

LCM Specification

() Preliminary Specification

() Final Specification

PRODUCT TYPE: TFT MODULE

PRODUCT P/N: **FD400WV089S**

FINE

DESIGNED BY	
CHECKED BY	
APPROVED BY	

Customer

INSPECTION RESULT	
TESTED BY	
APPROVED BY	

Revision History

CONTENTS

- n GENERAL FEATURES
- n ABSOLUTE MAXIMUM RATINGS
- n ELECTRICAL SPECIFICATIONS
- n TIMING OF POWER SUPPLY
- n BACKLIGHT CHARACTERISTICS
- n OPTICAL SPECIFICATIONS
- n INTERFACE DESCRIPTION
- n OUTLINE DIMENSION
- n INITIALIZATION SETUP
- n RELIABILITY AND INSPECTION STANDARD
- n INSPECTION CRITERION
- n PACKING DIMENSION
- n PRECAUTIONS

1. General Features

Item	Display Panel	Unit/note
Display Mode	Normally Black	
LCM size	3.97"	
Viewing Direction	IPS	
Input Signals	MIPI	
Outline Dimensions	96.58 (W)*57.14 (H)*2.2(T)	mm
Active Area	86.4 (H)×51.84(W)	mm
Number of Pixels	480×RGB×800	Pixels
Pixel Arrangement	RGB Vertical stripes	
Drive IC	JD9161	
Input voltage	2.8	V

2. Absolute Maximum Ratings

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

<Table 2. Absolute Maximum Ratings>

[VSS = GND = 0V]

Parameter	Symbol	Min	Max	Unit	Remark
LC Operating Voltage *1)	V _{op}		4.9	V	Ta = 25℃
Operating Temperature (Humidity)	T _{OP} (RH)	-20	+70 (90)	℃ %	(At 60 ℃ for Humidity)
Storage Temperature (Humidity)	T _{ST} (RH)	-30	+80 (90)	℃ %	(At 60 ℃ for Humidity)

*1) Liquid Crystal driving voltage

Due to the characteristics of LC Material, this voltage varies with environmental temperature

3. Electrical Specification

(Unless specified, the ambient temperature $T_a=25^{\circ}\text{C}$)

Item	Symbol	Values			Unit
		Min	Type.	Max	
TFT Operation Frame rate	Hz	50	60	70	Hz
TFT common electrode voltage	VCOM	-2.7	-	0	V
TFT gate on voltage	VGH	13	15	17	V
TFT gate off voltage	VGL	-10	-9	-8	V

Note 1:

VCOM value should be adjusted by different condition to optimize Flicker Value.

Note 2:

VGH and VGL are the operating voltages of TFT gate.

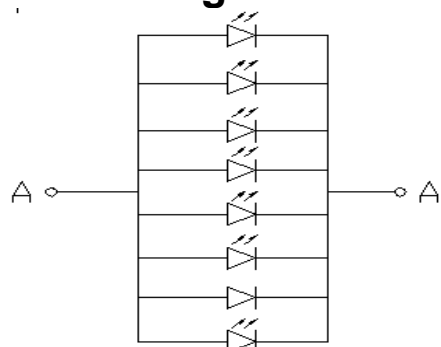
4. TIMING OF POWER SUPPLY

Please refer to the driver IC specification.

5. BACKLIGHT CHARACTERISTICS

Properties	Sym.	Min	Typ.	Max	Unit	Note
Forward voltage	Vf	3.0	3.2	3.5	V	
Luminance	Lv	280	350		cd/m ²	
Electric current	If	120	160	---	mA	
Number of LED	-	8			Piece	-
Connection mode	P	-----			-	

Circuit Diagram



6. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 500mm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Measurement condition:

