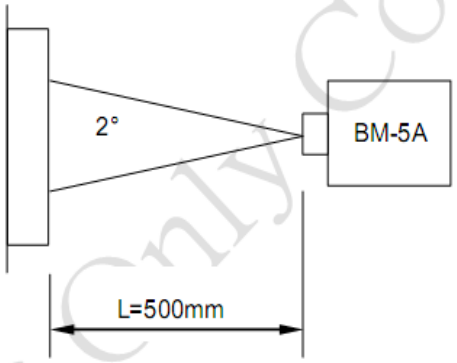


Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition
Supply Voltage	Vf	9.0	9.6	10.5	V	If=140mA
Luminous Intensity for LCM	I-	260	300	-	Cd/㎡	If=140mA
Uniformity for LCM	-	70	-	-	%	If=140mA
Life Time	-	20000	-	-	Hr	If=140mA
Backlight Color	White					

9. ELECTRO-OPTICAL CHARACTERISTICS

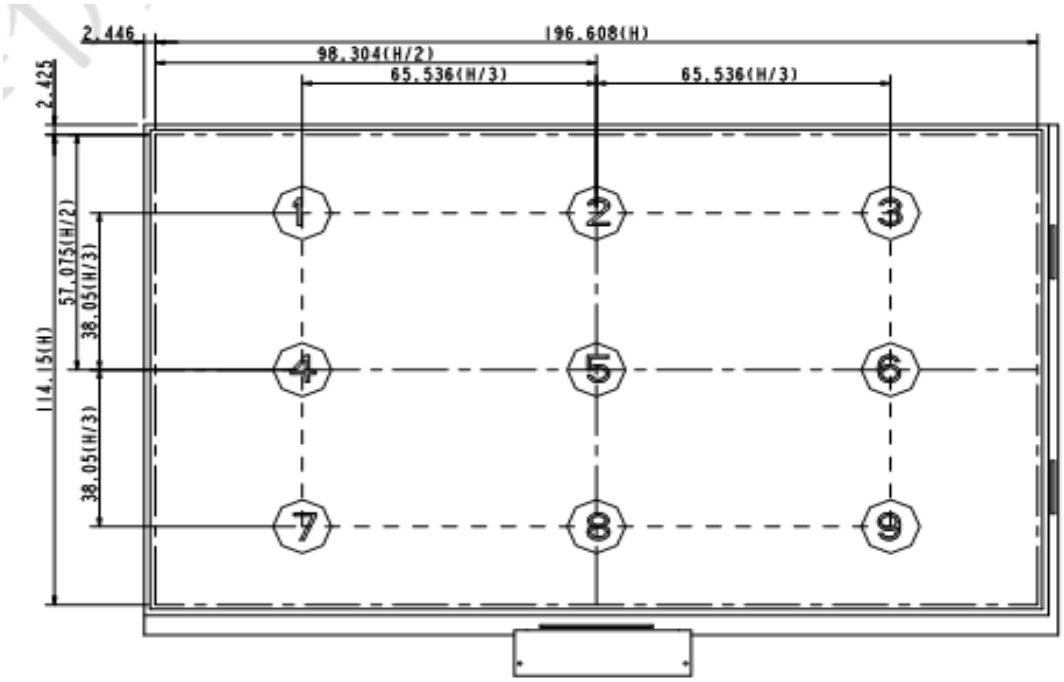
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Panel Transmittance		T	--	3.8	4.1	--	%	
Contrast Ratio		CR	Point-5	600	800	--	--	2
Response Time		Tr +Tf	Point-5	--	30	50	ms	3
NTSC				45%	50%	--		
Viewing Angle	Left	ϕ	Point-5 CR≧10	80	85			4
	Right	ϕ		80	85			4
	Upper	θ		80	85			4
	Lower	θ		80	85			4
Color Filter Chromacicity	White	x	θ=ϕ= 0°	0.270	0.290	0.310		
		y		0.311	0.331	0.351		
	Red	x	θ=ϕ= 0°	0.612	0.632	0.652		
		y		0.291	0.311	0.331		
	Green	x	θ=ϕ= 0°	0.277	0.297	0.317		
		y		0.516	0.536	0.556		
	Blue	x	θ=ϕ= 0°	0.120	0.140	0.160		
		y		0.134	0.154	0.174		

Note1: Measure condition：25℃±2℃，60±10%RH，under10 Lux in the dark room.BM-5A (TOPCON)，viewing angle2°。Mmeasurement after lighting on 10 mins.

