

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH050ST13-F01 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			

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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	2016-12-14	NEW ISSUE	LEO

2. General Description

2.1 Description

KWH050ST13-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 KWH050ST13-F01.

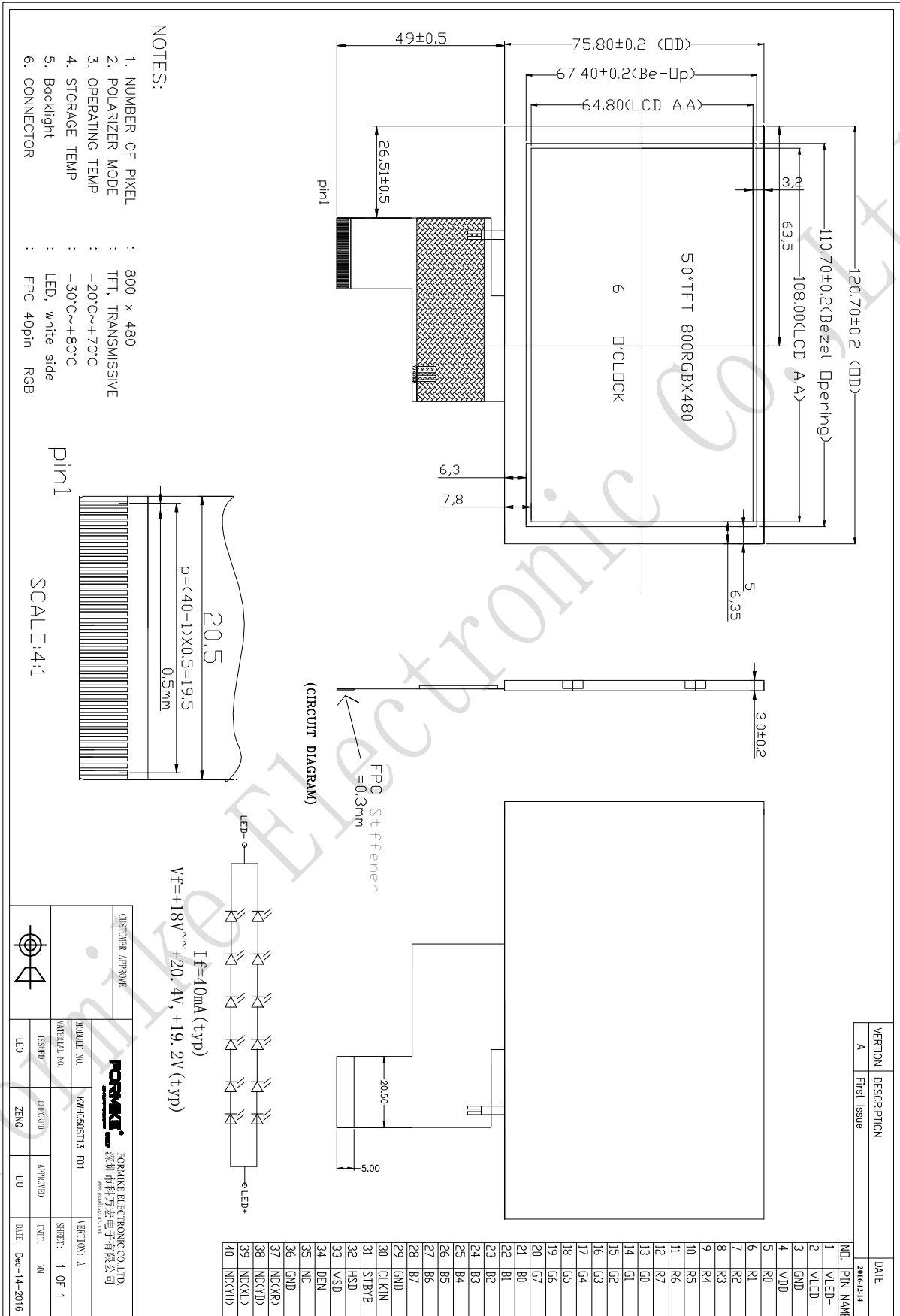
2.2 Application

Mobile phone, Multimedia products
and other electronic Products
Etc.