- *1):with Polarizer
- *2):without Polarizer
- *3):only color filter glass

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Transmittance (with Polarizer)	T (%)	$\Theta=0$ Normal viewing angle	—	4.14	—	%	Measuring with Polarizer · Reference Only	
Transmittance (without Polarizer)	T (%)		—	13.13	—	%		
Contrast	CR		720	900	—	—	(1)(2)	
Response time	Rising		T_R	—	16	21	msec	(1)(3)
	Falling		T_F	—	19	24		
Color gamut	(%)		—	70	—	%	C-light	
Color chromaticity (CIE1931)	White		W_x	-0.02	0.310	+0.02	—	(1)(4) CF glass
		W_y	0.336		—			
	Red	R_x	0.647		—			
		R_y	0.317		—			
	Green	G_x	0.275		—			
		G_y	0.582		—			
	Blue	B_x	0.140		—			
		B_y	0.088		—			
Viewing angle	Hor.	Θ_L	CR>10	—	80	—	(1)(4) Measuring with Polarizer · Reference Only	
		Θ_R		—	80	—		
	Ver.	Θ_U		—	80	—		
		Θ_D		—	80	—		
Optima View Direction	Free						(5)	

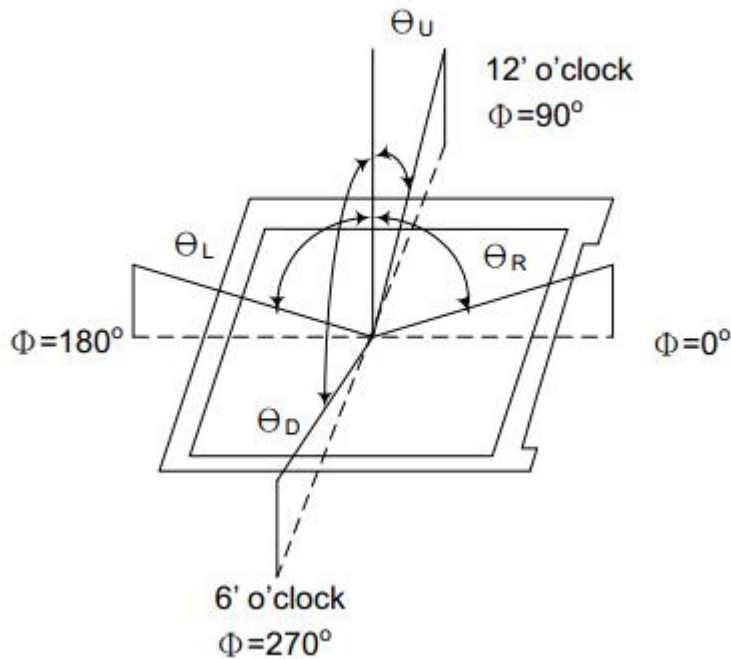
Measuring Condition

- 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.

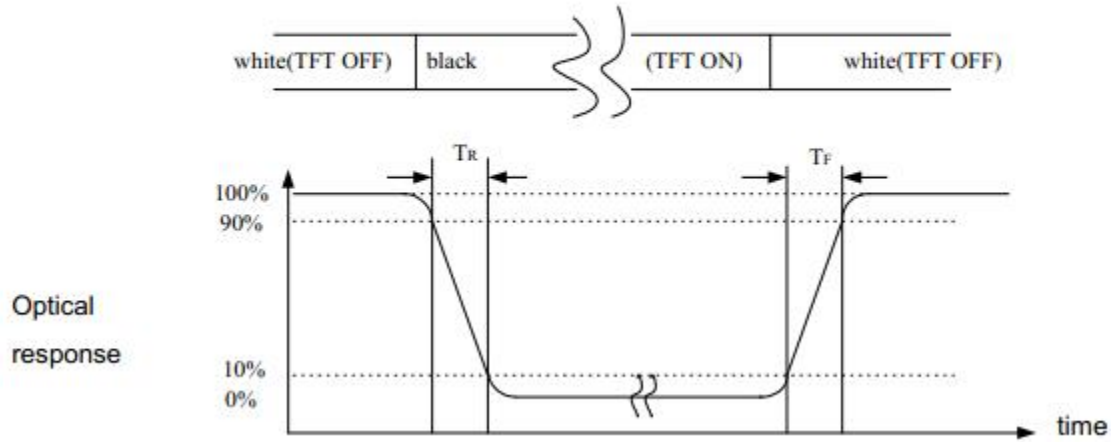
Note (1) Definition of Viewing Angle:



