FORMIKE ELECTRONIC CO.,LTD

PRODUCT SPECIFICATION

TFT LCD MODULE
MODEL : KWH043ST12-F03 V.2 V2.0

【 ◆ 】 Preliminary Specification
【　　】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PD REVIEWD	PREPARED BY
Leo	/	Deng	Roy

Prepared By :

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Http:// www.wandisplay.com

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

Issued Date:AUG-27-2014

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1. Record of Revision

Version	Issued Date	Page	Content	Created or Modified by
1.0	2013-01-24		New Creation	Deng
2.0	2014-08-27		Modify the brigtness	Leo

2. GENERAL DESCRIPTION

2.1 Description

KWH043ST12-F03 V.2 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,TP and a backlight unit. The following table described the features of FORMIKE KWH043ST12-F03 V.2.
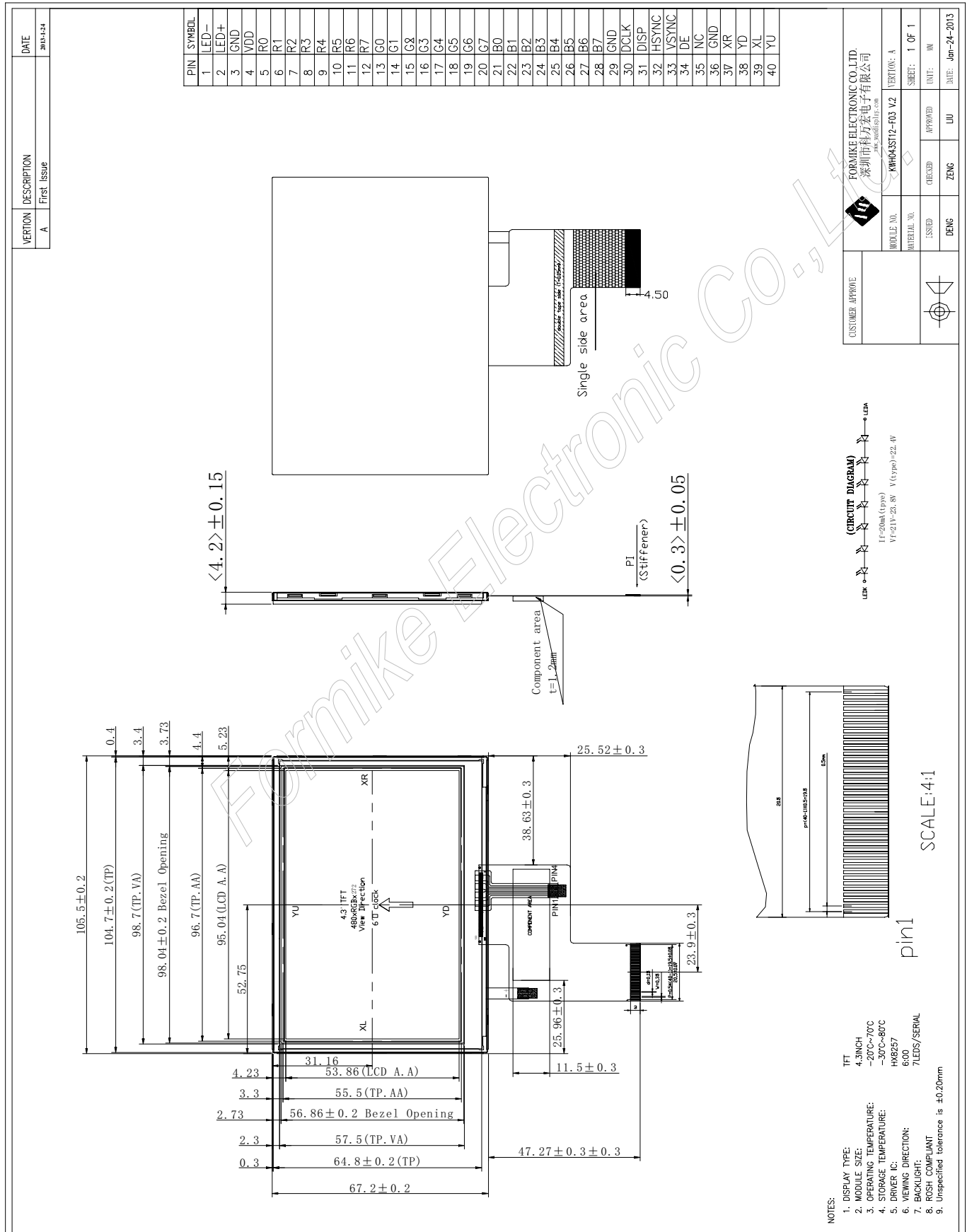
2.2 Application

PDA , PMP, MP4, DVB-S, GPS, medical device, Portable Navigation
Etc.

2.3 Features:

Feature	Description
Size	4.3 inch
Display Mode	Normally White, Transmissive
Surface Treatment	Anti-glare
Resolution	480 (RGB) x 272
Display Format	R.G.B. Stripe type
Color	16.7M color
Pixel Pitch (mm)	0.198 x 0.198
Inteface	R.G.B. 24 bit parallel data
Viewing Direction	6 o'clock
Outline Dimension (W x H x D) (mm)	105.5 x 67.2 x 4.2
Active Area(H x V mm)	95.04 x 53.856
With/Without TSP	With TSP
LED Numbers	7 LED serial type
Weight (g)	TBD

3.0 Mechanical Drawing

PIN	SYMBOL
1	LED−
2	LED+
3	GND
4	VDD
5	R0
6	R1
7	R2
8	R3
9	R4
10	R5
11	R6
12	R7
13	G0
14	G1
15	G2
16	G3
17	G4
18	G5
19	G6
20	G7
21	B0
22	B1
23	B2
24	B3
25	B4
26	B5
27	B6
28	B7
29	GND
30	DCLK
31	DISP
32	HSYNC
33	VSYNC
34	DE
35	NC
36	GND
37	XR
38	YD
39	XL
40	YU

