PRODUCT SPECIFICATION

TFT LCD MODULE
MODEL : KWH030ST11-F02 Version: 1.0

【 ◆ 】 Preliminary Specification
【　 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATA:

●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 :

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

Revision record

REV NO.	REV DATE	CONTENTS	Note
V1.0	2014-11-11	NEW ISSUE	

Table Of Contents

1. General Description

1.1 Description

KWH030ST11-F02 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, backlight and RTP unit . The following table described the features of FORMIKE KWH030ST11-F02.

1.2   Application

Mobile phone, Multimedia products
and other electronic Products
Etc.

1.3   Features:

Features	Description	UNITS
LCD type	3.0"TFT	--
Dot arrangement	240（RGB）×400	dots
Driver IC	ST7793	--
Color Depth	65K/262K	
Interface	CPU 8/9/16/18 bits	
Module size	45.04(W) ×77.00 (H)×3.7(T)	mm
Active area	38.88(W) ×64.80(H)	mm
Dot pitch	0.162 (W) ×0.162 (H)	mm
Back Light	4 White LED In parallel	--
With/Without TSP	With TSP	
Weight(g)	TBD	

2. External Dimensions
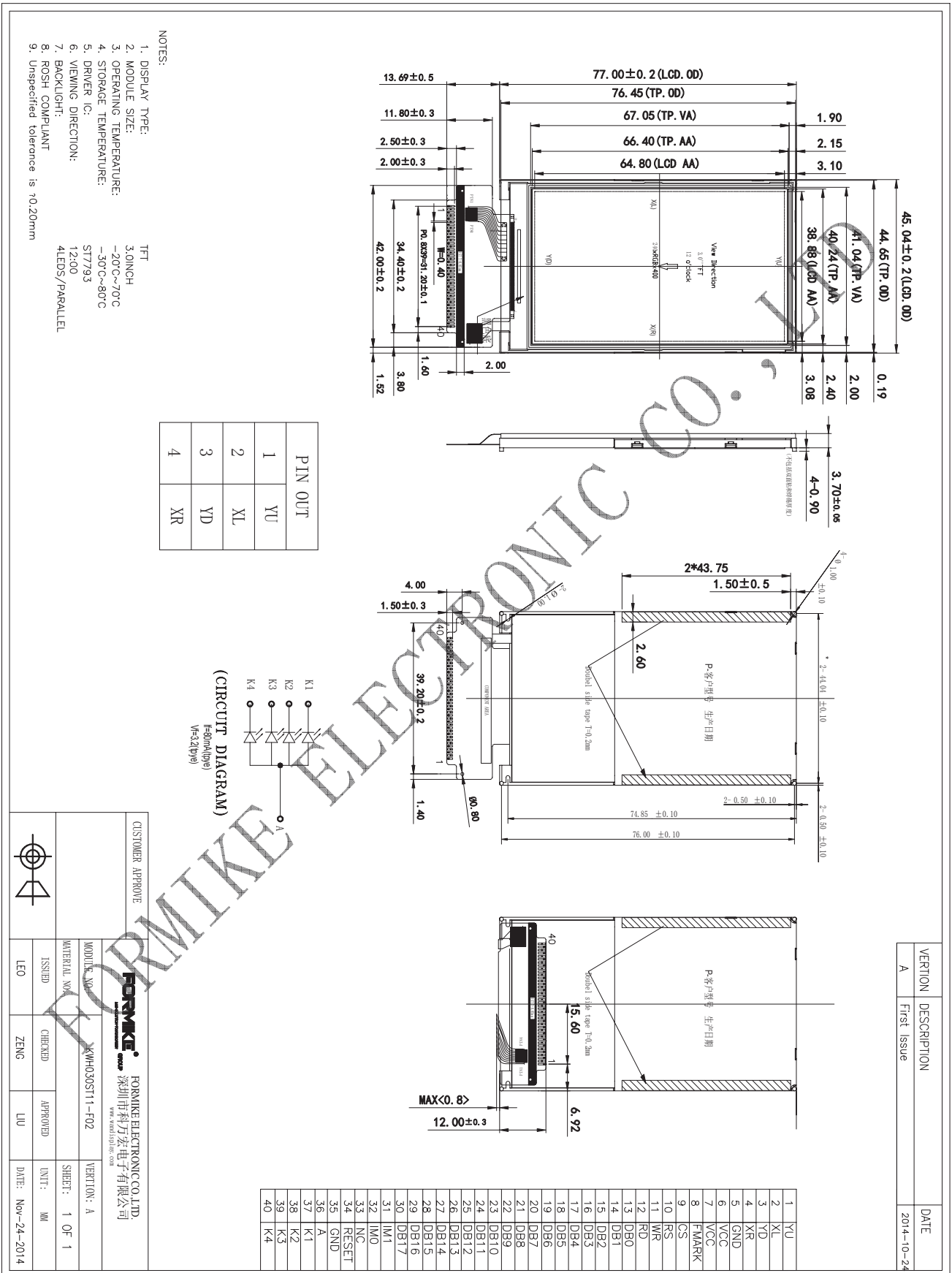
3. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1	YU	Touch Panel Up Side Wire.
2	XL	Touch Panel Left Side Wire.
3	YD	Touch Panel Down Side Wire.
4	XR	Touch Panel Right Side Wire.
5	GND	Ground.
6-7	VCC	Power supply (+2.5V~+3.3V).
8	FMARK	Frame head pulse. FMARK is used when writing data to the internal.
9	CS	Chip select signal, Active "L".
10	RS	Command / Display data selection 0: command;　1: display data.
11	WR	Write signal input, Active" L ".
12	RD	Read signal input, Active" L ".
13	DB0	80-system-18-Bit Data Bus.
14	DB1	80-system-18-Bit Data Bus.
15	DB2	80-system-18-Bit Data Bus.
16	DB3	80-system-18-Bit Data Bus.
