FORMIKE® GROUP
LCD·SOLUTION·TOUCHSCREEN

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH070KQ40-F09 Version: 1.0

【 】 Preliminary Specification
【 ◆ 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

●It signifies that you fully understand and accept all the contents of this specification if you sign and send back the first page of this specifications.

Designed by	R&D Checked by	Quality Department by	Approved by
LEO			

Prepared By :

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● This specification is subject to change without notice. Please contact FORMIKE or it's representative before designing your product based on this specification.

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Revision record

VER NO.	VER DATE	CONTENTS	Note
1.0	**2018-05-25**	**NEW ISSUE**	Leo

2. General Description

2.1 Description

KWH070KQ40-F09 is a Transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver IC, FPC and backlight unit . The following table described the features of FORMIKE KWH070KQ40-F09.

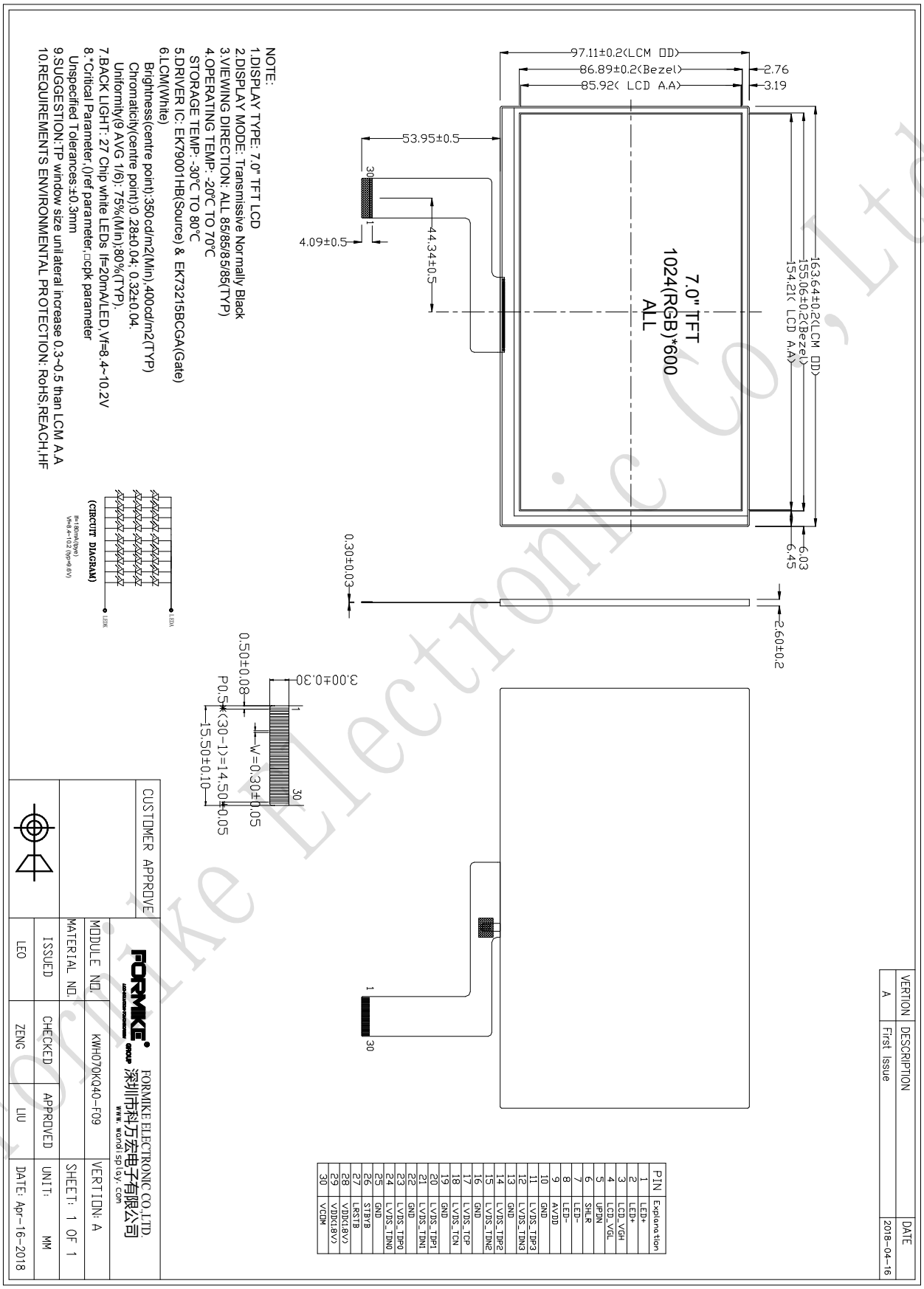
2.2 Application

PDA,GPS, Multimedia products
and other electronic Products
Etc.

2.3 Features:

Features	Description	UNITS
LCD type	7.0"TFT	--
Dot arrangement	1024（RGB）×600	dots
Driver IC	EK79001HB & EK73215BCGA	--
Color Depth	16.7M	
Interface	LVDS	--
View Direction	ALL	--
Module size	163.64(W) ×97.11 (H)×2.60(T)	mm
Active area	154.21(W) ×85.92(H)	mm
Dot pitch	0.1506 (W) ×0.1432 (H)	mm
Back Light	27 White LED In serial/parallel	--
With/Without TSP	Without TSP	
Weight(g)	-	

3. External Dimensions



4. Interface Description

For LCM

Pin No.	Symbol	Functional	Remark
1	LED+	Power for LED backlight (Anode)	
2	LED+	Power for LED backlight (Anode)	
3	LCD_VGH	Gate ON Voltage	
4	LCD_VGL	Gate OFF Voltage	
5	UPDN	Up/down selection	
6	SHLR	Left / right selection	
