SPECIFICATION FOR LCD MODULE

Model No.   **TM320240JKFWT**

Prepared by:	Date:
Checked by :	Date:
Verified by :	Date:
Approved by:	Date:

TIANMA MICROELECTRONICS CO., LTD

Ver. 1.0

REVISION RECORD

Date	Rev.No.	Revision Items	Prepared	Checked	Approved
9.17-04	preliminary				

CONTENTS

1.General Specifications

Item	Contents	Unit	Note
LCD Type	Color STN	-	
Display color	---		1
LCD Duty	1/240	-	
LCD Bias	1/13	-	
Viewing Direction	6:00	O'Clock	
Viewing Area(W×H)	70.2×53.4	mm	
Active Area(W×H)	67.19×50.39	mm	
Number of Dots	320(RGB)×240	mm	
Dote Size(W×H)	0.20×0.20	mm	
Dot Pitch(W×H)	0.21×0.21	mm	
Controller	None	-	
V_{DD}	3.0	V	
Vop=?	20.0	V	
Outline Dimensions	Refer to outline drawing on next page		
Backlight	LED(white)	-	
Operating Temperature	-20　+70	-	
Storage　Temperature	-30　+80	-	
Weight	TBD	g	2
Data Transfer	8 bits parallel	-	
Polarizer Mode	Transmissive/Negative	-	

Note 1:　Color tune is slightly changed by temperature and driving voltage.
Note 2:　TBD- To Be Determined.