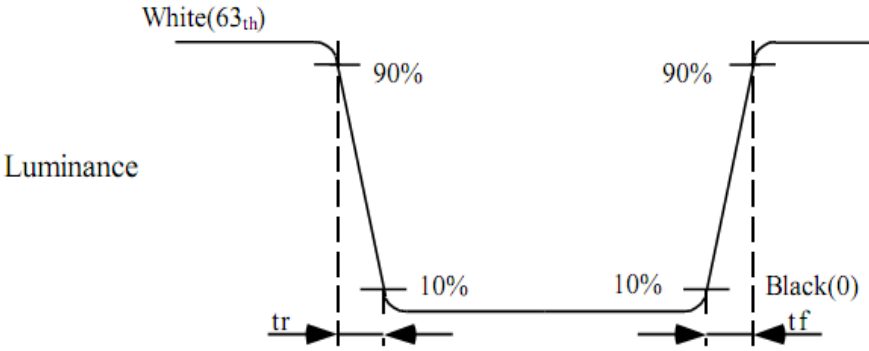


Note2: Definition of contrast ratio：

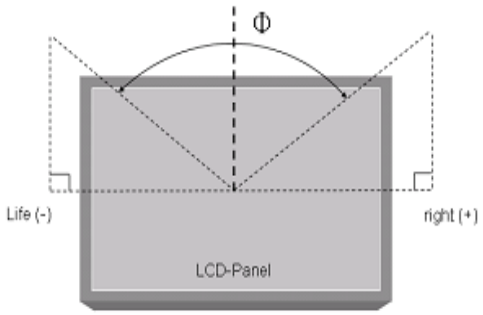
Contrast Ratio (CR)= (White) Luminance of ON ÷ (Black) Luminance of OFF

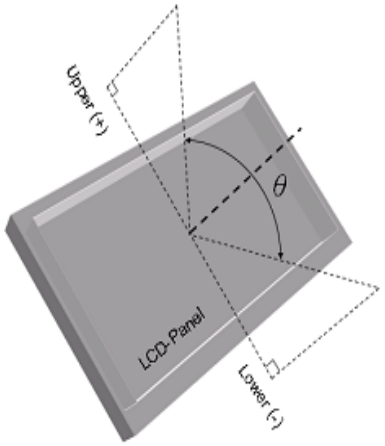


Note 3: Definition of Response Time.(White-Black)
The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 4: Definition of Viewing Angle(θ,ψ),refer to Fig.6 as below :





10. INPUT PIN DESCRIPTION

Pin NO.	SYMBOL	DESCRIPTION
1	VCOM	Common voltage
2~3	DVDD	Digital Power
4	NC	NC
5	Reset	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10KΩ, C=0.1μF)
6	STBYB	Standby mode, normally pull high STBYB=" 1", Normal Operation STBYB=" 0", Timing control, source driver will turn off, all output are High-Z
7	GND	Ground level for analog block
8	NIND0	Negative LVDS Differential Data Inputs
9	PIND0	Positive LVDS Differential Data Inputs
10	GND	Ground
11	NIND1	Negative LVDS Differential Data Inputs
12	PIND1	Positive LVDS Differential Data Inputs
13	GND	Ground
14	NIND2	Negative LVDS Differential Data Inputs
15	PIND2	Positive LVDS Differential Data Inputs
16	GND	Ground
17	NINC	Negative LVDS Differential Clock Inputs
18	PINC	Positive LVDS Differential Clock Inputs
19	GND	Ground
20	NIND3	Negative LVDS Differential Data Inputs
21	PIND3	Positive LVDS Differential Data Inputs
22	GND	Ground
23~24	NC	NC
25	GND	Ground
26~27	NC	NC
28	SELB	6 bit/8bit mode select
29	AVDD	Power for Analog Circuit