2.3 Features:

Features	Description	UNITS
LCD type	5" TFT	--
Dot arrangement	800 (RGB) × 480	dots
Driver IC	-	--
Color Depth	16.7M	--
Interface	24-Bit RGB Interface	--
View Direction	6 O'clock	--
Module size	120.7(W) × 75.80 (H) × 3.0(T)	mm
Active area	108.00(W) × 64.80(H)	mm
Dot pitch	0.135 (W) × 0.135 (H)	mm
Back Light	12 White LED In serial/parallel	--
With/Without TSP	Without TSP	--
Weight(g)	TBD	--

3. External Dimensions



4. Interface Description

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	CLKIN	Pixel clock.	
31	STBYB	Display on/off.	
32	HSD	Line synchronizing signal for RGB interface operation.	
33	VSD	Frame synchronizing signal for RGB interface operation.	
34	DE	Data Enable.	
35	NC	No Connector.	
36	GND	Power Ground.	
37	NC(XR)	NC(Touch Panel Right Side Wire).	
38	NC(YD)	NC(Touch Panel Down Side Wire).	
39	NC(XL)	NC(Touch Panel Left Side Wire).	
40	NC(YU)	NC(Touch Panel Up Side Wire).	

5. Absolute Maximum Ratings

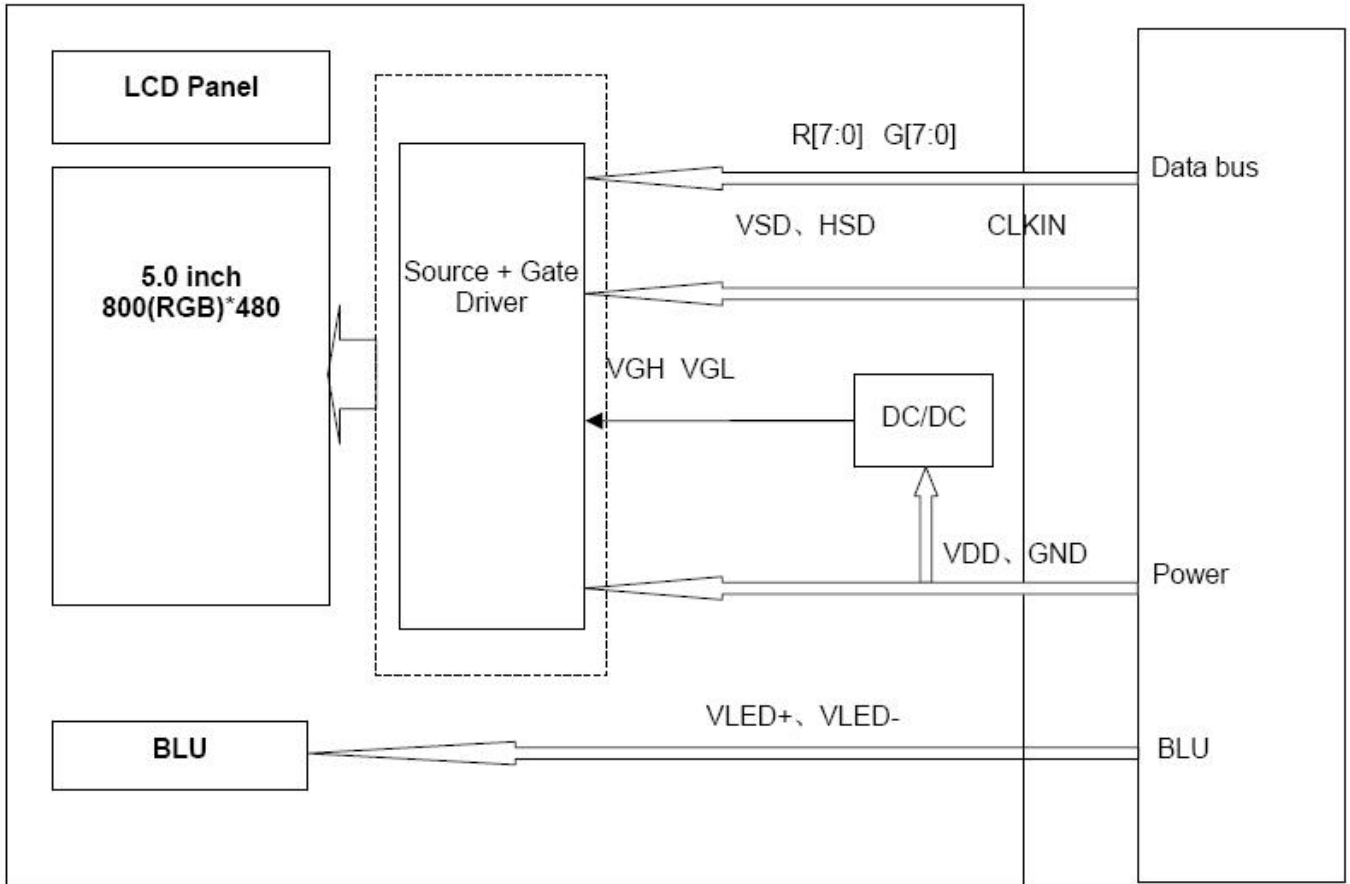
Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	V_{DD}	-0.3	5.0	V
Operating temperature	T_{OP}	-20	+70	°C
Storage temperature	T_{ST}	-30	+80	°C