7	LED-	Power for LED backlight (Cathode)	
8	LED-	Power for LED backlight (Cathode)	
9	AVDD	Power for Analog Circuit	
10	GND	Power ground.	
11	LVDS_TDP3	LVDS DSI differential data pair. (Data lane 3)	
12	LVDS_TDN3	LVDS DSI differential data pair. (Data lane 3)	
13	GND	Power ground.	
14	LVDS_TDP2	LVDS DSI differential data pair. (Data lane 2)	
15	LVDS_TDN2	LVDS DSI differential data pair. (Data lane 2)	
16	GND	Power ground.	
17	LVDS_TDCP	LVDS DSI differential clock pair	
18	LVDS_TDCN	LVDS DSI differential clock pair	
19	GND	Power ground.	
20	LVDS_TDP1	LVDS DSI differential data pair. (Data lane 1)	
21	LVDS_TDN1	LVDS DSI differential data pair. (Data lane 1)	
22	GND	Power ground.	
23	LVDS_TDP0	LVDS DSI differential data pair. (Data lane 0)	
24	LVDS_TDN0	LVDS DSI differential data pair. (Data lane 0)	
25	GND	Power ground.	
26	STBYB	Display on/off.	
27	LRSTB	Global reset pin.	
28	VDD(1.8V)	Power for Digital Circuit(1.8V)	
29	VDD(1.8V)	Power for Digital Circuit(1.8V)	
30	VCOM	Common Voltage	

5. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	VDD	-0.3	5.0	V
Operating temperature	TOP	-20	+70	°C
Storage temperature	TST	-30	+80	°C
Power supply voltage (1)	VGH	-0.3	42	V
Power supply voltage (2)	VGL	-20	0.3	V
Power supply voltage (3)	VGH - VGL	-0.3	40	V
Power supply voltage (4)	AVDD	0.5	15	V

Note 1: All of the voltages listed above are with respective to GND = 0V.
Note 2: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

6. Electrical Characteristics

(VCC = 3.3V, GND = 0V, Ta = 25℃)

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	VDD	1.8	3.3	3.6	V	VDD
Input voltage	V_{IL}	0	-	0.3VDD	V	
	V_{IH}	0.7 VDD	-	VDD	V	
Input voltage	V_{GH}	17	18	19	V	
Input voltage	V_{GL}	-6.6	-6.0	-5.4	V	
Input voltage	V_{AVDD}	9.4	9.6	9.8	V	
Input voltage	V_{COM}	2.85	3.15	3.45	V	

7.Timing Characteristics.