17	DB4	80-system-18-Bit Data Bus.
18	DB5	80-system-18-Bit Data Bus.
19	DB6	80-system-18-Bit Data Bus.
20	DB7	80-system-18-Bit Data Bus.
21	DB8	80-system-18-Bit Data Bus.
22	DB9	80-system-18-Bit Data Bus.
23	DB10	80-system-18-Bit Data Bus.
24	DB11	80-system-18-Bit Data Bus.
25	DB12	80-system-18-Bit Data Bus.
26	DB13	80-system-18-Bit Data Bus.
27	DB14	80-system-18-Bit Data Bus.
28	DB15	80-system-18-Bit Data Bus.
29	DB16	80-system-18-Bit Data Bus.
30	DB17	80-system-18-Bit Data Bus.
31	IM1	8080 System Interface Selection:
32	IM0	IM1=0 IM0=0 8080 18-Bit system Interface. DB[0-17] IM1=0 IM0=1 8080 9-Bit system Interface. DB[9-17] IM1=1 IM0=0 8080 16-Bit system Interface. DB[1-8] DB[10-17] IM1=1 IM0=1 8080 8-Bit system Interface. DB[10-17] Unused pins please connect the GND.
33	NC	NC.
34	RESET	Reset input pin, When reset is "L", Initialization is executed.
35	GND	Ground.
36	LEDA	Power supply for LED backlight Anode input.
37-40	LEDK1-K4	Power supply for LED backlight Cathode input.

4. Absolute Maximum Ratings

Item	Symbol	Range	Unit
Supply Voltage (Analog)	VDDA	- 0.3 ~ +4.6	V
Supply Voltage (I/O)	VDDI	- 0.3 ~ +4.6	V
Supply Voltage (Logic)	VDD	- 0.3 ~ +4.6	V
Driver Supply Voltage	VGH-VGL	-0.3 ~ +30.0	V
NVM Supply Voltage (Write)	VPP	-0.3 ~ +8.0	V
Logic Input Voltage Range	VIN	-0.3 ~ VDDI + 0.3	V
Logic Output Voltage Range	VO	-0.3 ~ VDDI+ 0.3	V
Operating Temperature Range	TOPR	-30 ~ +85	℃
Storage Temperature Range	TSTG	-40 ~ +110	℃

Table 1 Absolute Operation Range

Note: If one of the above items is exceeded its maximum limitation momentarily, the quality of the product may be degraded. Absolute maximum limitation, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the recommend range.