6. Electrical Characteristics

Item	Symbol	Min	Typ	Max	Unit	Applicable terminal
Supply voltage for logic	V_{DD}	3.0	3.3	3.6	V	V_{DD}
Input voltage	V_{IL}	0	-	$0.3V_{DD}$	V	
	V_{IH}	$0.7 V_{DD}$	-	V_{DD}	V	

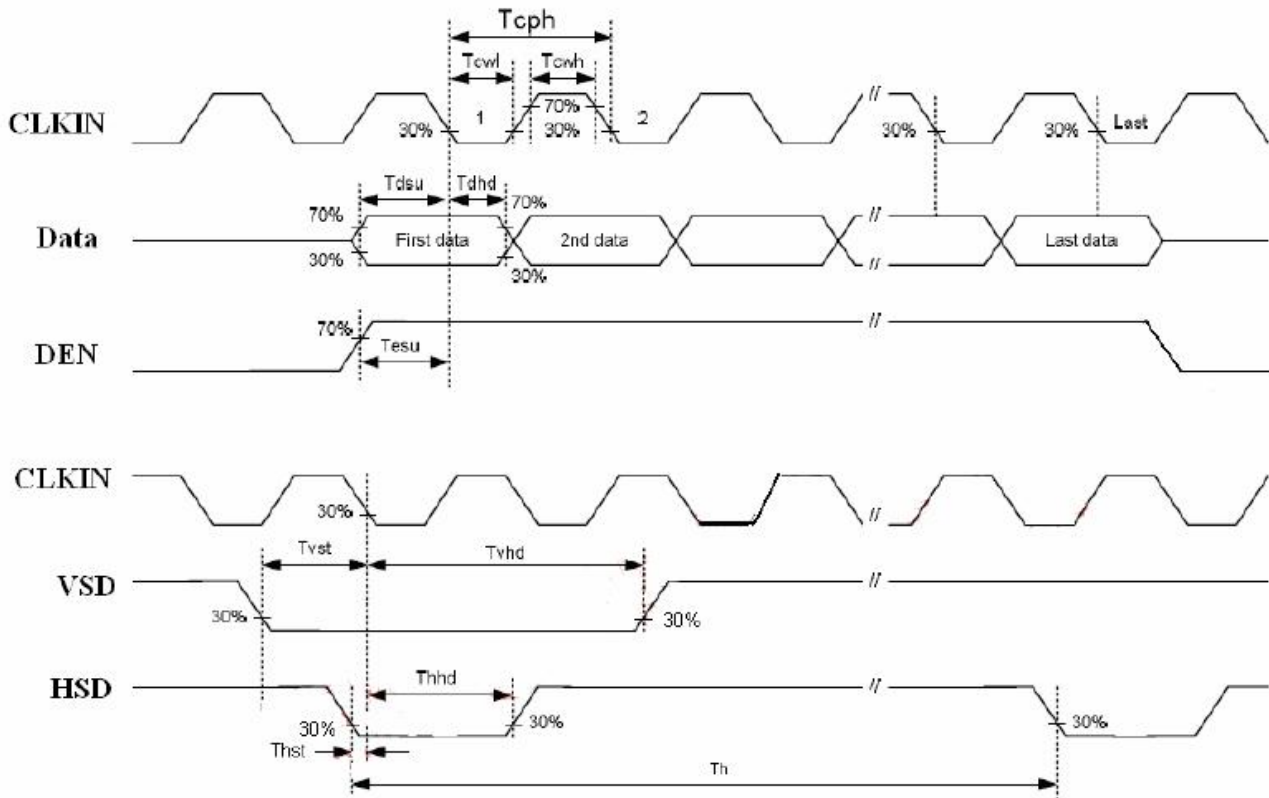
7. Timing Characteristics.

