PRODUCT SPECIFICATIONS

For Customer:_____   ☐ : APPROVAL FOR SPECIFICATION

Customer Model No. _____   ☐ : APPROVAL FOR SAMPLE

Module No.: *IE-A-0406CV02S-00-1*   *Date : 2017-10-31*

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For Customer's Acceptance:

Approved By	Comment

PREPARED	CHECKED	VERIFIED BY QA DEPT	VERIFIED BY R&D DEPT Dmjiang

2. Revision Record

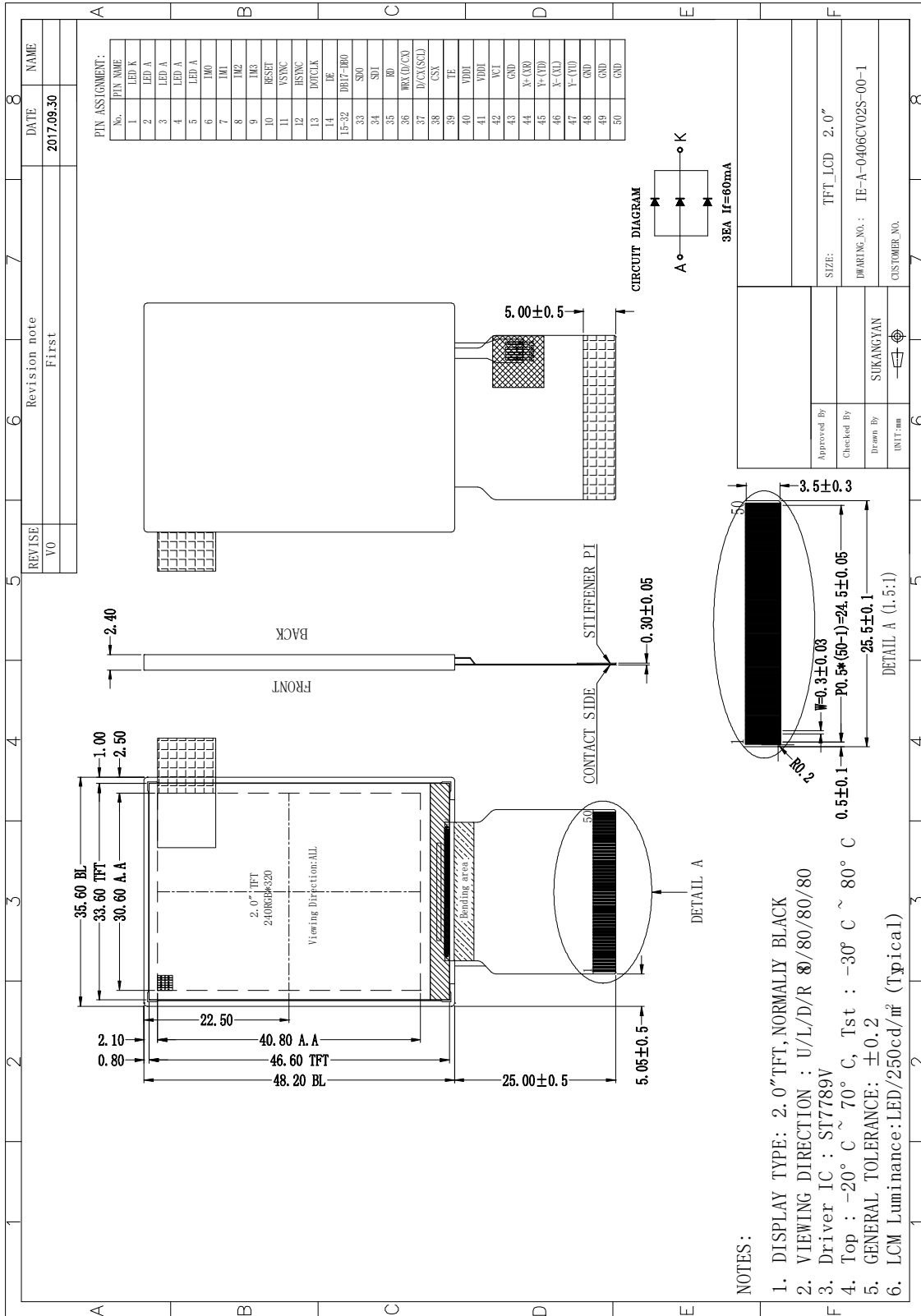| Date	Rev.No.	Page	Revision Items	Prepared
2017-10-31	**V0**		**The first release**	

3. General Specifications

IE-A-0406CV02S-00-1 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a backlight unit. The 2.2'' display area contains 240 x 320pixels and can display up to 262K colors. This product accords with RoHS environmental criterion.