NOTES:
1. DISPLAY TYPE: TFT
2. MODULE SIZE: 4.3INCH
3. OPERATING TEMPERATURE: −20℃~70℃
4. STORAGE TEMPERATURE: −30℃~80℃
5. DRIVER IC: HX8257
6. VIEWING DIRECTION: 6:00
7. BACKLIGHT: 7LEDS/SERIAL
8. ROSH COMPLIANT
9. Unspecified tolerance is ±0.20mm

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Condition
		Min.	Max.		
Power Voltage	VDD	0.3	5.0	V	
Logic Input Signal	VIN	-0.3	VDD+0.3	V	
Logic Output Signal	VOUT	-0.3	VDD+0.3	V	

Note: Device is subject to be damaged permanently if stresses beyond those absolute
maximum ratings listed above

5. ELECTRICAL CHARACTERISTICS

5.1. Operating conditions:

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power Supply	VDD	3.0	3.3	3.6	V	
Operating Current	IDD	-	15	-	mA	Black pattern
Frame frequency	Frame	-	60	90	Hz	
Dot Data Clock	DCLK	-	9.0	15	MHz	
Power Consumption	PLCD	-	49.5	-	mW	Black pattern

5.2 LED driving conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power Consumption	PLED	-	462	-	mW	
LED Current	If	-	20	-	mA	(1)
Backlight Voltage	Vb	-	23.1	-	V	(2)

Ta = 25℃
Brightess to be decreased to 50% of the initial value
Note (1) 7 LEDs serial type
    (2) Where If=20mA,Vb= PLED / If

6. DC CHARATERISTICS

arameter	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
Low level input voltage	V_{IL}	0	-	0.3*VDD	V	
Hight level input voltage	V_{IH}	0.7*VDD	-	VDD	V	

7. Timing CHARATERISTICS

7.1 DC Timing Characteristics

Signal	Item	Symbol	Min	Typ	Max	Unit	Note
Dclk	Frequency	DCLK	-	9.0	12	MHZ	
Hsync	Period	TH	-	525	-	DCLK	(1)
	Pulse Width	Thp	2	41	-	DCLK	(2)
	Back-Porch	Thb	2	-	-	DCLK	(2)
	Display Period	Thd	-	480	-	DCLK	
	Front-Porch	Thf	2	-	-	DCLK	(2)
Vsync	Period	Tv	-	286	-	TH	
	Pulse Width	Tvp	1	10	-	TH	
	Back-Porch	Tvb	1	2	-	TH	
	Display Period	Tvd	-	27		TH	
	Front-Porch	Tvf	1		-	TH	

Note1: Thd=480 DCLK, Thf=2 DCLK, Thp= 41   hb=2 DCLK
      525 DCLK= 480 + 2 + 41 + 2 (DCLK)
Note2: Thf+ Thp+ Thb >44
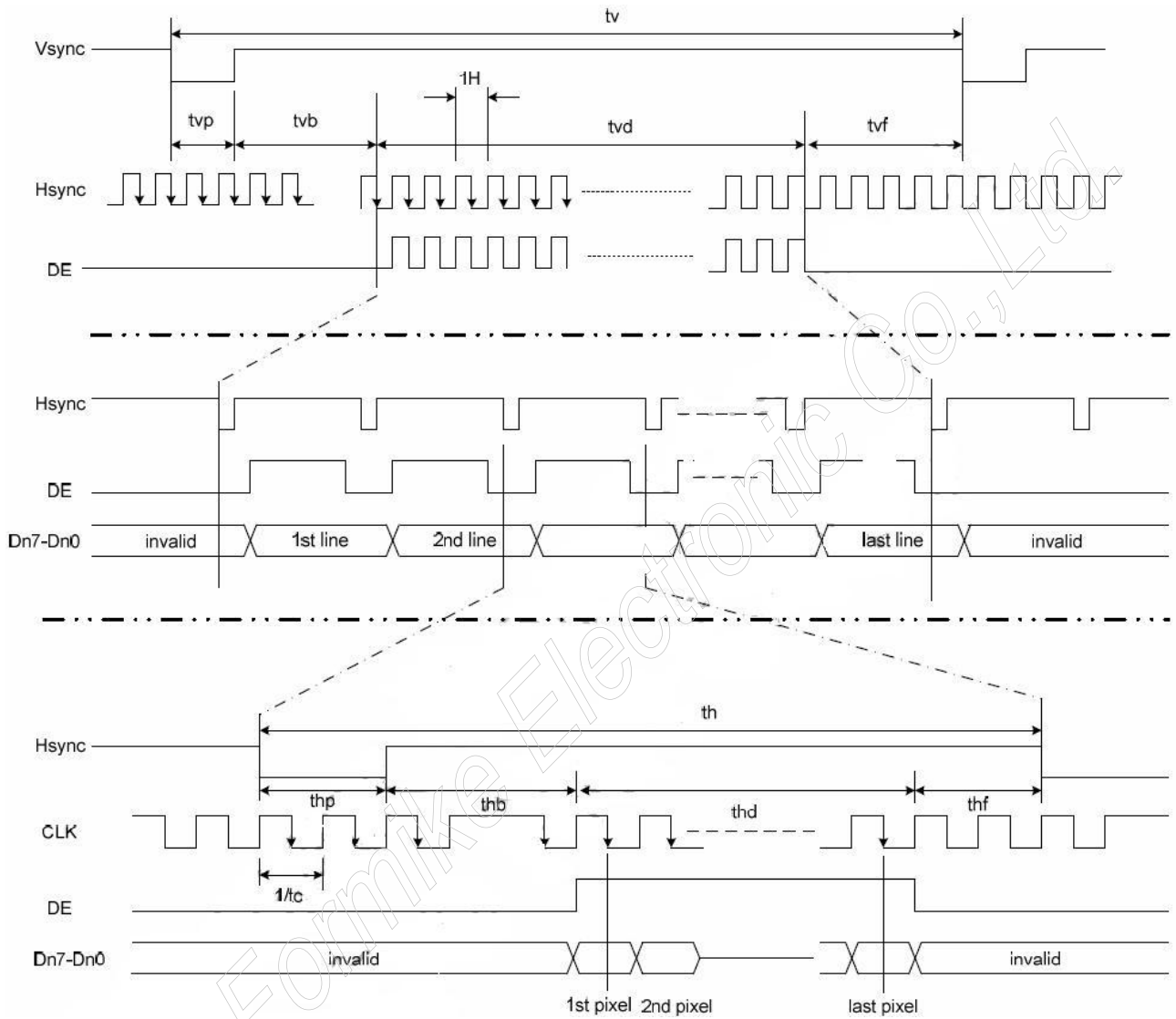
7.2 AC Timing Characteristics

