

Shenzhen Leadtek Electronics Co.,Ltd

PRODUCT SPECIFICATION

TFT-LCD MODULE

Module No: LTK040WVHLM02-V0

☒ Preliminary Specification

☐ Approval Specification

Designed by	Checked by	Approved by
<i>jona</i>	<i>tom</i>	<i>lan</i>

Final Approval by Customer

Approved by	Comment

※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.



ISSUE RECORD

NO.	VER.	DATE	PAGE	MODIFY CONTENTS
1	V0	2022/03/14	ALL	New issued



1.General Specifications

No.	Item	Specification	Unit	Remar
1	LCD Size	3.95	inch	-
2	Panel Type	IPS	-	-
3	Resolution	480xRGBx480	Pixel	-
4	Display Mode	Normally Black	-	-
5	Number of Colors	16.7M	-	-
6	Viewing Direction	ALL FULL	-	Note1
7	NTSC	70%	-	Typ.
8	Contrast Ratio	800	-	Min
9	Luminance	1100	cd/m2	Typ
10	Module Size	77.36(H)x80.28(V)x2.82(T)	mm	Note1
11	Panel Active Area	71.86(H)x70.18(V)	mm	Note1
12	Pixel Pitch	0.1497(H)x0.1462(V)	mm	-
13	Pixel Arrangement	RGB Vertical Stripe	-	-
14	Weight	TBD	g	-
15	TFT Driver IC	ST7701S	-	-
16	Light Source	15 white LEDs in 5S3P	-	-
17	Interface	MIPI 2-lane	-	-
28	Operating Temperature	-20~+85	°C	-
219	Storage Temperature	-30~+85	°C	-

Note 1: Please refer to the mechanical drawing ;

2.Pin Assignments

Pin No.	Symbol	Function
1	GND	Power Ground
2	LEDK	Backlight LED-
3	NC	Not connect
4	LEDA	Backlight LED+
5	GND	Power Ground
6	RESET	Reset signal (Low: Active).
7	GND	Power Ground
8	IOVCC	TFT power supply 1.8-2.8V
9	GND	Power Ground
10	VDD	TFT power supply 2.8V
11	GND	Power Ground
12	MIPI_TDP1	MIPI DSI differential data 1 positive
13	MIPI_TDN1	MIPI DSI differential data 1 negative
14	GND	Power Ground
15	MIPI_TCP	MIPI DSI differential clock positive
16	MIPI_TCN	MIPI DSI differential clock negative
17	GND	Power Ground
18	MIPI_TDPO	MIPI DSI differential data 0 positive
19	MIPI_TDNO	MIPI DSI differential data 0 negative
20	GND	Power Ground
21	CTP_VCC3.3V	CTP power supply Pin
22	CTP_RST3.3V	CTP reset Pin
23	CTP_INT3.3V	CTP interrupt Tearing effect signal output
24	CTP_SDA3.3V	CTP I2C data Power supply
25	CTP_GND	CTP power ground
26	CTP_SCL3.3V	CTP I2C clock Power Supply for I/O System
27	ID1(GND)	Power Ground
28	ID2(GND)	Power Ground
29	ID3(NC)	Not connect
30	GND	Power Ground

3. Electrical Specification

3.1 Absolute Maximum Ratings

Item	Symbol	Value	Unit	Remark
Power Supply Voltage	VCI	-0.3~+4.5	V	-
Power Supply Voltage	IOVCC	-0.3~4.5	V	

