FORMIKE ELECTRONIC CO.,LTD

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH050ST18-F01 Version: 1.0

【 ◆ 】 Preliminary Specification

【 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATA:

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

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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1. Revision record

VEV NO.	REV DATE	CONTENTS	Note
V1.0	**2013-9-27**	**NEW ISSUE**	

2. General Description

2.1 Description

KWH050ST18-F01 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 KWH050ST18-F01.

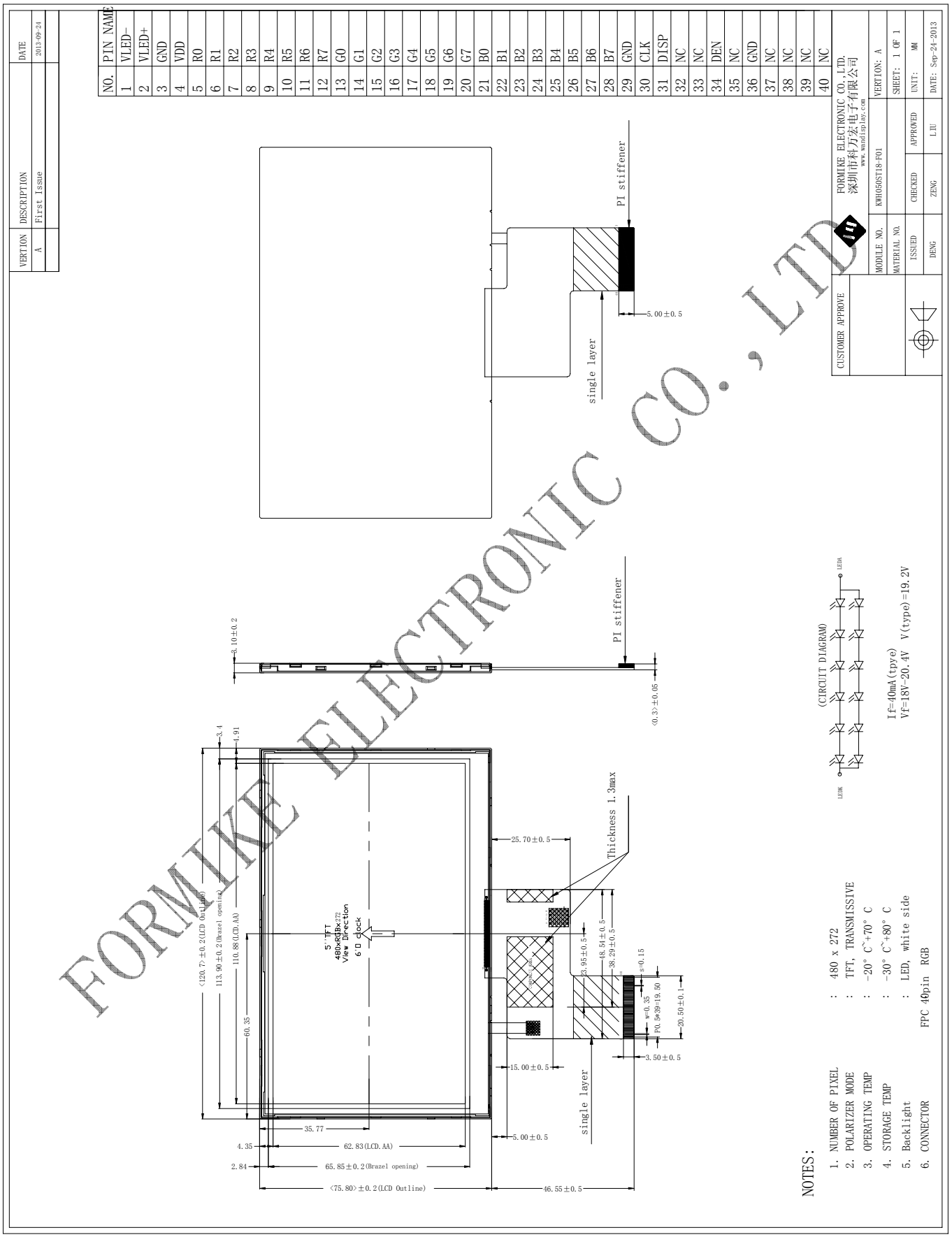
2.2 Application

Mobile phone, Multimedia products
and other electronic Products
Etc.