Parameter	Symbol	Spec.			Unit
		Min	**Typ**	**Max**	
DISP setup time	t_{diss}	10			ns
DISP hold time	t_{dish}	10			ns
Clock period	$PW_{CLK}^{(2)}$	66.7	-	-	ns
Clock pulse high period	$PWH^{(2)}$	26.7	-	-	ns
Clock pulse low period	$PWL^{(2)}$	26.7	-	-	ns
Hsync setup time	t_{hs}	10	-	-	n
Hsync hold time	t_{hh}	10	-	-	
Data setup time	t_{ds}	10	-		ns
Data hold time	t_{dh}	10	-		ns
DE setup time	t_{des}	10	-		ns
DE hold time	t_{deh}	10			ns
Vsync setup time	t_{vhs}	10		-	ns
Vsync hold time	t_{vhh}	10		-	ns
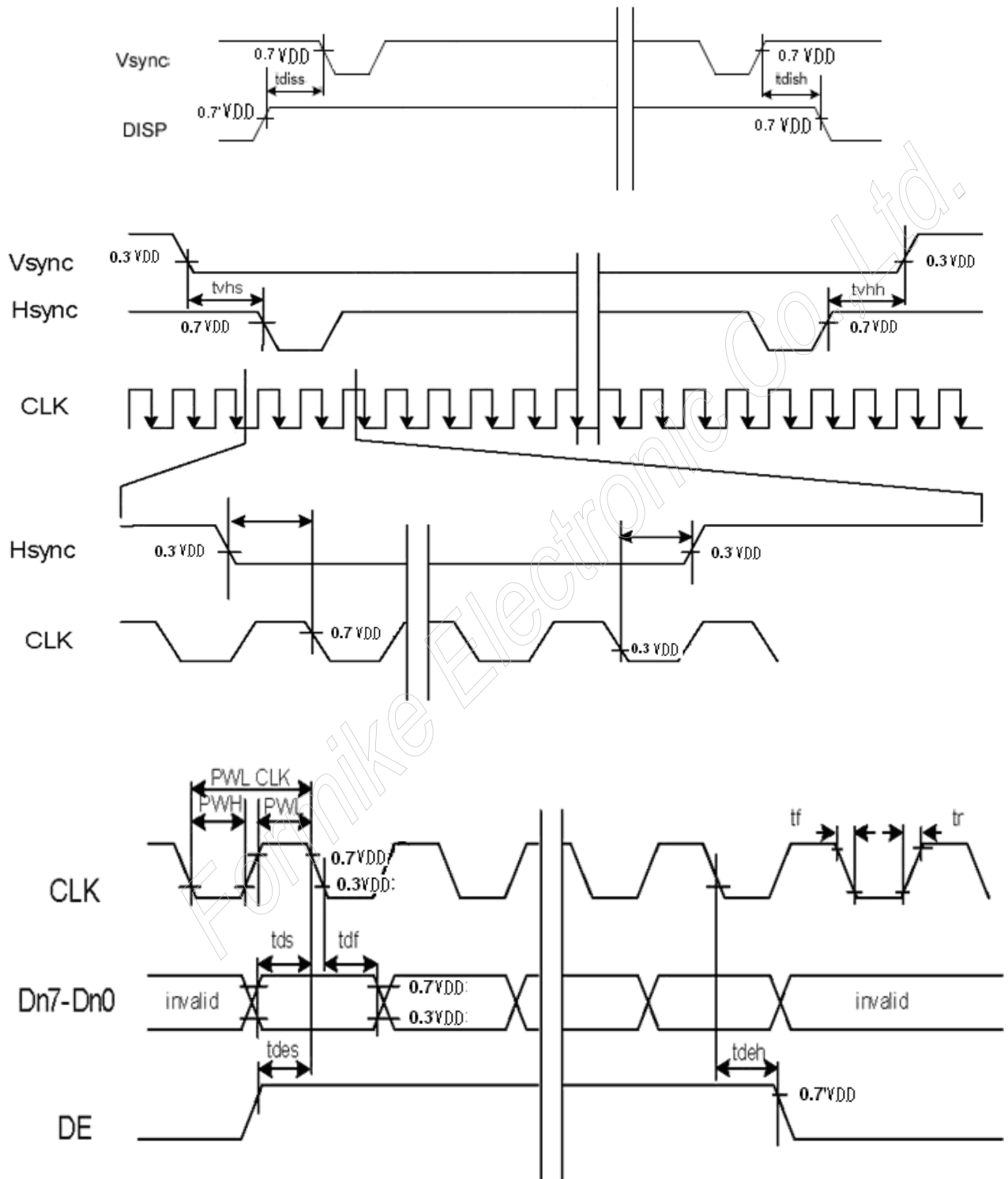
7.3 Power Sequence

