

湖南飞优特科技有限公司

SPECIFICATION FOR LCD MODULE

Customer : _____
Product Model: FUT0144QQ13H-LCM-A0
Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

<input type="checkbox"/> LCM Machinery OK Checked By _____	<input type="checkbox"/> LCM OK
<input type="checkbox"/> LCM Display OK Checked By _____	<input type="checkbox"/> 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.

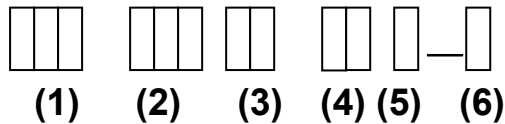
Revision History

Version	Contents	Date	Note
A	Original	2021-05-27	

Contents

No.	Item	Page
1	Numbering System	4
2	Scope	5
3	Normative Reference	5
4	Definitions	5~6
5	Technology Specifications	7~13
6	Reliability Test	14
7	Handling Precautions	15~16
8	Precaution for use	16
9	Package Drawing	17
10	Outline Dimension	18
11	BOM	19

1. Numbering System



No	Definition	Specifications
(1)	TFT LCM Productor No.	FUT ---- 飞优特电子科技有限公司, TFT 产品
(2)	Display monitor opposite angle line size	Unit : inch
(3)	Product Resolution	... QQ: QQVGA 128*160 QC: QCIF 186*220 QV: QVGA 240*320, HV: HVGA320*480, WV:WVGA 480*800, QH:QHD 540*960 HD:720*1280, FHD1080*1920 ...
(4)	Product Development Series No.	By two figures characters expression from 01 to 99
(5)	LCD Type	A----AUO ; M----CMI ; C----CPT; B----BOE; G----LG; S---CTC; H----HSD; T----Tianma; Y----Hydis; I----INNOLUX; L---- IVO; D---Laibao;
(6)	Product Development edition No.	By The English litters : A~ Z

2. Scope

This specification applies to the TFT LCD module which is designed and manufactured by LCM Factory of HuNan FUT Technology Co. Ltd.

3. Normative Reference

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

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

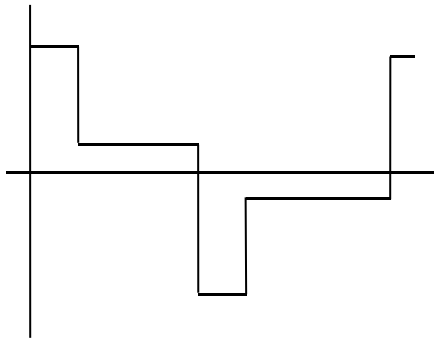
GB/T2423 《Basic Testing Procedures for Electric and Electronic Products》

IEC61747-1 《SIXTH PART GB2828`2829-87 《National Standard of PRC》

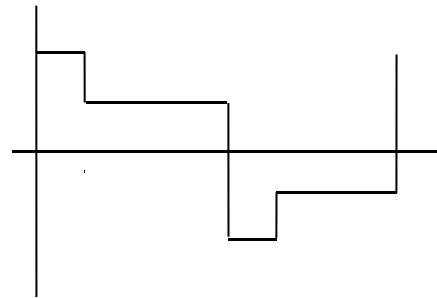
4. Definitions

4.1 Definitions of Vop

The definitions of threshold voltage V_{th1} , V_{th2} the following typical waveforms are applied on liquid crystal by the method of equalized voltage for each duty and bias.