2. Outline Drawing
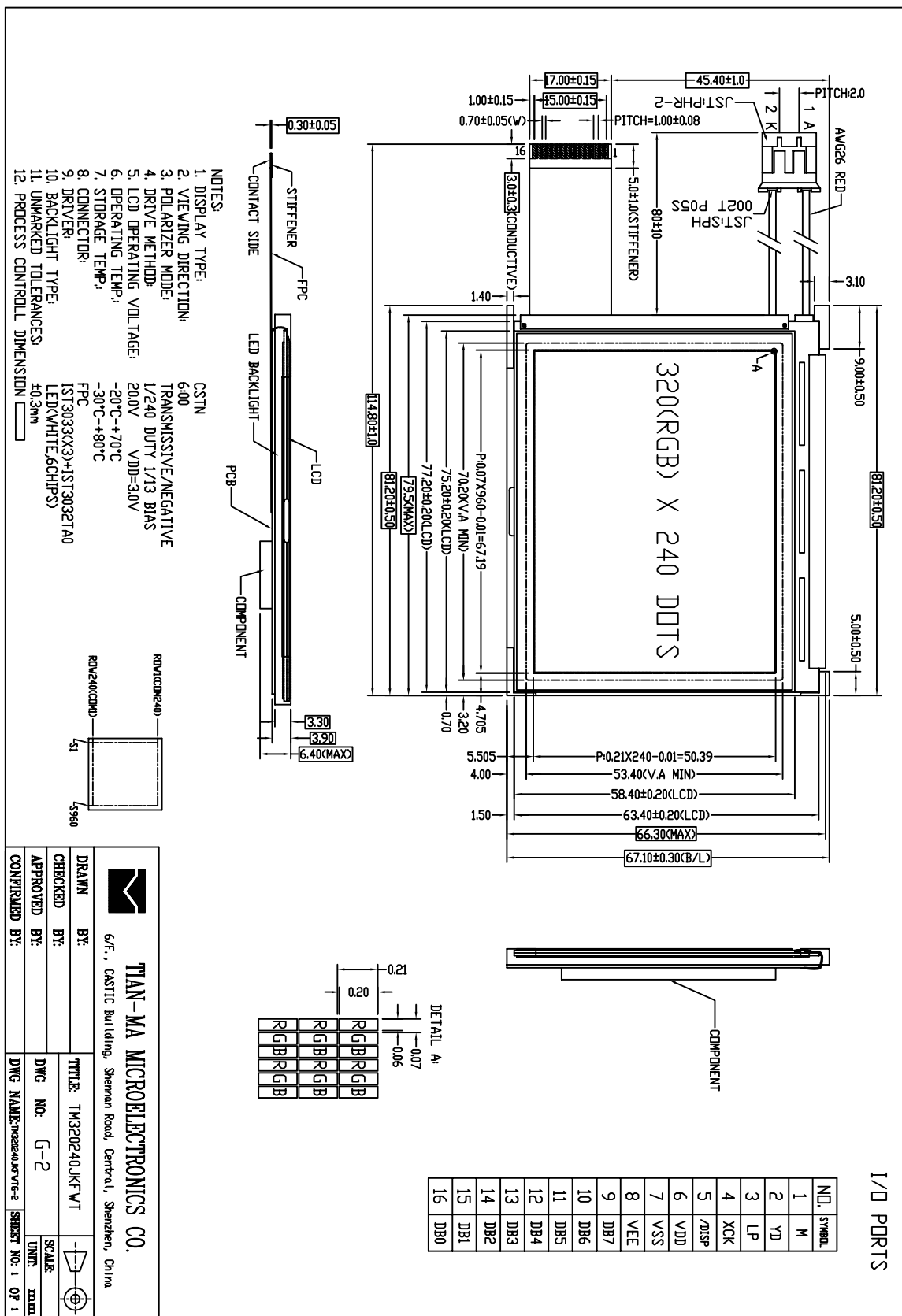
3. Circuit Block Diagram

4. Absolute Maximum Ratings(Ta=25   )

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	-0.3	7.0	V	
Power Supply Voltage for LCD	Vop= VEE-VSS	-0.3	25	V	
Logic Signal Input Voltage	V_I	-0.3	V_{DD}+0.3	V	
Operating Temperature	Top	-20	+70		
Storage Temperature	Tst	-30	+80		

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_{DD} >V_{SS} must be maintained.

5. Electrical Specifications and Instruction Code

5.1 Electrical characteristics (Ta=25)

Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Supply voltage		V_{DD}	Ta=25	2.7	3.0	3.3	V	
Operation voltage		V_{OP}	Ta=25	19.0	20.0	21.0	V	1
Input voltage	'H'	V_{IH}	V_{DD}=3.0V	$0.8V_{DD}$	-	V_{DD}	V	
	'L'	V_{IL}	V_{DD}=3.0V	Vss	-	$0.2V_{DD}$	V	
Output voltage	'H'	V_{OH}	-	$0.8V_{DD}$	-	V_{DD}	V	
	'L'	V_{OL}	-	Vss	-	$0.2V_{DD}$	V	
Current Consumption		I_{CC1}	Normal mode	-	TBD.	-.	mA	2
		I_{CC2}	Stand-by mode	-	TBD.	-	mA	3
		I_{CC3}	dimming mode	-	TBD.	-	mA	4

Note:

1: At the condition at V_{DD}=3.0V.

2: Display full white. Backlight on state.

3: IC on standby mode.

4: Display full white. Backlight dimming state

5.2 LED backlight specification

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Forward voltage		V_f	I_f=30mA	9.0	9.9	10.8	V	
Reverse voltage		V_r	-	-	-	-	V	
Forward current	Normal	I_{pn}	3-chip serial (x2)	20	30	40	mA	
	Dimming	I_{pd}						
Reverse Current		I_r	V_r=-V	-	-	-	μA	
Uniformity			I_f=30mA	70%	-	-		

5.3 Indicator LED Specification

Color	Condition	VF(V)			coordinate	
		Min	Typ	Max	x	y
white	If=30mA	9.0	9.9	10.8	TBD.	TBD.