The LCD panel power ON/OFF sequence is as below.
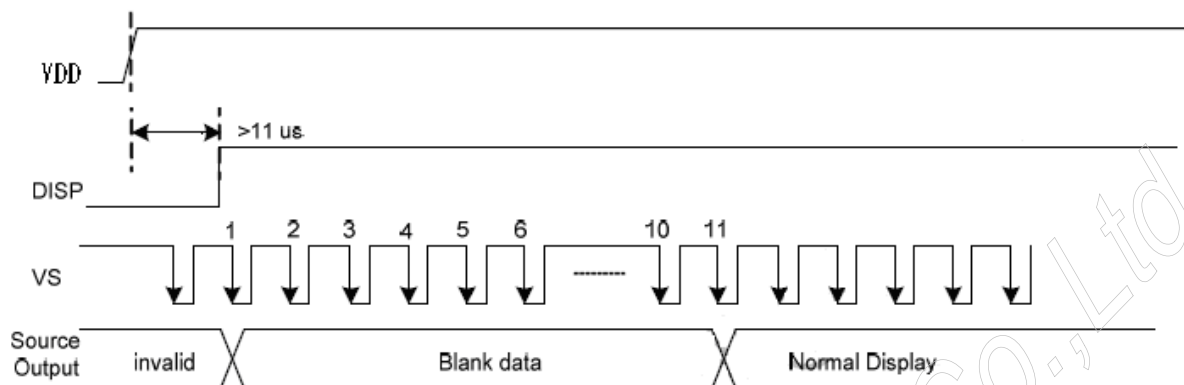
Power On Sequence
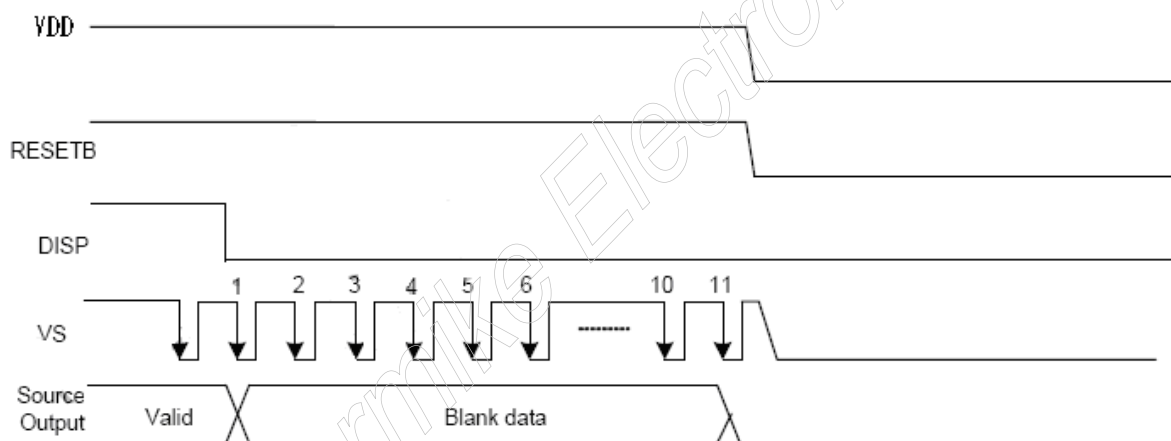
Power Off Sequence

8. OPTICAL CHARATERISTIC

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Brightness				200	250	-	cd/m2	
Response time		TR	Θ=0	-	15	-	ms	(3)(5)
		TF		-	15	-	ms	
Contrast ratio		CR	At optimized viewing angle	450	550	-	-	(4)
Color Chromaticity	White	Wx	Θ=0	0.26	0.31	0.36	-	(2)(6)
		Wy		0.28	0.33	0.38		
Viewing Angle	Hor.	ΘR	CR≧10	50	70	-	-	(1)
		ΘL		50	70	-		
	Ver.	φH		40	55	-		
		φL		50	70	-		
Uniformity				75	80		%	(8)

5±2℃, ILED=20mA

Note 1: Definition of viewing angle range
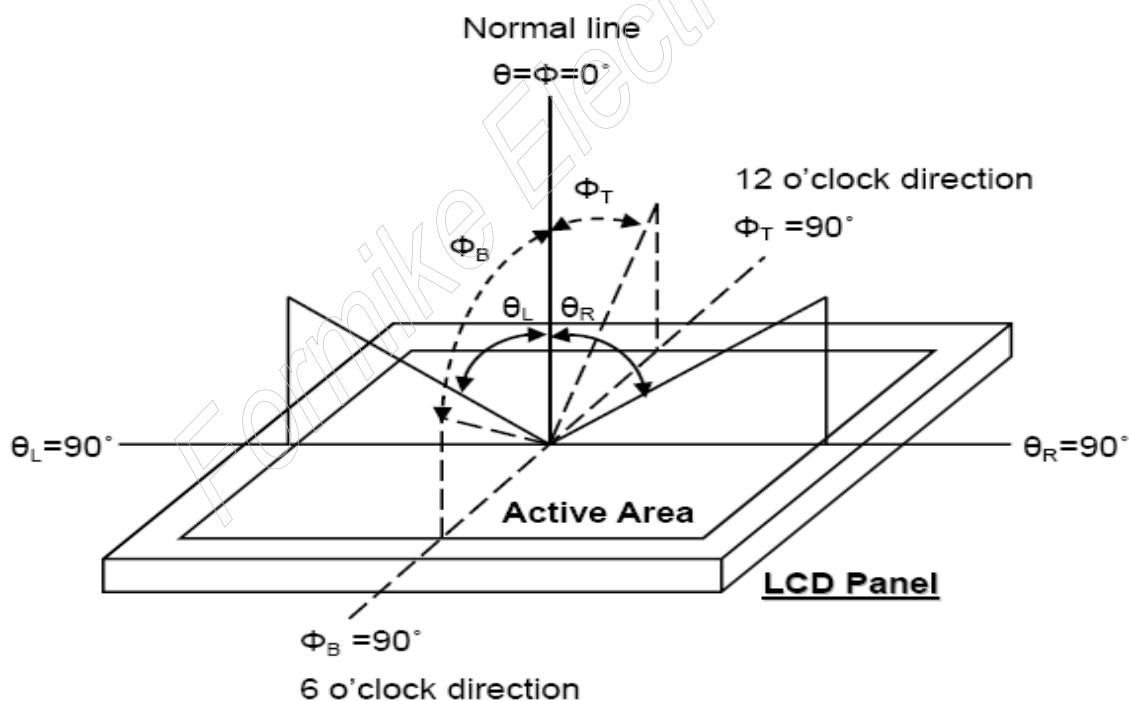
Fig. 8-1 Definition of viewing angle