Item	Contents	Unit	Note
LCD Type	TFT	-	
Display color	262K		
Viewing Direction	Free	O'Clock	
Operating temperature	-20~+70	℃	
Storage temperature	-30~+80	℃	
Module size	Refer to outline drawing	mm	
Active Area(W×H)	30.60X40.80	mm	
Number of Dots	240X320	dots	
Controller	ST7789V	-	
Power Supply Voltage	2.8	V	
Outline Dimensions	Refer to outline drawing	-	
Backlight	3-LEDs (white)	pcs	
Weight	---	g	
Interface	RGB/MCU	-	

Note 1:   Color tune is slightly changed by temperature and driving voltage.

Note 2:   Without FPC and Solder.

4.Outline.Drawing

NOTES:
1. DISPLAY TYPE: 2.0"TFT, NORMALLY BLACK
2. VIEWING DIRECTION : U/L/D/R 80/80/80/80
3. Driver IC : ST7789V
4. Top : -20° C ~ 70° C, Tst : -30° C ~ 80° C
5. GENERAL TOLERANCE: ±0.2
6. LCM Luminance:LED/250cd/㎡ (Typical)

PIN ASSIGNMENT:

No.	PIN NAME
1	LED K
2	LED A
3	LED A
4	LED A
5	LED A
6	IM0
7	IM1
8	IM2
9	IM3
10	RESET
11	VSYNC
12	HSYNC
13	DOTCLK
14	DE
15-32	DB17-DB0
33	SDO
34	SDI
35	RD
36	WRX (D/CX)
37	D/CX(SCL)
38	CSX
39	TE
40	VDDI
41	VDDI
42	VCI
43	GND
44	Y+ (XR)
45	Y+ (YD)
46	Y- (XL)
47	Y- (YU)
48	GND
49	GND
50	GND

CIRCUIT DIAGRAM
3EA If=60mA

SIZE: TFT_LCD 2.0"
DRAWING NO.: IE-A-0406CV02S-00-1
CUSTOMER_NO.:

Approved By
Checked By
Drawn By SUKANGYAN
UNIT:mm

REVISE V0
Revision note First
DATE 2017.09.30
NAME

2.0"TFT
240RGB*320
Viewing Direction:ALL

DETAIL A
DETAIL A (1.5:1)

35.60 BL
33.60 TFT
30.60 A.A
22.50
2.10
0.80
40.80 A.A
46.60 TFT
48.20 BL
5.05±0.5
25.00±0.5

2.40
BACK
FRONT
0.30±0.05
STIFFENER PI
CONTACT SIDE
5.00±0.5

3.5±0.3
25.5±0.1
24.5±0.05
P0.5*(50-1)=
W=0.3±0.03
0.5±0.1
R0.2

1.00
2.50

5. Absolute Maximum Ratings(Ta=25℃)

5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VCI	-0.3	4.6	V	1，2
	VDDI	-0.3	4.6		

Notes:

1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.

2. $V_{CI} > V_{SS}$ must be maintained.

3. Please be sure users are grounded when handing LCD Module.

5.2 Environmental Absolute Maximum Ratings.

Item	Storage		Operating		Note
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-30℃	80℃	-20℃	70℃	1,2
Humidity	-	-	-	-	3

1. The response time will become lower when operated at low temperature.

2. Background color changes slightly depending on ambient temperature.

   The phenomenon is reversible.