5.4 Interface Signals

Pin No.	Symbol	Level	Description
1	M	H/L	Input of signal to AC electrify the liquid crystal drive output
2	YD	H/L	Scan start pulse
3	LP	H/L	Display data latch pulse input
4	XCK	H/L	Display data shift clock input
5	DISPOFF	H/L	H: Display on, L: Display off
6	VDD	+3.0V	Supply voltage for logic
7	VSS	0V	Ground
8	VEE	+20V	LCD voltage output
9	D7	H/L	Data bit 7
10	D6	H/L	Data bit 6
11	D5	H/L	Data bit 5
12	D4	H/L	Data bit 4
13	D3	H/L	Data bit 3
14	D2	H/L	Data bit 2
15	D1	H/L	Data bit 1
16	D0	H/L	Data bit 0
-	A	9.9V	Power supply for LED backlight anode
-	K	0V	Power supply for LED backlight cathode

5.5 Interface Timing Chart

Note: Please refer to Integrated Solutions Technology's driver specification. IST3032 and IST3033

5.6 INSTRUCTION

6. Optical Characteristics

Item	Symbol		Condition	Min.	Typ.	Max.	Unit	Note
Brightness	Bp		$\Phi_1=0°$ $\Phi_2=0°$	80			Cd/m²	1
Uniformity	Bp			70%				1,2
Viewing Angle	Φ_1(up down)		Cr≥2	-40 +35			Deg	3
	Φ_2(left right)			-30 +30				
Contrast Ratio	Cr		$\Phi_1=0°$ $\Phi_2=0°$	30	40	60	-	4
Response Time	Tr			-	-	180	ms	5
	T_f			70	-	90		
Color of CIE Coordinate	W	x	$\Phi_1=0°$ $\Phi_2=0°$	-	0.30	-	-	1,6
		y		-	0.36	-	-	
	R	x		-	0.53	-	-	
		y		-	0.37	-	-	
	G	x		-	0.31	-	-	
		y		-	0.51	-	-	
	B	x		-	0.16	-	-	
		y		-	0.18	-	-	
NTSC Ratio	S				27%			

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 9 measured spots. Measurement equipment PR-705 (Φ10mm)
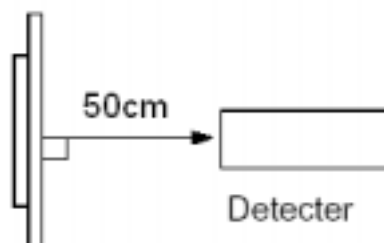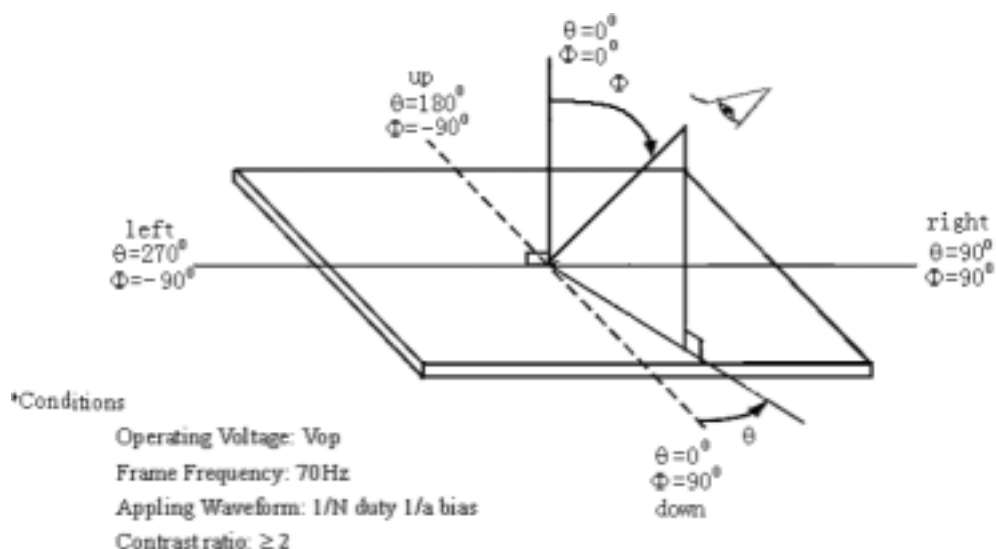

Note 2:　Bp = Bp (Min.) / Bp (Max.)×100 (%)