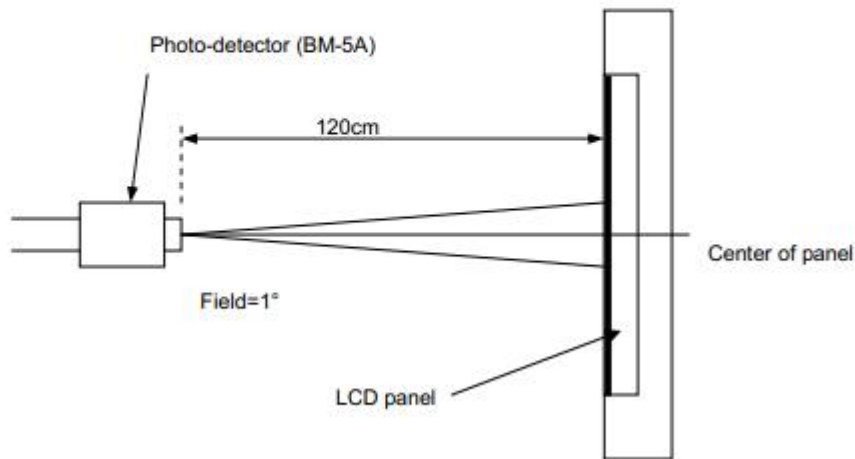
Note (2) Definition of Contrast Ratio (CR) :
measured at the center point of panel

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

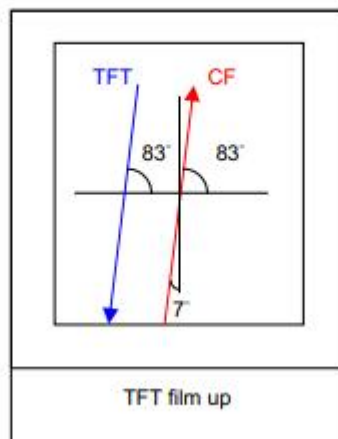
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)