Note 2: Test equipment setup:
After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 luminance meter 1.0° field of view at a distance of 50cm and normal direction.
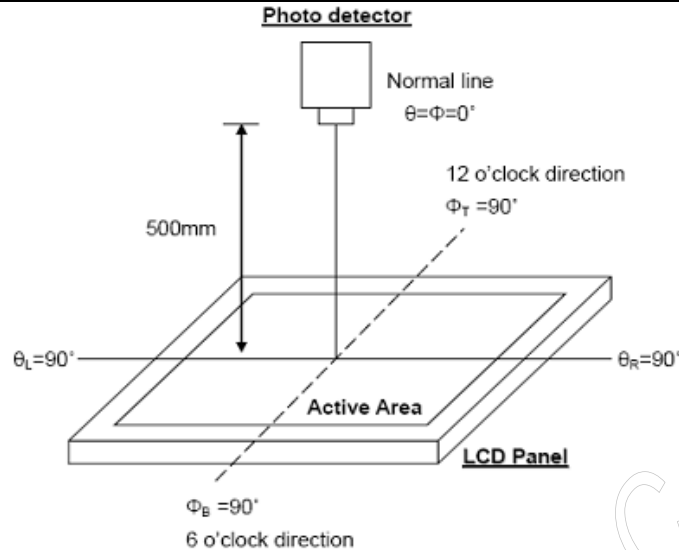
Fig. 8-2 Optical measurement system setup

Note 3: Definition of Response time:
The response time is defined as the LCD optical switching time interval between "White" state and"Black" state. Rise time, Tr, is the time between photo detector output intensity changed from 90﹪ to 10﹪ . And fall time, Tf, is the time between photo detector output intensity changed from10﹪ to 90﹪ .
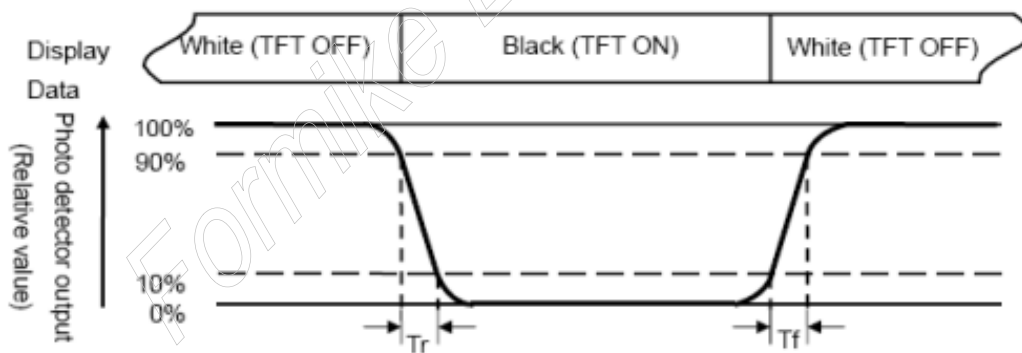

Fig. 3-3 Definition of response time

Note 4: Definition of contrast ratio:
The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: White Vi = V_{i50} ± 1.5V
Black Vi = V_{i50} ± 2.0V
"±" means that the analog input signal swings in phase with VCOM signal.
"±" means that the analog input signal swings out of phase with VCOM signal.
The 100% transmission is defined as the transmission of LCD panel when all the input terminals

of module are electrically opened.
Note 6: Definition of color chromaticity (CIE 1931)
Color coordinates measured at the center point of LCD

Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 8 : Uniformity (U) = $\dfrac{\text{Brightness (min)}}{\text{Brightness (max)}}$ x 100%

9. INTERFACE

9.1. LCM PIN Definition (Connector type : 40Pin / 0.5mm pitch / Top contact)
- Hirose : FH12 series

Pin	Symbol	I/O	Function	Remark
1	VLED-	I	LED Ground	
2	VLED+	I	LED Power	
3	GND	I	Ground	
4	VDD	I	Power Supply (+3.3 V)	
5	R0	I	Red Data Bit0 (LSB)	
6	R1	I	Red Data Bit1	
7	R2	I	Red Data Bit2	
8	R3	I	Red Data Bit3	
9	R4	I	Red Data Bit4	
10	R5	I	Red Data Bit5	
11	R6	I	Red Data Bit6	
12	R7	I	Red Data Bit7 (MSB)	
13	G0	I	Green Data Bit0 (LSB)	
14	G1	I	Green Data Bit1	
15	G2	I	Green Data Bit2	
16	G3	I	Green Data Bit3	
17	G4	I	Green Data Bit4	
18	G5	I	Green Data Bit5	
19	G6	I	Green Data Bit6	
20	G7	I	Green Data Bit7 (MSB)	
21	B0	I	Blue Data Bit0 (LSB)	
22	B1	I	Blue Data Bit1	
23	B2	I	Blue Data Bit2	
24	B3	I	Blue Data Bit3	
25	B4	I	Blue Data Bit4	
26	B5	I	Blue Data Bit5	
27	B6	I	Blue Data Bit6	
28	B7	I	Blue Data Bit7 (MSB)	
29	GND	I	Ground	
30	DCLK	I	Dot Data Clock	
31	DISP	I	Display On/Off	Note 1
32	Hsync	I	Horizontal Sync Input	
33	Vsync	I	Vertical Sync Input	

34	DE	I	Data Enable Control	Note 2
35	NC	I	No Connect	
36	GND	I	Ground	
37	TP	I	XR	
38	TP	I	YD	
39	TP	I	XL	
40	TP	I	YU	

Note1: During set to DISP=" H ", input data are valid. During set to DISP=" L ", input data are invalid and white display data is written to data register automatically.