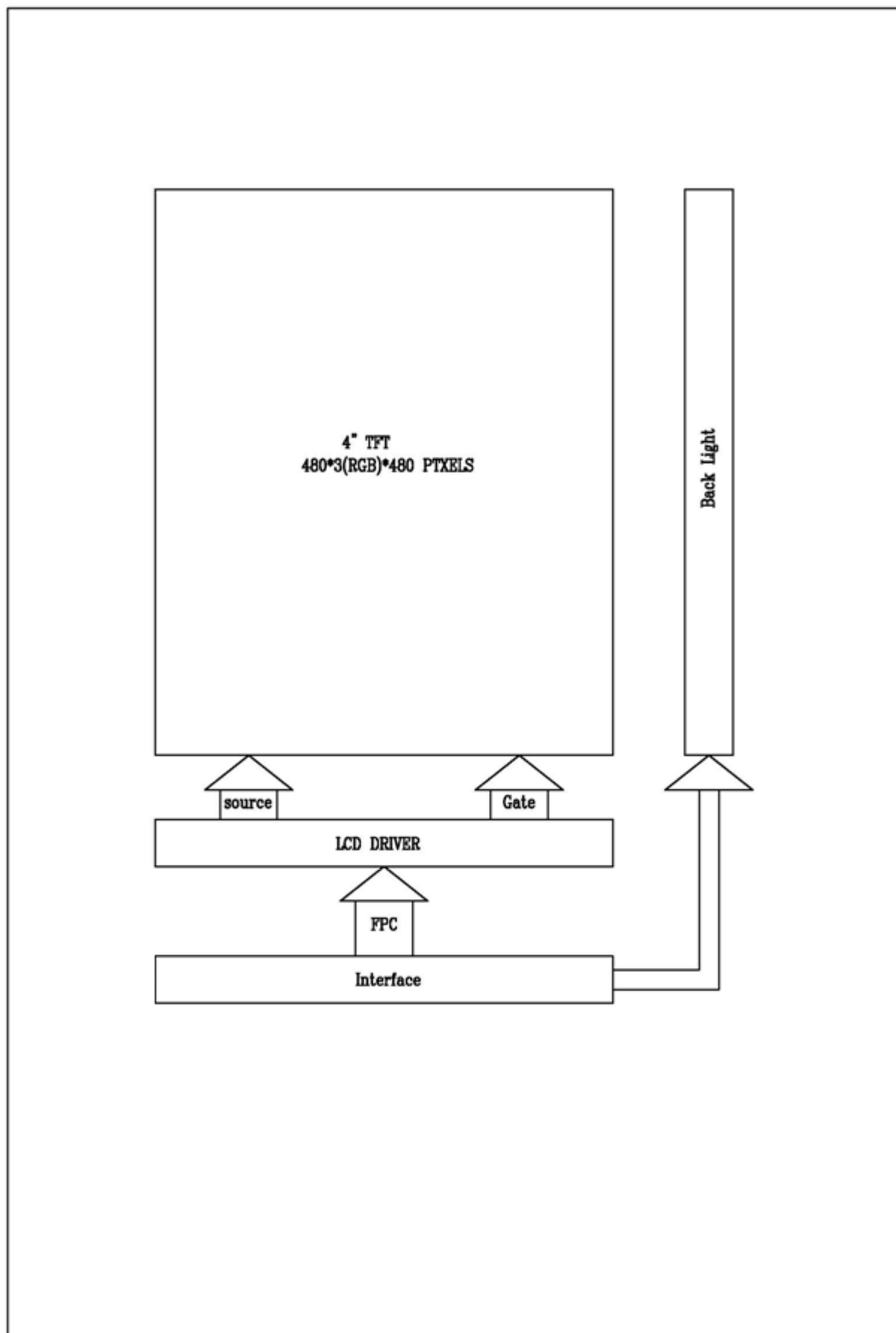
3.2 Typical Operation Conditions

Item	Symbol	Min.	Typ.	Max.	Unit
Analog Supply Voltage	VCI	2.7	3.0	3.3	V
I/O Supply Voltage	IOVCC	1.65	1.8	3.3	
Input High Voltage	V _{IH}	0.7* IOVCC	-	IOVCC	V
Input Low Voltage	V _{IL}	0	-	0.3* IOVCC	V
Output High Voltage	V _{OH}	0.8* IOVCC	-	-	V
Output Low Voltage	V _{OL}	-	-	0.2* IOVCC	V

3.3 Backlight Circuit Characteristics

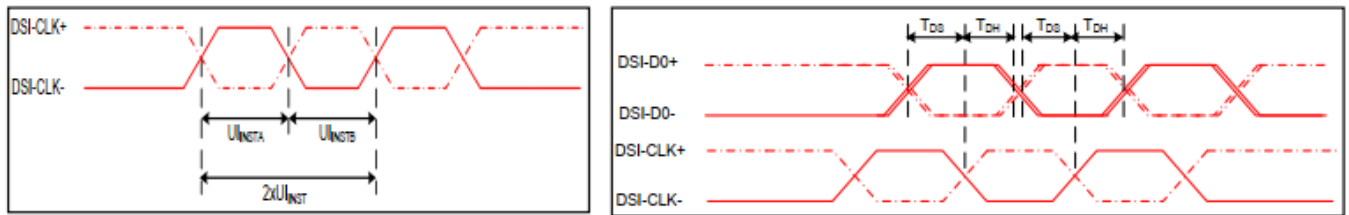
Item	Symbol	Min.	Typ.	Max.	Unit
LED Current	I _B	-	60	-	mA
LED Voltage	V _f	-	15.5	-	V
Power Consumption	P _{BL}	-	930	-	mW