【 selected waveform 】



【 non-selected waveform 】

① V_{th1} : The voltage which the brightness of segment indicates 50% of saturated value on the conditions of selected waveform

($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

② V_{th2} : The voltage which the brightness of segment indicates 50% of saturated value on the conditions of non-selected waveform

($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

③ V_{op} : $(V_{th1}(50\%)+V_{th2}(50\%))/2$ ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

4.2 Definition of Response Time T_r , T_d

① T_r : The time required which the brightness of segment becomes 10% from 100% when waveform is switched to selected one from non-selected one. ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

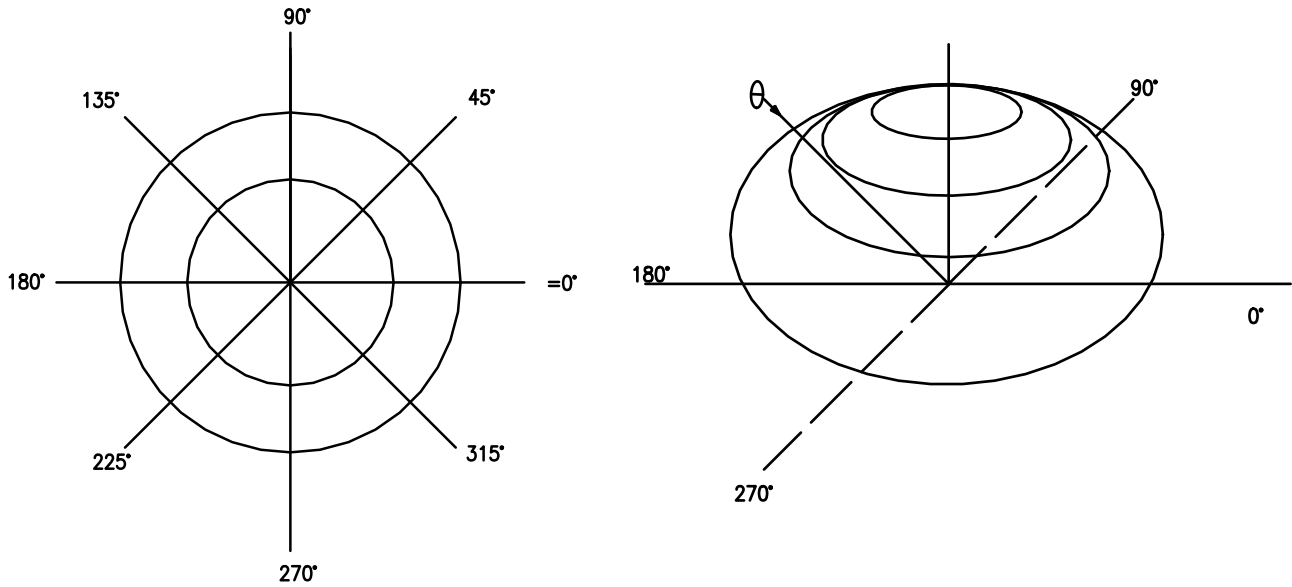
② T_d : The time required which the brightness of segment becomes 90% from 10% when waveform is switched to selected one from selected one. ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

4.3 Definition of Contrast Ratio Cr

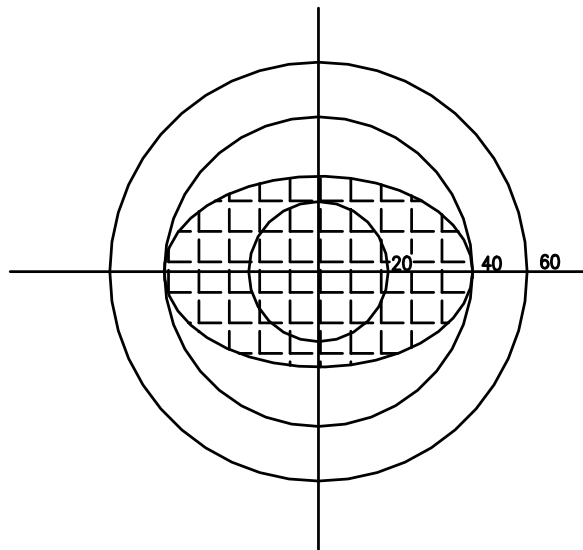
$$Cr=A/B$$

- 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

FUT0144QQ13H-LCM-A0 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 1.44" display area contains 128(RGB) x128 pixels and can display up to 262K colors. This product accords with ROHS environmental criterion.