Bp (Max.) = Maximum brightness in 9 measured spots

Bp (Min.) = Minimum brightness in 9 measured spots.
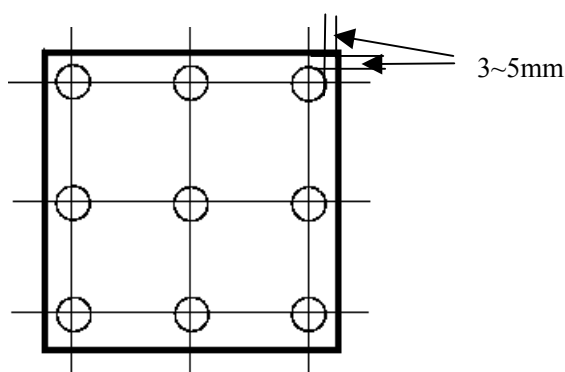
Measurement equipment PR-705 (Φ10mm)
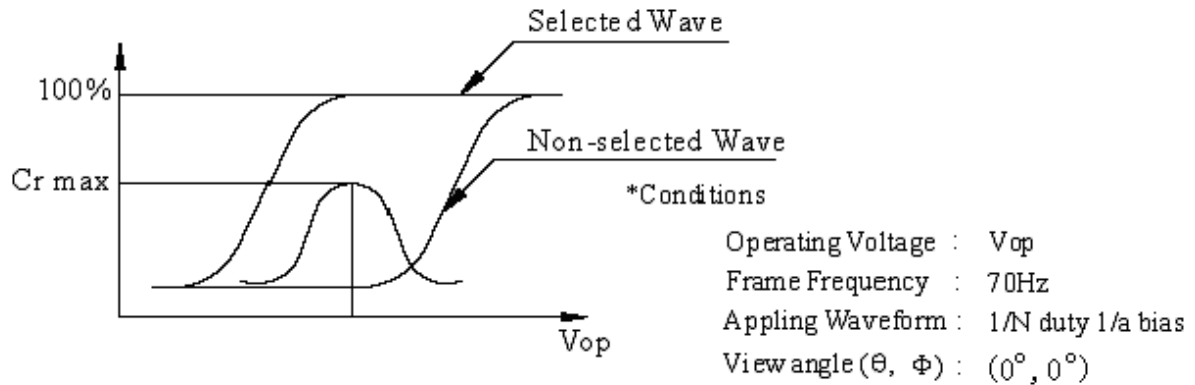
Note 3: Definition of Viewing Angle(Test LCD using DMS501)

*Conditions

Operating Voltage: Vop

Frame Frequency: 70Hz

Appling Waveform: 1/N duty 1/a bias

Contrast ratio: ≥ 2

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

*Conditions

Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
View angle (θ, Φ) : (0°, 0°)

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

Note 5: Definition of Response time(Test LCD using DMS501)
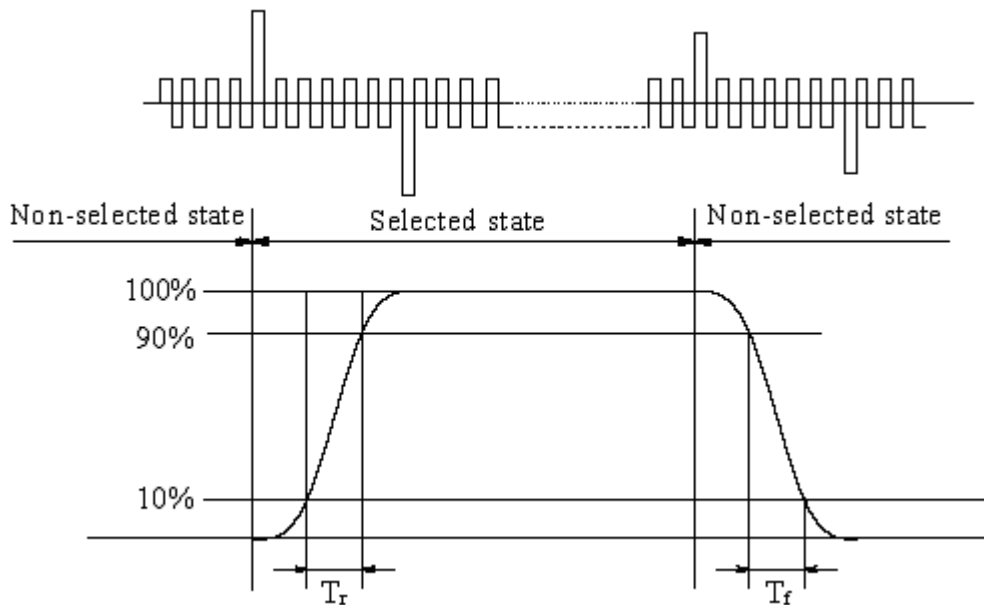
Operating Voltage: Vop
Frame Frequency: 70Hz
Appling Waveform: 1/N duty 1/a bias
View angle (θ, Φ): $(0^0, 0^0)$