Note2: DE=" H ": data can be access, DE=" L ": data cannot be access

10. BLOCK DIAGRAM
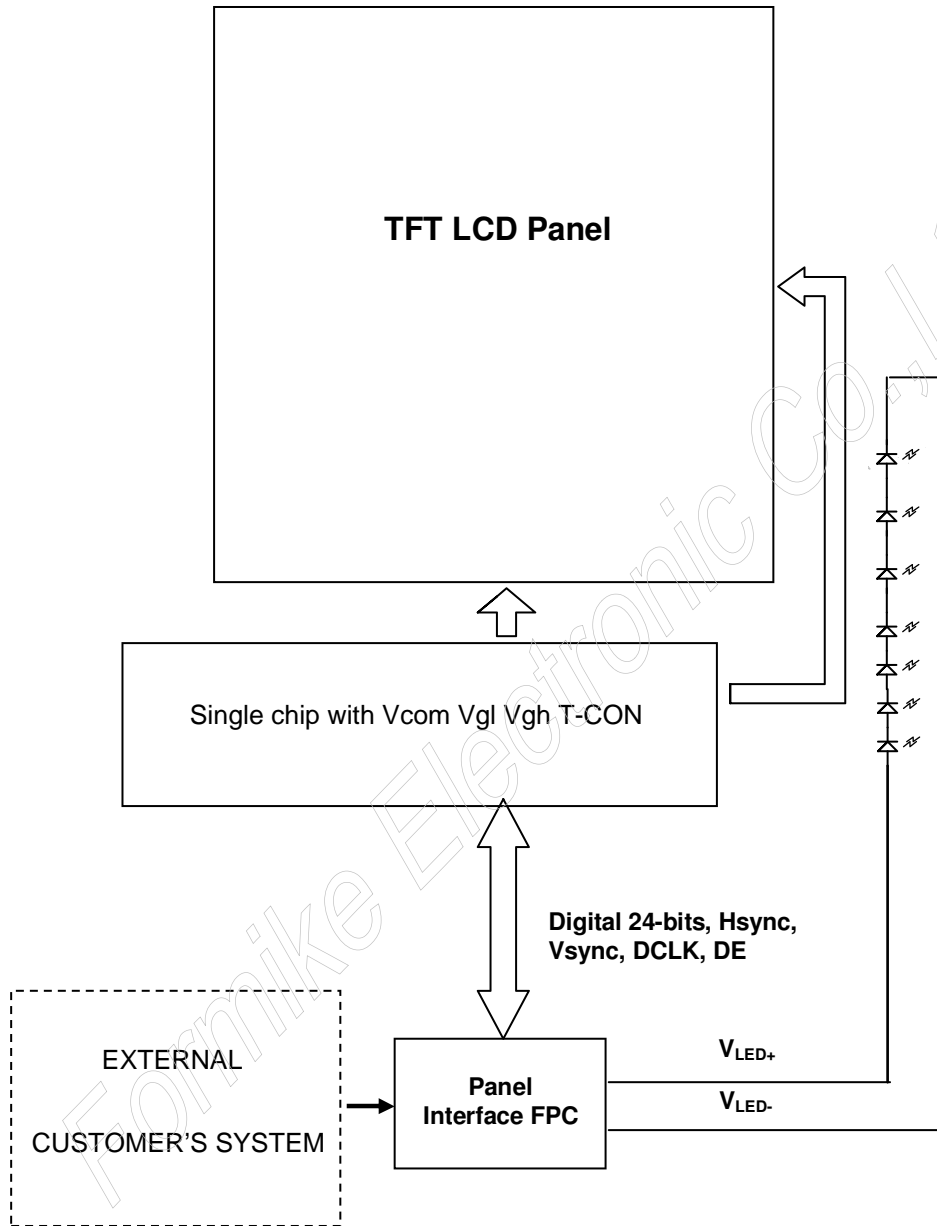
11. QUALITY ASSURANCE

No.	Test Items	Test Condition	REMARK
1	High Temperature Storage Test	Ta=80℃ Dry 240h	
2	Low Temperature Storage Test	Ta=-30℃ Dry 240h	
3	High Temperature Operation Test	Ta=70℃ Dry 240h	
4	Low Temperature Operation Test	Ta=-20℃ Dry 240h	
5	High Temperature and High Humidity Operation Test	Ta=60℃ 90%RH 240h	
6	Electro Static Discharge Test	Panel surface / top case Contact / Air：±6KV / ±8KV， 150pF，330Ω	Non-operating
7	Shock Test (non-operating)	Shock Level : 180G Waveform: Half Sinusoidal wave Shock Time : 2ms 3 Axis for all six faces/ each	
8	Vibration Test (non-operating)	Frequency Range: 10~500Hz/ Sweep: 1.5G Amplitude: 0.37 oct/min For 3 Axis 1hrs/axis	
9	Thermal Shock Test	-30℃(0.5Hr) ~ +80℃(0 5Hr) for 100 cycles	

Note1: The test samples have recovery time for 4 hours at room temperature before the function check.
    In the standard conditions, there is no display function NG issue occurred.

