SPECIFICATION
OF
LCD MODULE
MODULE NO.： SF-TC240H-8952B-CT

Customer Approval:

☐ **Accept** ☐ **Reject**

SAEF TECHNOLOGY LIMITED	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

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DOCUMENT REVISION HISTORY

Sample Version	Doc. Version	DATE	DESCRIPTION	CHECKED BY
01	A	2023-05-25	First Release.	

CONTENTS

1. GENERAL DESCRIPTION:

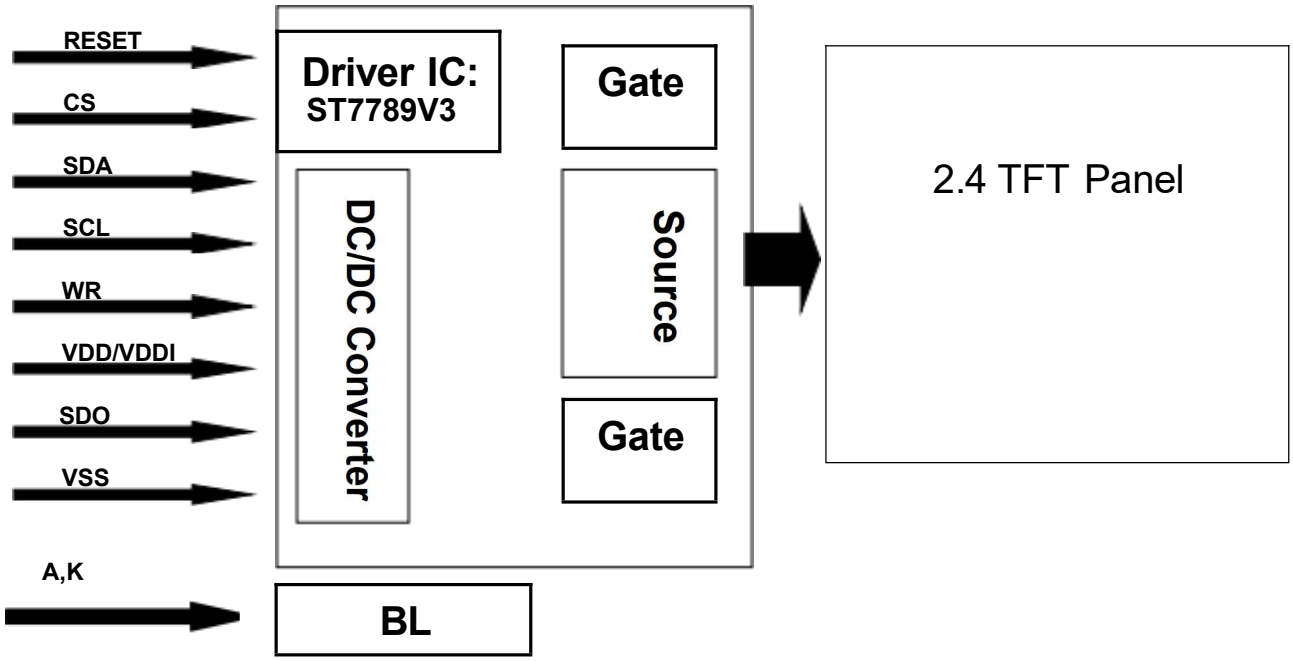
Display & LCD Type: 240*320,TFT-Panel
Viewing Direction: 12 o'clock
Backlight Type: White LED