2.3 Features:

Features	Description	UNITS
LCD type	5”TFT	--
Dot arrangement	480（RGB）×272	dots
Driver IC	ILI6482	--
Color Depth	16.7M	
Interface	24-Bit RGB Interface	--
View Direction	6 O’clock	--
Module size	120.7(W) ×75.8 (H)×3.10(T)	mm
Active area	110.88(W) ×62.832(H)	mm
Dot pitch	0.231 (W) ×0.231 (H)	mm
Back Light	12 White LED In serial/parallel	--
With/Without TSP	Without TSP	
Weight(g)	TBD	

3. External Dimensions



4. Interface Description

FPC Connector is used for the module electronics interface. The recommended model is FH19SC-40S-0.5SH manufactured by HIROSE.

Pin No.	Symbol	Functional	Remark
1	VLED-	Power for LED backlight cathode.	
2	VLED+	Power for LED backlight anode.	
3	GND	Power ground.	
4	VDD	Power voltage.	
5	R0	Red data(LSB).	
6	R1	Red data.	
7	R2	Red data.	
8	R3	Red data.	
9	R4	Red data.	
10	R5	Red data.	
11	R6	Red data.	
12	R7	Red data(MSB).	
13	G0	Green data(LSB).	
14	G1	Green data.	
15	G2	Green data.	
16	G3	Green data.	
17	G4	Green data.	
18	G5	Green data.	
19	G6	Green data.	
20	G7	Green data(MSB).	
21	B0	Blue data(LSB).	
22	B1	Blue data.	
23	B2	Blue data.	
24	B3	Blue data.	
25	B4	Blue data.	
26	B5	Blue data.	
27	B6	Blue data.	
28	B7	Blue data(MSB).	
29	GND	Power Ground.	
30	CLK	Pixel clock.	
31	DISP	Display on/off.	
32	NC	No Connector.	
33	NC	No Connector.	
34	DE	Data Enable.	
35	NC	No Connector.	
36	GND	Power Ground.	
37	NC	No Connector.	
38	NC	No Connector.	
39	NC	No Connector.	
40	NC	No Connector.	

5. Absolute Maximum Ratings

Logic supply voltage, VDDIO	-0.5V to 5V
Analog supply voltage, VINT1	-0.3V to 7.0V
VGL	-16V to 0.3V
VGH~VGL	-0.3V to 35V
Operating Ambient Temperature, TA	-20°C to 85°C
Storage Temperature, TSTR	-55°C to 125°C

The device stressed above those lists under "Absolute Maximum Ratings" operation may cause a permanent damage. The functional operation of the device at these or any other condition above those indicated in the operational sections of this specification is not implied and exposed to absolute maximum rating conditions for extended periods may affect device reliability.

Recommended Operating Range

(GND = AGND = PGND = 0V and TA = -20°C to 85°C)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
Digital Supply Voltage	VDD	3.0	3.3	3.6	V	
Charge Pump Supply Voltage	PVDD	3.0	3.3	3.6	V	
Digital Interface Supple Voltage	VDDIO	1.8	-	VDD	V	
Digital Input Voltage	Din	0	-	VDDIO	V	
OTP Supply Voltage	VPP_OTP	7.0	7.5	8.0-	V	
VCOM AC Voltage	VCOMH - VCOML	2.92	-	6.2	V	