DE mode

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency @Frame rate=60hz	fclk	40.8	51.2	67.2	Mhz
Horizontal display area	thd		1024		DCLK
HSYNC period time	th	1114	1344	1400	DCLK
HSYNC blanking	thb+thfp	90	320	376	DCLK
Vertical display area	Tvd		600		H
VSYNC period time	Tv	610	635	800	H
VSYNC blanking	Tvb+Tvfp	10	35	200	H

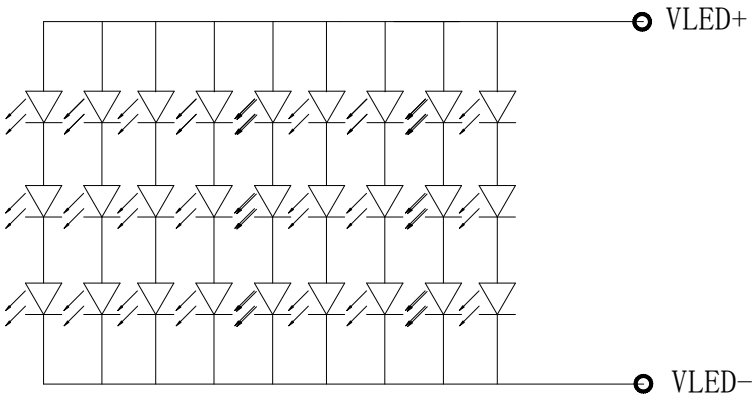
HV mode
Horizontal input timing

Parameter		Symbol	Value			Unit
Horizontal display area		thd		1024		DCLK
DCLK frequency@ Frame rate=60hz		fclk	Min.	Typ.	Max.	
			44.9	51.2	63	Mhz
1 Horizontal Line		th	1200	1344	1400	DCLK
HSYNC pulse width	Min.	thpw		1		
	Typ.			–		
	Max.			140		
HSYNC blanking		thb	160	160	160	
HSYNC front porch		thfp	16	160	216	

HV mode
Vertical input timing

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	tvd		600		H
VSYNC period time	tv	624	635	750	H
VSYNC pulse width	tvpw	1	–	20	H
VSYNC back porch	tvb	23	23	23	H
VSYNC front porch	tvfp	1	12	127	H

8. Backlight Characteristics.



(CIRCUIT DIAGRAM)

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	**Vf**	**8.4**	**9.9**	**10.2**	**V**	**If=180 mA**	**-**
Supply Current	**If**	**-**	**180**	**-**	**mA**	**-**	**-**
Reverse Voltage	**Vr**	**-**	**-**	**5**	**V**	**10uA**	
Power dissipation	**Pd**	**-**	**1782**	**-**	**mW**	**-**	
Luminous Intensity for LCM		**350**	**400**	-	**cd/m²**	**If=180 mA**	
Uniformity for LCM	**-**	**80**	**-**	**-**	%	**If=180 mA**	
Life Time	**-**	**50000**	**-**	**-**	**Hr**	**If=180 mA**	**-**
Backlight Color	**x**	**0.24**	**0.28**	**0.32**	**-**	**If=180 mA**	**-**
	y	**0.28**	**0.32**	**0.36**	**-**	**If=180 mA**	**-**