5.2 General Specifications

No.	Item	Specification
1	LCD size	1.44 inch
2	Resolution	128 (RGB)X128
3	Display mode	Normally white
4	Pixel pitch	0.1992 (H) x 0.207 (V)
5	Active area	25.4976 (H) x 26.496 (V)
6	Module size	31(W)*36(H)*2.75(T)
7	Pixel arrangement	RGB-stripe
8	Interface	SPI

5.3 Interface Pin Connection

Pin No.	Symbol	Function
1	IOVCC	Power Supply for I/O system.
2	VCC	Power Supply for Analog, Digital System and Booster Circuit.
3	SDA	serial data input/output bi-direction pin
4	RS	data/ command selection
5	CS	Chip select input signal
6	SCL	Serial Clock
7	NC	NC
8	RESET	Reset input signal
9	LED+	Power Supply For LED Backlight Anode Input.
10	LED-	Pwer Supply For LED Backlight Cathode Input.
11	VSS	Ground
12	VSS	Ground

5.4 DC Characteristics

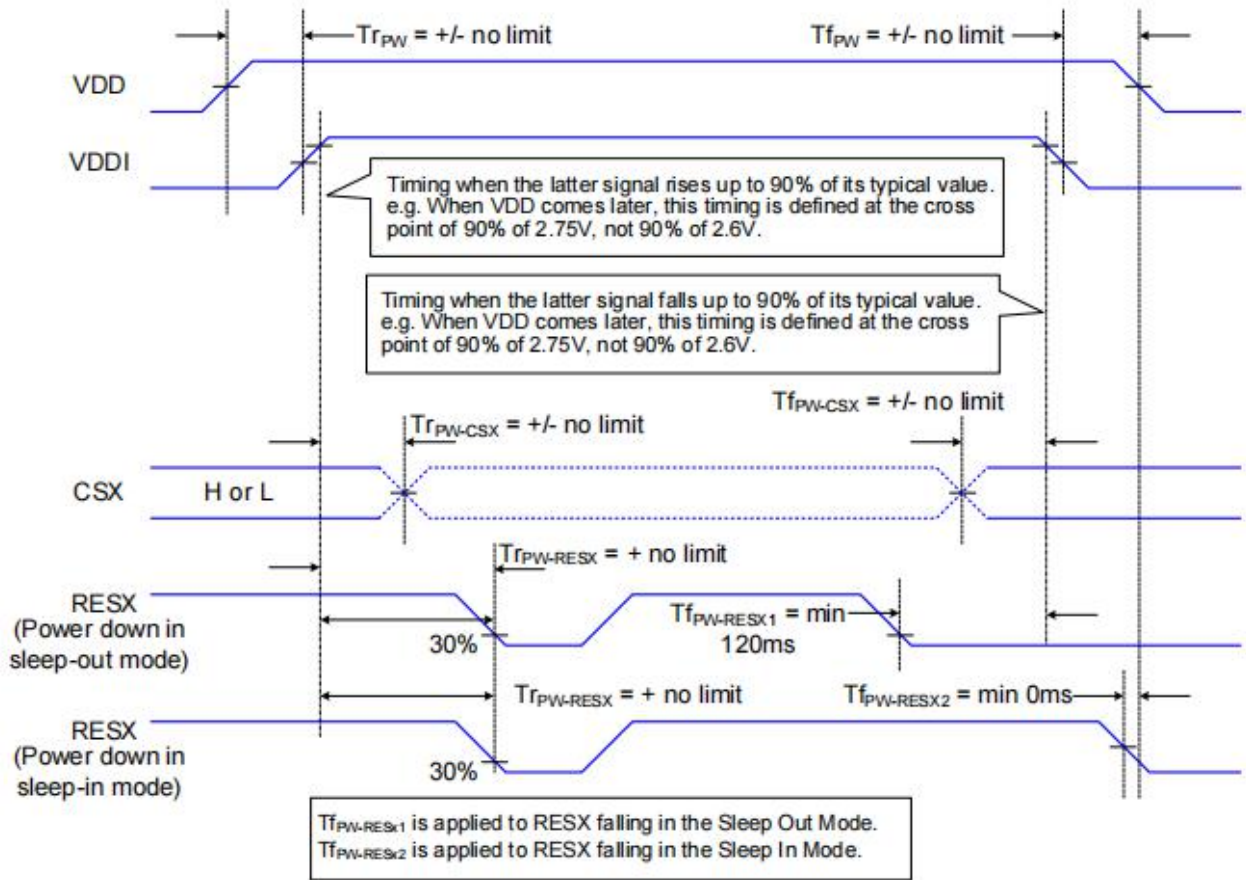
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Analog Supply Voltage	V _{DD}	2.5	2.75	4.8	V	-
Input High Voltage	V _{IH}	0.7IOV	-	IOV	V	Digital input pins
Input Low Voltage	V _{IL}	GND	-	0.3IOV	mA	Digital input pins
Output High Voltage	V _{oH}	0.8IOV	-	IOV	mA	Digital input pins
Output Low Voltage	V _{oL}	GND	-	0.2IOV	W	Digital input pins
(Panel+LSI) Power Consumption	Black Mode	-	0.9	-	mA	VDD=2.75V
	Sleeping Mode	-	15	-	uA	VDD=2.75V