5. Electrical Characteristics

Parameter	Symbol	Condition	Specification			Unit	Related Pins
			MIN.	TYP.	MAX.		
Power & Operation Voltage							
System Voltage	VDD / VDDA	Operating voltage	2.5	2.75	3.3	V	
Interface Operation Voltage	VDDI	I/O Supply Voltage	1.65	1.8	VDD	V	
Gate Driver High Voltage	VGH		12.16	-	15.05	V	
Gate Driver Low Voltage	VGL		-12.37	-	-7.7	V	
Gate Driver Supply Voltage		| VGH-VGL |	-	-	27.4	V	
Current consumption Shoutdown operation	IDDA	VDDI=VDD=2.8v	12	--	30		

| Input / Output							
Logic-High Input Voltage	VIH		0.8VDDI		VDDI	V	Note 1
Logic-Low Input Voltage	VIL		VSS		0.2VDDI	V	Note 1
Differential Input High Threshold Voltage	VIT+			0	50	mV	MDDI_STB, MDDI_DATA
Differential Input Low Threshold Voltage	VIT-		-50	0		mV	
Single-ended Receiver Input Operation Voltage Range	VIR		0.5		1.2	V	
Logic-High Output Voltage	VOH	IOH = -1.0mA	0.8VDDI		VDDI	V	Note 1
Logic-Low Output Voltage	VOL	IOL = +1.0mA	VSS		0.2VDDI	V	Note 1
Logic-High Input Current	IIH	VIN = VDDI			1	uA	Note 1
Logic-Low Input Current	IIL	VIN = VSS	-1			uA	Note 1
Input Leakage Current	ILI	IOH = -1.0mA	-0.1		+0.1	uA	Note 1
VCOM Voltage							
VCOM Voltage	VCOM			0	-	V	
Source Driver							
Source Output Range	VSout		-4.2		+6.4	V	
Source Output Settling Time	Tr	Below with 99% precision			20	us	Note 2
Output Offset Voltage	VOFFSET				35	mV	Note 3

Table 2 Basic DC Characteristics

Notes:

1. TA= -30 to 85℃.

2. Source channel loading= 2KΩ+12pF/channel, Gate channel loading=5KΩ+40pF/channel.

3. The max. value is between measured point of source output and gamma setting value.

6.Timing Characteristics.

6.1 Reset Timing Characteristics.
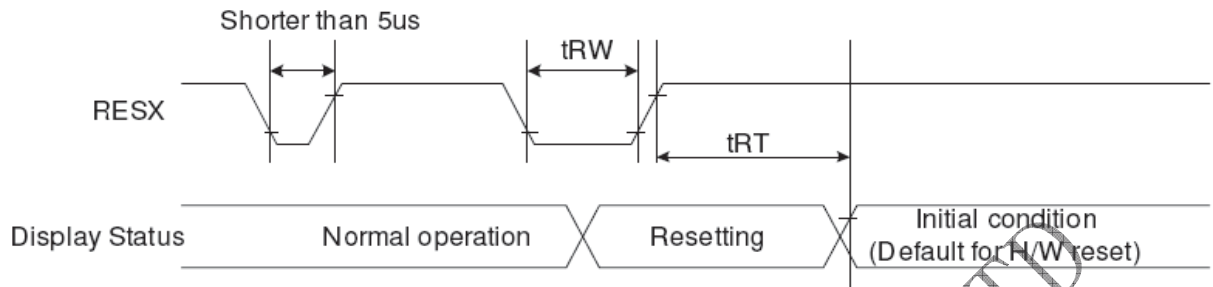
| Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

Note 1: The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NV memory to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

Note 2: Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below: -

RESX Pulse	Action
Shorter than 5μs	Reset Rejected
Longer than 10us	Reset
Between 5μs and 10us	Reset starts

Note 3: During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In -mode.) And then return to Default condition for Hardware Reset.