9.Optical Characteristics

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio		CR	θ=ψ= 0°	600	800	--	--	*1) 2)
Transmittance (with HC/Plain Polarizer)		T%	θ=ψ= 0°	3.8	4.1	--	%	*1) 6) Measuring with Polarizer , Reference Only
Response Time		Tr+Tf	θ=ψ= 0°	--	30	40	ms	*3)
View angle	Left	ϕ	CR≧10	80	85	--	°	*4) Measuring with Polarizer , Reference Only
	Right	ϕ		80	85	--	°	
	Upper	θ		80	85		°	
	Lower	θ		80	85		°	
Color Filter Chromaticity	W	X	θ=ψ= 0° Base on C light	0.280	0.300	0.320	--	*5) CF glass Base on C light
		Y		0.320	0.340	0.360		
	R	X		0.612	0.632	0.652	--	
		Y		0.296	0.316	0.336		
	G	X		0.277	0.297	0.317	--	
		Y		0.516	0.536	0.556		
	B	X		0.120	0.140	0.160	--	
		Y		0.134	0.154	0.174		
	NTSC(CIE 1931)		Base on C light	47	50	-	%	

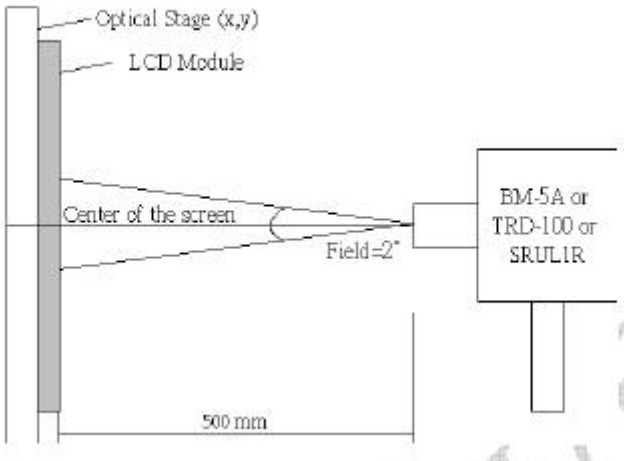
【Note】

*1) Setup of Measurement Equipment :

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.

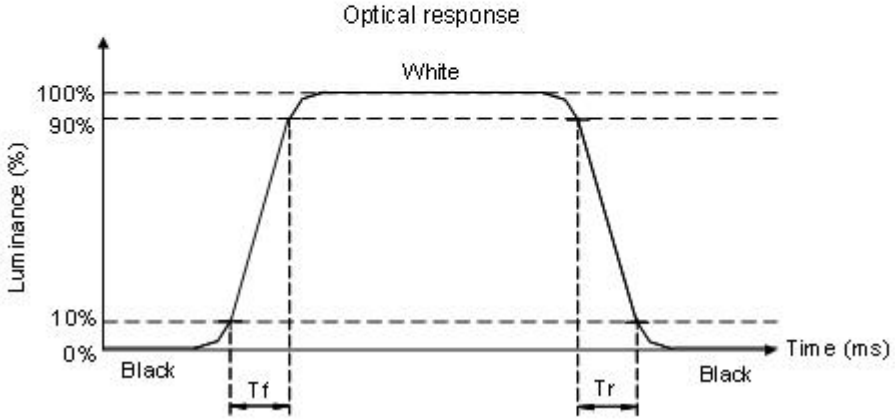
*2) Definition of contrast ratio :

CR = White Luminance (ON) / Black Luminance (OFF)

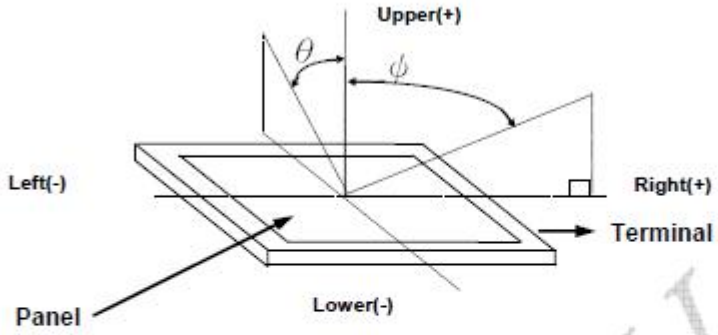


*3) Definition of response time :
The response time is defined as the time interval between the 10% and 90% amplitudes.