5.5 LED Back Light Specification (1 White Chips)

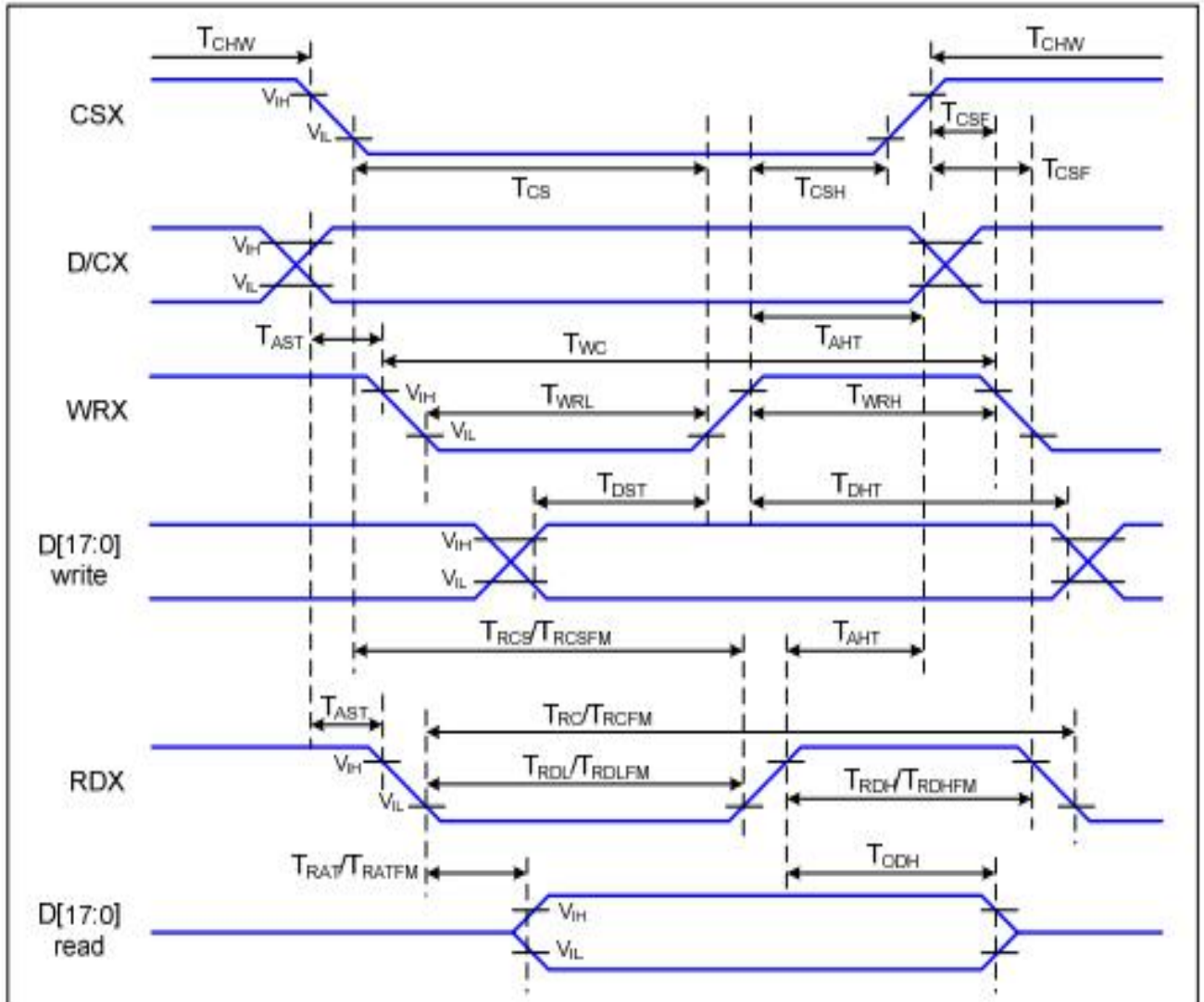
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V _f	I _f =20mA	3.0	3.2	3.4	V
Uniformity (with L/G)	Δ B _p	I _f =20mA	75	80	-	%
Luminance for LCM	/	I _f =20mA	TBD	-	-	cd/m ²
Backlight Power Consumption	WBL	I _f =20mA	-	64	-	mW
Backlight Color	black					