2. MECHANICAL SPECIFICATIONS:

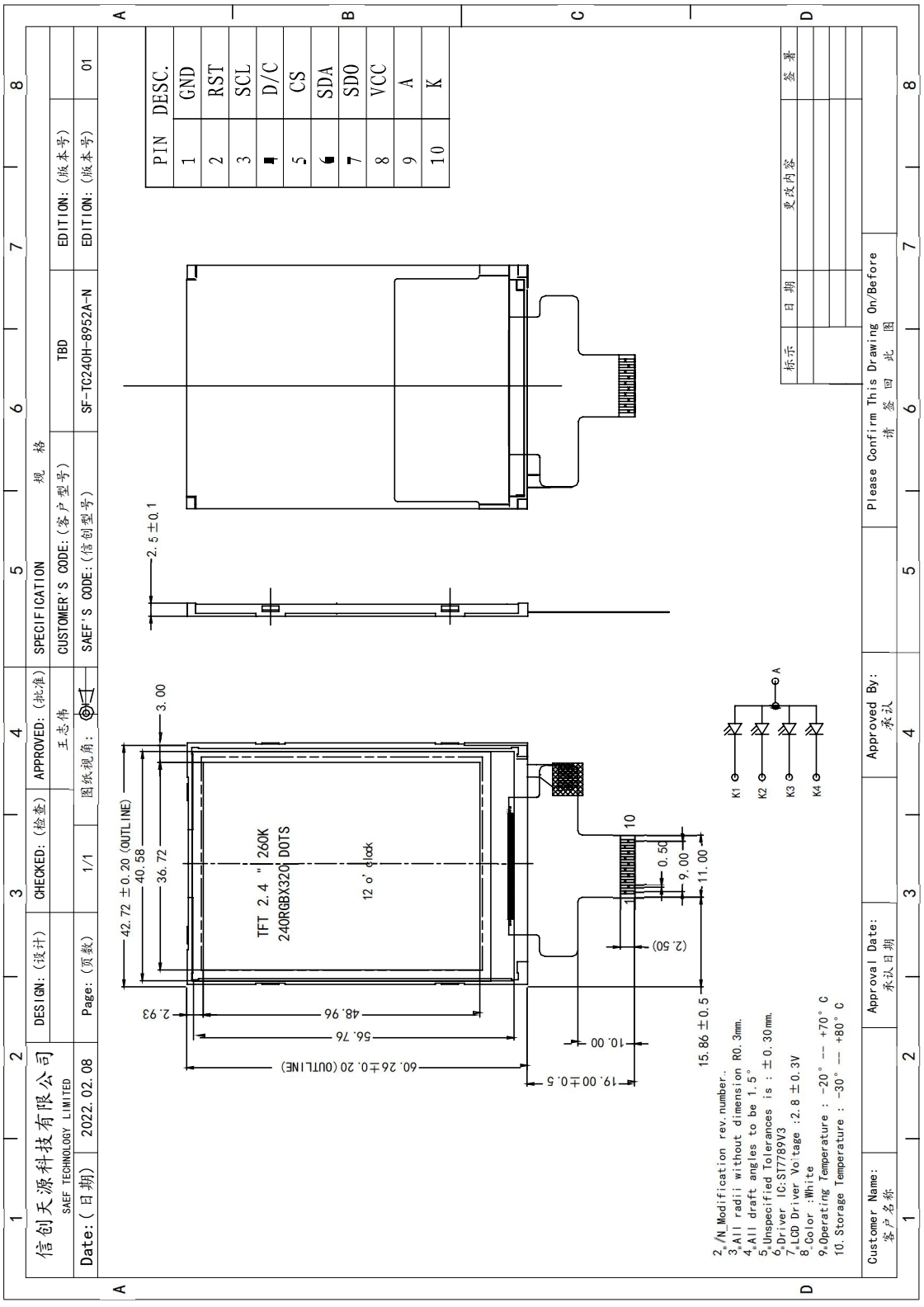
ITEM	SPECIFICATION	UNIT
DISPLAY SIZE	2.4	inch
OUTLINE DIMEMSIONS LCD	46.72*65.16*3.5 mm	mm
DRIVER IC	ST7789V3	-
INTERFACE TYPE	4SPI	-
CTP IC	CST8922	

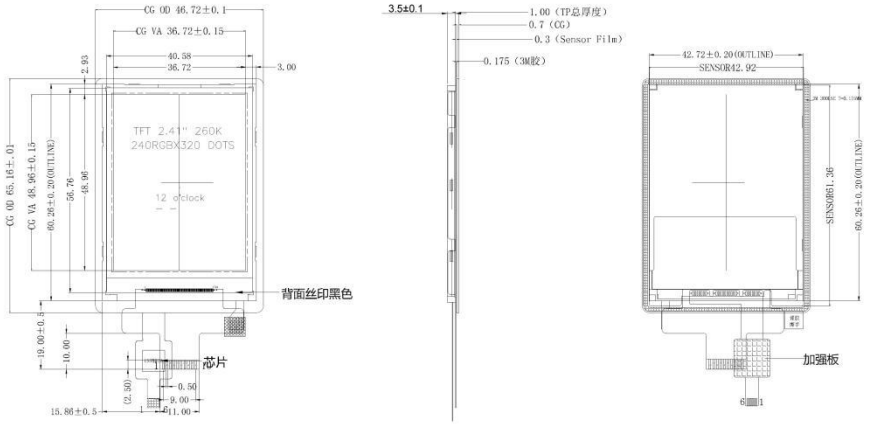
***See attached drawing for details.**

3.BLOCK DIAGRAM:



4.DIMENSIONAL OUTLINE:





技术参数：
1. Cover Lens+SENSOR+FPC
--COVER LENS Glass:0.70mm(旭硝子)
ITO SENSOR FILM:0.28mm
引　线:FPC
总厚度：0.98±0.10mm
IC：CST8922
2. 工作电压：2.8V-3.3 V
3. 透光率：≥82%
4. 表面硬度：6H
5. 工作环境：-20℃~+70℃，≤90%RH
6. 储存环境：-30℃~+80℃，≤90%RH
7. 尺寸未注公差:±0.10,
8. 未注明倒角±0.15

GFF

COVER GLASS (0.70mm)
OCA (0.125mm)
ITO Film(0.05mm)
OCA (0.05mm)
Bottom Film(0.05mm)

TP接口定义

PIN#	ASSIGNMENT
1	SDA
2	SCL
3	INT
4	RST
5	VCC
6	GND

20230525更新

图样标记 重　量比
共3页　第3页

5. PIN DESCRIPTION:

NO.	PIN NAME	I/O	Description
1	GND	I	System Ground
2	RST	I	LCM Reset input signal
3	SCL	I	This pin is used to be serial interface clock.
4	D/C	I	Display data/command selection pin in 4-line serial interface.
5	CS	I	-Chip selection pin
6	SDA	I	SPI interface input pin.
7	SDO	I	SPI interface output pin.
8	VCC	I	Power Supply 2.8V Voltage
9	A	O	LED Anode
10	K	O	LED Cathode

Note:

6. MAXIMUM ABSOLTE LIMIT:

Item	Symbol	Value	Unit
Power supply voltage for logic	V_{DD}	1.6~3.3	V
Input voltage	Vin	V_{DD}+0.3	V
Operating temperature	Topr	-20 to 70	。C
Storage temperature	Tstg	-30 to 80	。C

Note: Note1: Absolute maximum rating is the limit value beyond which the IC maybe broken. They do not assure operations.