7.1 Block Diagram.



7.2 Input Clock And Data Timing

Parameter	Symbol	Min	Typ	Max	Unit	Remark
HSD Setup Time	T_{hst}	8			ns	
HSD Hold Time	T_{hhd}	8	-	-	ns	
VSD Setup Time	T_{vst}	8			ns	
VSD Hold Time	T_{vhd}	8	-	-	ns	
Data Setup Time	T_{dsu}	8			ns	
Data Hold Time	T_{dhd}	8	-	-	ns	
DE Setup Time	T_{esu}	8			ns	
DE Hold Time	T_{ehd}	8	-	-	ns	
CLKIN Cycle Time	T_{cph}	20	-	-	ns	
CLKIN Pulse Width	T_{cwh}	40	50	60	%	
Output stable time	T_{sst}	-	-	6	us	
VDD Power ON Slew rate	T_{por}			20	ms	
RSTB pulse width	TR_{rst}	10	-	-	us	

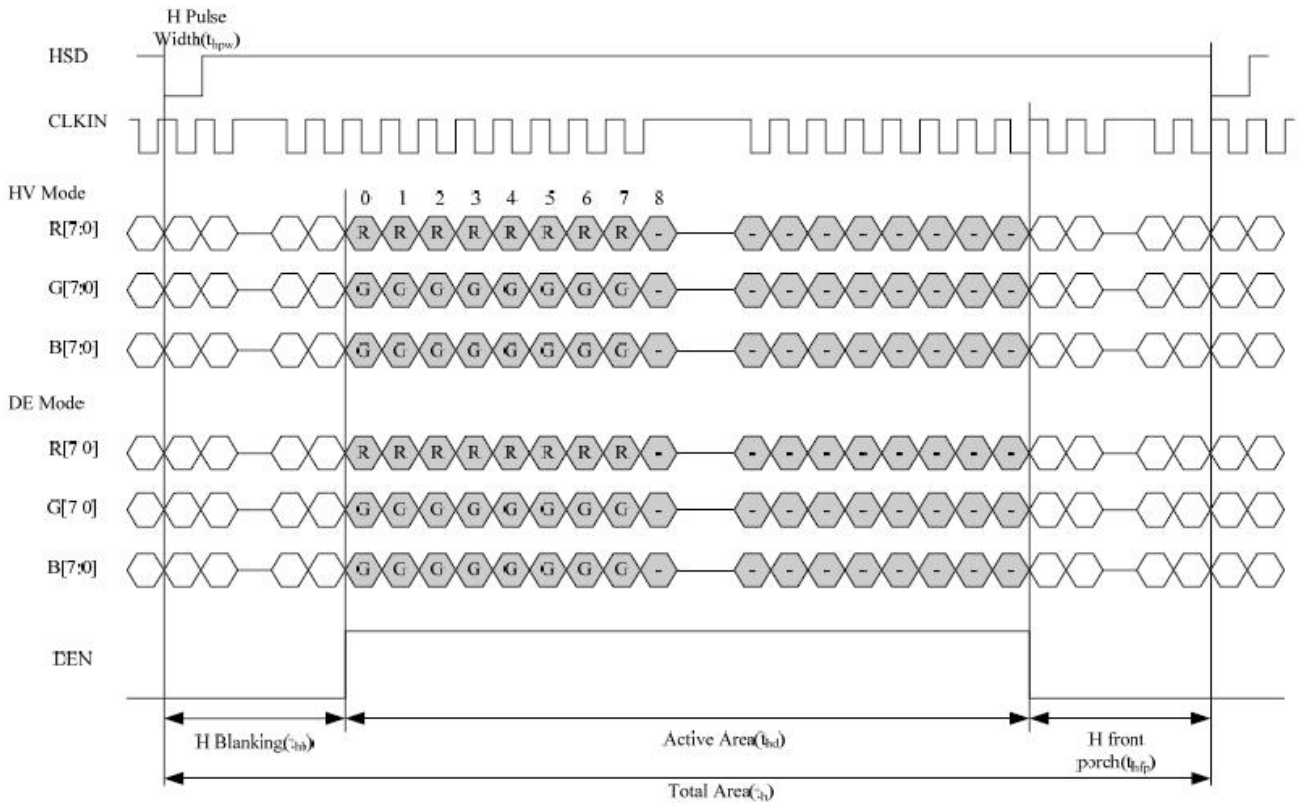


7.3 Parameter Setting Of Timing

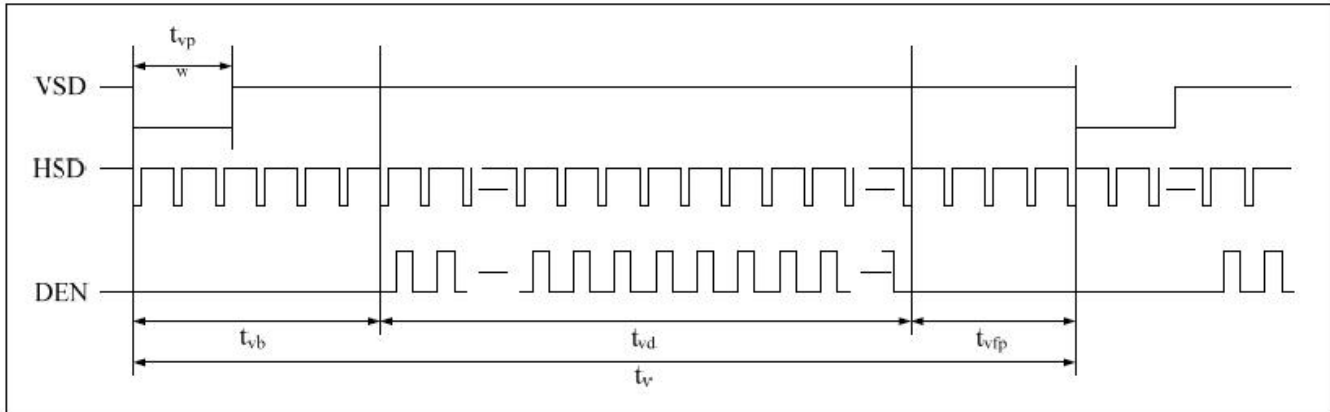
Horizontal Input Timing						
Parameter	Symbol	Value			Unit	
		Min.	Typ.	Max.		
Horizontal display area	t_{HD}	--	800	--	CLKIN	
CLKIN frequency	f_{CLK}	--	33.3	50	MHz	
1 Horizontal line period	t_H	862	1056	1200	CLKIN	
HSD pulse width	t_{HPW}	Min.	--	1	CLKIN	
		Typ.	--	--	CLKIN	
		Max.	--	40	CLKIN	
HSD back porch	SYNC	t_{HBP}	46	46	46	CLKIN
HSD front porch	SYNC	t_{HFP}	16	210	354	CLKIN