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

1931 CIE Chromaticity Diagram
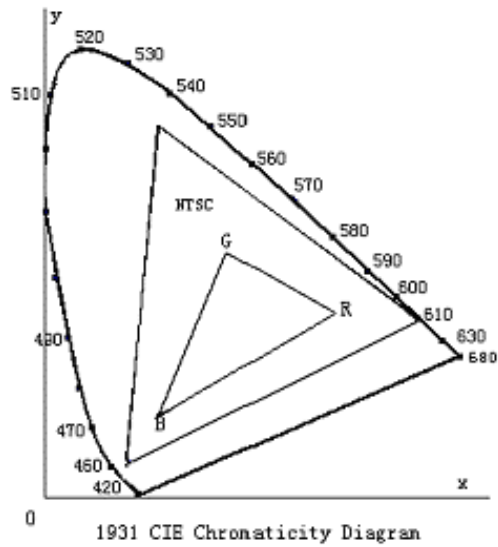
Color gamut:
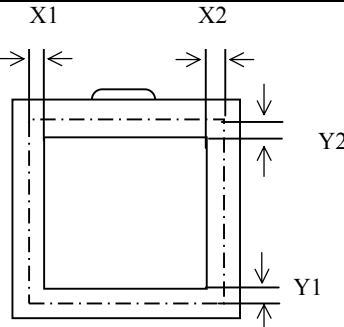
$$S = \frac{area \ \ of \ \ RGB \ \ triangle}{area \ \ of \ \ NTSC \ \ triangle} \times 100\%$$