4.Block Diagram



5.Timing

MIPI interface High speed mode



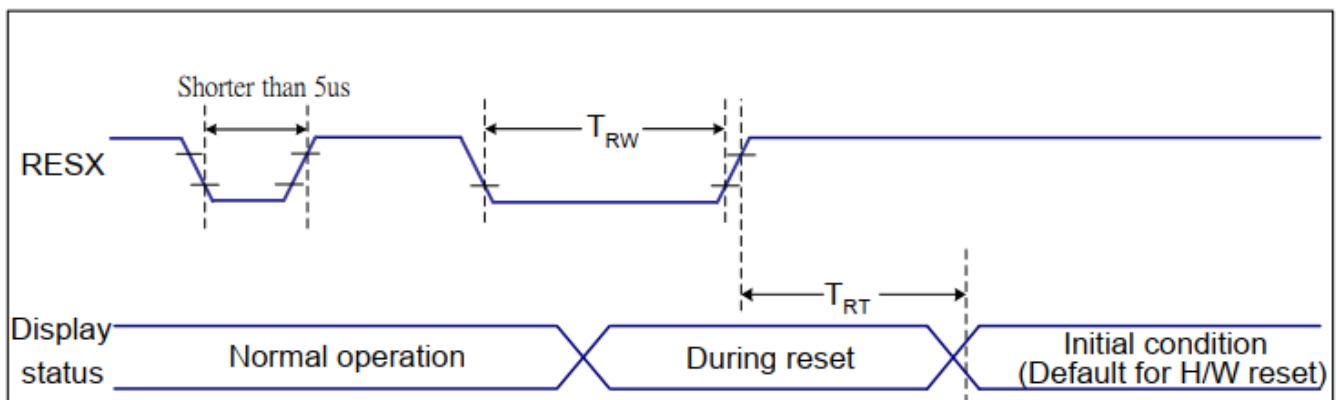
DSI clock channel timing

VDDI=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
DSI-CLK+/-	2xUI_INSTA	Double UI instantaneous	4	25	ns	
DSI-CLK+/-	UI_INSTA UI_INSTB	UI instantaneous halves	2	12.5	ns	UI = UI_INSTA = UI_INSTB
DSI-Dn+/-	tDS	Data to clock setup time	0.15	-	UI	
DSI-Dn+/-	tDH	Data to clock hold time	0.15	-	UI	

Mipi Interface- High Speed Mode Timing Characteristics

Reset Timing:



VDDI=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 °C

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

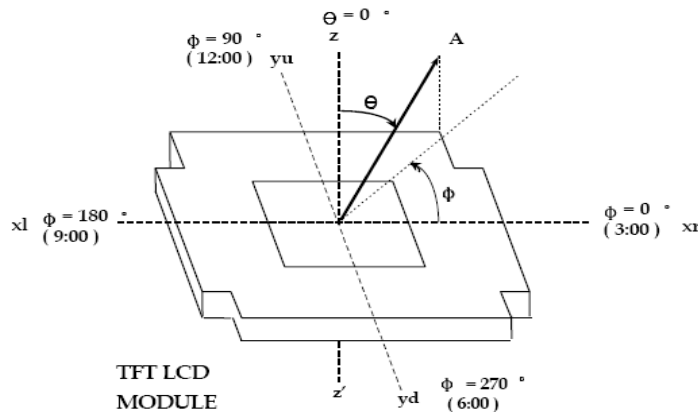
6.Optical Specification

6.1 LCM Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle Range	Left	θ_L	$CR \geq 10$	-	80	-	degree
	Right	θ_R		-	80	-	
	Top	θ_T		-	80	-	
	Bottom	θ_B		-	80	-	
Response Time		$T_{on} + T_{of}$ f	$\theta = \Phi = 0^\circ$	-	25	-	ms
LCD Surface Luminance				-	1100		cd/m ²
Contrast Ratio		CR	$\theta = \Phi = 0^\circ$	-	800	-	-
Color Chromaticity (CIE1931)	White	W_x	Normal $\theta = \Phi = 0^\circ$	-	0.326	-	-
		W_y		-	0.379	-	
	Red	R_x		-	0.623	-	
		R_y		-	0.361	-	
	Green	G_x		-	0.325	-	
		G_y		-	0.600	-	
	Blue	B_x		-	0.152	-	
		B_y		-	0.120	-	