Vertical Input Timing					
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Vertical display area	t_{VD}	--	480	--	HSD
VSD period time	t_V	510	525	650	HSD
VSD pulse width	t_{VPW}	1	--	20	HSD
VSD back porch	t_{VBP}	23	23	23	HSD
VSD front porch	t_{VFP}	7	22	147	HSD

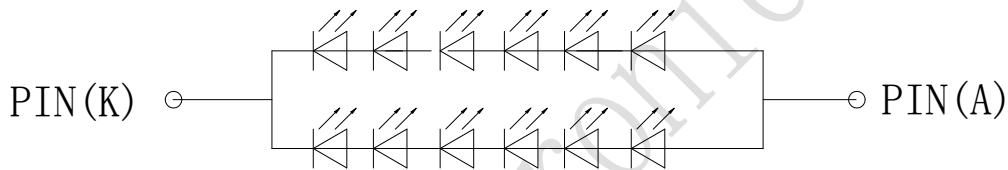
7.4 Horizontal Input Timing Diagram



7.5 Vertical Input Timing Diagram



8. Backlight Characteristics.



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		300	350	-	Cd/m²	If=40 mA	-
Uniformity for LCM	-	80	-	-	%	If=40 mA	-
Life Time	-	50000	-	-	Hr	If=40 mA	-
Backlight Color		White					

9.Optical Characteristics

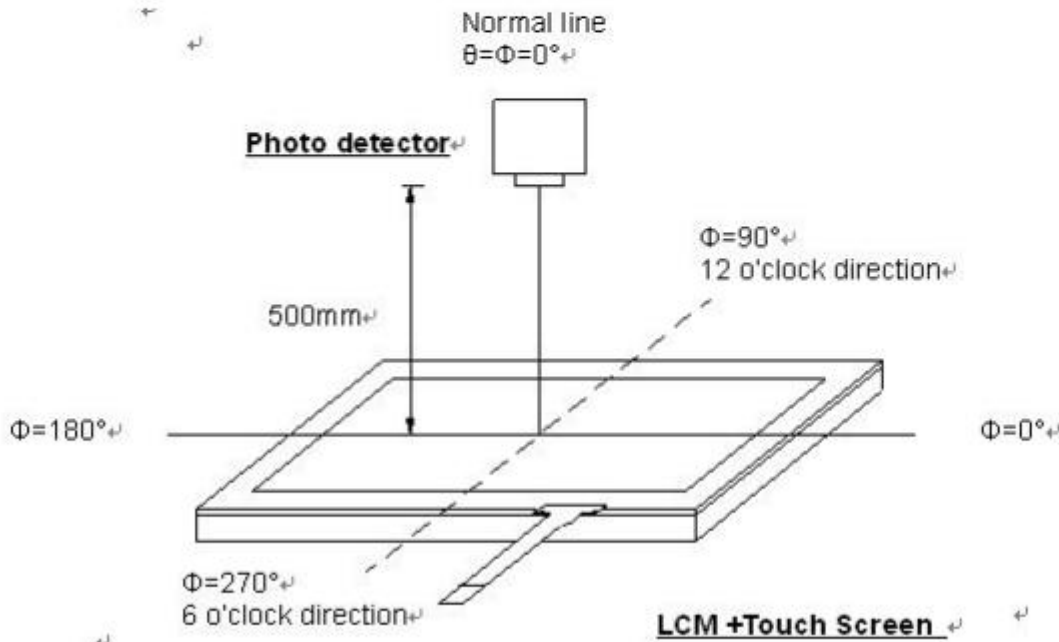
Item	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Viewing angle (CR≥ 10)	θ_L	$\Phi=180^\circ$ (9 o'clock)	60	70	-	degree	Note 1
	θ_R	$\Phi=0^\circ$ (3 o'clock)	60	70	-		
	θ_T	$\Phi=90^\circ$ (12 o'clock)	40	50	-		
	θ_B	$\Phi=270^\circ$ (6 o'clock)	60	70	-		
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	20	msec	Note 2 Note 3
	T_{OFF}		-	15	30		
Contrast ratio	CR		400	500	-	-	Note 4
Color chromaticity	W_X		0.26	0.31	0.36	-	Note 5
	W_Y		0.28	0.33	0.38	-	
Transmittance	Tr		3.73	4.66		%	