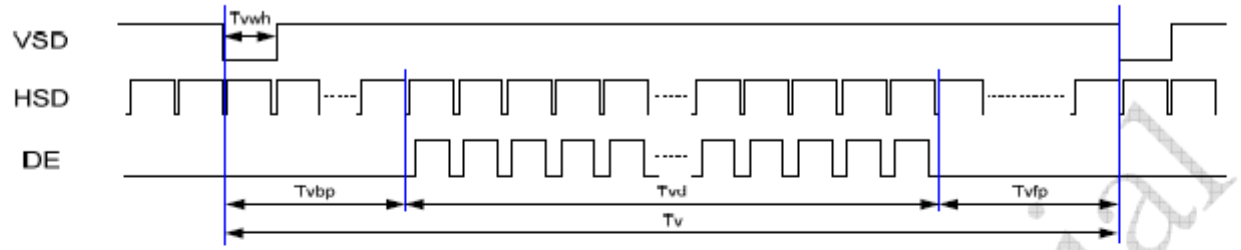
6. Electrical Characteristics

(VDDIO=1.8V to VDD, VDD=3.0V to 3.6V, GND=AGND=PGND=0V, and TA= -20°C to 85°C)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Conditions
Digital Block Circuit						
Low Level Input Voltage	Vil	GND	-	0.3xVDDIO	V	Digital input pins
High Level Input Voltage	Vih	0.7xVDDIO	-	VDDIO	V	Digital input pins
Input Leakage Current	Ii	-	-	±1	μA	Digital input pins
Pull-high/low Impedance	Rin	-	200k	-	ohm	Digital control input pins @ VDDIO=3.3V
High Level Output Voltage	Voh	VDDIO-0.4	-	-	V	Digital input pins @ Ioh=400μA
Low Level Output Voltage	Vol	GND	-	GND+0.4	V	Digital output pins @ Iol=-400μA
Digital Stand-by Current	Idst	-	TBD	TBD	μA	Outputs @ High-Z & all pins are set default
Digital Operating Current	Icc	-	TBD	-	mA	DCLK=9MHz & Fld=17.28kHz In 24-bit RGB mode & without loading
Analog Block Circuit						
GAMMA reference voltage	VGAMH	-	5	-	V	
Step-up Circuit 1 Output Voltage	VINT1	5.4	-	-	V	
VCOMH Output Level	VCOMH	2.46		5	V	By VCOMH[6:0] setting
VCOML Output Level	VCOML	-3.0		-0.46	V	By VCOML[6:0] setting; VCOML>VINT3
Voltage Deviation of Outputs	Vvd	-	±20	±35	mV	Vo=0.1V ~ 0.5V & VDDA-0.5 ~ VDDA-0.1
		-	±15	±20	mV	Vo=0.5V ~ VDDA-0.5V
Dynamic Range of Ouput	Vdr	0.1	-	VDDA-0.1	V	S1 to S720
Low-level Output Current of VCOM	IOLC	-	TBD	-	mA	VCOMH=4V, VCOML=-1V VCOM output=-1V vs. -0.1V
High-level Output Current of VCOM	IOHC	-	TBD	-	mA	VCOMH=4V, VCOML=-1V VCOM output=4V vs. 3.1V
Source Low-level Output Current	IOLS	TBD	-	-	μA	S1 to S720; VO=0.1V vs. 1V
Source High-level Output Current	IOHS	TBD	-	-	μA	S1 to S720; VO=4.9V vs. 4.0V
Gate Low-level Output Current	IOLG	TBD	-	-	μA	G1 to G544; VO=VGL vs. VGL+0.5V
Gate High-level Output Current	IOHG	TBD	-	-	μA	G1 to G544; VO=VGH vs. VGH-0.5V
Analog Stand-by Current	Iast	-	-	100	μA	STB= "L," All functions are shutdown
Analog Operating Current	IDD	-	TBD	-	mA	DCLK=9MHz, Fld=17.28kHz (@ 24bit RGB mode), No load

