TFT LCD MODULE
SPECIFICATIONS

CUSTOMER	
MODEL	BLT2402432I-37C
CUSTOMER APPROVED	

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Zhejiang BOE Display Technology Co.,Ltd

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1.1 Caution

1. This TFT LCD module has been specifically designed for use only in Electronic devices.
The module should not be used in applications where panel failure could result in physical harm or
loss of life, and we expressly disclaims any and all liability relating in any way to the use of the module
in such applications.

1.2 Description

BLT2402432I-37C is a transmissive type color active matrix TFT liquid crystal display that use
amorphous silicon TFT as switching devices. This module is composed of a TFT-LCD module , a driver
circuit and back-light unit. The resolution of 2.4" contains 240*320 pixels.

1.3 General Specifications

ITEM	Specification	
LCD Mode	TFT; RGB Color; Normal White; Transmissive	
Controllable Color	Indication data: Red-5bit, Green-6bit, Blue-5bit gradation control	262 K Colors
Backlight	LED white colored Backlight (LED unit, 4 chip LED)	
Driver IC	HX8347G	
Resolution	(240×3) (W) ×320(H) Dots	
Outline area(mm)	42.72*60.26	
Active Area (mm)	36.72*48.96	
Weight (g)	TBD	

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2.1 Absolute maximum ratings

Item	Symbol	Value	Unit
Operation Temperature	Top	-20~70	℃
Storage Temperature	Tstr	-30~80	℃
Power supply voltage	V_{CC}	-0.3~4.6	V

2.2 LED back light specification (per a Chip)

Item		Symbol	Condition	Min	Type	Max	Unit
Forward voltage		V_f	I_f=15mA	-	3.2	-	V
Forward current		I_{pn}	/1-chip	-	15	-	mA
Reverse voltage		V_r	per chip	-	-	4.0	V
Reverse Current		I_r	V_r=4V	-	-	15	uA
Uniformity (with L/G)		-	I_f=15mA	70	-	-	%
Luminance	No LCD	Lv	I_f=15mA	-	-	-	cd/m2
	With LCD	Lv	I_f=15mA	-	200	-	cd/m2
Luminous color		White					

Driver Voltage		V_{ak}		-	3.2	3.5	V
Driver Current		I_{ak}		-	60	80	mA
LED Configuration		4PCS LED Chips in paralles					