5.6 Power Sequence

The power on/off sequence is illustrated below



5.8 Timing Characteristics



5.9 Optical specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Transmittance (without Polarizer)		T(%)	—	—	17.5	—	—
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle —	400	500	—	—
Response time	Rising	T_R	—	—	4	8	msec
	Falling	T_F	—	—	12	24	
Color gamut		S(%)			53		%
Color chromaticity (CIE1931)	White	W_x		0.273	0.293	0.313	
		W_y		0.305	0.325	0.345	
	Red	R_x		0.616	0.636	0.656	
		R_y		0.308	0.328	0.348	
	Green	G_x		0.263	0.283	0.303	
		G_y		0.511	0.531	0.551	
	Blue	B_x		0.115	0.135	0.155	
		B_y		0.114	0.134	0.154	
Viewing angle	Hor.	Θ_L	CR> 10	60	70	—	
		Θ_R		60	70	—	
	Ver.	Θ_U		60	70	—	
		Θ_D		50	60	—	
Optima View Direction		12 O'clock					

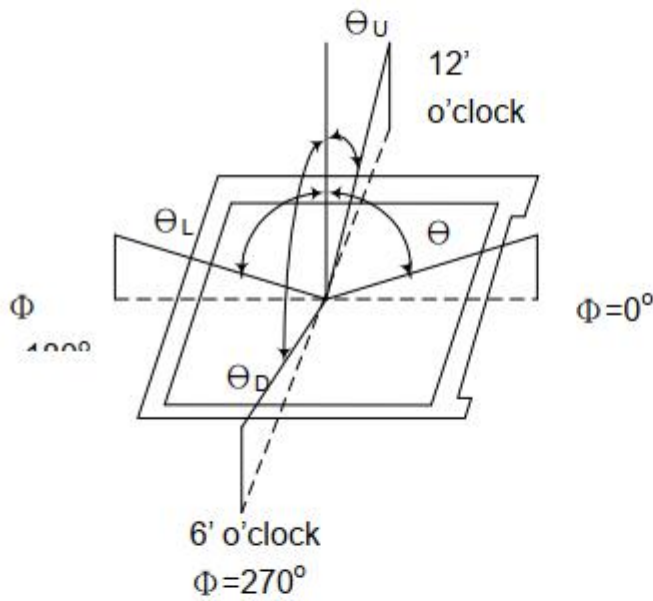
Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