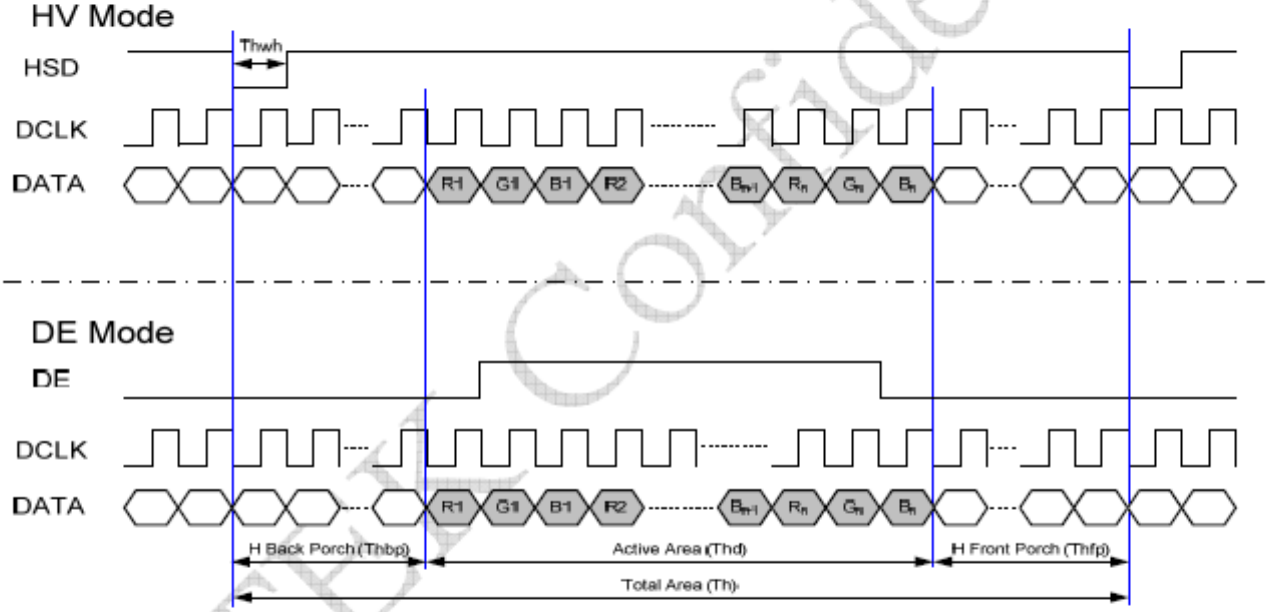
7.Timing Characteristics.

Vertical Input Timing



Serial 8bit RGB Mode Data Format

HV Mode



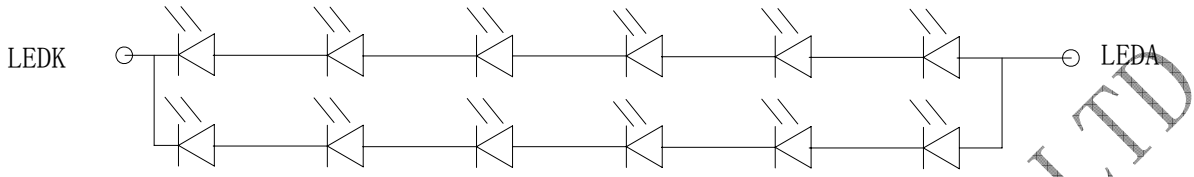
DE Mode

Serial RGB input timign table

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
DCLK frequency	fclk	-	27	-	MHz
VSD period time	Tv	277	288	400	H
VSD display area	Tvd		272		H
VSD back porch	Tvb	3	8	31	H
VSD front porch	Tvfp	2	8	97	H
HSD period time	Th	-	1728	-	DCLK
HSD display area	Thd		1440		DCLK
HSD back porch	Thbp	-	120	-	DCLK
HSD front porch	Thfp	-	168	-	DCLK

8. Backlight Characteristics.

(CIRCUIT DIAGRAM)



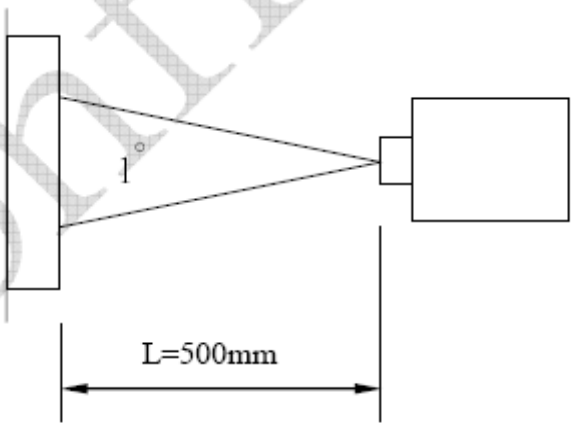
If=40mA(tpye)
Vf=18V-20.4V V(type)=19.2V