7. Reliability
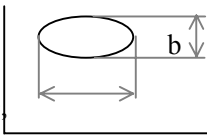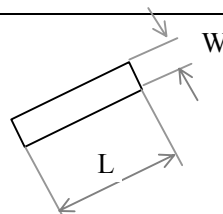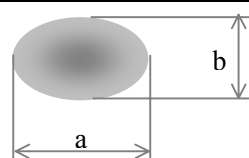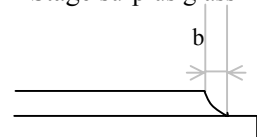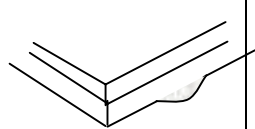
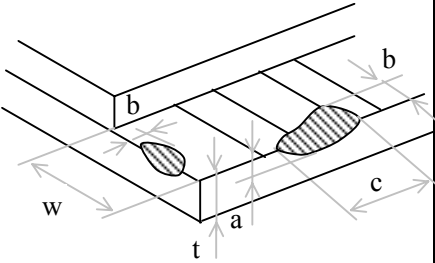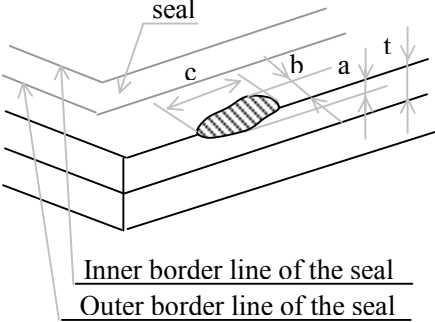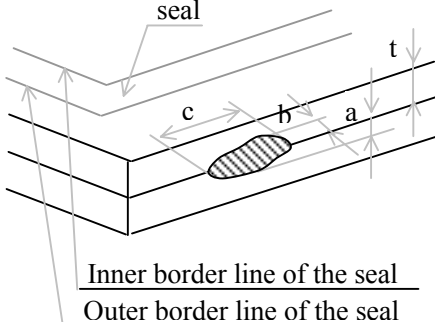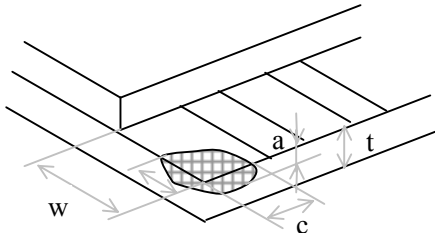| No.	Test Item	Test condition	Criterion
1	High Temperature Storage	80 ±2 96H Restore 4H at 25	1. After testing, cosmetic defects should not happen. 2.Total current consumption should not be over 10% of initial value.
2	Low Temperature Storage	-30 ±2 96H Restore 4H at 25	
3	High Temperature Operation	70 ±2 48H Restore 4H at 25	
4	Low Temperature Operation	-20 ±2 48H Restore 4H at 25	
5	High Temperature /Humidity Storage	40 ±2 90%RH 48H	
6	Temperature Cycle	-30 ←→25 ←→80 　　5min　30min ←→25 , 　5min after 10cycle, Restore 4H at 25	
7	Vibration Test (package state)	10Hz~150Hz, 100m/s2, 120min	Not allowed cosmetic and electrical defects.
8	Shock Test (package state)	Half- sine wave, 300m/s2, 18ms	
9	Atmospheric Pressure Test	25kPa 16H Restore 2H	
10	Cable Bending Test	Bending area and angle follow design document requirement	More than 50000 times

8 Quality level

8.1 Notes for quality standard

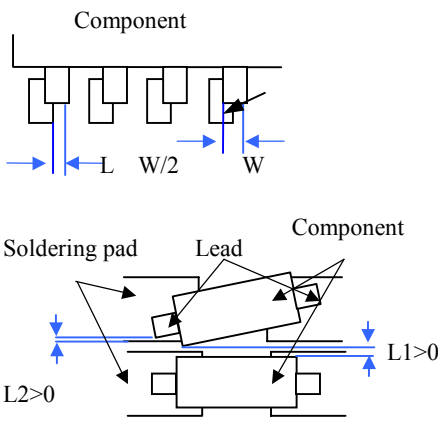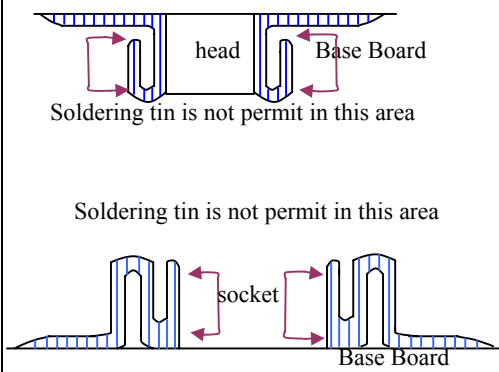|	Note		
General	1. Should any defects which are not specified in this standard happen, additional standard shall be determined by mutual agreement between customer and Tianma. 2. Viewing Area should be the area which Tianma guarantees. 3. Limited sample should be prior to this Inspection standard. 4. Viewing Judgement should be under static pattern. 5. Inspection conditions 　　Inspection distance　　: 250 mm (from the sample) 　　Temperature　　: 25±5 　　Inspection angle　　: 45degrees in LCD view direction		
Definitions of Inspection items	Pinhole, Bright spot, Black spot, White spot, Black line, White Line, Foreign particle, Bubble	The color of a small area is different from the remainder. The phenomenon dose not change with voltage.	
	Contrast variation	The color of a small area is different from the remainder. The phenomenon changes with voltage.	
	Polarizer defect	Scratch, Dirt, Particle, Bubble on polarizer or between polarizer and glass.	
	Glass defect	Glass crack, Shaved corner of glass, Surplus glass	
Definitions of Inspection ranges	X1　　　　X2　Y2　Y1	Dividing A zone and B zone proceed to make a judgment. A zone : Inside Viewing area B zone : Outside Viewing area X1(A.A~V.A):　mm X2(A.A~V.A):　mm Y1(A.A~V.A):　mm Y2(A.A~V.A):　mm	
Outgoing Inspection standard	Inspection level　　Normal Inspection Sampling standard conforms to GB2828		
	Rank	Inspection Item	AQL(Number of defective LCMs counted)
	Major defect	All Functional defects(Such as No display, Display abnormally, Open or missing segment, Short circuit Missing component, No sound, Blight abnormally),Outline　dimension　beyond　the drawing	0.65
	Minor defect	Appearance defects, such as Black/White spot, Bright spot, Pinhole, Black/White line, Contrast variation, Bubble Glass defect,　Polarizer defect, and so on. Details of the standard as follows.	1.50