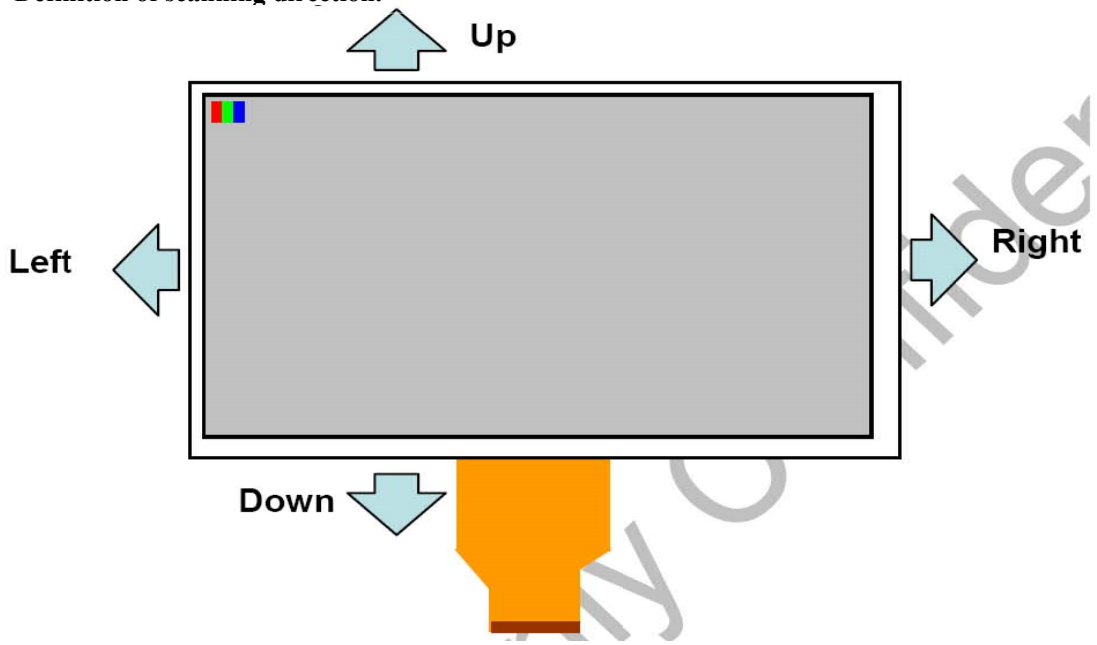
30	GND	Ground
31~32	LED-	LED cathode
33	SHLR	Horizontal Inversion
34	UPDN	Vertical Inversion
35	VGL	Negative Power for TFT
36~37	NC	NC
38	VGH	Positive Power for TFT
39~40	LED+	LED Anode