Note (1) Definition of Viewing Angle:



Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

6. Reliability Test Conditions And Methods

Item	Test Conditions	Remark
High Temperature Storage	Ta = 80°C 120hrs	
Low Temperature Storage	Ta = -30°C 120hrs	
High Temperature Operation	Ts = 70°C 120hrs	
Low Temperature Operation	Ta = -20°C 120hrs	
Operate at High Temperature and Humidity	60°C, 90%RH max. 120hrs	Operation
Thermal Shock	-20°C ~ +70°C 10 cycles 1Hrs/cycle	Non-operation
Vibration Test	Frequency: 10Hz~55Hz~10 Amplitude: 1.5mm X,Y,Z direction for total 3ho (Packing Condition)	
Drooping Tes	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
Electrostatic Discharge	Contact=±4KV, class B Air=±8KV, class B	

7. Handling Precautions

7.1 Mounting method

The LCD panel of FUT LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is 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) , Sulfur (S)

If goods were sent without being silicon 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), Sulfur (S) from customer, Responsibility is on customer.

7.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to V_{dd} or V_{ss}, 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 employs 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 directly 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 than the limit causes 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 than the operating temperature range and on the other hand at higher temperature LCD's show 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

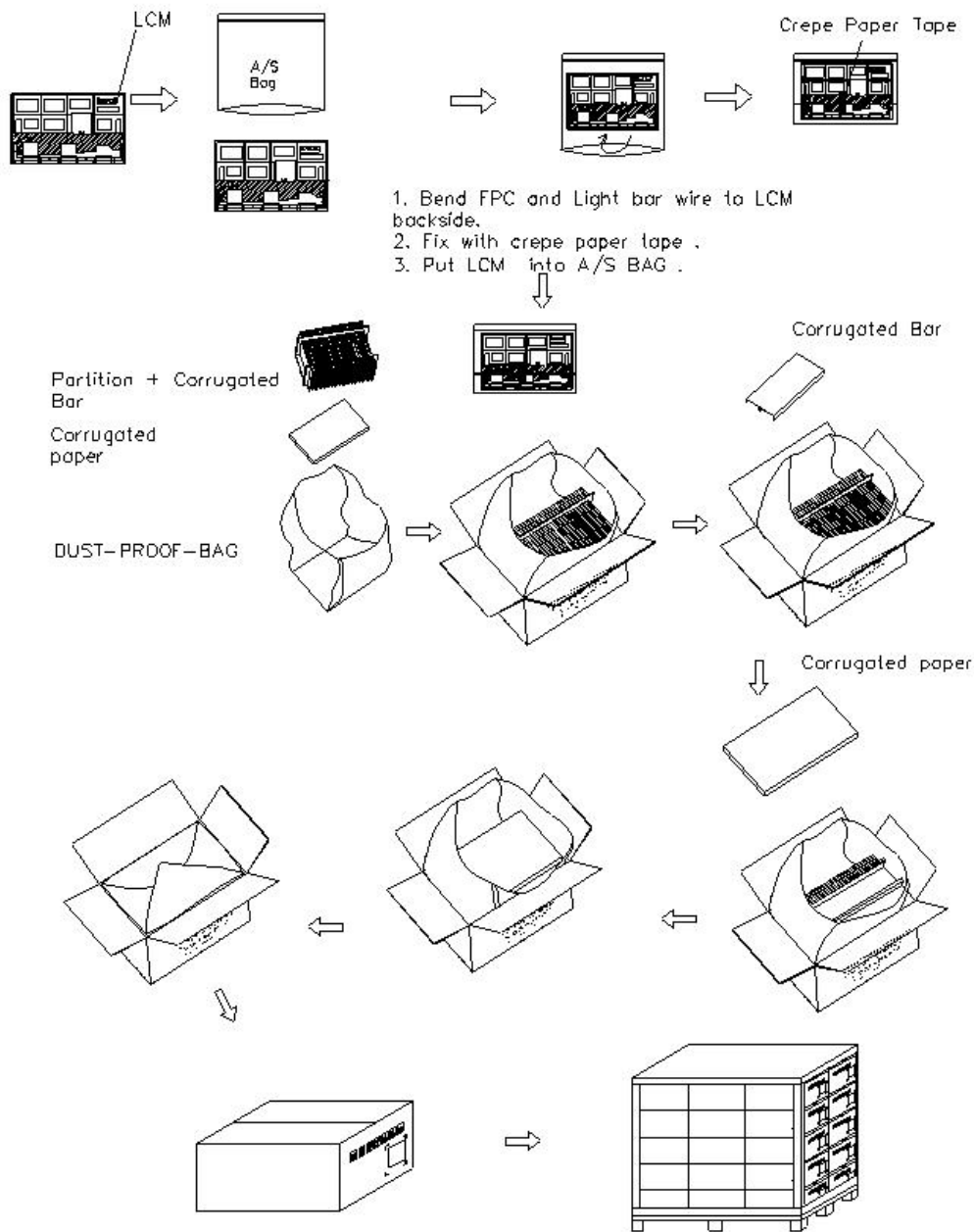
A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