Note 4: Spike Rejection also applies during a valid reset pulse as shown below:
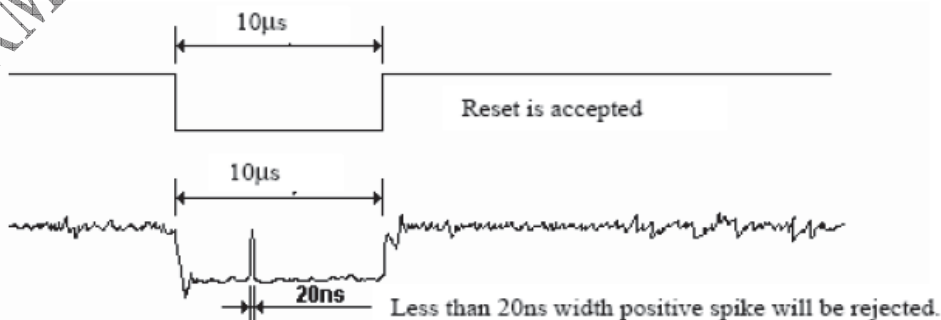
Note 5: When Reset applied during Sleep In Mode.

Note 6: When Reset applied during Sleep Out Mode.

Note 7: It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

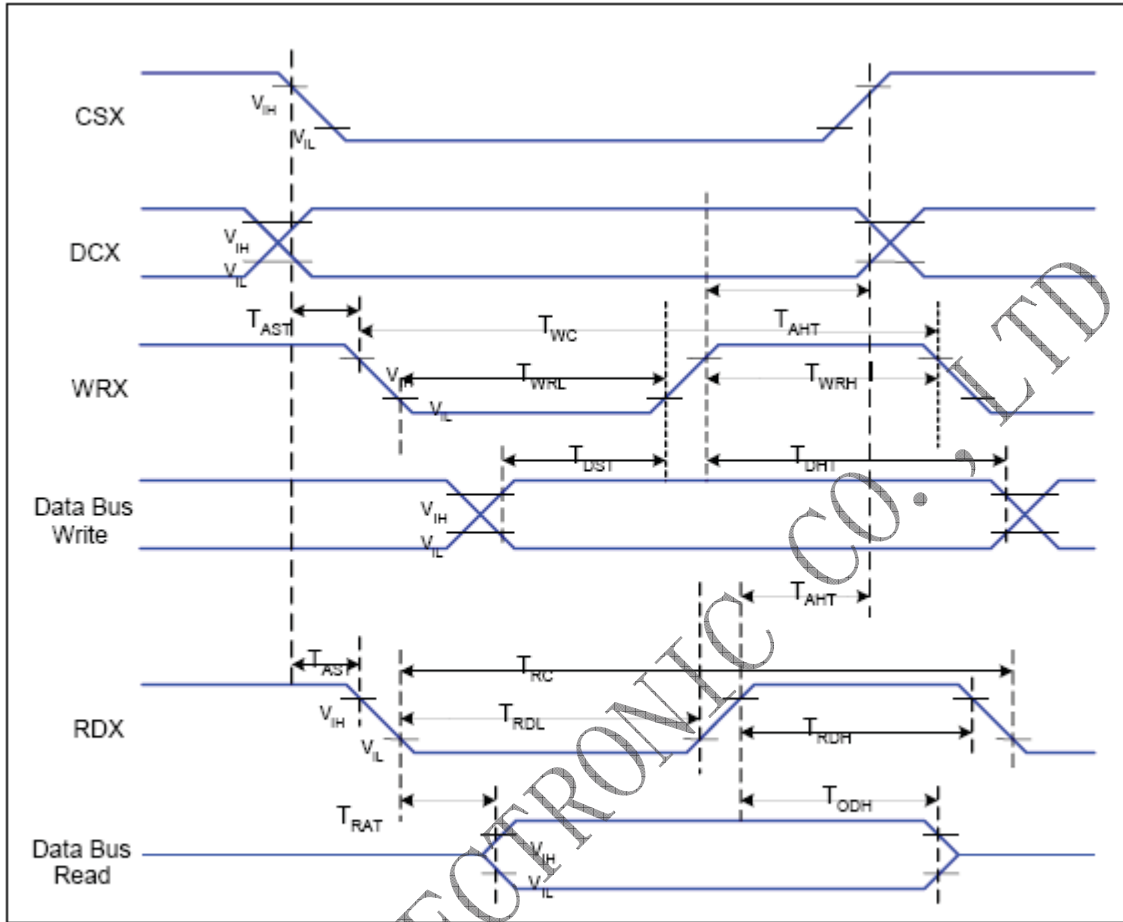## 6.2. i80-System Interface Timing Characteristics.