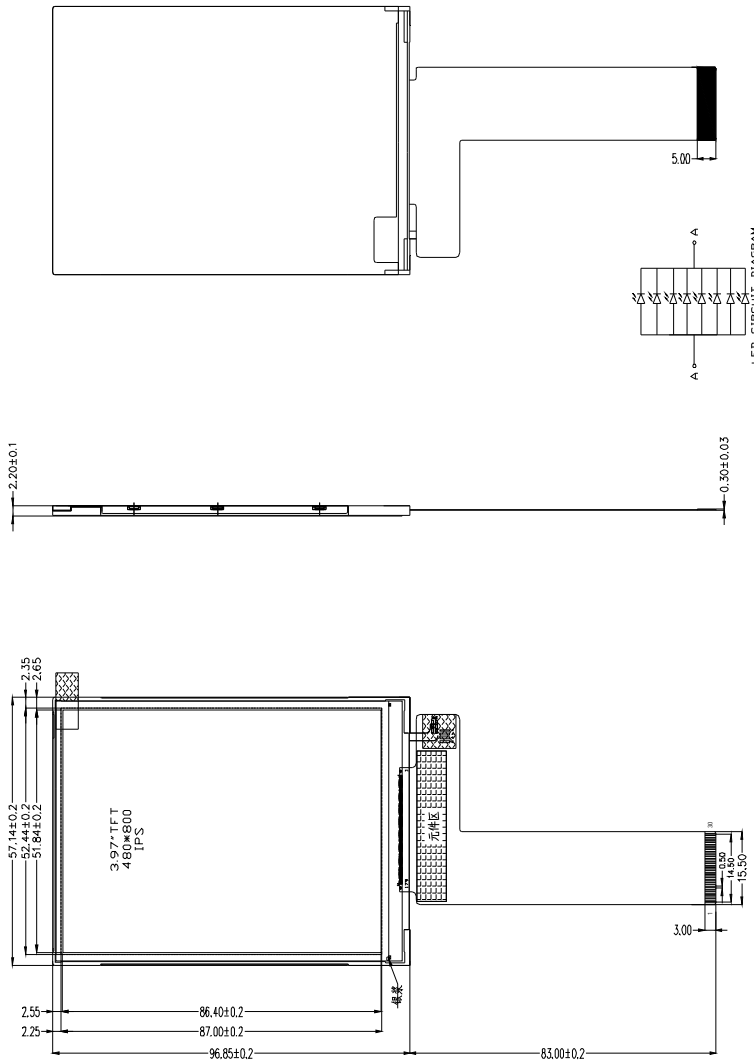
7. Interface Description

Pin NO.	Symbol	Description	Remark
1	VCC	I	Connect 2.8V
2	VCC	I	Connect 2.8V
3	NC	NC	Not used
4	GND	GND	Power ground
5	GND	GND	Power ground
6	TE	I/O	Tearing effect output pin to synchronies MCU
7	RESET	I/O	LCD Reset Terminal active "L"
8	GND	GND	Power ground
9	D0N	I/O	MIPI-DSI data lane 0 negtive-end input/output pin
10	D0P	I/O	MIPI-DSI data lane 0 positive-end input/output pin
11	GND	GND	Power ground
12	CLKN	I/O	MIPI-DSI clock lane negtive-end input/output pin
13	CLKP	I/O	MIPI-DSI clock lane positive-end input/output pin
14	GND	GND	Power ground
15	D1N	I/O	MIPI-DSI data lane 1 negtive-end input/output pin
16	D1P	I/O	MIPI-DSI data lane 1 positive-end input/output pin
17	GND	GND	Power ground
18	NC	NC	Not used
19	NC	NC	Not used
20	IOVCC	I	Connect 1.8V/2.8V
21	GND	GND	Power ground
22	GND	GND	Power ground
23	GND	GND	Power ground
24	GND	GND	Power ground
25	NC	NC	Not used
26	A	I	Anode for back light driver voltage
27	NC	NC	Not used
28	K	I	Cathode for back light driver voltage
29	NC	NC	Not used
30	ID	NC	Not used

8. Outline Dimension

Customer No.: CUSTOMER_NO.:

Pad No.	Pad Name
1	VCI (2.8)
2	VCI (2.8)
3	NC
4	GND
5	GND
6	FTE(FMARK)
7	RESET
8	GND
9	DATA_N(D0_N)
10	DATA_P(D0_P)
11	GND
12	STB_N(CLK_N)
13	STB_P(CLK_P)
14	GND
15	DATA_N(D1_N)
16	DATA_P(D1_P)
17	GND
18	NC
19	NC
20	IOVCC(1.8V)
21	GND
22	GND
23	GND
24	GND
25	NC
26	BL_LED-A
27	NC
28	BL_LED-K
29	NC
30	LCD_ID



浙江凯航显示科技有限公司
ZHEJIANG KAIHANG DISPLAY TECHNOLOGY CO., LTD

POLARIZER SIZE	TRANSMISSIVE
Display Resolution	DOTS:480(R.G.B)*800
Viewing Angle	IPS
LCD Controller/Driver	JD9161
BACKLIGHT	12CHIP-WHITE LED
Operation Temperature	-20°C ~ 70°C
Storage Temperature	-30°C ~ 80°C

PRODUCT NO.	FD400WV0089S	DRAW NO.	REV
DWN	DSN	****	A
CHKD	APPD	*****	
UNIT	mm	SCALE	1:1
DATE		NOT IN SCALE	
CONTENT		UNIT	
ND.		SHEET	分頁号

9. initialization Setup

Please consult our technical department for detail information.

10. Reliability and Inspection Standard

No.	Test Item		Test Conditions	Remark
1	High Temperature	Storage	70°C, 120Hr	Note
		Operation	60°C, 120Hr	Note
2	Low Temperature	Storage	-30°C, 120Hr	Note
		Operation	-20°C, 120Hr	
3	High Temperature and High Humidity		60°C, 90%RH, 120Hr	Note
4	Temperature Cycle	Storage	-10°C(1Hr)à 25°C(5min)à 60°C(1Hr) 32 Cycles	Note
		Operation	-20°C(1Hr)à 25°C(5min)à 60°C(1Hr) 25 Cycles	
5	Peeling Off (Storage)		≥500gf/cm	Note
6	FPC Bending Test		≥6,000 times, 2/sec	Note
7	Vibration Test(Storage)		50HZ, 30min, Amplitude: 2 cm, X/Y/Z directions	Note
8	Drop Test		60cm/ 3Corner/ 8Face, 1Cycle	Note

Note:

- 1) The test samples should be applied to only one test item.
- 2) Sample size for each test item is 5~10pcs.
- 3) For Damp Proof Test, pure water(Resistance>1MΩ) 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 judged 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) After the reliability test, the test samples should be inspected after 2 hours at least.
- 7) Functional test is OK. Missing segment, shorts, unclear segment, non display, display abnormally, liquid crystal leak are not allowed.
- 8) After testing, the current Idd should be within initial value ±20%.
- 9) No low temperature bubbles ,end seal loose and fall, frame rainbow, ACF bubble growing are allowable in the appearance test.