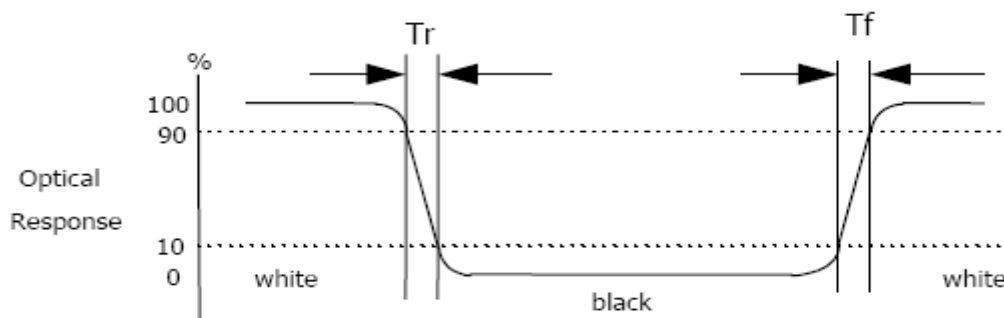
6.2 Measurement system

6.2.1 LCM Viewing Angle



Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.

6.2.2 Response time



Response time is the time required for the display to transition from white to black (Rising time, T_r) and from black to white (Falling time, T_f) for additional information.

6.2.3 Contrast Ratio (CR)

Contrast Ratio (CR) is defined mathematically as:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white.

7.Mechanical Drawing

1

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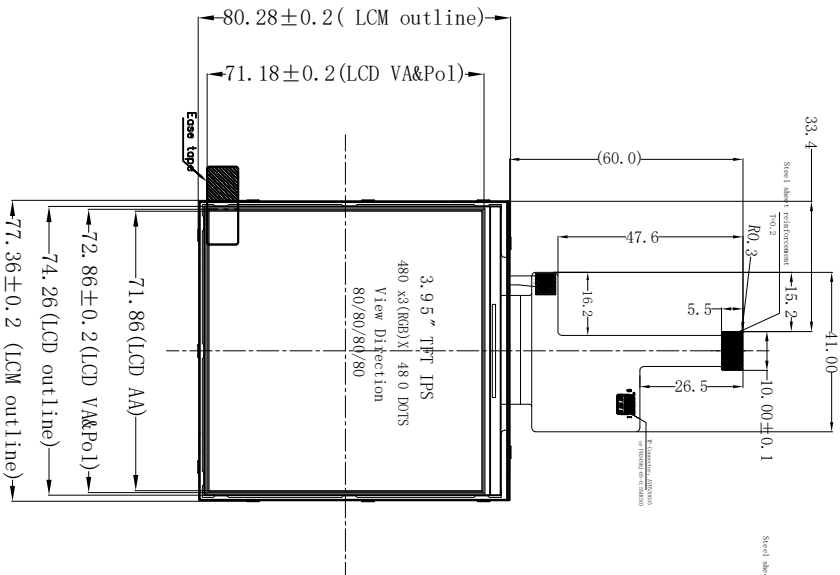
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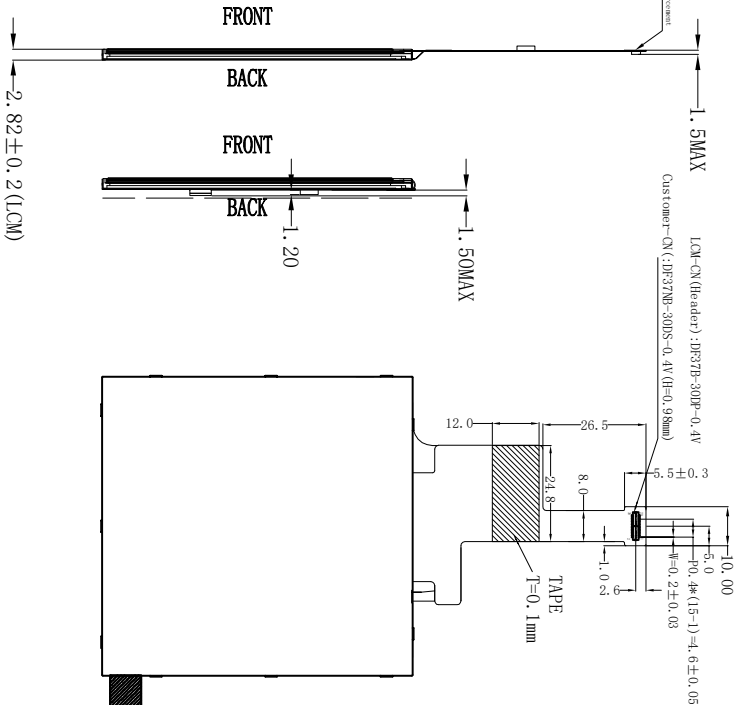
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6