Figure 2 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to VDD, VDD=2.5 to 3.3V, AGND=DGND=0V, Ta=25 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
DCX	TAST	Address Setup Time	0	--	ns	
	TAHT	Address Hold Time (Write/Read)	2	--	ns	
WRX	TWC	Write Cycle	75	--	ns	
	TWRH	Control Pulse "H" Duration	25	--	ns	
	TWRL	Control Pulse "L" Duration	30	--	ns	
RDX	TRC	Read Cycle (ID)	450	--	ns	When Read ID Data
	TRDH	Control Pulse "H" Duration (ID)	250	--	ns	
	TRDL	Control Pulse "L" Duration (ID)	170	--	ns	

Signal	Symbol	Parameter	Min	Max	Unit	Description
DB[17:0]	TDST	Data Setup Time	20	--	ns	TRAT, TRATFM: 3K ohm Pull up or Down and 30pF Parallel Cap. To GND. TODH: 3K ohm Pull up or Down.
	TDHT	Data Hold Time	10	--	ns	
	TRAT	Read Access Time (ID)	--	150	ns	
	TODH	Output Disable Time	10	--	ns	

Table 3 8080 Parallel Interface Characteristics

7. Backlight Characteristics.
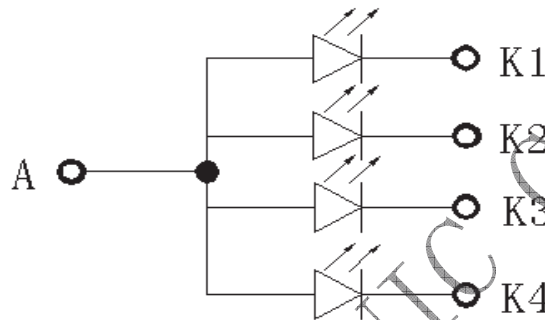
| Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	3.0	3.2	3.4	V	If=60 mA	-
Supply Current	If	-	60	-	mA	-	-
Reverse Voltage	Vr	-	-	5	V	10uA	
Power dissipation	Pd	-	192	-	mW	-	
Luminous Intensity for LCM		-	320	-	Cd/m^2	If=60 mA	
Uniformity for LCM	-	80	-	-	%	If=60 mA	
Life Time	-	50000	-	-	Hr	If=60 mA	-
Backlight Color	White						

8.Optical Characteristics

(Using CPT LC+ EWV Polarizer+Corresponding Backlight, reference only)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance		T		5.2	5.5		%	
Contrast Ratio		CR	*1)		250	-	--	Note 3
Response Time		Tr+ Tf	*3)	-	30		ms	Note 4
Viewing Angle	Vertical	θ *2)	CR≧10	100	110	-		Note 5
						-		
	Horizontal	φ *2)		120	130	-		
						-		
Color Filter Chromacicity	White	x	θ=φ=0°	0.288	0.308	0.328		Note 6
		y		0.322	0.342	0.362		
		Y		27.8	30.8	33.8		
	Red	x	θ=φ=0°	0.633	0.653	0.673		
		y		0.311	0.331	0.351		
		Y		15.4	18.4	21.4		
	Green	x	θ=φ=0°	0.291	0.311	0.331		
		y		0.554	0.574	0.594		
		Y		55.0	59.0	63		
	Blue	x	θ=φ=0°	0.114	0.134	0.154		
		y		0.114	0.134	0.154		
		Y		12.3	15.3	18.3		
	NTSC			-	61%	-		