Test Conditions:

1. $V_{CC}=3.3V$, $V_{LED}=5.0V$.The ambient temperature is $25^\circ C$.
2. The test systems refer to Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)



Optical measurement system setup

Note 2: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

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10. RELIABILITY

No.	Test Item	Test Condition	Remark
1	High Temperature Storage	+80°C± 2°C, 96 hrs	Note
2	Low Temperature Storage	-30°C± 2°C, 96 hrs	Note
3	High Temperature Operation	+70°C± 2°C, 96 hrs	Note
4	Low Temperature Operation	+20°C± 2°C, 96 hrs	Note
5	High Temperature & High Humidity Storage Test	+50°C± 5°C, 90%R.H, 96 hours	Note
6	Temperature Cycle (non operation)	-30°C ← +25°C → +80°C (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°C~35°C, 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°C) 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:

11.3.1.1 Major 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: $25 \pm 5^{\circ}$ C.

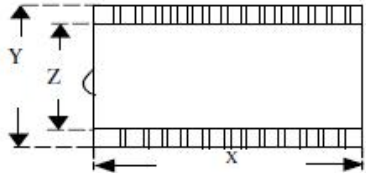
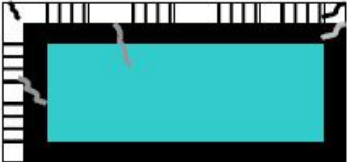
11.4.3 Humidity: $50 \pm 20\%$ RH.

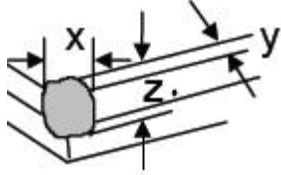
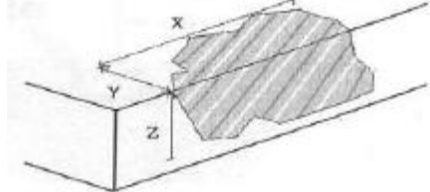
Illumination: 300 ~ 700 Lux.

11.4.4 Inspection Distance: 35 ± 5 cm

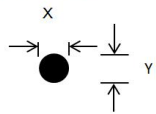
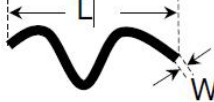
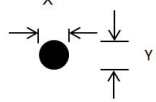
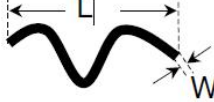
11.5 TFT Inspection Criteria