11. Inspection Criterion

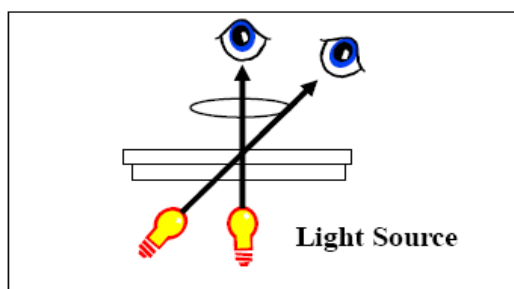
11.1. Sampling Method

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customer's incoming inspection.

- 1) Lot size: Quantity per shipment lot
- 2) Sampling type: Normal inspection , single sampling
- 3) Inspection level: II
- 4) Sampling table: MIL-STD-105D
- 5) Acceptable Quality Level(AQL): Major=0.65 Minor=1.5

11.2. Inspection Method

- 1) Ambient Condition:
 - a. Temperature: Room temperature $25\pm 5^{\circ}\text{C}$
 - b. Illumination: Single fluorescent lamp non-directive(300 to 700 Lux)
- 2) Viewing distance
The distance between the LCD and the inspector' s eyes shall be at least 30-50cm.
- 3) Viewing Angle
The inspection shall be conducted within normal viewing angle range.

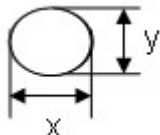
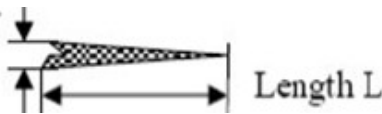


11.3. Inspection Criteria

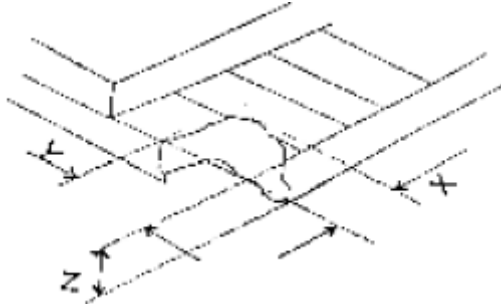
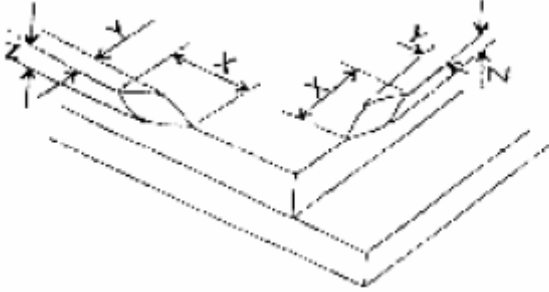
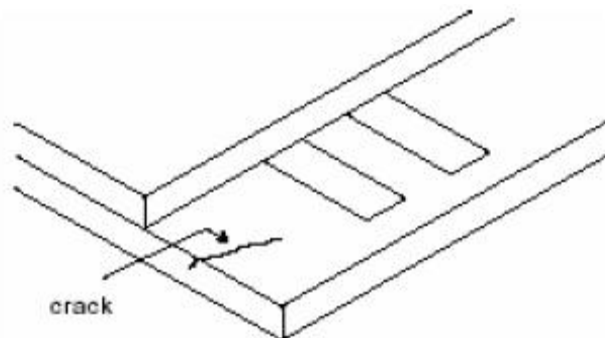
11.3.1. Major defect

No.	Item	Inspection Standard	Classification of defects
1	All functional defects	1) No display 2) Display abnormally 3) Open or missing segment 4) Short circuit 5) Excess power consumption 6) Backlight no lighting, flickering and abnormal lighting	Major
2	Missing	Missing component	Major
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	Major