The output signals of photo detector are measured when the input signals are changed from "black" to "white" (rising time) and from "white" to "black" (falling time) respectively.



*4) Definition of view angle(θ、ϕ) :



*5) Light source: Base on C light.

*6) Definition of transmittance (T%) :
Transmittance=(Luminance of LCD module/Luminance of backlight)* 100%

10. RELIABILITY

No.	Test Item	Test Condition	Remark
1	High Temperature Storage	+80℃± 2℃，96 hrs	Note
2	Low Temperature Storage	-30℃± 2℃，96 hrs	Note
3	High Temperature Operation	+70℃± 2℃，96 hrs	Note
4	Low Temperature Operation	+20℃± 2℃，96 hrs	Note
5	High Temperature & High Humidity Storage Test	+50℃± 5℃, 90％R.H, 96 hours	Note
6	Temperature Cycle (non operation)	-30℃ ← +25℃ → +80℃ (30mins ← 5mins →30mins) 10 Cycles	Note
7	Electronic Static Discharge	Air Discharge: 2KV to with 5 times	Discharge for each polarity Mode of Operation: Single Discharge, successive discharge at least 1 sec
		Ambiance: 15℃~35℃,30%~60%R.H Resistance(Rd): 330Ω ±10% Capacitance(Cs + Cd): 150pF±10%	
8	Vibration (Packaged)	Frequency range: 10Hz ~ 55 Hz Amplitude: 1.5mm Direction of X.Y. Z for 3 Hrs in total	
9	Drop Test (Packaged)	Height: 80cm, Time: 1 1 corner, 3 edged, 6 surfaces	

Note : Recovery Time should be 2~4 hours at room temperature (20±8℃) and humidity (below 60% R.H). No abnormalities in functions and appearance

11.INSPECTION CRITERION

11.1 Scope

Display Quality Evaluation
Mechanics Specification

11.2 Sampling Plan

MIL-STD-105E
Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E
Lot size: Quantity per shipment as one lot (different model as different lot).
Sampling type: Normal inspection, single sampling
Sampling level: Level II.

11.3 Acceptable Quality Level

Item	Major	Minor
Appearance	1.0%	1.5%
Electrical	0.65	1.0%

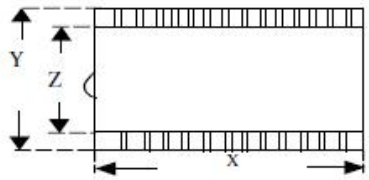
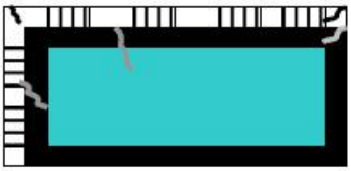
11.3.1 Classification of defects：
11.3.1.1Major defect
Any defect may result in functional failure, or reduce the usability of product for its purpose. For Example：Electrical failure, deformation and etc.
11.3.1.2 Minor defect
The criteria on major or minor judgment will be according with the classification of defects.

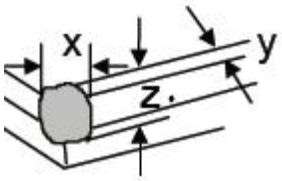
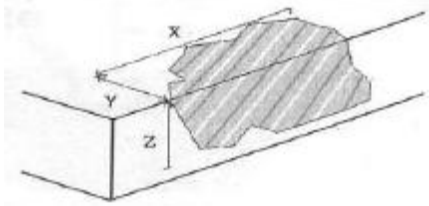
11.4 Panel Inspection Condition