2.3 Time Sequence
2.3.1 Display Parallel 18/16/9/8-bit Interface Timing Characteristics (8080-series)

Notes: 1. PWLW and PWLR are defined by the overlap period when CS is low and when WR or RD is low.
2. Fix unused DB pins to either IOVcc or GND level.
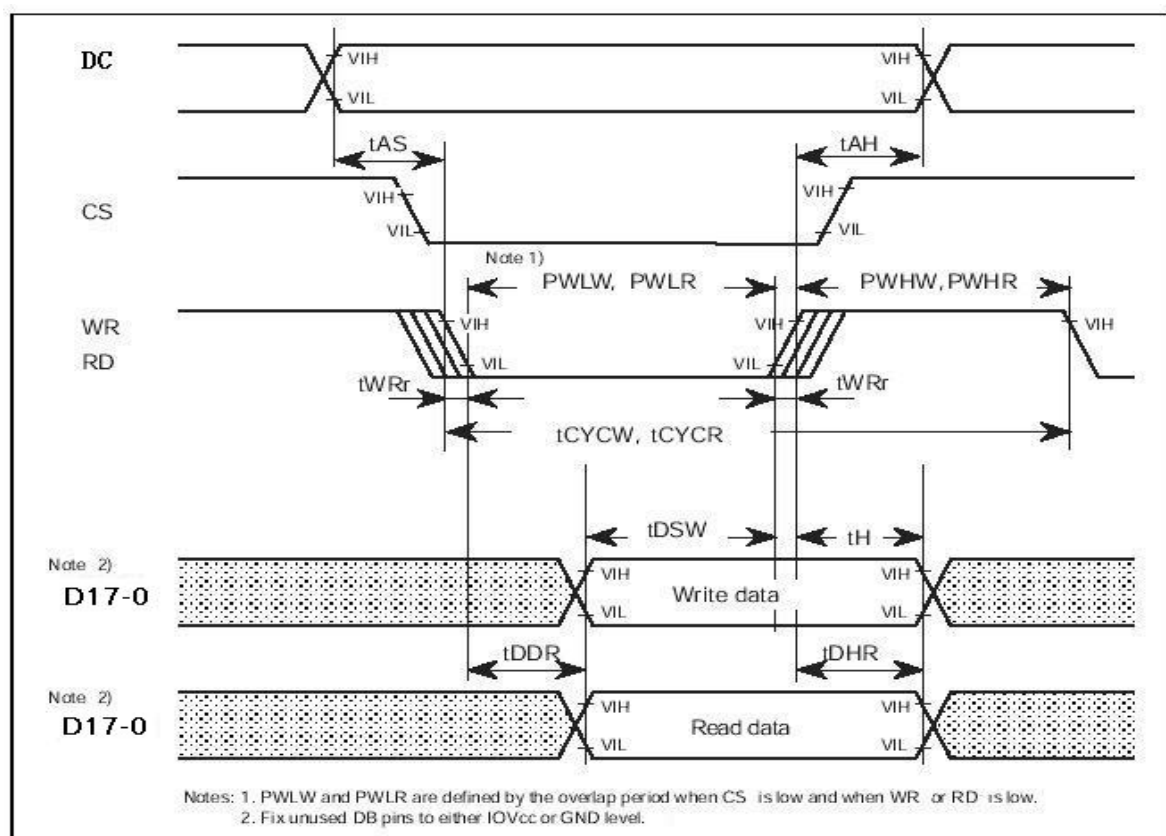
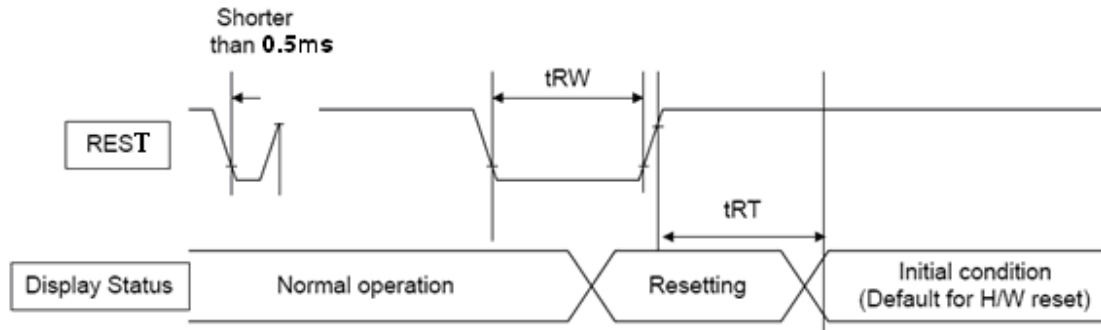| Document	Specifications		No.	
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80-system Bus Interface Timing Characteristics (18-bit/16-bit Transfer Mode)
IOVcc = 1.65V to 3.30V, Vci = 2.4V ~ 3.3V

Item		symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	t_{CYCW}	ns	125	-	-
	Read	t_{CYCR}	ns	450	-	-
Setup time	Write (RS~CS, WR)	t_{AS}	ns	0	-	-
	Read (RS~CS, RD*)			10		
Write high-level pulse width		PW_{HW}	ns	70	-	-
Read high-level pulse width		PW_{HR}	ns	250	-	-
Write/Read rise/fall time		t_{WRr}, t_{WRf}	ns	-	-	25
Address hold time		t_{AH}	ns	2	-	-
Write data setup time		t_{DSW}	ns	10	-	-
Write data hold time		t_H	ns	10	-	-
Read data delay time		t_{DD}	ns	-	-	150
Read data hold time		t_{DHR}	ns	5	-	-
Write low-level pulse width		PW_{LW}	ns	45	-	500
Read low-level pulse width		PW_{LR}	ns	170	-	-

80-system Bus Interface Timing Characteristics (9-bit /8-bit Transfer Mode)
IOVcc = 1.65V to 3.30V, Vci = 2.4V ~3.3V

Item		symbol	Unit	Min.	Typ.	Max.
Bus cycle time	Write	t_{CYCW}	ns	70	-	-
	Read	t_{CYCR}	ns	450	-	-
Setup time	Write (RS~CS, WR)	t_{AS}	ns	0	-	-
	Read (RS~CS, RD)			10		
Write high-level pulse width		PW_{HW}	ns	25	-	-
Read high-level pulse width		PW_{HR}	ns	250	-	-
Write/Read rise/fall time		t_{WRr}, t_{WRf}	ns	-	-	25
Address hold time		t_{AH}	ns	2	-	-
Write data setup time		t_{DSW}	ns	10	-	-
Write data hold time		t_H	ns	10	-	-
Read data delay time		t_{DD}	ns	-	-	150
Read data hold time		t_{DHR}	ns	5	-	-
Write low-level pulse width		PW_{LW}	ns	30	-	-
Read low-level pulse width		PW_{LR}	ns	170	-	-

