FORMIKE® GROUP
LCD·SOLUTION·TOUCHSCREEN

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL:KWH035ST18 F04 V.2 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
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Issued Date:26-03-2021

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1. Record of Revision

Version	Issued Date	Page	Content	Created or Modified by
1.0	2021-03-26	27	ALL NEW	Leo

2. GENERAL DESCRIPTION

2.1 Description

KWH035ST18-F04 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, ICs, FPC, RTP and a backlight unit. The following table described the features of FORMIKE KWH035ST18-F04 V.2.

2.2 Application

GPS, camera, phone, camcorder, and other electronic products etc
Etc.

2.3 Features:

Feature	Description
Size	3.5 inch
Display Mode	Normally White, Transmissive
Surface Treatment	Anti-glare (3H)
Resolution	320 (RGB) x 240
Display Format	R.G.B. Stripe type
Pixel Pitch (mm)	0.219x0.219
Inteface	R.G.B. 24 bit parallel data
Viewing Direction	6 o'clock
Outline Dimension (W x H x D) (mm)	76.9 x 63.9 x 4.3
Active Area(H x V mm)	70.08 x 52.56
With/Without TSP	With TSP
LED Numbers	6 LEDS
Weight (g)	TBD

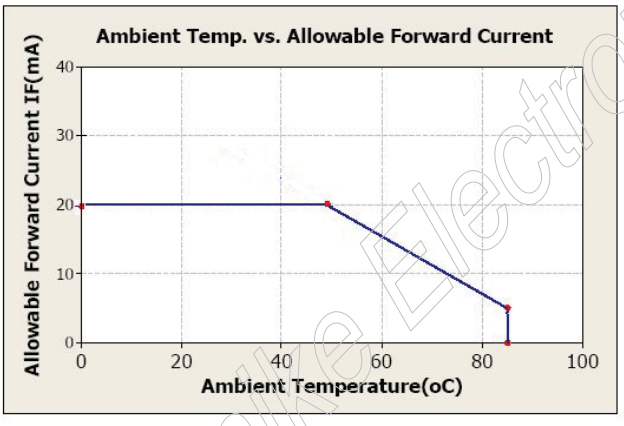
3. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	DVDD,AVDD	GND=0	-0.3	5.0	V	
Input Signal Voltage	V_{in}	GND=0	-0.3	VDD+0.3	V	NOTE
Logic Output Voltage	V_{OUT}	GND=0	-0.3	VDD+0.3	V	NOTE

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

1. Temp. ≤ 60℃, 90% RH MAX.
   Temp. ＞ 60℃, Absolute humidity shall be less than 90% RH at 60℃

2.



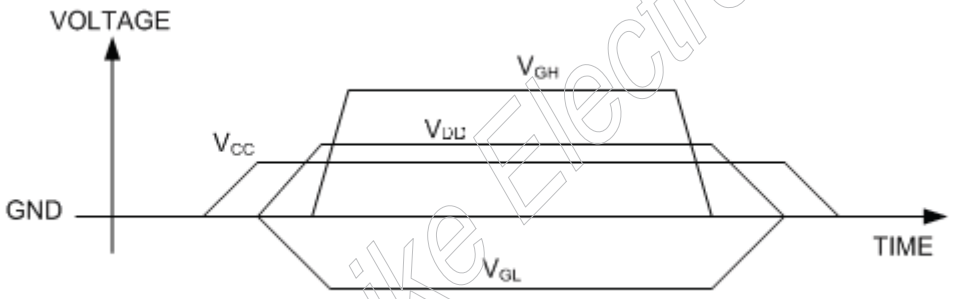
4.ELECTRICAL CHARACTERISTICS

4.1. Operating conditions:

Parameter	Symbol	Rating			Unit	Condition
		Min.	Typ.	Max.		
Power Voltage	VCC	3.0	3.3	3.6	V	
Digital Operation Current	Icc		8.6		mA	
Gate On Power	VGH	14	15	18	V	
Gate Off Power	VGL	-11	-10	-8	V	
Vcom High Voltage	VcomH		3.7		V	Note1
Vcom low Voltage	VcomL		-1.6		V	Note1
Vcom level max	VcomA			6	V	