Front View



Side View



Back View

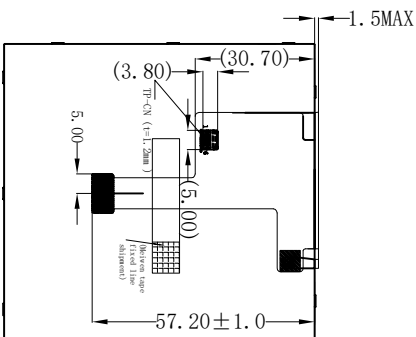
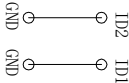
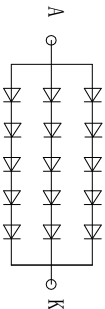


diagram of bending



NO	PIN NAME
1	GND
2	LEDK
3	NC
4	LEDA
5	GND
6	RESET
7	GND
8	IOVCC1. 8/2. 8V
9	GND
10	VDD 2. 8V
11	GND
12	MIPI_TDP1
13	MIPI_TDN1
14	GND
15	MIPI_TCP
16	MIPI_TCN
17	GND
18	MIPI_TDP0
19	MIPI_TDNO
20	GND
21	CTP_VCC3. 3V
22	CTP_RST3. 3V
23	CTP_INT3. 3V
24	CTP_SDA3. 3
25	CTP_GND
26	CTP_SCL3. 3V
27	ID1 (GND)
28	ID2 (GND)
29	ID3 (NC)
30	GND

IF=60mA, VF=15. 5±1. 0V



- TFT Notes:
1. Display : 3.95" , TFT IPS
 2. Resolution: 480XRGBx480
 3. LCD Viewing Direction: ALL
 4. DisplayMode: Normally Black
 5. LCD Driver: ST7701S
 6. OPERATING VOLTAGE: VDD 2.8~3.3V
 7. Luminance: 1100cd/m2 (Type) (SURFACE CTP)
 8. *:Critical dimension : () Reference dimension:
 9. Unmarked tolerance: ±0.2mm
 10. OPERATING TEMP: -20° C ~ +85° C
 11. STORAGE TEMP: -30° C ~ +85° C
 12. Requirements on Environmental Protection: ROHS

LEADTEK COMPANY LIMITED



SCALE: 1/1 UNIT: mm PAGE: 1/1

Part No: LTK040WHLM02 Ver: V0

Customer No: Ian

Customer No: Ian

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8. Reliability Test Items

Test Item	Test Condition	Test result determinant gist
High temperature storage	85±3°C , 96H ;	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Non-display; 3. Glass crack; 4. The electrical characteristics requirements shall be satisfied.
Low temperature storage	-30±3°C , 96H ;	
High temperature operation	85±3°C , 96H ;	
Low temperature operation	-20±3°C , 96H ;	
High temperature /humidity	60°C±3°C, 90%±3%RH , 96H ;	
Thermal Shock	-30°C/0.5h~+80°C/0.5h for a total 24 cycles ;	
Vibration Test	Frequency 10Hz~55Hz~10Hz Amplitude : 1.5mm, X , Y , Z direction for total 1H ; (Packing condition)	
ESD test	±2KV, Human Body Mode, 150pF/330Ω ; ±8KV, Air Mode, 150pF/330Ω ;	

9.Packing and Storage Specification

9.1 .Packing Method

1. Put module into tray cavity.
2. Tray stacking.
3. Put 1 foam under the tray stack and 1 foam above.
4. Fix the cardboard to the tray stack with adhesive tape.
5. Put the tray stack into carton.
6. Carton sealing with adhesive tape.