Note 1.Ambient condition：25℃±2℃ ；60±10%RH， under 10 Lunx in the darkroom。
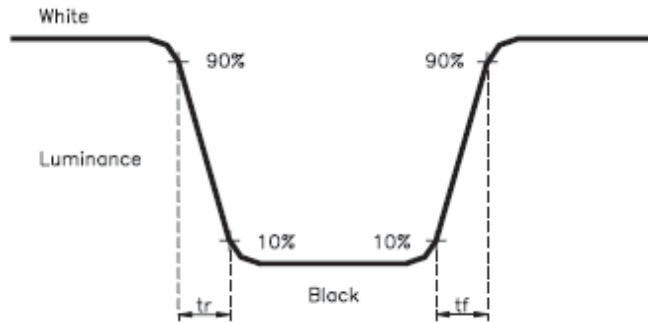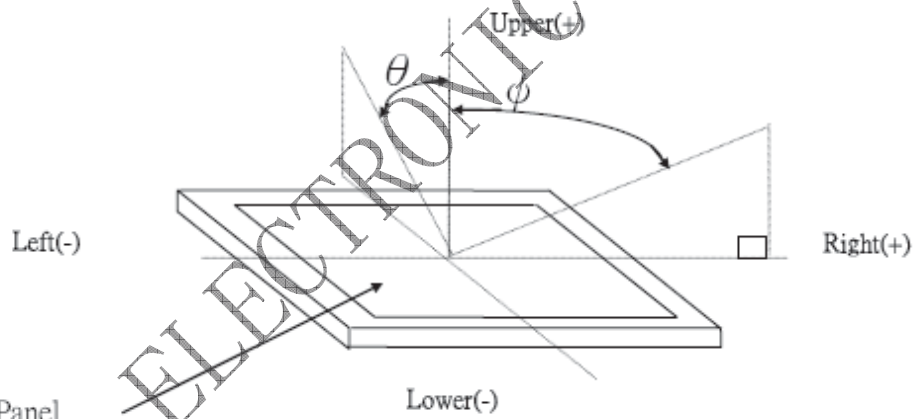
Note 2.Measure device：BM-5A (TOPCON)， viewing cone= 1 °， Iᴸ=20mA。
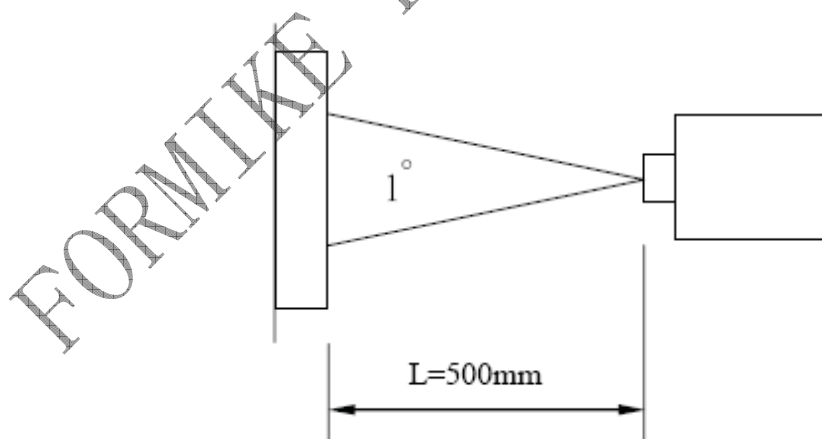
Note 3. Definition of Contrast Ratio：
CR = White Luminance (ON) / Black Luminance (OFF)

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.

9. Reliability Test Conditions And Methods

N O.	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.

10.Inspection Standard

Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

If this standard is not the same as FORMIKE quality official documents, please refer to the FROMIKE quality department official documents.

If the customer have other agreement with FROMIKE for standard, please refer to the standard agreement.

If the defects not mentioned below or in the QA official documents, please refer to the sample.