Note2: All the cosmetic specifications are judged before the reliability stress.

12.PRECAUTIONS FOR USE

12.1.Safety

(1) Do not swallow any liquid crystal,   even   if   there is no proof   that liquid   crystal is poisonous.

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

(3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

12.2.Storage Conditions

(1) Store   the   panel   or   module   in   a   dark   place   where   the   temperature   is 23±5℃   and the humidity is below 50±20%RH.

(2) Store in anti-static electricity container.

(3) Store in clean environment, free from dust, active gas, and solvent.

(4) Do not place the module near organics solvents or corrosive gases.

(5) Do not crush, shake, or jolt the module.

(6) Do not exposed to direct sun light of fluorescent lamps.

12.3.Installing LCD Module

Attend to the following items when installing the LCD Module.

(1) Cover the surface with a transparent protective plate or touch panel to protect the polarizer and LC cell.

(2) When assembling the LCD Module into other equipment, the spacer to the bit between the LCD Module and the fitting plate should have enough height to avoid   causing   stress   to   the   module   surface,   refer   to   the   individual specifications   for   measurements.   The   measurement   tolerance   should   be ±0.1mm.

12.4.Precautions For Operation

(1) Viewing   angle   varies   with   the   change of   liquid   crystal driving voltage   (Vo).   Adjust Vo to show the best contrast.

(2) Driving the LCD in the voltage above the limit will shorten its lifetime.

(3) Response   time   is   greatly   delayed   at   temperature   below   the   operating

temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.

(4) When turning the power on, input each signal after the positive/negative   voltage becomes stable.

(5) Do not apply water or any liquid on product which composed of T/P.

12.5.Handling Precautions

(1) Avoid   static   electricity which can damage the CMOS   LSI;   please   wear   the wrist strap when handling.

(2) The polarizing plate of the display is very fragile. so, please handle it very carefully.

(3) Do not give external shock.

(4) Do not apply excessive force on the surface; it may cause display abnormal .

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

(6) Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

(7) Do not operate it above the absolute maximum rating.

(8) Do not remove the panel or frame from the module.

(9) Do not apply water or any liquid on product, which composed of T/P.

12.6.Warranty

(1) The period is within 12   months since the   date   of   shipping out   under normal using and storage conditions.

(2) The warranty will be avoided in case of defect induced by customer.

1. Incoming Inspection

Both parties agree that the inspection specifications of TFT-LCD Modules (hereinafter known as "Modules") stipulated hereunder is the only and final standard applicable in the process of inspection. Formike shall beunder no liability or obligation (including incidental loss, products liability or other consequential loss) whatsoever for any defect in quality or performance or shortage in quantity of the Modules that have passed such inspection.

2. Liability

2.1 Inspection Deadline

The Customer should inspect the Modules either at the Delivery Point or within twenty (20) calendar days after arrival at the Delivery Destination.

2.2 Notification of Rejection

The Customer may reject one or more defective or non-conforming Modules if the Modules fail to meet the AQL (Acceptable Quality Level) and pass the inspection. In that case, the customer should notify FORMIKE of the rejection by either documents or mail within in three (3) business days from the date of reception of the Modules. Otherwise, the Modules shall be deemed to have met the AQL and passed the inspection.

3. Inspection Specifications

Both parties agree that the inspection shall contain and follow the inspection specifications stipulated in the attachment, including:

3.1 Scope

3.2 Sampling Plan

3.3 Panel Inspection Condition

3.4 Display Quality

3.5 Mechanics Specifications

3.6 Notification for Storage Handling

4. Limited Warranty

Formike represents and warrants that all Modules shall (i) conform to the specifications set hereunder, and (ii) be free from any defects in material and workmanship for twelve (12) months after the Customer's acceptance or deemed acceptance. Formike will replace, rework orrefund the Customer for the defective or non-conforming Modules at Formike's option, provided that the Customer (i) promptly informs Formike of the defects or non-conformities within the warranty period, (ii) complies with the specifications and conditions hereunder, and (iii) complies with Formike's procedure for Modules replacement, reworking and/or return. The warranty period for the Modules replaced or reworked shall be the remaining term for such Modules.

5. THE WARRANTIES AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, TERMS OR CONDITIONS, EXPRESS OR IMPLIED, EITHER IN FACT OR BY OPERATION OF LAW, STATUTORY OR OTHERWISE, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. FORMIKE'S WARRANTIES HEREIN APPLY ONLY TO THE CUSTOMER AND ARE NOT TO BE EXTENDED TO ANY THIRD PARTY.

6. **Governing Law**

    This Agreement shall be governed and construed in accordance with the laws of the The Government of the Hong Kong Special Administrative Region. Both parties agree to submit any dispute, which cannot be amicably resolved, to Hong Kong District Court for the first instance.

Inspection Specifications

1. Scope

Specifications contain

   1.1 Display Quality Evaluation

   1.2 Mechanics Specification

2. Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E.

   2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

   2.2 Sampling type: Normal inspection, single sampling.

   2.3 Sampling level: Level II.

   2.4 AQL: Acceptable Quality Level

         Major defect: AQL=0.65

         Minor defect: AQL=1.0

3. Panel Inspection Condition

  3.1 Environment:

     Room Temperature: 25±5°C.

     Humidity: 65±5% RH.

     Illumination: 300 ~ 700 Lux.

  3.2 Inspection Distance:

    35±5 cm

  3.3 Inspection Angle:

    The vision of inspector should be perpendicular to the surface of the Module.

  3.4 Inspection time

    Perceptibility Test Time:20 seconds max.

4. Display Quality

  4.1 Function Related:

    The function defects of line defect, abnormal display, and no display are considered Major defects.