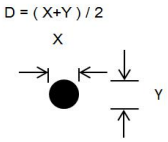
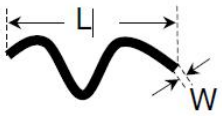
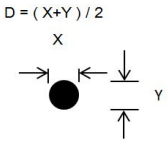
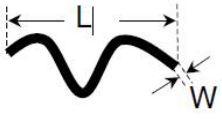
11.4.1 Environment:
11.4.2 Room Temperature: 25±5° C.
11.4.3 Humidity: 50±20% RH.
Illumination: 300 ~ 700 Lux.
11.4.4 Inspection Distance: 35±5 cm

11.5 TFT Inspection Criteria

11.5.1 Visual inspection criterion in cosmetic / appearance

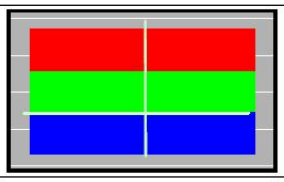
Glass defect			
No	Item	Criteria	Remark
1	Dimension (Minor)	By engineering diagram	
2	Crack (Major)	Extensive crack	

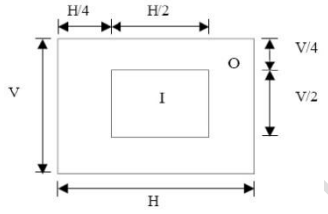
3	Corner (Minor)	X ≤4 mm Y ≤4 mm Z≤ T Ignore	 T: Glass thickness Z: Thickness X: Length Y: Width
4	Side (Minor)	X ≤6mm Y ≤4 mm Z≤ T Ignore	 T: Glass thickness Z: Thickness X: Length Y: Width

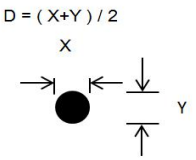
TFT defect in appearance			
No	Item	Criteria	Remark
1	Foreign Spot (Minor) Including: Black spot, White spot Pin hole Foreign particle	D≤0.3mm，Ignore 0.3mm<D≤0.5mm，N≤5 0.5mm<D，N=0 Distance≥5mm Ignore if out of Area AA	D =(X+Y)/2, X: Length, Y: Width 
2	Foreign Line(Minor) Including: Black line White line Bright line	W≤0.08mm，Ignore 0.08mm<W≤0.1mm, L≤6mm, N≤5 0.1mm<W≤0.15mm, L≤5mm, N≤2 W>0.15mm, N=0 Ignore if out of Area AA	L: Length, W: Width 
3	Polarizer Dent/Air Bubble (Minor)	D≤0.3mm，Ignore 0.3mm<D≤0.5mm，N≤5 D>0.50mm, N=0 Distance≥5mm Ignore if out of Area AA	D =(X+Y)/2, X: Length, Y: Width 
4	Polarizer Scratches (Minor)	W≤0.08mm，Ignore 0.08mm<W≤0.1mm, L≤6mm, N≤5 0.1mm<W≤0.15mm, L≤5mm, N≤2 W>0.15mm, N=0 Ignore if out of Area AA	L: Length, W: Width 

Other defects			
No	Item	Criteria	Remark
1	FPC (Minor)	Any crack or breakage which effect the function are not allowed Disregard if the dirty removed	
2	Backlight (Minor)	Power up is allowed. Breaking off is not allowed. The scratch which may causes a problem in practical use is not allowed	
3	Bezel (Minor)	Erasable dirt is ignore	

11.5.2 Visual inspection criterion in electrical display

Glass defect			
No	Item	Criteria	Remark
1	No display (Major) Abnormally Short circuit	Not allowed	
2	Missing line (Major)	Not allowed	
3	Darker or lighter line (Major)	Not allowed	
4	Weak line (Minor)	By limit sample	

<table>
<tr><td colspan="4">Display Inspection</td></tr>
<tr><td>No</td><td>Item</td><td>Criteria</td><td>Remark</td></tr>
<tr><td>1</td><td>Bright / Dark dot</td><td>
<table>
<tr><td>Items</td><td>Area I</td><td>Area O</td><td>Total</td></tr>
<tr><td>Bright</td><td>2</td><td>2</td><td>3</td></tr>
<tr><td>Dark</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Bright & Dark</td><td>4</td><td>5</td><td>7</td></tr>
<tr><td>2 adjacent dots</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td colspan="4">Minimum Distance ≥ 5mm</td></tr>
</table>
</td><td> 