3. Ta<=40℃:85%RH MAX.

   Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics(Vss=0V ,Ta=25℃)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Power supply		VCI	Ta=25℃	2.4	2.8	3.6	V	
		VDDI		1.65	1.8	3.6		
Input voltage	'H'	V_{IH}	V_{CI}=2.8V	$0.8V_{CI}$	-	V_{CI}	V	
	'L'	V_{IL}	V_{CI}=2.8V	0	-	$0.2V_{CI}$	V	
Current Consumption		I_{CC1}	Normal mode	-	-	-	mA	1
		I_{CC2}	Sleep mode	-	-	-	mA	1

Note:

1: Tested in 1×1 chessboard pattern.

6.2 LED backlight specification(VSS=0V ,Ta=25℃)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage	Vf	If=60mA	-	3.0	-	V	
Uniformity	△Bp	If=60mA	75			%	
Life Time	time	If=60mA		--		hours	1
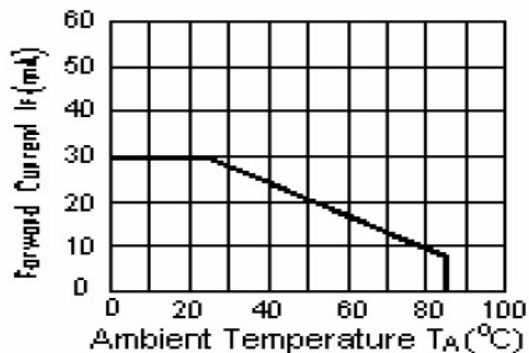
6.3 Interface signals

Pin No.	Symbol	I/O	Function
1	LED-K	P	LED cathode
2-5	LED-A	P	LED anode
6	IM0	I	Select the interface Refer to IC Datasheet
7	IM1	I	Select the interface Refer to IC Datasheet
8	IM2	I	Select the interface Refer to IC Datasheet
9	IM3	I	Select the interface Refer to IC Datasheet
10	RESET	I	Reset signal
11	VSYNC	I	Frame signal for interface operation
12	HSYNC	I	Line signal for interface operation
13	DOTCLK	I	Dot clock signal
14	DE	I	Data enable signal
15-32	DB17-DB0	I	Data input
33	SDO	O	Serial output signal
34	SDI	I	Serial input signal
35	RD	I	Read signal
36	WRX(D/CX)	I	Write signalL
37	(D/CX)SCL	I	The serial interface clock
38	CSX	I	Chip select input pin
39	TE	O	Effect output pin to frame writing
40-41	VDDI	p	Digital IO Pad power supply
42	VCI	P	Power Supply for logic
43	GND	P	Ground
44	X+(XR)	O	Touch pin
45	Y+(YD)	O	
46	X-(XL))	O	
47	Y-(YU)	O	
48-50	GND	P	Ground

7. *Optical Characteristics*

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness (with TP)	Bp		θ=0° Φ=0°	-	250	-	Cd/m^2	1
Uniformity	△Bp			75	-	-	%	1,2
Viewing Angle	3:00		Cr≥10	-	80	-	Deg	3
	6:00			-	80	-		
	9:00			-	80	-		
	12:00			-	80	-		
Contrast Ratio	Cr		θ=0° Φ=0°	640	800		-	4
Response Time	T$_r$+T$_f$			-	30	40	ms / ms	5
Color of CIE Coordinate	W	x	θ=0° Φ=0°	+/-0.02	0.296	+/-0.02	-	1,6
		y			0.325		-	
	R	x			0.647		-	
		y			0.329		-	
	G	x			0.279		-	
		y			0.550		-	
	B	x			0.134		-	
		y			0.123		-	
NTSC Ratio	S			54	60	-	%	

Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 5 measured spots. Measurement equipment BM-7 (Φ5mm)