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	**Vf**	**18**	**19.2**	**20.4**	**V**	**If=40 mA**	**-**
Supply Current	**If**	**-**	**40**	**-**	**mA**	**-**	**-**
Reverse Voltage	**Vr**	**-**	**-**	**5**	**V**	**10uA**	
Power dissipation	**Pd**	**-**	**768**	**-**	**mW**	**-**	
Luminous Intensity for LCM		-	**350**	-	**Cd/m^2**	**If=40 mA**	
Uniformity for LCM	-	**80**	**-**	**-**	%	**If=40 mA**	
Life Time	-	**50000**	**-**	**-**	**Hr**	**If=40 mA**	**-**
Backlight Color	**White**						

9.Optical Characteristics

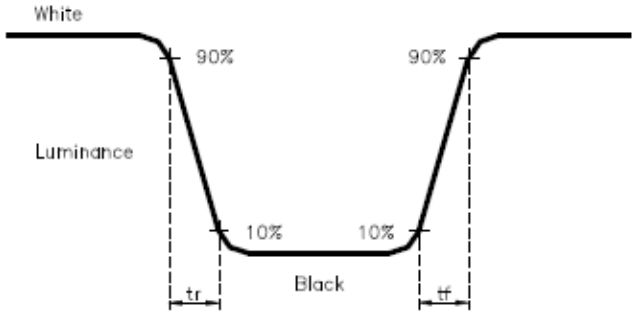
ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance		T		5.6	6.3		%	
Contrast Ratio		CR	*1)	350	500	-	--	Note 3
Response Time		Tr+ Tf	*3)	-	30		ms	Note 4
Viewing Angle	U	θ*2)	CR≧10	45	55	-		Note 5
	D			55	65	-		
	L	ψ*2)		55	65	-		
	R			55	65	-		
Color Filter Chromacicity	White	x	θ=ϕ= 0°	0.285	0.305	0.325		Note 6
		y		0.314	0.334	0.354		
		Y		29.9	32.9	35.9		
	Red	x	θ=ϕ= 0°	0.588	0.608	0.628		
		y		0.296	0.316	0.336		
		Y		17.8	20.8	23.8		
	Green	x	θ=ϕ= 0°	0.285	0.305	0.325		
		y		0.536	0.556	0.576		
		Y		57.6	61.6	65.6		
	Blue	x	θ=ϕ= 0°	0.115	0.135	0.155		
		y		0.117	0.137	0.157		
		Y		13.2	16.2	19.2		
	NTSC		-	-	53%	-		

Note 1.Ambient condition：25℃±2℃，60±10%RH，under 10 Lunx in the darkroom。
Note 2.Measure device：BM-5A (TOPCON)，viewing cone=1°，I_L=20mA。

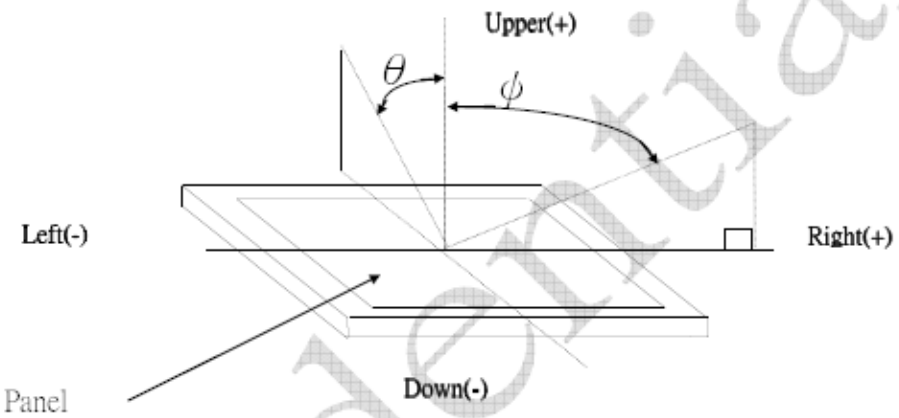


Note 3. Definition of Contrast Ratio：
CR = White Luminance (ON) / Black Luminance (OFF)

Note 4. Definition of response time：The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ、ψ)：



Note 6. Light source: C light.