5. Mechanics specifications

As for the outside dimensions and weight of the Modules, please refer to product specifications for more details.

6. Notification for Storage Handling

6.1 Storage:
6.1.1 Enviroment condition must be within the product specifications, otherwise the Module might be damaged.

6.1.2 Pile of stacking shall follow the instruction of **FORMIKE**.

6.2 Handling:
6.2.1 Twisting or Bending of the Module is prohibited.

6.2.2 All chemicals are unfit for use unless otherwise instructed by **FORMIKE**.

6.2.3 Plugging in & unplugging:

The power must be turned off before plugging in or unplugging the Module.

6.2.4 ESD protection:

The Module must not be touched without proper grounding.

6.2.5 High Voltage:

The rear side of Module must not be touched without protection.

6.2.6 Power sequence:

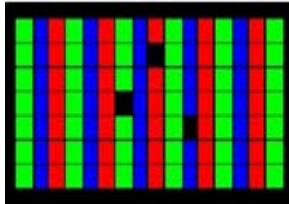Shall follow the instruction of **FORMIKE**.
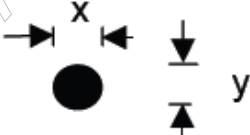
7. Inspection Criteria
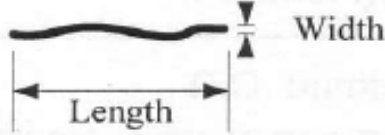
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

7.1 Major defect

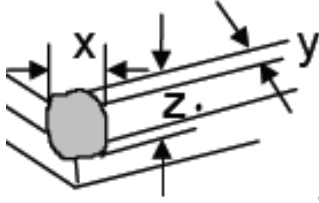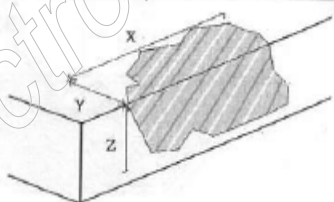| Item No	Items to be inspected	Inspection Standard
5.1.1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
5.1.2	missing	Missing function component
5.1.3	Crack	Glass Crack

7.2   Minor defect

Item No	Items to be inspected	Inspection standard	
7.2.1	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)	Acceptable Quantity
		φ≤0.15	Ignore
		0.15 < φ≤0.30	3
		0.30 < φ	Not allowed

7.2.2	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

7.2.3	Polarizer Dent/Bubble	Sizeφ(mm)	Acceptable Quantity
		φ≤0.25	Ignore
		0.25＜Φ≤0.5	3
		0.5 < φ	0

7.2.4	Electrical Dot Defect	Bright and Black dot define: and		
		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

7.2.5	Glass defect	1.Corner Fragment:	
		Size(mm)	Acceptable Quantity
		X≤3mm Y≤3mm Z≤T	Ignore T：Glass thickness X: Length Y: Width Z: thickness
		2. Side Fragment:	
		Size(mm)	Acceptable Quantity
		X≤5.0mm Y ≤1mm Z≤T	Ignore T：Glass thickness X: Length Y: Width 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.

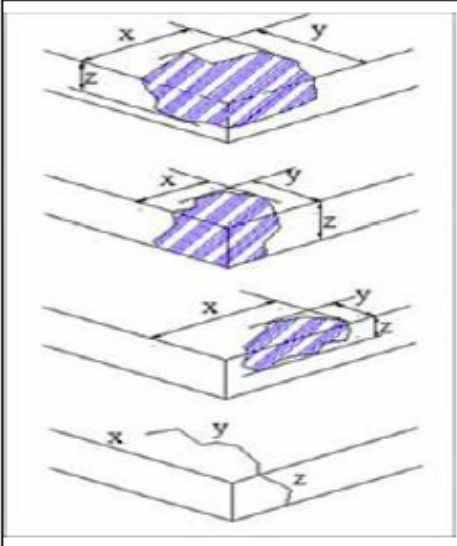4. The definitions of the inner display area And outer display area
        I: Inner display area
      O: Outer display area
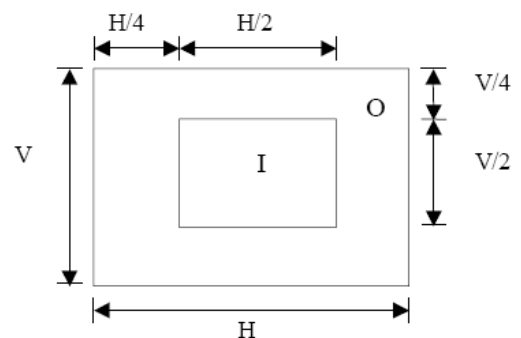
8. Inspection Standard of touch screen

Item	Specifications (mm)		Description
Scratch	W≤0.03	L ≤20	Ignoret
	0.03<W≤0.05	L ≤10	3 accepted defect
	W>0.05 or W≤0.03 or 0.03<W<0.05	L>20 L>10	Reject
Lint (Fibrous materials, Hair adhesive, and other colorful lint	W≤0.03	L≤5	Ignore
	0.03<W≤0.05	L≤5	Two or less accepted defect
	W>0.05 or L>5		Reject
Hollow Spot or Protuberance Spot	D≤0.4		Accept
	D>0.4		Reject
Opaque Spot	D<0.2		Ignore
	0.2≤D≤0.3		Accept 3 spots
	D>0.3		Reject
Translucent Defect	D≤0.3		Ignore
	0.3<D≤0.60		Accept
	D>0.6		Reject
Water Stain	In View area		Reject
	In Active Area as following W≤3 or D ≤3 3<W≤10 or 3<D≤10 W>10 or D> 10 or L>20	 L≤20 	 Ignore Accept Reject
Newton Ring	Inspect criteria by limiting sample a. The distance between produce and eye is about 30cm b. The angle between eyey and lighting source is 60 degree c. The lightness of environment is 500 Lux		
Crack			