Measuring condition:
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

Measured value at the center point of LCD panel after more than 5 minutes while backlight
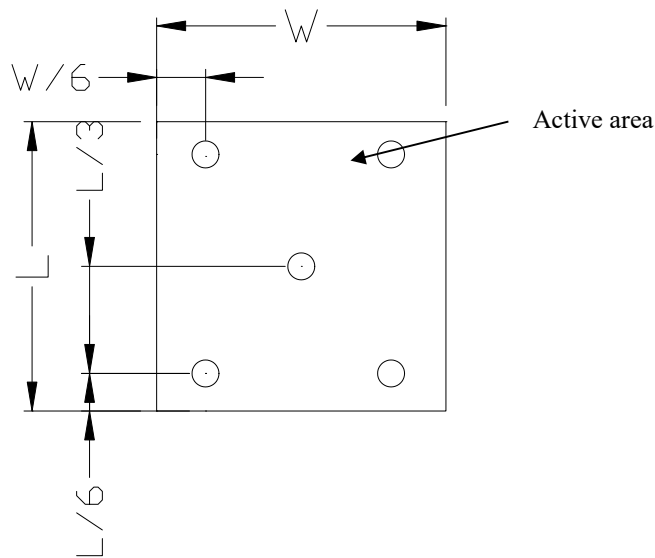
turning on.
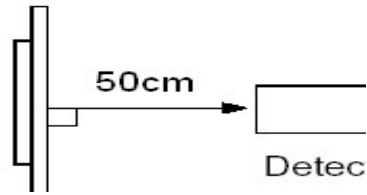
Note 2: The luminance uniformity is calculated by using following formula.

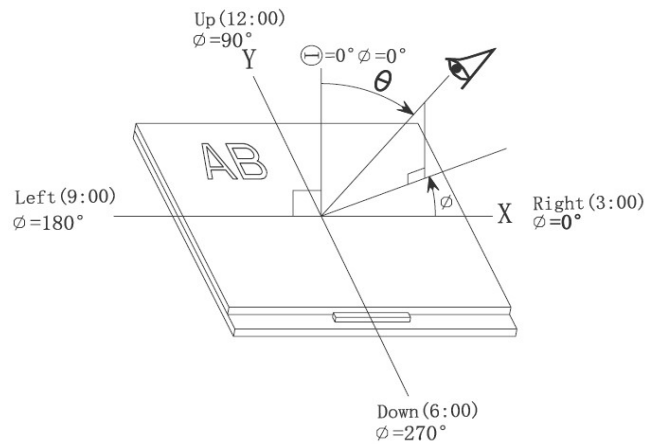$\triangle Bp = Bp\ (Min.) / Bp\ (Max.) \times 100\ (\%)$

$Bp\ (Max.) = $ *Maximum brightness in 5 measured spots*

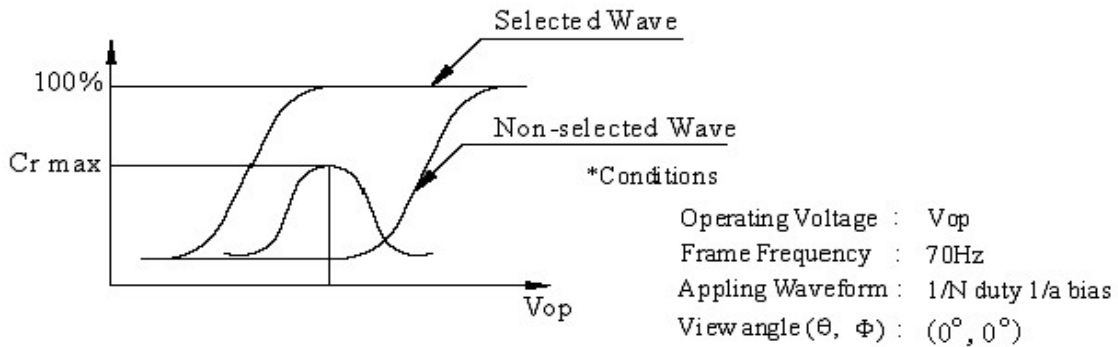$Bp\ (Min.) = $ *Minimum brightness in 5measured spots.*

Active area

Note 3: The definition of viewing angle:

*Refer to the graph below marked by ϑ and Φ*

Note 4: Definition of contrast ratio.(Test LCD using DMS501)

$$Contrast\ ratio(Cr) = \frac{Brightness\ of\ selected\ dots}{Brightness\ of\ non-selected\ dots}$$

Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.
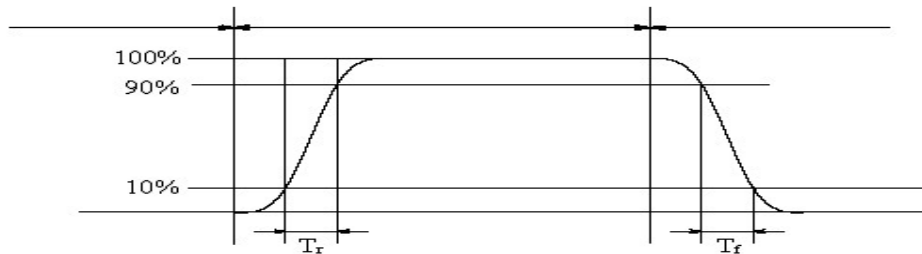
The definition of response time

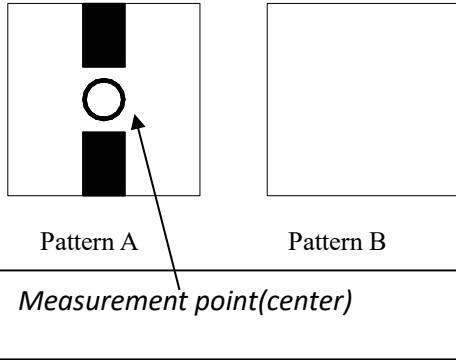*Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.*
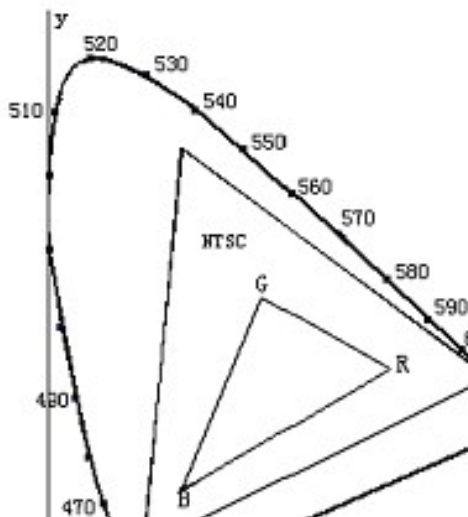
Color gamut:

$$S = \frac{area\ of\ RGB\ triangle}{area\ of\ NTSC\ triangle} \times 100\%$$

Note 7: Definition of cross talk.

*Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100*

Pattern A   Pattern B

Measurement point(center)

Electric volume value=3F+/-3Hex

8. Reliability Test Items and Criteria

No	Test Item	Test condition	Criterion
1	High Temperature Storage	80℃±2℃ 96H Restore 2H at 25℃ Power off	1. After testing, cosmetic and electrical defects should not happen. 2. Total current consumption should not be more than twice of initial value.
2	Low Temperature Storage	-30℃±2℃ 96H Restore 2H at 25℃ Power off	
3	High Temperature Operation	70℃±2℃ 96H Restore 2H at 25℃ Power on	
4	Low Temperature Operation	-20℃±2℃ 96H Restore 4H at 25℃ Power on	
5	High Temperature/Humidity Operation	60℃±2℃ 90%RH 96H Power on	
6	Temperature Cycle	–30℃ ←————→ 80℃ 30min 5min 30min after 5 cycle, Restore 2H at 25℃ Power off	
7	Vibration Test	10Hz~150Hz, 100m/s^2, 120min	Not allowed cosmetic and electrical defects.
8	Shock Test	Half- sine wave,300m/s^2,11ms	

Note: Operation: Supply 2.8V for logic system.

The inspection terms after reliability test, as below

ITEM	Inspection
Contrast	CR>50%
IDD	IDD<200%
Brightness	Brightness>60%
Color Tone	Color Tone+/-0,05

9. *Precautions for Use of LCD Modules*

9.1 Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

> *— Isopropyl alcohol — Ethyl alcohol*

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water — Ketone — Aromatic solvents

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

> *a. Be sure to ground the body when handling the LCD Modules.*
>
> *b. Tools required for assembly, such as soldering irons, must be properly ground.*
>
> *c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.*
>
> *d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.*

9.2 Storage precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature :   0℃ ～ 40℃

Relatively humidity: ≤80%

9.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

9.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

END