3.5 Reset Timing

Signal	Symbol	Parameter	Min	Max	Unit
RESET	tRW	Reset pulse duration	3		ms
	tRT	Reset cancel		5(note 5)	ms
				120(note 6,7)	ms

Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from EEPROM to registers. This loading is done every time when there is HW reset cancel time(RT) within 5ms after a rising edge of RESET.

2. Spice due to and electrostatic discharge on RESET line does not cause irregular system reset according to the table below:

RESET pulse	Action
Shorter than 0.5ms	Reset Rejected
Longer than 3ms	Reset
Between 0.5ms and 3ms	Reset starts

3. During the Resetting period, the display will be blanked (the display is entering blanking sequence, which maximum time is 120ms, when Reset Starts in Sleep Out-mode. The display remains the blank state in sleep in-mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:
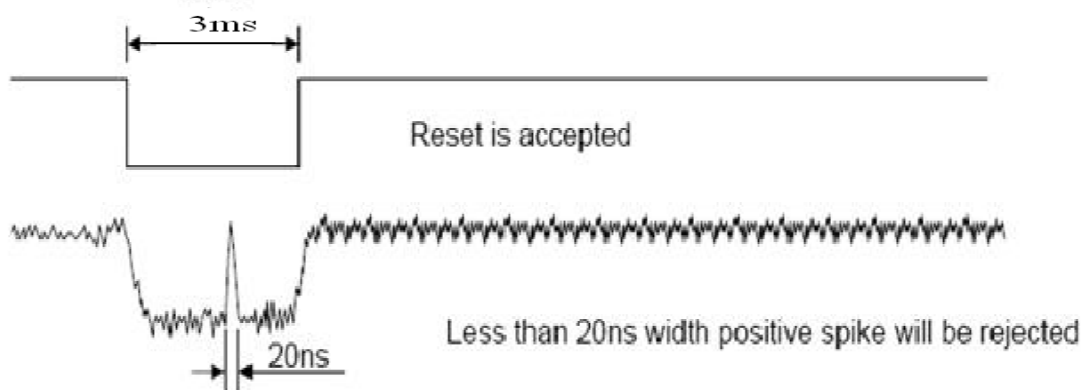
5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESET before sending commands. Also Sleep Out command cannot be sent for 120 msec.

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4. Electrical & Optical Characteristics

4.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	Power supply	VCC	2.4	2.8	3.3	V
	Analog	VCI	2.4	2.8	3.3	V
	IO	IOVCC	1.65	1.8	2.8	V
Logic Low input voltage		V_{IL}	-0.3IOVCC	-	0.3IOVCC	V
Logic High input voltage		V_{IH}	0.7IOVCC	-	IOVCC	V
Logic Low output voltage		V_{OL}	-	-	0.2IOVCC	V
Logic High output voltage		V_{OH}	0.8IOVCC	-	-	V
Current Consumption	Normal display	Ivdd	-	-	-	mA
	Standby mode	Ivdd-	-	-	-	uA
Frame Frequency		f_{FR}	-	TBD	-	Hz

4.2. Optical Characteristics

Ta=25ºC, VCC=2.8V, TN LC+ Polarizer

	Item		Symbol	Condition	Specification			Unit
					Min.	Typ.	Max.	
Backlight On (Transmissive Mode)	Luminance			Normally viewing angle	-	200	-	cd/m²
	Contrast ratio		CR	$\theta_X = \theta_Y = 0º$	-	800	-	-
	Response time		T_R		-	16	21	ms
			T_F	-	-	19	24	
	Chromaticity Transmissive	Red	X_R	-	0.589	0.609	0.629	
			Y_R		0.310	0.330	0.350	
		Green	X_G		0.267	0.287	0.307	
			Y_G		0.507	0.527	0.547	
		Blue	X_B		0.127	0.147	0.167	
			Y_B		0.118	0.138	0.158	
		White	X_W		0.283	0.303	0.323	
			Y_W		0.304	0.324	0.344	
	Viewing Angle	Horizontal	θx+	Center CR≥10	-	80	-	Deg.
			θx-		-	80	-	
		Vertical	θY+		-	80	-	
			θY-		-	80	-	
	NTSC Ratio(Gamut)		-	-	-	50.0	-	%