Note2: Background color changes slightly depending on ambient temperature. This Phenomenon is reversible.

Ta≦70℃: 75%RH max

Ta>70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃

Note3: Ta at -30℃ will be <240hrs, at 80 ℃ will be <240hrs

7.ELECTRICAL CHARACTERISTICS

7-1 DC Characteristics (V_{DD}=2.8V,Ta=25。C)

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	2.6	2.8	3.3	V	-
Supply current	I_{DD}	-	12	15	mA	V_{DD}=2.8V,Ta=25。C
Input voltage	V_{IH}	0.8VDD	-	VDD	V	-
	V_{IL}	0	-	0.2VDD	V	
Input leakage current	I_{IL}	-1.0	-	1.0	μA	V_{IN}=V_{DD} or V_{SS}

Note: Voltage greater than above may damage the module.

All voltages are specified relative to V_{SS}=0V.

7-2 Backlight Electrical-optical Characteristics

1. Stander Lamp Styles (Edge Lighting Type):

The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:

2. The Main Advantages of the LED Backlight are as following:

2. 1 The brightness of the backlight can simply be adjusted by a resistor or a potentiometer.

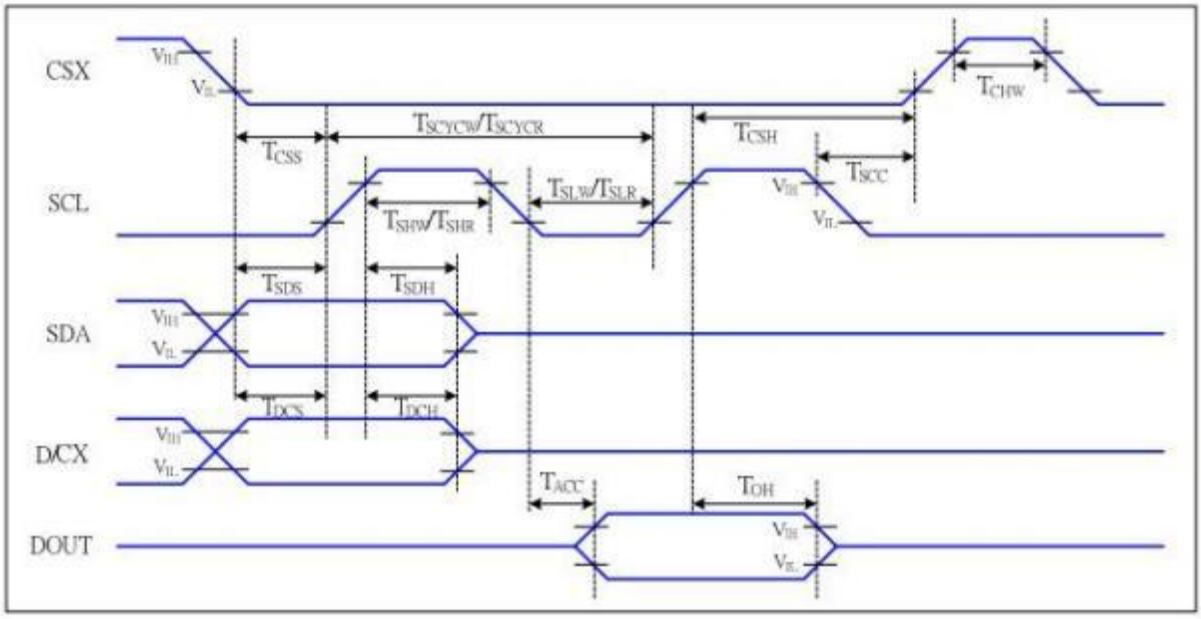
3. Data About LED Backlight:LED lifetime is at least 52.560 hours @ 50% brightness

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	-	**3.2**	-	V	If=80MA	-
Supply Current	If	-	**80**		mA	-	-
Reverse Voltage	Vr	-	-	5	V	-	
Power dissipation	Pd	-	256	-	mW	-	
Luminous Intensity for LCM	-	-	300	-	Cd/m^2	If=80MA	Without CTP
Uniformity for LCM	-	80	-	-	%	If=80MA	-
Backlight Color	White						

NOTE:

8. AC CHARACTERISTICS (V_{DD}=2.8V, TA=25。C)

8.1. Interface：System Bus Read/Write Characteristics.



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

9. OPTICAL CHARACTERISTICS:

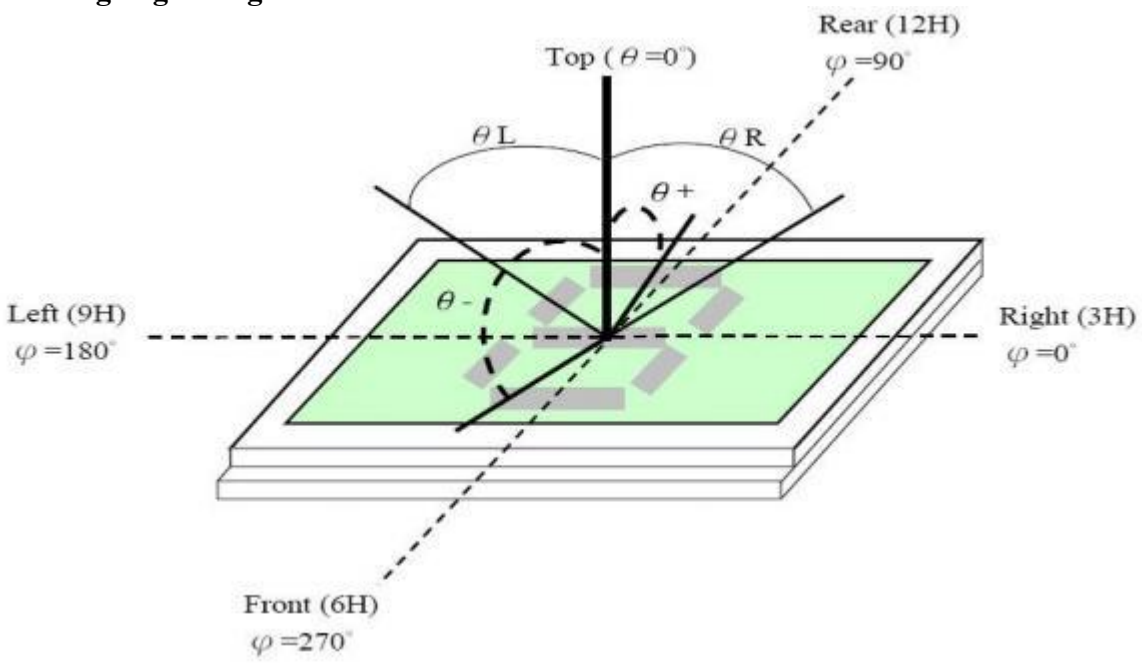
No.	ITEM		Symbol	Conditions	Specification			Unit	Note
					Min	Typ	Max		
1	Response Time		Tr+Tf	25℃	-	6	12	Ms	(1)(2)
2	Contrast Rate		Cr	θ=0, Normal viewing angle	400	500	-	-	(1)(3)
3	Viewing Angle	Hor.	θR	CR>10		45	-	Deg	-
			θL			45	-		
		Ver.	Θ+		-	45	-		
			Θ-		-	30	-		

Measure Conditions:

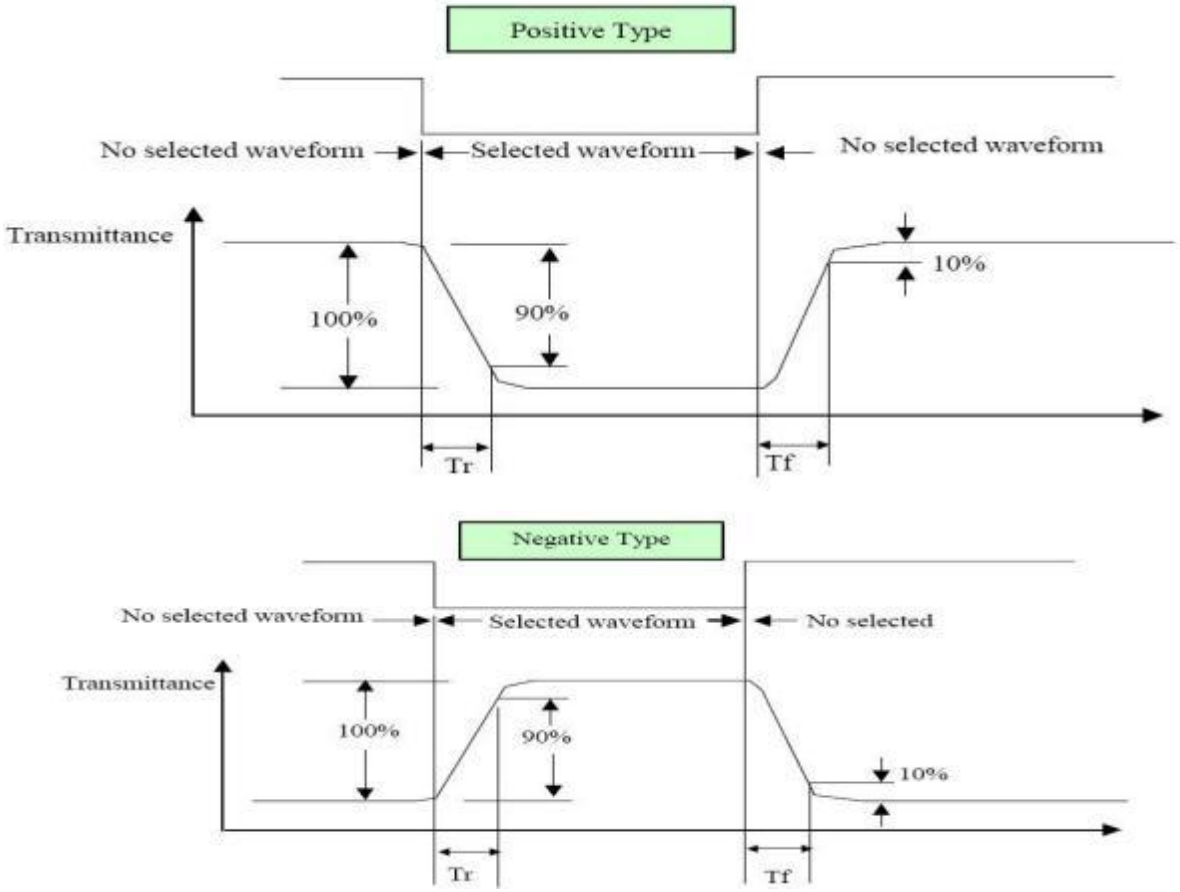
1. Measure surrounding：dark room;
2. Ambient temperature: 25±2℃;
3. 30min.warm-up time.
4. POL:Sumitomo No：SRNS4IAPNSLD6