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 FUT , 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



10. Outline Dimension

Customer Approve By		REV A0	DESCRIPTION 1' ST DESIGN	MODIFY BY WD	DATE 2021-05-26

NO.	SYMBOL
01	IOVCC
02	VCC
03	SDA
04	RSX
05	CSX
06	SCL
07	NC
08	RESET
09	LED+
10	LED-
11	VSS
12	VSS

FPC弯折示意图

FPC展开示意图
展开出货

BL CIRCUIT DIAGRAM

Note: RoHS

1. Display Module: 1.44" TFT/TN
 2. Driving Condition: VDD=2.8V
 3. Viewing Direction: 6H
 4. Operating Temp: -20~+70°C
 5. LCD: HSD014B4NI-A00
 6. IC: ST7735S
 7. Backlight: WHITE LED*1
 8. Unspecified tolerance is ±0.20mm
 9. ROHS Request

(LEDA=3.2V,ILED=20mA)

ITEM	Symbol	Condition	Min	Typ	Max
color	White	Vx	0.273	0.293	0.313
		Vy	0.305	0.325	0.345
	Red	Rx	0.616	0.636	0.656
		Ry	0.305	0.328	0.348
Chromaticity	Green	Gx	0.263	0.283	0.303
	Blue	Gy	0.511	0.531	0.551
viewing angle	Hor	Bx	0.115	0.135	0.155
		by	0.114	0.134	0.154
	Ver	L	60	70	-
		R	60	70	-
contrast Ratio	U	60	70	-	
	D	50	70	-	
Luminance	CR	400	500	-	
	Lv	100cd/m ²	-	-	

	湖南飞优特电子科技有限公司 Human Future Electronics Technology Co., Ltd.	C/D UNIT: MM SIZE: A4 SHEET: 1 OF 1
DRAWN BY :	CHECKED BY :	APPROVED BY :

LCM NO. : FUT0144QQ13H DWG NO. : FUT0144QQ13H-LCM-A0

11.BOM 物料清单

编号	名称	厂家	型号	数量 (PCS)
1	LCD	HSD	HSD014B4N1-A	1
2	IC	矽创	ST7735SV-G6	1
3	偏光片/上下片	日东	27.3*28.64*0.13 上砂下光	1
4	FPC	软讯光电	FUT0144QQ01H-FPC-A0	1
5	背光	HB	HB-BL144A01-21	1
6	LED	谷麦	Q9I35	1
7	反射膜	长阳	DJX-100	1
8	扩散膜	大容	DR50	1
9	上增光	康得新	KBBP-065N	1
10	黑黑胶	科盛	KS803	1
11	背面黑双面胶	科盛	KS803	1
12	正面黑色单面胶	科盛	KS703	1