11.1 Inspection Condition

Room Temperature: 25±5°C.
Humidity: 65±5% RH.
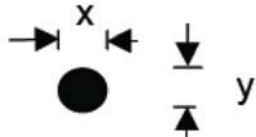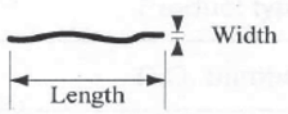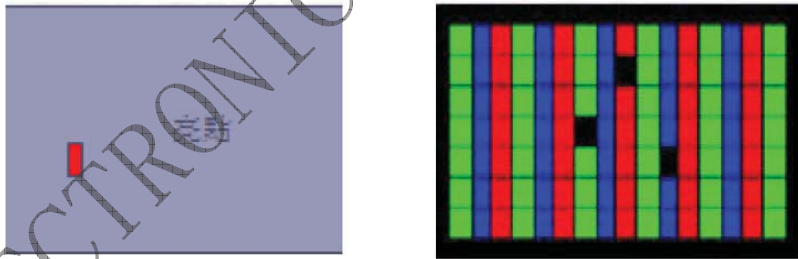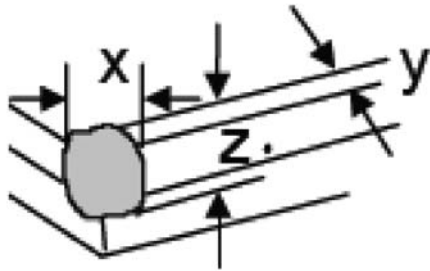Illumination: 300 ~ 700 Lux.
Distance:35±5 cm

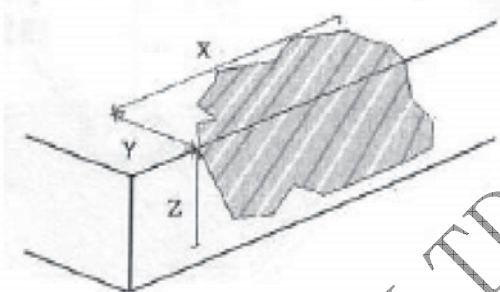## 11.2 Major defect.

| Item No	Items to be inspected	Inspection Standard
1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
2	missing	Missing function component
3	Crack	Glass Crack

11.3 Minor defect.

Item No	Items to be inspected	Inspection standard	
1	Spot Defect Including Black spot White spot Pinhole Foreign particle Polarizer dirt	For dark/white spot is defined: $\varphi = (x+y)/2$ 	
		Size φ(mm)	Size φ(mm)
		φ≤0.15	Ignore
		0.15 < φ≤0.30	3
		0.30 < φ	Not allowed

2	Line Defect Including Black line White line Scratch	Define:		
		Width(mm) Length(mm)	Acceptable Quantity	
		W≤0.03	Ignore	
		0.03 < W≤0.1 L ≤ 4.0	3	
		0.1 < W L>4.0	Not allowed	
3	Polarizer Dent/Bubble	Width(mm) Length(mm)	Acceptable Quantity	
		φ≤0.25	Ignore	
		0.25＜Φ≤0.5	3	
		0.5 < φ	0	

4.	Electrical Dot Defect	Bright and Black dot define:		
		Inspection pattern: Full white、 Full black、 Red、 green and blue screens		
		Item	Acceptable Quantity		
			I area	O area	Total
		Black dot defect	1	3	3
		Bright dot defect	1	1	1
		Total Dot	2	4	4

5	Glass defect	1.Corner Fragment:		
		Size(mm)	Acceptable Quantity	
		X≤3mm	Ignore	
		Y≤3mm	T：Glass thickness	

		Z≤T	X: Length Y: Width Z: thickness
5	Glass defect	2.Side Fragment: 	
		Size(mm)	Acceptable Quantity
		X≤5.0mm Y ≤1mm Z≤T	Ignore T：Glass thickness X: Length Y: Width Z≤T Z: thickness

Note:
1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.
2. The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.
3. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.
4. The definitions of the inner display area
And outer display area
I: Inner display area
O: Outer display area
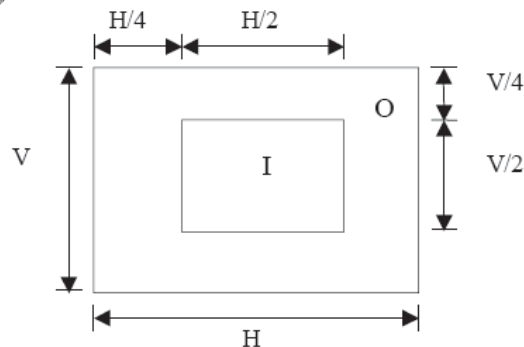
11. Handling Precautions

11.1 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.

11.2 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 (CI) , 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.

11.3 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.

11.4 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

11.5 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.

11.6 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

11.7 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

12. Precaution For Use

12.1

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.

12.2

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.