Note Definition:

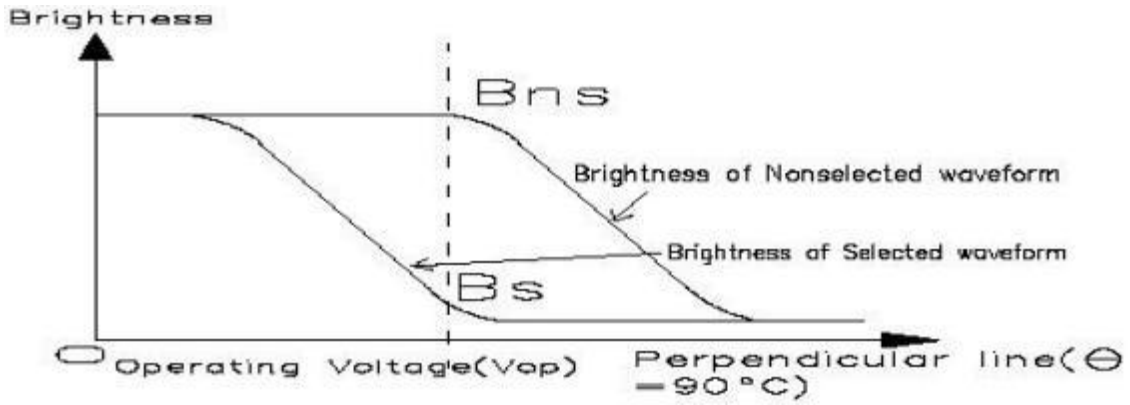
Note(1)Viewing angle range:



Note(2)Response Time:

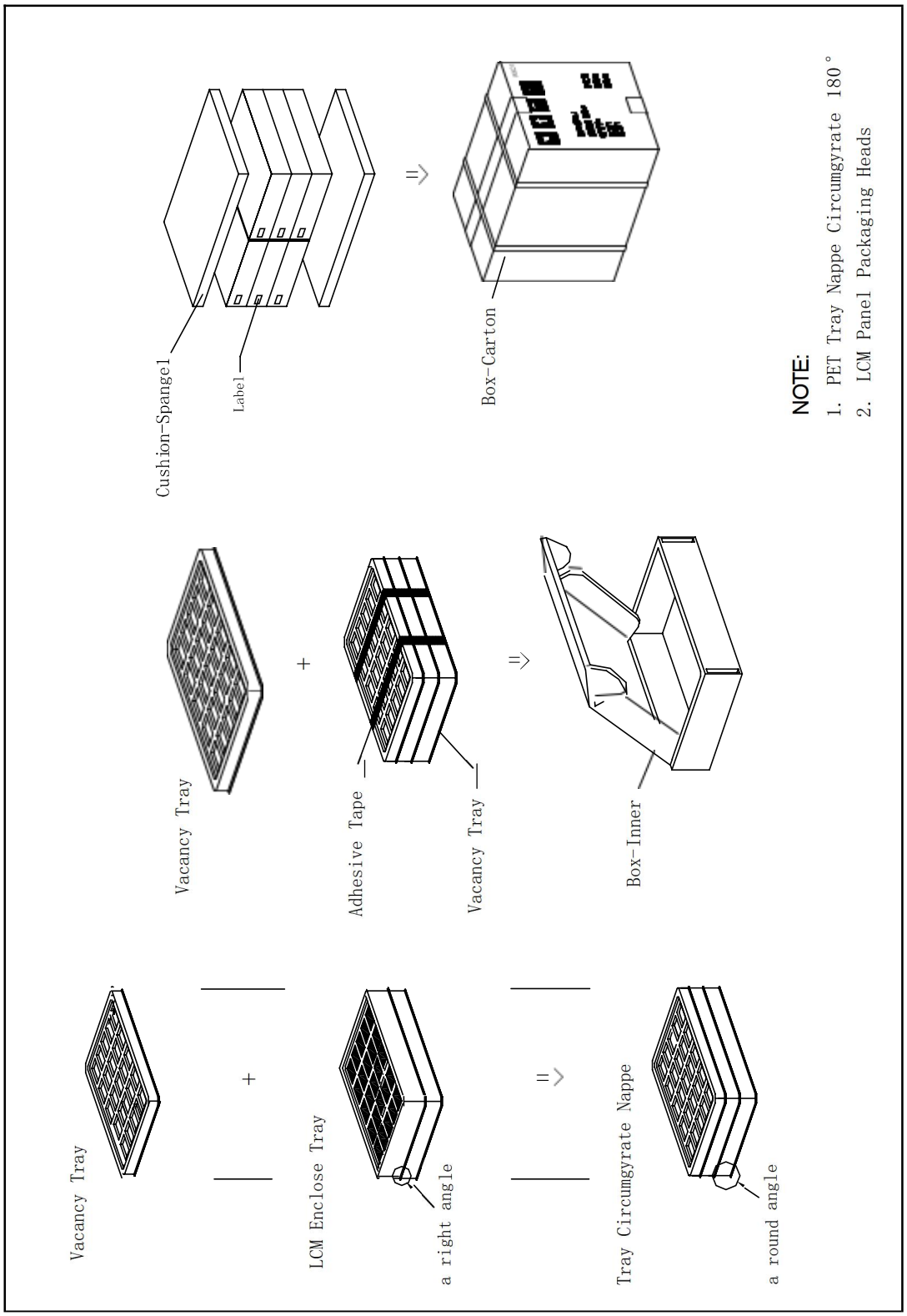


Note(3)Contrast Ratio Definition:



$$\text{Contrast Ratio (Cr)} = \frac{\text{Luminance with all pixel white}}{\text{Luminance with all pixel black}}$$

10.PACKAGE.


Cushion-Spangel
Label
Box-Carton
NOTE:
1. PET Tray Nappe Circumgyrate 180°
2. LCM Panel Packaging Heads
Vacancy Tray
Adhesive Tape
Vacancy Tray
Box-Inner
Vacancy Tray
LCM Enclose Tray
a right angle
Tray Circumgyrate Nappe
a round angle

11. STANDARD SPECIFICATION FOR RELIABILITY:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80。C	240	No abnormalities in functions and appearance
High temp. Operating	70。C	240	
Low temp. Storage	-30。C	240	
Low temp. Operating	-20。C	240	
Humidity	60。C/ 90%RH	240	
Thermal Shock Temp. Cycle	-20。C ⟷ 70。C (1hour ← 5 min → 1 hour)	10cycles	

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 52560 hours under ordinary operating and storage conditions room temperature (25±10℃), normal humidity (45±20% RH), and in area not exposed to direct sun light. (Life time of backlight, please refer to Data about backlight.)

Testing Conditions and Inspection Criteria:

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in up Table, Standard specifications for Reliability have been executed in order to ensure stability.

Item	Test Model	In section Criteria
Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
Appearance	Visual inspection	Defect free.

12.SPECIFICATION OF QUALITY ASSURANCE:

12.1 Purpose

This standard for Quality Assurance should affirm the quality of LCD Module products to supply to purchaser by Saef Technology Limited.

12.2 Standard for Quality Test

a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

b. Electro-Optical Characteristics:

According to the individual specification to test the product.

c. Test of Appearance Characteristics:

According to the individual specification to test the product.

d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E.General Inspection Level Ⅱ take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

12-3. Nonconforming Analysis & Deal With Manners

a. Nonconforming Analysis:

(i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.

(ii) After accepting the detail data from purchaser, the analysis of nonconforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before two weeks.

b. Disposition of nonconforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

12-4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides think that it must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

12-5 Standard of The Product Appearance Test

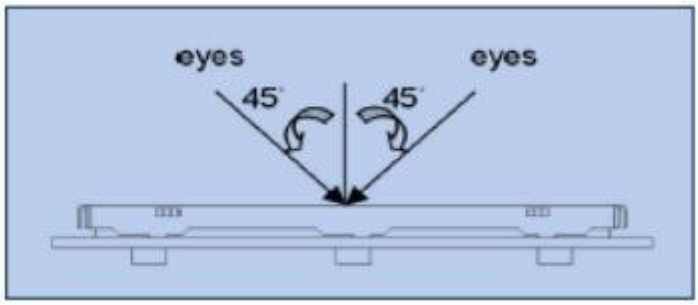
a. Manner of appearance test: This specification should be applied for both light on and off situation.

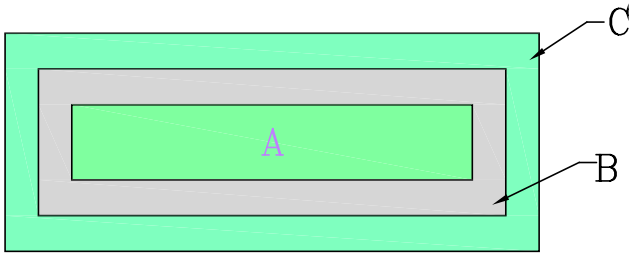
(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must be at 30±5cm.

(ii) When test the model of transmissive product must add the reflective plate.

(iii)The test direction is base on about around 10° of vertical line (Left graph)

(iiii)Temperature: 25±5℃ Humidity: 65±10%RH





(iv) Definition of area (Right graph)

A. Area: Viewing area. B. Area: Out of viewing area.(Outside viewing area)

b. Basic principle:

(i) It will accord to the AQL when the standard can not be described.

(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

(iii) Must add new item on time when it is necessary.

c. Standard of inspection: (Unit: mm)

Allowable limits defined in follow Dot defect Table should be met for each white, black , R, G, B raster. The limits apply to the entire area. Missing white in 60% or more of typical (one color, R or G or B) pixel aperture is defined as a bright defect, less than 60% is acceptable .Black spot in 60% or more of typical pixel aperture is defined as a dark defect, less than 60% is acceptable.