9.2. Storage Method

- 1.Store in an ambient temperature of $23^{\circ}\text{C}\pm 5^{\circ}\text{C}$, and in a relative humidity of $55\%\pm 15\%$. Don't exceed 12 months and expose to sunlight or fluorescent light.
2. Store in a clean environment, free from dust, active gas, and solvent.
3. Store in antistatic container.

10. Precautions

Please pay attention to the following when you use this TFT LCD module

10.1. Mounting Precautions

- (1) You must mount a module using arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the module. And, the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (1) Please attach a transparent protective plate to the surface in order to protect the polarizer.
Transparent protective plate should have sufficient strength in order to the resist external force.
- (4) You should adopt radiation structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not describe because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.
Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are determined to the polarizer)
- (7) When the surface becomes dusty, please wipe gently with adsorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

10.2 Operating Precautions

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage: $V=\pm 200\text{mV}$ (Over and under shoot voltage)
 - (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
 - (3) Brightness depends on the temperature. (In lower temperature, it becomes lower)
- And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (2) Be careful for condensation at sudden temperature change. Condensation makes damage To polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
 - (5) When fixed patterns are displayed for a long time, remnant image is likely to occur. (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and Shielding methods may be important to minimize the interference.

10.3 Electrostatic Discharge Control

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wristband etc. And don't touch interface pin directly.

10.4 Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

10.5 Storage

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped

10.6 Handling Precautions for protection film

- (1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

- (2) The protection film is attached to the polarizer with a small amount of glue. Is apt to remain on the polarizer. Please carefully peel off the protection film without rubbing it against the polarizer.
- (3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- (4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

11. Inspection Standards

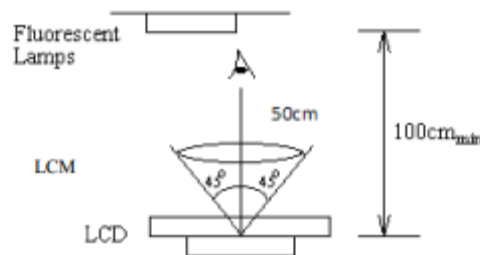
11.1. Acceptable quality level

The AQL define:

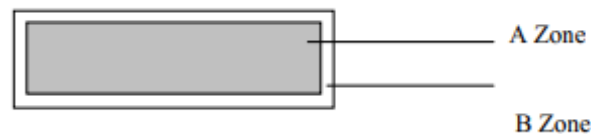
Inspection Item	Major defect	Minor defect
Cosmetic	1.0%	1.5%
Electrical test	0.65%	1.00%

11.2. Basic conditions for inspection

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 50 cm or more.



Definition of zone:



A Zone: Active display area (minimum viewing area).

B Zone: Non-active display area (outside viewing area).

Note: It is acceptable when it is no trouble for quality and assembly in customer's end product. Include bad bright/dark dot, concave point, air bubble, fold mark, linear scar, etc.

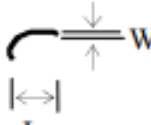
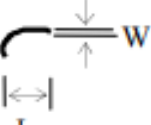
(1) Function Inspection

Inspecting items	Inspecting criterion	Classification of defects
All functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting or abnormal lighting, and abnormally lighting. 6) Obvious striation 7) Current consumption exceeds limit	Major
Missing	Missing component	
Outline dimension	Referred to counter drawing	

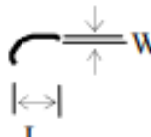
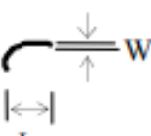
(2) TFT-LCD Pixel Inspection

Items	Judgment striation		
	$S \leq 5.0\text{inch}$	$5.0 < S \leq 7.0\text{inch}$	$7.0 < S \leq 12.1\text{inch}$
Bad dot-bright dot(R、G、B)	1	2	3
Two adjacent bright point	0	1	2
Three or more adjacent bright point	0	0	0
Total points for bad dot-bright dot	1	3	5
Bad dot-dark dot	2	4	5
Two adjacent bright point	1	2	3
Three or more adjacent bright point	0	1	1
Total points for bad dot-dark dot	3	7	9