Note1. VcomH& VcomL：Adjust the color with gamma data. Vp-p should be higher then 4V.(Option 5V)

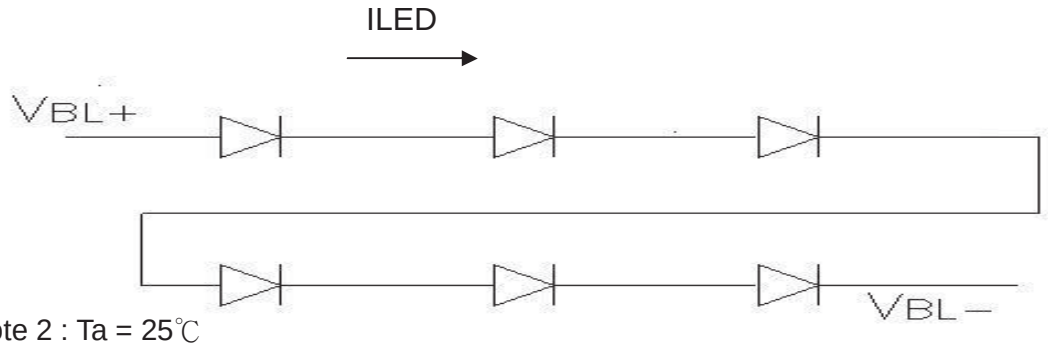
Note: Please power on following the sequence VCC → VDD



4.2 LED driving conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
LED current		-	20	-	mA	
Power Consumption		-	400	420	mW	
LED voltage	VBL+	18.6	19.8	21	V	Note 1
LED Life Time	-		(50,000)-	-	Hr	Note 2,3

Note 1 : There are 1 Groups LED



Note 2 : Ta = 25℃

Note 3 : Brightess to be decreased to 50% of the initial value

5.DC CHARACTERISTIC

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

6.AC CHARACTERISTIC

Digital Parallel RGB interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	156	-	ns
	High Time	Tch	-	78	-	ns
	Low Time	Tcl	-	78	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns
Hsync	Period	TH	-	408	-	Tosc
	Pulse Width	THS	5	30	-	Tosc
	Back-Porch	Thb		38		Tosc
	Display Period	TEP	-	320	-	Tosc
	Hsync-den time	THE	36	68	88	Tsoc
	Front-Porch	Thf	-	20	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-Porch	Tvf	2	4	-	TH

Note: 1. Thp + Thb = 68, the user is make up by yourself.
2. Tv = Tvs + Tvb + Tvd + Tvf , the user is make up by yourself.
3.When SYNC mode is used,1st data start from 68th Dclk after Hsync falling

Digital Serial RGB interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	52	-	ns
	High Time	Tch	-	78	-	ns
	Low Time	Tcl	-	78	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns
Hsync	Period	TH	-	1224	-	Tosc
	Pulse Width	THS	5	90	-	Tosc
	Back-Porch	Thb		114		Tosc
	Display Period	TEP	-	960	-	Tosc
	Hsync-den time	THE	108	204	264	
	Front-Porch	Thf	-	60	-	Tosc
Vsync	Period	Tv	-	262	-	TH
	Pulse Width	Tvs	1	3	5	TH
	Back-Porch	Tvb	-	15	-	TH
	Display Period	Tvd	-	240	-	TH
	Front-Porch	Tvf	2	4	-	TH

Note: 1. Thp + Thb = 204, the user is make up by yourself.
2. Tv = Tvs + Tvb + Tvd + Tvf , the user is make up by yourself.
3. When SYNC mode is used,1st data start from 204th Dclk after Hsync falling