Dot defect table:

Item		White dot defect	Black dot defect	Total
1	Defect counts	2	5	7
2	Combined defect Counts	No combined dot defect allowed. Two Single dot defect that within 5mm during each dot defect should becounted as combined dot defect.		

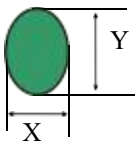
12-6 Inspection specification LCD

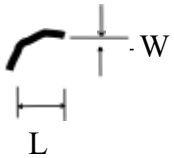
AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling

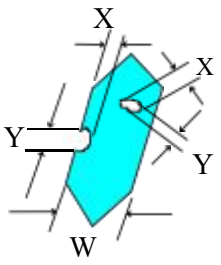
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		Contrast defect (dim, ghost)		
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction	2	
		Wrong Back-light	7	
	Non-display	Flat cable or pin reverse	9	
		Wrong or missing component	10	
Minor	Display state	Background color deviation	2	2.5
		Black spot and dust	3	
		Line defect	4	
		Scratch		
		Rainbow	5	
		Pin hole	6	
	Polarizer	Bubble and foreign material	3	
		Scratch	4	
	PCB,FPC	Scratch	4	
	Soldering	Poor connection	8	
	Wire	Poor connection	9	
	LCD	CHIP OUT	11	

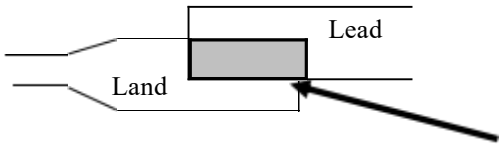
Note on defect classification:

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td rowspan="2">2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust (incl. Polarizer) ex.: dirt under polarizer,
Pinhole of reflector ,glass scratch, dirt under glass,scratch on polarizer
φ = (X+Y)/2</td><td> 

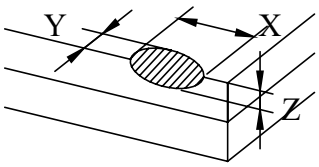
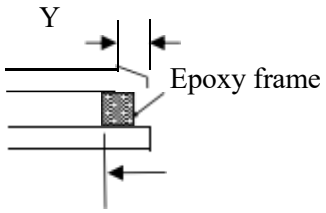
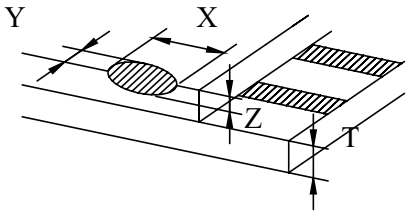
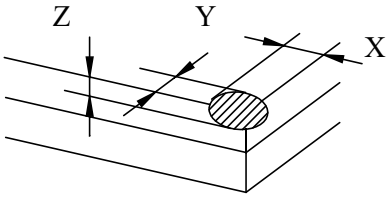
<table>
<tr><td>Point</td><td>Acceptable Qty.</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>φ<0.10</td><td>Disregard</td></tr>
<tr><td>0.10<φ≤0.20</td><td>3</td></tr>
<tr><td>0.20<φ≤0.25</td><td>2</td></tr>
<tr><td>0.25<φ≤0.30</td><td>1</td></tr>
<tr><td>φ>0.30</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect</td><td> 

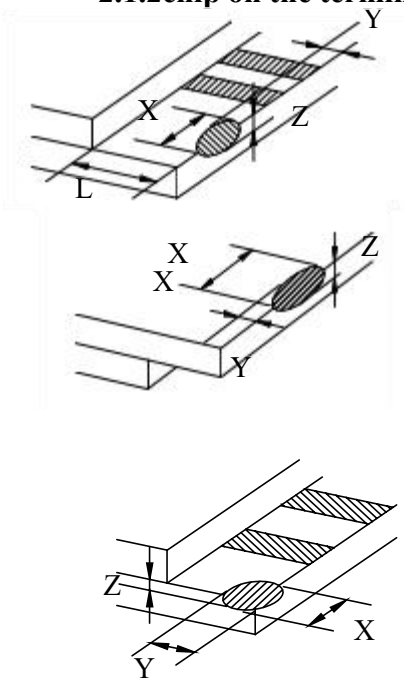
<table>
<tr><td></td><td>Line</td><td>Acceptable Qty.</td></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>0.015≥W</td><td>Disregard</td></tr>
<tr><td>3.0≥L</td><td>0.03≥W</td><td rowspan="2">2</td></tr>
<tr><td>2.0≥L</td><td>0.05≥W</td></tr>
<tr><td>1.0≥L</td><td>0.1＞W</td><td>1</td></tr>
<tr><td>---</td><td>0.05<W</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>6</td><td>Segment pattern
W = Segment width
φ = (X+Y)/2</td><td>(1) Pin hole
φ < 0.15mm is acceptable.
 

<table>
<tr><td>Point Size</td><td>Acceptable Qty</td></tr>
<tr><td>φ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< φ≤1/2W</td><td>1</td></tr>
<tr><td>φ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>7</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>8</td><td>Soldering</td><td>(1) Not allow heavy dirty and solder ball on PCB or FPC.
(The size of dirty refer to point and dust defect)
(2) Over 50% of lead should be soldered on Land.
 