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5. Module outline

Pin description table:

PIN	DESCRIPTION
1	DB0
2	DB1
3	DB2
4	DB3
5	GND
6	VCC
7	/CS
8	RS
9	/WR
10	/RD
11	GND
12	XL
13	YU
14	XR
15	YD
16	LED-A
17	LED-K1
18	LED-K2
19	LED-K3
20	LED-K4
21	IM3
22	DB4
23	DB8
24	DB9
25	DB10
26	DB11
27	DB12
28	DB13
29	DB14
30	DB15
31	REST
32	VCC
33	VCC
34	GND
35	DB5
36	DB6
37	DB7

If=15*4mA Vf=3.2V

双面胶T=0.1MM

2.37±0.1
0.13±0.03

240x3RGBx320 DOTS

1.	DISPLAY MODE	Positive/Transmissive
2.	THE CONNECTOR WAY	COG((IC:HX8347G)
3.	VIEWING DIRECTION	80/80/80/80
4.	OPERATING TEMP	−20℃~ +70℃
5.	STORAGE TEMP	−30℃~ +80℃
6.	BACKLIGHT	4 CHIP−WHITE LED
7.	UNMARK TOLERANCE	±0.2MM
8.	ROHS	YES

Unit: mm   Projection?   Sheet: 1/1

Scale: 1:1   Version: 0.1

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File No.
Document No.
Customer REF.
Model No.
Product No.
Drawing No.

42.72±0.2(BL)
39.72(TFT)
36.72(A.A)
48.96(A.A)
52.16(TFT)
55.96(TFT)
60.26±0.2(BL)
2.90
1.40
21.50
4.96
2.00
1.50
1.50
3.00
3.30
1.45
W=0.45±0.03
2.00
P0.8*36=28.80±0.05

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6. Interface

NO.	Symbol	I/O	Definition
1	DB0		
2	DB1		
3	DB2		
4	DB3		
5	GND		
6	VCC		
7	/CS		
8	RS		
9	/WR		
10	/RD		
11	GND		
12	XL		
13	YU		
14	XR		
15	YD		
16	LED-A		
17	LED-K1		
18	LED-K2		
19	LED-K3		
20	LED-K4		
21	IM3		Please connect it to GND
22	DB4		
23	DB8		
24	DB9		
25	DB10		
26	DB11		
27	DB12		

28	DB13		
29	DB14		
30	DB15		
31	/RESET		
32	VCC		
33	VCC		
34	GND		
35	DB5		
36	DB6		
37	DB7		

In this module, interface format and interface parameter inital set as below.
IFSEL=0
IM3=IM2=IM1=IM0=0

IFSEL	Interface Format Selection
0	Register-content interface mode
1	Command-Parameter interface mode

IM3	IM2	IM1	IM0	Interface
0	0	0	0	8080 MCU 16-bit Parallel type I

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7. Reliability Test Conditions And Methods
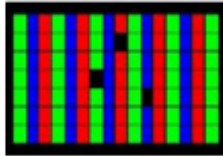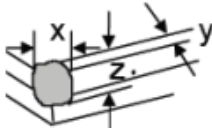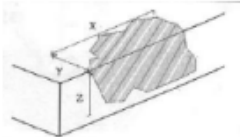
NO	Item	Condition	Method
1	High temperature and high humidity operation	60℃,90%RH,240H	Check and record every 48Hrs
2	High Temperature storage	80℃±2℃ 240H	Check and record every 48Hrs
	Low Temperature storage	-30℃±2℃ 240H	
3	High Temperature operating	70℃±2℃ 240H	Check and record every 48Hrs
	Low Temperature operating	-20℃±2℃ 240H	
4	Temperature Cycle	Temperature cycle -30℃ ↔ 25℃ ↔ 80℃ ↔ 25℃ 30min 30min 30min 30min 1 cycle 10 cycles	Each 5 cycles end, check and record
5	Vibration	10Hz~55Hz~10Hz Amplitude: 1.5mm 2hrs for each direction (X, Y, Z)	Each direction end, Check the Appearance and Electrical Characteristics
6	Slump	A packing case product, in 80 centimeters place, along 6 surface two edge two cents for each face, edge and corner of the once free-falling campaign	Meets the LCD each performance index requirement
7	Poach	Ordinary product 6Hrs, distinctive product 8Hrs	