CCIR601/656 Interface

Signal	Item	Symbol	Min	Typ	Max	Unit
Dclk	Frequency	Tosc	-	37	-	ns
	High Time	Tch	-	78	-	ns
	Low Time	Tcl	-	78	-	ns
Data	Setup Time	Tsu	12	-	-	ns
	Hold Time	Thd	12	-	-	ns

6.1 Waveform

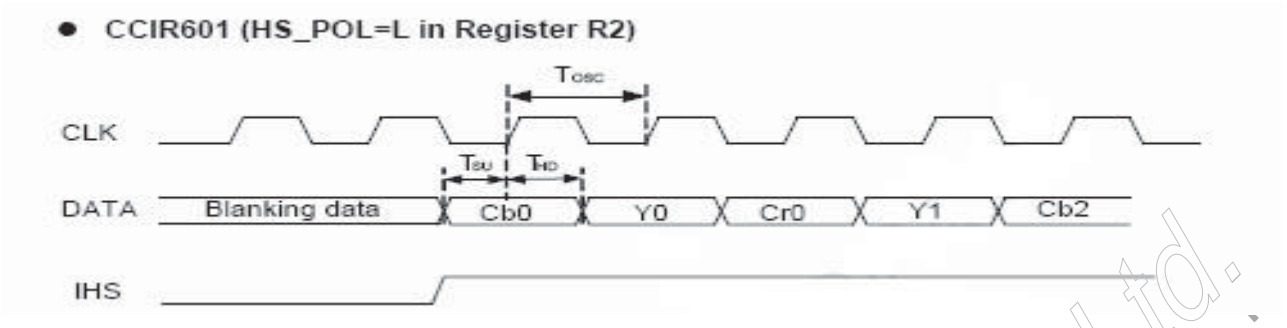


Figure1 CLK,DATA and HIS waveforms in CCIR601

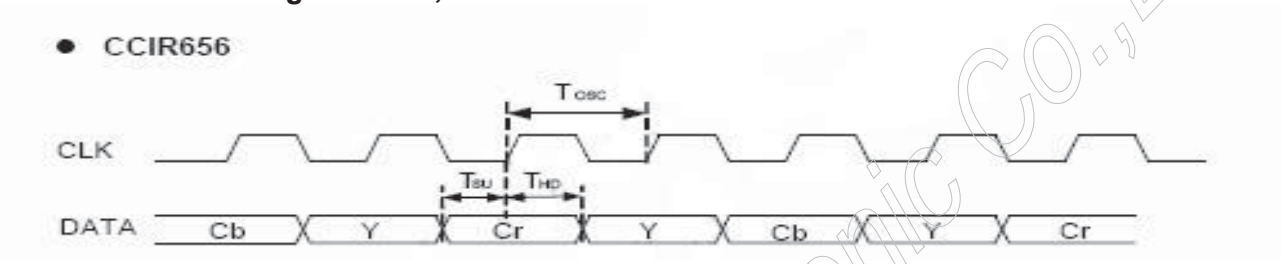


Figure2 CLK and DATA waveforms in CCIR656

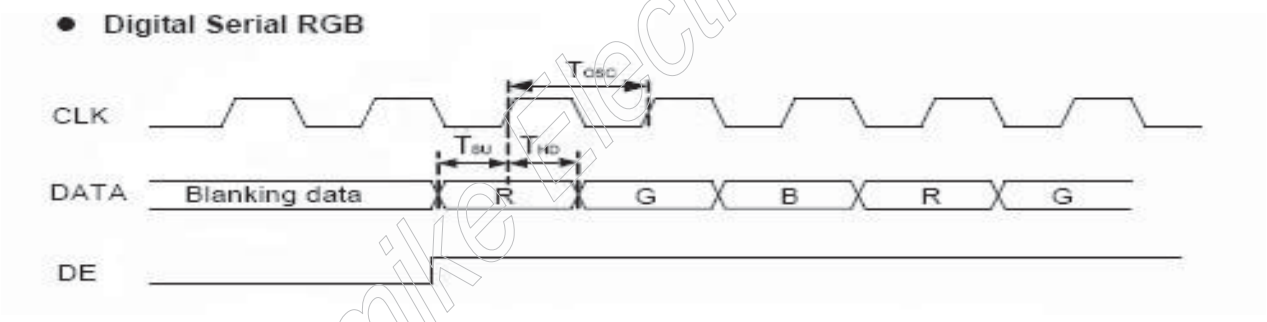


Figure3 CLK, DATA and DE waveforms in Digital Serial RGB