50% lead</td></tr>
<tr><td>9</td><td>Wire</td><td>(1) Copper wire should not be rusted
(2) Not allow crack on copper wire connection.
(3) Not allow reversing the position of the flat cable.
(4) Not allow exposed copper wire inside the flat cable.</td></tr>
<tr><td>10</td><td>PCB,FPC</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

11	LCD	**2.1.1 chip on the surface**     Note: A:LCD Length X / Y / Z >1/8A / ≤0.3mm / ≤1/2T ≤1/8A / Not enter into epoxy frame / ≤T ≤1/8A / Not enter into the inner edge of epoxy / ≤1/2T

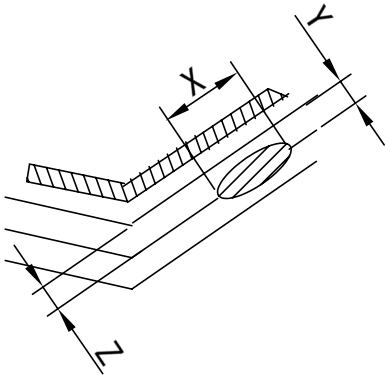
11	LCD	**2.1.2chip on the terminal** 

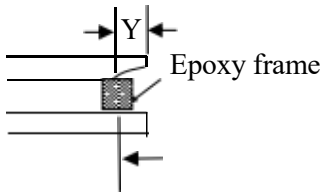
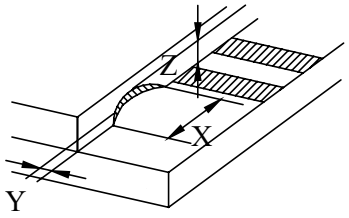
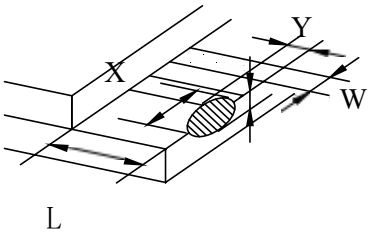
X	Y	Z
>1/8A	≤0.3mm	≤ 1/2T
≤1/8A	≤1/2L	≤T
≤1/8A&≤1mm	≤L	≤T
≤1/8A&≤2mm	≤L	≤ 1/2T

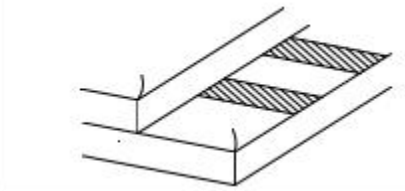
Note: A:LCD Length.

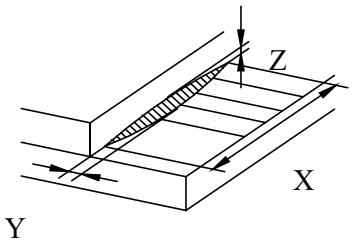
the distance between crack and contact pad must be greater than the width of 1st contact pad.

2.1.3chip out on between side



11	**LCD**	  X ｜ Y ｜ Z ≤ 1/8A ｜ Not enter into epoxy frame ｜ Z≤2T ≤ 1/8A ｜ Not enter into 1/2 epoxy frame ｜ Z≤1/2T Note: A : LCD Length 2.1.4 including corner chip and side chip  Note: A:LCD Length X ｜ Y ｜ Z >1/8A ｜ ≤1/6L ｜ ≤1/2T ≤1/8A ｜ ≤1/3L ≤1/4W ｜ ≤2/3L

<table>
<tr><td>11</td><td>LCD</td><td>
2.2 Chip out

1) Chip out is that crackles extend to inner edge.
2) Crackles round epoxy frame will be rejected.
3) Chip out on the terminal will be rejected: Z=T length >1mm or Z<T length >2mm
4) The chip out at ITO will be rejected.

2.3 Poor cutting


<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>>1/8 A</td><td>≤0.3</td><td>≤1/2T</td></tr>
<tr><td>≤1/8 A</td><td>According to drawing</td><td>1/2T≤Z≤T</td></tr>
</table>
Note : A: LCD Length.
</td></tr>
<tr><td>12</td><td>SMT</td><td>According to the <Acceptable of electronic assemblies>
IPC-A-610C class 2 stander. Component missing or function defect are Major defect ,the others are Minor defect.</td></tr>
<tr><td colspan="3">Any one out of the specification will be rejected.</td></tr>
</table>

13. GENERAL PRECAUTIONS

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifloroethane

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

- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend 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 table. And assembly equipment to protect against static electricity.

(4) Packaging

Modules use 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.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- 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 operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.

- As light dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40。C, 50%RH or less is required.

(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 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 is.

Keeping temperature in the specified 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)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please washit off well with soap and water.

Limited Warranty

The LCM of Saef Technology Limited are not consumer products, but may be incorporated by Saef Technology Limited' customers into consumer products or components thereof, Saef Technology Limited does not warrant that its components are fit for any such particular purpose.

1. The liability of Saef Technology Limited is limited to repair or replacement on the terms set forth below. Saef Technology Limited will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between Saef Technology Limited and the customer, Saef Technology Limited will only replace or repair any of its LCM which is found defective electrically or visually when inspected in accordance with Saef Technology Limited.
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCM, they must be properly packaged; there should be detailed description of the failures or defect.

Saef Technology Limited reserves the right to change this specification.
URL:http://www. Saef.com.cn

- END -