10. Reliability Test Conditions And Methods

NO.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	80℃±2℃×200Hours	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1,Air bublle in the LCD. 2,Sealleak. 3,Non-display. 4,Missing segments. 5,Glass crack. 6,Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8, The electric Characteristics requirements shall be satisfied.
②	Low Temperature Storage	-30℃±2℃×200Hours	
③	High Temperature Operating	70℃±2℃×120Hours	
④	Low Temperature Operating	-20℃±2℃/120Hours	
⑤	Temperature Cycle(Storage)	-30℃±2℃ ⟺ 25℃ 80℃±2℃ (30min) (5min) (30min) 1cycle Total 10cycle	
⑥	Damp Proof Test	50℃±5℃×90%RH×120Hours	
⑦	Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5M X,Y,Z direction for total 3hours (Packing Condition)	
⑧	Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
⑨	ESD Test	Voltage: ± 8KV,R:330Ω,C:150PF,Air Mode,10times	

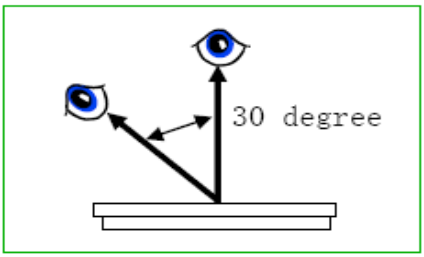
REMARK:
1,The Test samples should be applied to only one test item.
2,Sample side for each test item is 5~10pcs.
3,For Damp Proof Test,Pure water(Resistance＞10MΩ)should be used.
4,In case of malfunction defect caused by ESD damage,if it would be recovered to normal state after resetting,it would be judge 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, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

11.Inspection Standard

This standard apply to TFT module specification.

1. Inspection condition:

Under daylight lamp 20~40W, product distance inspector'eye 30cm,incline degree 30° 。



2. Inspection standard

<table>
<tr><th>NO.</th><th>Item</th><th>Inspection standard</th><th>Rate</th></tr>
<tr><td>2.1</td><td>Dot</td><td>Case of Dot defect is below
① Bright Dot (whit spot) : “0”
② Dark Dot (black spot) : “0” (In case of Dark Dot on Main TFT LCD)
- NG if there's full Dot defect.
- Damaged less than the size of sub-pixel is not counted as defect
- Dots darker than the size of sub-pixel are not defined as bright dot defect

<table>
<tr><th>area
size （mm）</th><th>Acceptable number</th></tr>
<tr><td>Φ≤0.10</td><td>ignore</td></tr>
<tr><td>0.10＜Φ≤0.15</td><td>3</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td>2</td></tr>
<tr><td>0.25＜Φ≤0.25</td><td>1</td></tr>
<tr><td>0.25＜Φ</td><td>0</td></tr>
</table></td><td rowspan="2">minor</td></tr>
<tr><td>2.2</td><td>line</td><td>
<table>
<tr><th colspan="2">Size （mm）</th><th>Acceptable number</th></tr>
<tr><td>ignore</td><td>W≤0.03</td><td>ignore</td></tr>
<tr><td>L≤4.0</td><td>0.03＜W≤0.04</td><td>2</td></tr>
<tr><td>L≤4.0</td><td>0.04＜W≤0.05</td><td>1</td></tr>
<tr><td></td><td>0.05＜W</td><td>Treat with dot non-conformance</td></tr>
</table></td></tr>
</table>

12. Handling Precautions

12.1 Mounting method

The LCD panel of FORMIKE ELECTRONIC CO,.LTD. module consists of two thin glass plates with polarizes which easily be damaged. And since the module in so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

12.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

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

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Salfur (S)

If goods were sent without being sili8con coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happen by miss-handling or using some materials such as Chlorine (CI), Salfur (S) from customer, Responsibility is on customer.

12.3 Caution against static charge

The LCD module use C-MOS LSI drivers, so we recommended 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 areas, assembly equipment to protect against static electricity.

12.4 packing

- Module employ 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 direct to sunshine or high temperature/humidity

12.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature then the operating temperature range and on the other hand at higher temperature LCD's how 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 operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%Rh or less is required.

12.6 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 the opening 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's keeping the 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 from us

12.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

13. Precaution For Use

13.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

13.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to FORMIKE ELECTRONIC CO,.LTD,and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.