8. Inspection standard

NO	ITEM	Content	Standard	Method	AQL
1	Model confirmed	With Model	**An unusual mixed model, not allowed**	Compared with the sample (visual or sounding)	0.65
2	Polarizer	Air Bubble	<table><tr><td>**Size**</td><td>**Allow a few**</td></tr><tr><td>Φ≤0.20</td><td>Ignore</td></tr><tr><td>0.20＜Φ≤0.30</td><td>2</td></tr><tr><td>0.30＜Φ≤0.40</td><td>1</td></tr><tr><td>Φ＞0.40</td><td>0</td></tr><tr><td>Total QTY</td><td>3</td></tr></table>	Open backlight or visual observation, Benchmark testing	1.5
		Protective film	1. Protective film or falling over sideways area of LCD 1/3 be allowed 2. Polarizer protective film off, not allowed	Visual	
		Partial affixed	Polarizer edges cannot exceed the LCD glass as a fringe.	Visual	
		Scratch	LCD boxes linear defects	Open backlight or visual observation, Benchmark testing	
		Injured	LCD boxes Point defects.		
		Wrinkles	The naked eye can clearly distinguish allowed	Visual	
		Cock	Polarizer edge cock (unglued), not allowed.	Visual	
		Water bellows	Limits of reference samples.	Visual	
		Surface dirt	Surface dirt alcohol cloth to clean the surface dirt is prinked gently, as if to remove qualified, wiping not to be ineligible.	Visual	
3	LCD	Rainbow (box uneven thickness)	Rainbow emphasis on "restrictions" for failure.	Polarizing inspection	0.65

		Electrical not defect	Bright and Black dot define: and Inspection pattern: Full white、Full black、Red、green and blue screens 	Item	Acceptable Quantity		
			Black dot defect	2
			Bright dot defect	0
			Total Dot	2

| | | **Glass defect** | 1.Corner Fragment:

 Size(mm) — Acceptable Quantity
 X≤3mm, Y≤3mm, Z≤T — Ignore, T: Glass thickness, X: Length, Y: Width, Z: thickness

  2. Side Fragment:

 Size(mm) — Acceptable Quantity
 X≤5.0mm, Y ≤1mm, Z≤T — Ignore, T: Glass thickness, X: Length, Y: Width, Z: thickness | **Caliper** | |

4	**FPC**	**FPC bad press**	**FPC visually evident with the undocking LCD，Unqualified**	**Visual**	**0.65**
		FPC deviation	**FPC deviation，Unqualified**	**Visual**	
		FPC damaged	**FPC Wrinkle, torn and damaged, FPC damage to the components Unqualified**	**Visual**	
		FPC surface dirt	**Obviously the milk attachment，Unqualified**	**Visual**	
5	**Back light**	**Crack**	**In light district are obvious cracks, or from the brink of a regional extension to the light of the trend of the cracks. Unqualified.**	**Visual**	
		Breaking	**The edge or corner breaking display has been exposed. Unqualified**	**Visual**	
6	**IC**	**IC breaking**	**IC any degree of damage, Unqualified.**	**Visual**	
7	**Sillicone**	**Silicone Uniformity**	**Silicone uneven, as well as some regional non-gel, but in some regions and the impact of too many plastic assembly, Unqualified.**	**Visual**	
8	**Other**	**Bad labeling**	**Marking and labeling requirements of the position and inconsistent, Unqualified.**	**Visual**	**1.5**
		Shading belt	**There were bubbles and the crimp, tilt beyond Zebra paper edge, and polarizer overlapping folds, such as scratches phenomenon to be ineligible,**	**Visual**	
		Separation of components	**Backlight LCD screen with the undocking, not allowed.**	**Visual**	**0.65**

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9. Handling Precautions

9.1 Mounting method

The LCD panel of HCH 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.

9.2 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 happens by miss handling or using some materials such as Chlorine (Cl), Salfur (S) from customer, Responsibility is on customer.

9.3 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, and assembly equipment to protect against static electricity.

9.4 packing

- Modules 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

9.5 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.**

- **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.

9.6 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

9.7 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**

10. Precaution for use

10.1 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.

10.2 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 HCH, 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.