8.2 Standards of inspection items

Inspection item			Judgement standard		
			Category	Acceptable number	
				A zone	B zone
1	Black spot, White spot Bright Spot, Pinhole Foreign Particle, Bubble and Particle Between polarizer and glass, Scratch on polarizer	=(a+b)/2(mm)	A 0.15 B 0.15< 0.20 C 0.20< 0.30 D 0.30< Total defective point(B,C)	Neglecte 2 1 0 3	Neglected
2	Black line, White line, Bubble and Particle Between Polarizer and glass, Scratch on polarizer	W:Width, L:Length(mm)	A W 0.10 B 0.01<W 0.03 L 3.0 C 0.03<W 0.05 L 3.0 D 0.05<W Total defective point(B,C)	Neglected 2 1 0 2	Neglected
3	Contrast variation	Φ=(a+b)/2(mm)	A Φ 0.2 B 0.2<Φ 0.3 C 0.3<Φ 0.4 D 0.4<Φ Total defective point(B,C)	Neglected 2 1 0 3	Neglected
4	Bubble inside cell		any size	none	none
5	Polarizer defect (if Polarizer is used)	Scratch and damage on polarizer, Particle on polarizer or between polarizer and glass.	Refer to item 1 and item 2.		
		Bubble, dent and convex	A Φ 0.3 B 0.3<Φ 0.7 C 0.7<Φ Total defective point(B,C)	Neglected 2 0 2	Neglected
6	Surplus glass	Stage surplus glass	b 0.3mm		
		Surrounding surplus glass	Should not influence outline dimension and assembling.		

Inspection item			Judgment standard	
			Category(application: B zone)	
7	Glass defect crack	The front of lead terminals	A	If a ≥ t and b ≤ 1.0, c is not limited
			B	a ≤ t, 1 ≤ b ≤ 2mm, c ≤ 3mm
			C	If glass crack cover alignment mark, b ≤ 0.5mm.
			D	Crack at two sids of lead terminals should not cover patterns and alignment mark
		Surrounding crack—non-contact side		b < Inner borderline of the seal
		Surrounding crack— contact side		b < Outer borderline of the seal
		Corner	A	a ≤ t, b ≤ 3.0, c ≤ 3.0
				*Glass crack should not cover patterns used for

Inspection item			Judgement standard
8	PCB defect	Component soldering: No cold soldering short open circuit burr tin ball The flat encapsulation component position deviation must be less than 1/2 width of the pin (Pic.1) the sheet component deviation: Pin deviates from the pad and contact with the near components is not permitted Pic.2	
		lead defect: The lead lack must be less than 1/2of its width; The lead burr must be less than 1/2 of the seam; Impurities connect with the near leads is not permitted	
		Connector soldering: Soldering tin is at contact position of the plug and socket is not permitted No foundation is scald Serious cave distortion on plug and socket contact pin is not permitted	

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.