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	



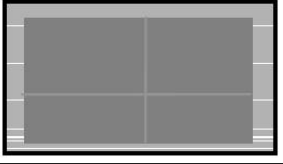
3	Corner (Minor)	$X \leq 3 \text{ mm}$ $Y \leq 3 \text{ mm}$ $Z \leq T$ Ignore	 <p>T: Glass thickness Z: Thickness X: Length Y: Width</p>
4	Side (Minor)	$X \leq 5 \text{ mm}$ $Y \leq 3 \text{ mm}$ $Z \leq T$ Ignore	 <p>T: Glass thickness Z: Thickness X: Length Y: Width</p>

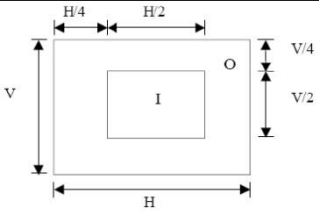
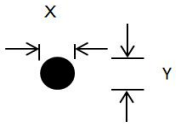
TFT defect in appearance

No	Item	Criteria	Remark
1	Foreign Spot (Minor) Including: Black spot, White spot Pin hole Foreign particle	$D \leq 0.25 \text{ mm}$, Ignore $0.25 \text{ mm} < D \leq 0.5 \text{ mm}$, $N \leq 3$ $0.5 \text{ mm} < D$, $N = 0$ Distance $\geq 5 \text{ mm}$ Ignore if out of Area AA	$D = (X+Y)/2$, X: Length, Y: Width $D = (X+Y)/2$ 
2	Foreign Line(Minor) Including: Black line White line Bright line	$W \leq 0.05 \text{ mm}$, Ignore $0.05 \text{ mm} < W \leq 0.08 \text{ mm}$, $L \leq 4 \text{ mm}$, $N \leq 3$ $0.08 \text{ mm} < W \leq 0.1 \text{ mm}$, $L \leq 4 \text{ mm}$, $N \leq 1$ $W > 0.1 \text{ mm}$, $N = 0$ Ignore if out of Area AA	L: Length, W: Width 
3	Polarizer Dent/Air Bubble (Minor)	$D \leq 0.25 \text{ mm}$, Ignore $0.25 \text{ mm} < D \leq 0.5 \text{ mm}$, $N \leq 4$ $D > 0.50 \text{ mm}$, $N = 0$ Distance $\geq 5 \text{ mm}$	$D = (X+Y)/2$, X: Length, Y: Width $D = (X+Y)/2$ 
4	Polarizer Scratches (Minor)	$W \leq 0.05 \text{ mm}$, Ignore $0.05 \text{ mm} < W \leq 0.08 \text{ mm}$, $L \leq 4 \text{ mm}$, $N \leq 3$ $0.08 \text{ mm} < W \leq 0.1 \text{ mm}$, $L \leq 4 \text{ mm}$, $N \leq 1$ $W > 0.1 \text{ mm}$, $N = 0$ 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	

Display Inspection						
No	Item	Criteria				Remark
1	Bright / Dark dot	Items	Area I	Area O	Tota I	 <p>1.1 sub-pixel: 1R or 1G or 1B 2. Point defect area \geq 1/2 sub pixel</p>
		Bright	1	2	2	
		Dark	2	3	4	
		Bright & Dark	2	4	5	
		2 adjacent dots	0	0	0	
Minimum Distance \geq 5mm						
2	Tiny bright dot	Visible through 6% ND filter $D \leq 0.25\text{mm}$, Ignore $0.25\text{mm} < D \leq 0.5\text{mm}$, $N \leq 4$ $D > 0.5\text{mm}$, $N = 0$ Distance $\geq 5\text{mm}$ Ignore if out of Area AA				$D = (X+Y)/2$, X: Length, Y: Width $D = (X+Y) / 2$ 
4	Mura/Waving/ Hot spot	Not visible through 6% ND filter in 50% gray or judge by limit sample if necessary				

* Note:

- Defect which is on the Black Matrix (outside of active area) are not considered as a defect.
- If any specific defect is not included in the above defect table, this defect should be judged by Formike.
- 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 $300 \pm 10^{\circ}\text{C}$ 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 $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 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.