11.3.2. Cosmetic Defect

No.	Item	Inspection Standard		Classification of defects							
1	(spot defect) Black and White spot pinhole	For dark/white spot, size Φ is defined as $\Phi=(x+y)/2$		Minor							
		<table border="1"> <thead> <tr> <th>Size Φ (mm)</th> <th>Acceptable Quantity</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.1$</td> <td>Ignore</td> </tr> <tr> <td>$0.10 \leq \Phi \leq 0.15$</td> <td>2</td> </tr> <tr> <td>$0.15 \leq \Phi \leq 0.2$</td> <td>1</td> </tr> <tr> <td>$0.2 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	Size Φ (mm)		Acceptable Quantity	$\Phi \leq 0.1$	Ignore	$0.10 \leq \Phi \leq 0.15$	2	$0.15 \leq \Phi \leq 0.2$	1
Size Φ (mm)	Acceptable Quantity										
$\Phi \leq 0.1$	Ignore										
$0.10 \leq \Phi \leq 0.15$	2										
$0.15 \leq \Phi \leq 0.2$	1										
$0.2 < \Phi$	0										
2	(line defect) Black and White line Polarizer scratch	Define:		Minor							
		<table border="1"> <thead> <tr> <th>Width(mm)</th> <th>Length(mm); Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.05$</td> <td>$L \leq 3.0$; $N \leq 2$</td> </tr> <tr> <td>$0.05 < W \leq 0.1$</td> <td>$L \leq 2.0$; $N \leq 2$</td> </tr> <tr> <td>$0.1 < W$</td> <td>Define as spot defect</td> </tr> </tbody> </table>	Width(mm)		Length(mm); Acceptable Qty	$\Phi \leq 0.03$	Ignore	$0.03 < W \leq 0.05$	$L \leq 3.0$; $N \leq 2$	$0.05 < W \leq 0.1$	$L \leq 2.0$; $N \leq 2$
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$\Phi \leq 0.03$	Ignore										
$0.03 < W \leq 0.05$	$L \leq 3.0$; $N \leq 2$										
$0.05 < W \leq 0.1$	$L \leq 2.0$; $N \leq 2$										
$0.1 < W$	Define as spot defect										
3	Polarizer defect	Dent or bubble(between the polarizer and glass)		Minor							
		<table border="1"> <thead> <tr> <th>Size Φ(mm)</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.10$</td> <td>Ignore</td> </tr> <tr> <td>$0.10 < \Phi \leq 0.20$</td> <td>2</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.30$</td> <td>1</td> </tr> <tr> <td>$0.30 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	Size Φ (mm)		Acceptable Qty	$\Phi \leq 0.10$	Ignore	$0.10 < \Phi \leq 0.20$	2	$0.20 < \Phi \leq 0.30$	1
Size Φ (mm)	Acceptable Qty										
$\Phi \leq 0.10$	Ignore										
$0.10 < \Phi \leq 0.20$	2										
$0.20 < \Phi \leq 0.30$	1										
$0.30 < \Phi$	0										

11.3.3. Cosmetic Defect

No.	Item	Inspection Standard	Classification of defects						
1	Glass defect	<p>1) Chip on the corner</p>  <table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤3.0</td> <td>≤S</td> <td>≤T</td> </tr> </table> <p>Remark: S=contact pad length; T=the thickness of glass Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal. Acceptable Quantity N≤2.</p>	X	Y	Z	≤3.0	≤S	≤T	Minor
		X	Y	Z					
		≤3.0	≤S	≤T					
<p>2) Chip on the edge of glass</p>  <table border="1"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>Ignore</td> <td>≤0.5</td> <td>≤T</td> </tr> </table> <p>Acceptable Quantity: N≤2</p>	X	Y	Z	Ignore	≤0.5	≤T	Minor		
X	Y	Z							
Ignore	≤0.5	≤T							
<p>3) Creak</p> <p>Creaks tend to break are not allowed.</p> 	Minor								