【Note1】SHLR：left or right setting

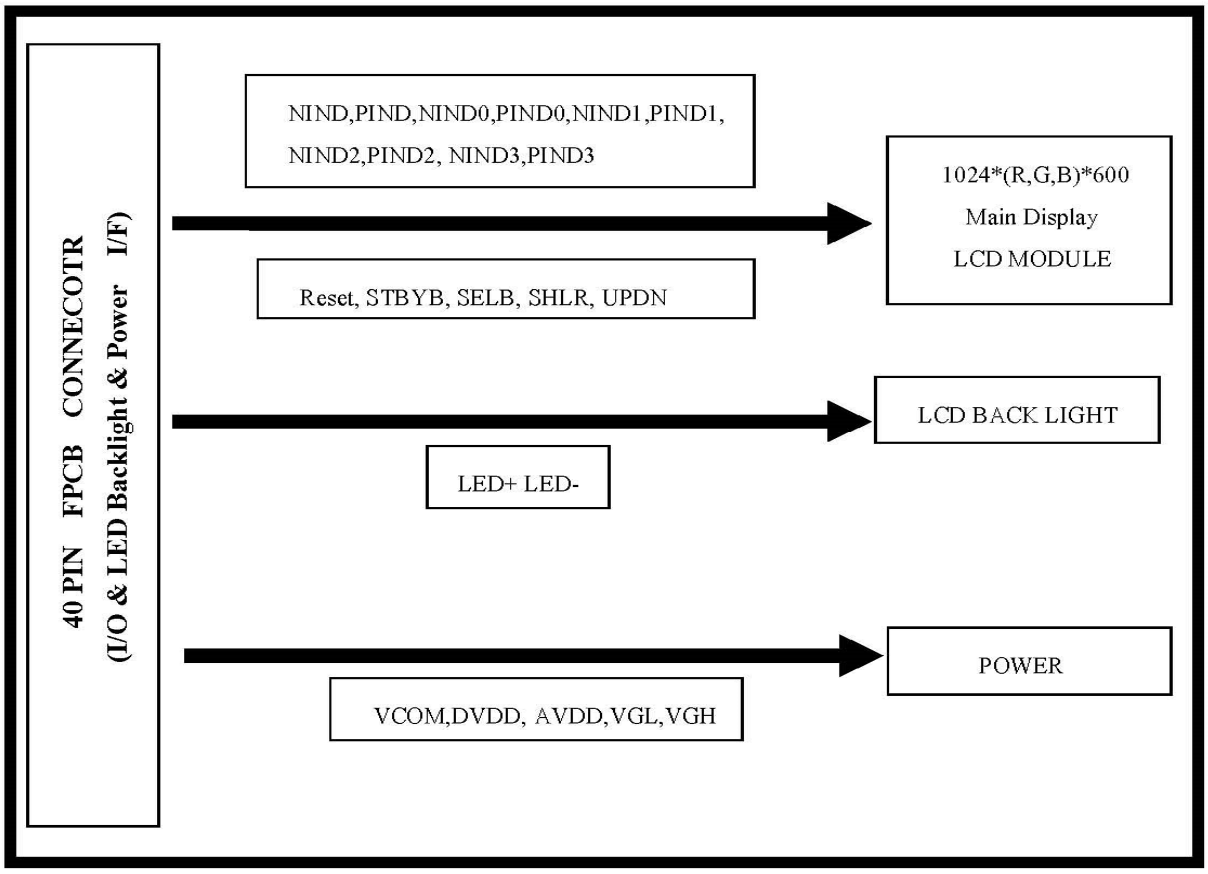
UPDN：up or down setting

UPDN	SHLR	Data shifting
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

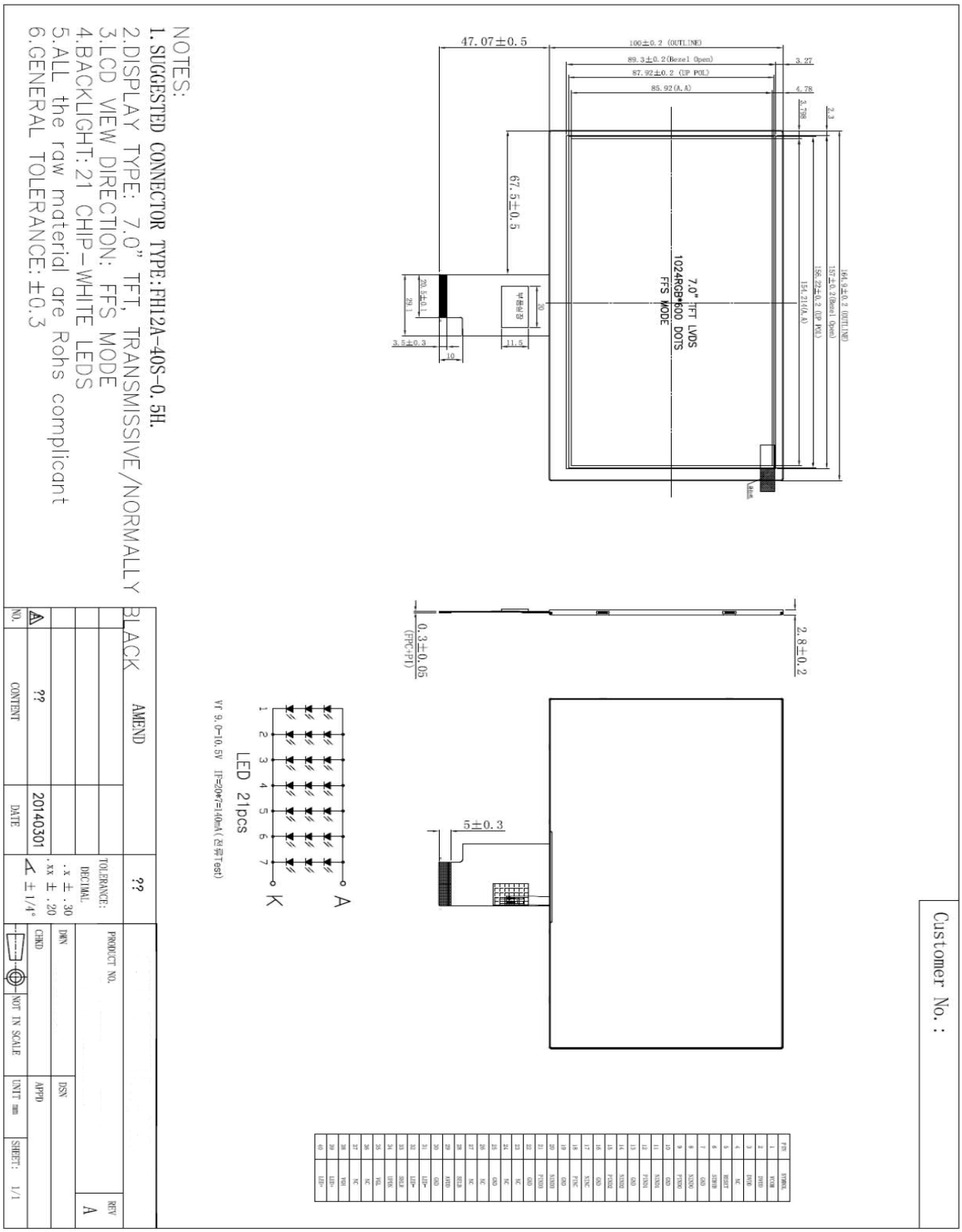
Definition of scanning direction.



11. BLOCK DIAGRAM



12. MODULE DIMENSION

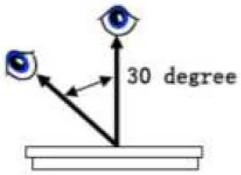


13. INSPECTION SPECIFICATIONS.

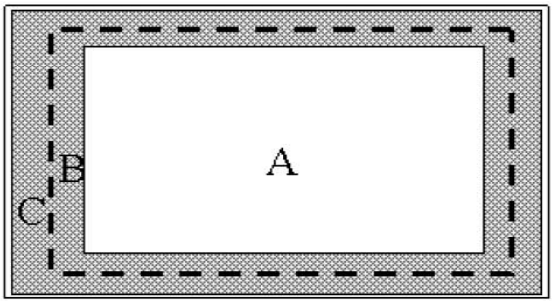
This standard apply to TFT module specification,

1:Inspection condition:

Under daylight lamp 20~40W,product distance inspector 'eye 30cm,in e degree 30°



2:Definition of inspection zone in LCD

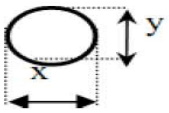


Zone A: character/Digit area

Zone B: viewing area except Zone A (Zone A + Zone B=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer' s product)

2:Inspection standard

N	Item	Inspection standard	Rate
2.1	Dot	For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$  Case of Dot defect is below: ①:Bright Dot(with spot) "0" ②:Dark Dot(black spot) "0"(In case of Dark Dot on Main TFT LCD) -NG if there's full Dot defect -Damaged less than the size of sub-pixel is not counted as defect -Dots darker than the size of sub-pixel are not defined as bright dot defect	minor