(3) TFT Module Dot And Line Inspection

Item	Judgment criterion					Figure
	LCD Size		$S \leq 5.0\text{inch}$	$5.0 < S \leq 7.0\text{inch}$	$7.0 < S \leq 12.1\text{inch}$	
Dot inspection	$D \leq 0.1$		allowed	allowed	allowed	 $D = (X+Y)/2$
	$0.1 < D \leq 0.25$		4	allowed	allowed	
	$0.25 < D \leq 0.5$		0	5	6	
	$0.5 < D \leq 0.75$		0	0	6	
	$D > 0.75$		0	0	0	
	The distance between two defect dot: $DS \geq 5\text{mm}$					
Line inspection	L(mm)	W(mm)	Judgment criterion			 L
	disregard	$W \leq 0.05$	allowed	allowed	allowed	
	$L \leq 12$	$0.05 < W \leq 0.1$	4	5	7	
	$L > 12$	$W > 0.1$	0	0	0	
Concave point and air bubble for polarizer	LCD size(mm)		Judgment criterion			 $D = (X+Y)/2$
	$D \leq 0.3$		allowed	allowed	allowed	
	$0.3 < D \leq 1.0$		3	4	5	
	$01.0 < D \leq 1.5$		1	2	3	
	$D > 1.5$		0	0	0	
Fold mark、linear scar for polarizer	L(mm)	W(mm)	Judgment criterion			 L
	disregard	$W \leq 0.05$	allowed	allowed	allowed	
	$2 < L \leq 12$	$0.05 < W \leq 0.2$	3	4	5	
	$L > 12$	$W > 0.2$	0	0	0	
Glass chips of touch sensor and TFT display	Chip on edge		X/Y: $OK \leq 3\text{mm}$ Z: $OK \leq t$	X/Y: $OK \leq 5\text{mm}$ Z: $OK \leq t$	X/Y: $OK \leq 6\text{mm}$ Z: $OK \leq t$	
	Chip on corner		X/Y: $OK \leq 3\text{mm}$ Z: $OK \leq t$	X/Y: $OK \leq 5\text{mm}$ Z: $OK \leq t$	X/Y: $OK \leq 6\text{mm}$ Z: $OK \leq t$	
	Remarks: a. t = thickness of glass. b. Edge chipping cannot be close to the ITO trace/PAD. Chipping if present will not impact function, performance or reliability.					

(4) TFT And PCBA Module Dot And Line Inspection

Item	Judgment criterion				Figure	
	TFT Module Size	$S \leq 5.0\text{inch}$	$5.0 < S \leq 7.0\text{inch}$	$7.0 < S \leq 12.1\text{inch}$		
Dot inspection	$D \leq 0.1$	allowed	allowed	allowed	 $D = (X + Y) / 2$	
	$0.1 < D \leq 0.25$	6	allowed	allowed		
	$0.25 < D \leq 0.5$	0	8	9		
	$0.5 < D \leq 0.75$	0	0	6		
	$D > 0.75$	0	0	0		
	The distance between two defect dot: $DS \geq 5\text{mm}$					
Line inspection	L(mm)	W(mm)	Judgment criterion		 L	
	disregard	$W \leq 0.05$	allowed	allowed		allowed
	$L \leq 12$	$0.05 < W \leq 0.1$	6	7		8
	$L > 12$	$W > 0.1$	0	0		0
	The distance between two defect dot: $DS \geq 20\text{mm}$					
Concave point and air bubble for polarizer	LCD size(mm)	Judgment criterion			 $D = (X + Y) / 2$	
	$D \leq 0.3$	allowed	allowed	allowed		
	$0.3 < D \leq 1.0$	5	6	7		
	$1.0 < D \leq 1.5$	3	4	5		
	$D > 1.5$	0	0	0		
Fold mark、linear scar for polarize	L(mm)	W(mm)	Judgment criterion		 L	
	disregard	$W \leq 0.05$	allowed	allowed		allowed
	$2 < L \leq 12$	$0.05 < W \leq 0.2$	3	4		5
	$L > 12$	$W > 0.2$	0	0		0

(5) Module Cosmetic criteria

Item	Judgment Criterion
Difference in Spec	None allowed
Pattern peeling	No substrate pattern peeling and floating
Soldering defects	No soldering missing No soldering bridge No cold soldering
Stain	No stain to spoil cosmetic badly
Plate discoloring	No plate fading, rusting and discoloring
Newton ring	Referring to limited sample
Mura	Invisible with 5%ND,allowed
Light leaks	Referring to limited sample