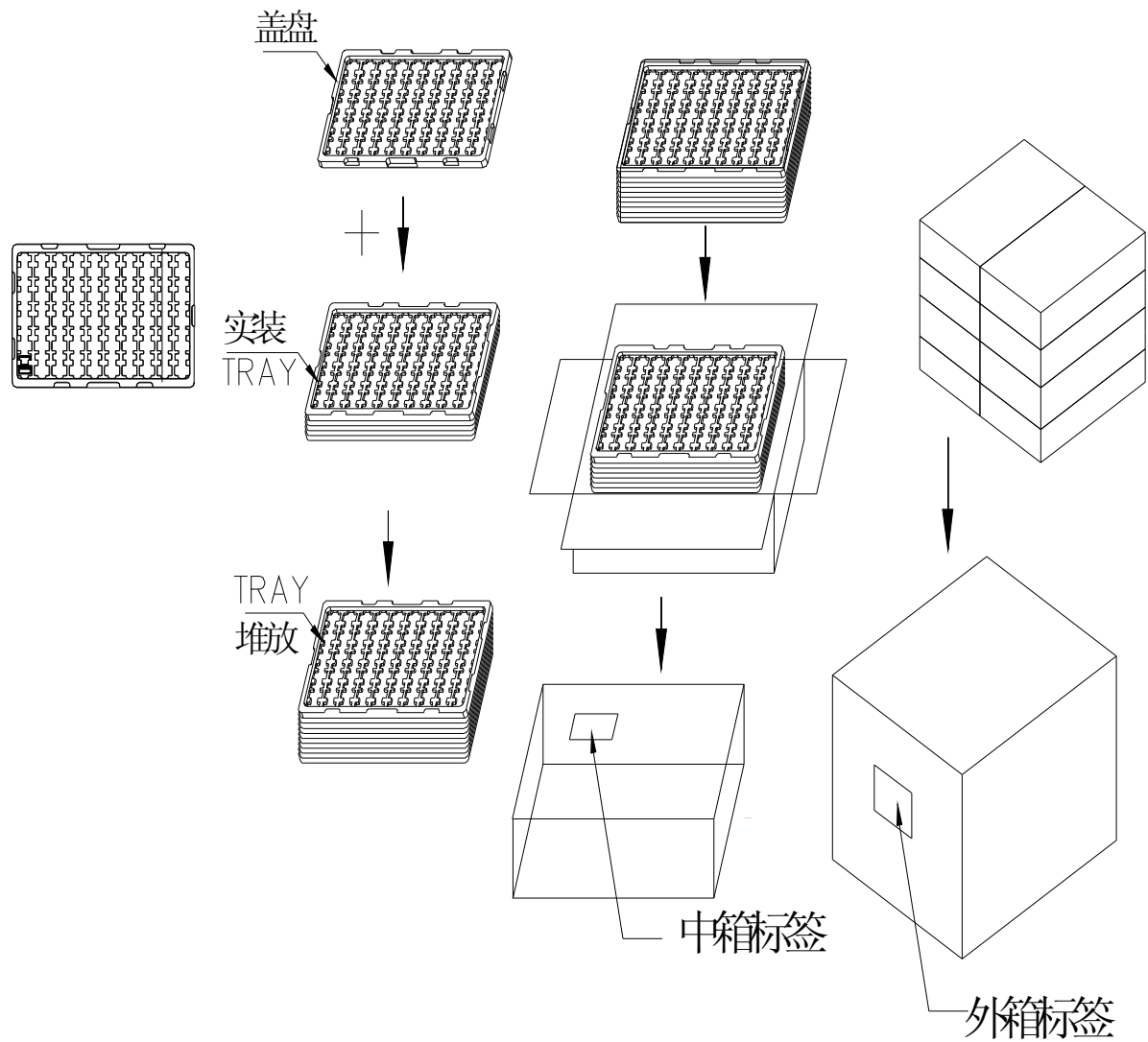
12. Packing Dimension

Packaging Quantity:

One tray Include: TBD pcs module;

One B-F Box Include: TBD pcs tray; TBD pcs Module;

One Carton Include: TBD-set B-F Box; TBD pcs tray; TBD pcs Module



n PRECAUTIONS FOR USING LCD MODULES

Handling Precautions

- (1) The display panel is made of glass and polarizer. As glass is fragile, it tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.
- (2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
- (3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
- (5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
 - Isopropyl alcohol
 - Ethyl alcoholDo not scrub hard to avoid damaging the display surface.
- (6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
 - Water
 - Ketone
 - Aromatic solventsWipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.
- (7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
- (8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
- (9) Do not attempt to disassemble or process the LCD module.
- (10) NC terminal should be open. Do not connect anything.
- (11) If the logic circuit power is off, do not apply the input signals.
- (12) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
 - Do not alter, modify or change the shape of the tab on the metal frame.
 - Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

Storage Precautions

When storing the LCD modules, the following precaution is necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
- Terminal electrode sections.