<table>
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<tr><th rowspan="2">Size(mm)</th><th colspan="3">Acceptable number</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>¢ ≤0.10</td><td colspan="2">ignore</td><td rowspan="5">ignore</td></tr>
<tr><td>0.10<¢ ≤0.15</td><td colspan="2">3</td></tr>
<tr><td>0.15<¢ ≤0.20</td><td colspan="2">2</td></tr>
<tr><td>0.20<¢ ≤0.25</td><td colspan="2">1</td></tr>
<tr><td>0.25<¢</td><td colspan="2">0</td></tr>
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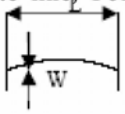
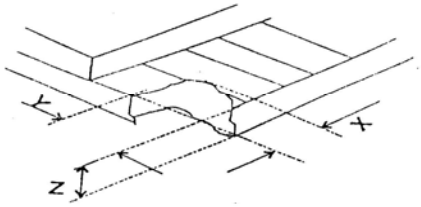
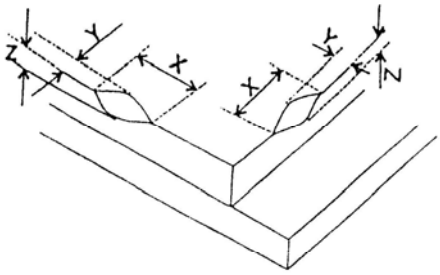
</td><td></td></tr>
<tr><td>2.2</td><td>line</td><td>
Line defect Black line White line, Foreign material under polarizer


<table>
<tr><th colspan="2">Size(mm)</th><th colspan="3">Acceptable number</th></tr>
<tr><th>L(Length)</th><th>W(Width)</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>ignore</td><td>W≤0.03</td><td colspan="2">ignore</td><td rowspan="4">ignore</td></tr>
<tr><td>W≤4.0</td><td>0.03<W≤0.04</td><td colspan="2">2</td></tr>
<tr><td>W≤4.0</td><td>0.04<W≤0.05</td><td colspan="2">1</td></tr>
<tr><td></td><td>0.05<W</td><td colspan="2">0</td></tr>
</table>
</td><td>minor</td></tr>
<tr><td>2.3</td><td>LCD Glass defect</td><td>
A:Chips on corner


<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3.5</td><td>≤S</td><td>Disregard</td></tr>
</table>
Notes: S=contact pad length
Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.
</td><td></td></tr>
</table>

B:Usual surface cracks



X	Y	Z
≤ 1/3 S	≤ 2.0mm	Disregard

Notes: S=contact pad length

Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.

14. RELIABILITY TEST CONDITIONS AND METHODS.

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80℃±2℃×200Hours	Inspection after 2~4hours storage at room temperature,the samples should be free from defects: 1,Air bublle in the LCD. 2,Sealleak. 3,Non-display. 4,Missing segments. 5,Glass crack. 6,Current IDD is twice higher than initial value. 7,The surface shall be free from damage. 8,The electric charateristic requirements shall be satisfied.
②	Low Temerature Storage	-30℃±2℃×200Hours	
③	High Temperature Operating	70℃±2℃×120Hours	
④	Low Temperature Operating	-20℃±2℃×120Hours	
⑤	Temperature Cycle(Storage)	-20℃ ⟺ 25℃ ⟺ 70℃ (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test	50℃±5℃×90%RH×120Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
⑨	ESD Test	Voltage:±8KV,R:330Ω,C:150PF, Air Mode,10times	

REMARK:

1,The Test samples should be applied to only one test item.

2,Sample side for each test item is 5~10pcs.

3,For Damp Proof Test,Pure water(Resistance＞10MΩ)should be used.

4,In case of malfunction defect caused by ESD damage,if it would be recovered to normal state after resetting,it

would be judge as a good part.

5,EL evaluation should be excepted from reliability test with humidity and temperature:Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.

6,Failure Judgment Criterion:Basic Specification Electrical Characteristic,Mechanical Characteristic,Optical Characteristic.

15. HANDLING PRECAUTIONS.

15.1 Mounting method

The LCD panel of SC 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.

15.2 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 (CI), Salfur (S) from customer, Responsibility is on customer.

15.3 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.

15.4 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**

15.5 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.

15.6 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

15.7 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**

16. PRECAUTION FOR USE.

16.1

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.

16.2

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 GT LCD , 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.**

17. PACKING METHOD.