1.1sub-pixel: 1R or 1G or 1B
2.Point defect area≥ 1/2 sub pixel</td></tr>
<tr><td>2</td><td>Tiny bright dot</td><td>Visible through 6% ND filter
D≤0.3mm，Ignore
0.3mm<D≤0.5mm，N≤5
D>0.5mm, N=0
Distance≥5mm
Ignore if out of Area AA</td><td>D =(X+Y)/2,
X: Length, Y: Width
 
</td></tr>
<tr><td>4</td><td>Mura/Waving/ Hot spot</td><td>Not visible through 6% ND filter in 50% gray or judge by limit sample if necessary</td><td></td></tr>
</table>

* Note:
1. Defect which is on the Black Matrix (outside of active area) are not considered as a defect.
2. If any specific defect is not included in the above defect table, this defect should be judged by Formike.
3. W：Width, L：Length D：Average Diameter N: Count.

12. PRECAUTION RELATING & PRODUCT HANDLING

Display is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification.

12.1 SAFETY

12.1.1 If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.

12.1.2 If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

12.2 HANDLING

12.2.1 Avoid any strong mechanical shock which can break the glass.

12.2.2 Avoid static electricity which can damage the CMOS LSI - When working with the module, be sure to ground your body and any electrical equipment you may be using. The followings should be noted:

12.2.2.1 CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.

12.2.2.2 Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.

12.2.2.3 Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.

12.2.2.4 The modules should be kept in anti-static bags or other containers resistant to static for storage.

12.2.2.5 Only properly grounded soldering irons should be used.

12.2.2.6 If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.

12.2.2.7 The normal static prevention measures should be observed for work clothes and working benches.

12.2.3.8 Since dry air is inductive to static, a relative humidity of 50-60% is recommended

12.2.3 Do not remove the panel or frame from the module.

12.2.4 The polarizing plate of the display is very fragile. Please handle it very carefully, do not touch, push or rub the exposed polarizing with anything harder than an HB pencil lead (glass, tweezers, etc.)

12.2.5 Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.

12.2.6 Do not touch the display area with bare hands, this will stain the display area.

12.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.

12.2.8 To control temperature and time of soldering is 300± 10℃and 3-4 sec.

To avoid liquid (include organic solvent) stained on LCD Module.

12.3 STORAGE

12.3.1 Store the panel or module in a dark place where the temperature is 25℃±5℃and the humidity is below 60% RH.

12.3.2 Avoid exposure to direct sunlight or to the light of fluorescent lamps.

12.3.3 Do not place the module near organic solvents or corrosive gases.

Do not crush, shake, or jolt the module.

12.4 LIMITED WARRANTY

12.4.1 FORMIKE modules are not consumer products, but may be incorporated by FORMIKE's customers into consumer products or components thereof, FORMIKE does not warrant that its modules and components are fit for any such particular purpose.

12.4.2 The liability of FORMIKE is limited to repair or replacement on the terms set forth below. FORMIKE 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 FORMIKE and the customer, FORMIKE will only replace or repair any of its Modules which is found defective electrically or visually when inspected in accordance with FORMIKE INSPECTION CRITERIA

12.4.3 No warranty can be granted if any of the precautions state in handling liquid crystal display has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

12.4.4 In returning the modules, they must be properly packaged; there should be detailed description of the failures or defect.

13. OTHERS

13.1 If there is any not specified quality standard in this specification as well as RMA , please refer to < INSPECTION CRITERIA>. Contact FORMIKE to get the complete <INSPECTION CRITERIA> by the contact window or feedback@wandisplay.com.

13.2 Special agreement of <INSPECTION CRITERIA> is recognized only in writhing between FORMIKE and the customer also indicated it before ordering.