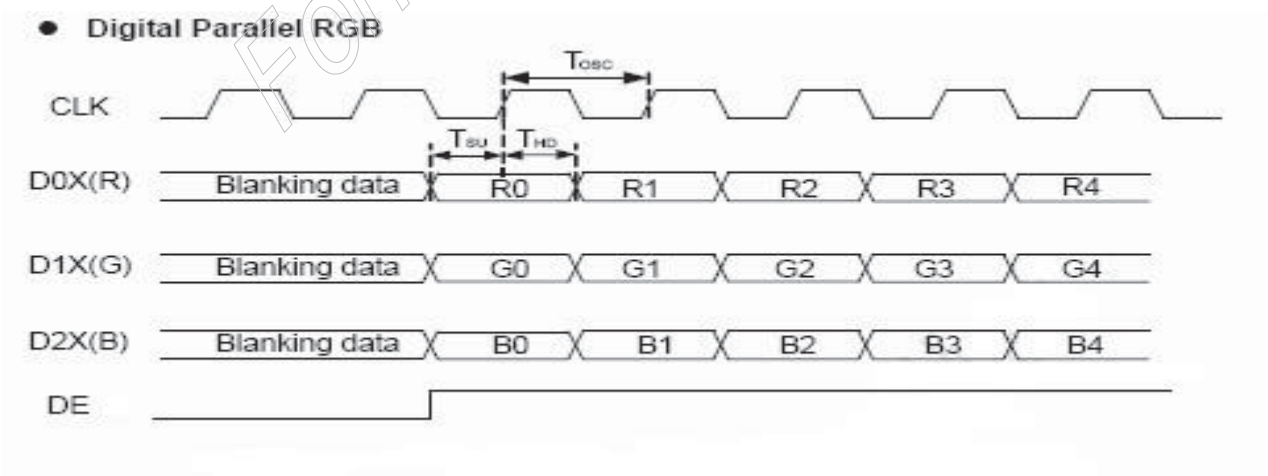


Figure4 CLK, DATA and DE waveforms in Digital Parallel RGB

6.1.1 Standby ON/OFF Control

This module has a power ON/OFF sequence control function. When STB pin is pulled L,blank data is outputted for 5-frames first, form the falling edge of the following VSYNC signal. The blank data would be gray level 255 for normally white LC.

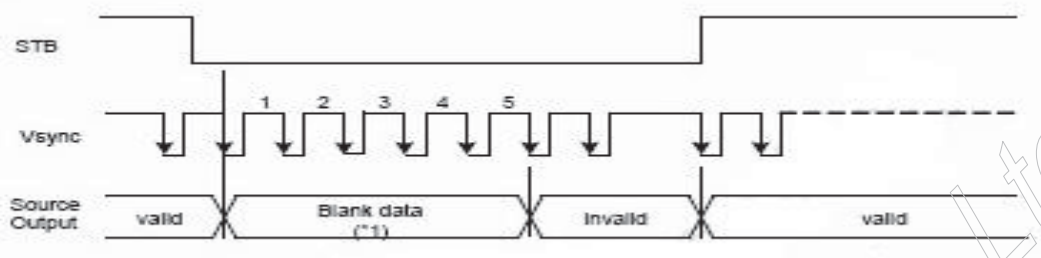


Figure5 Standby ON/OFF Control

6.1.2 Clock and Sync waveform

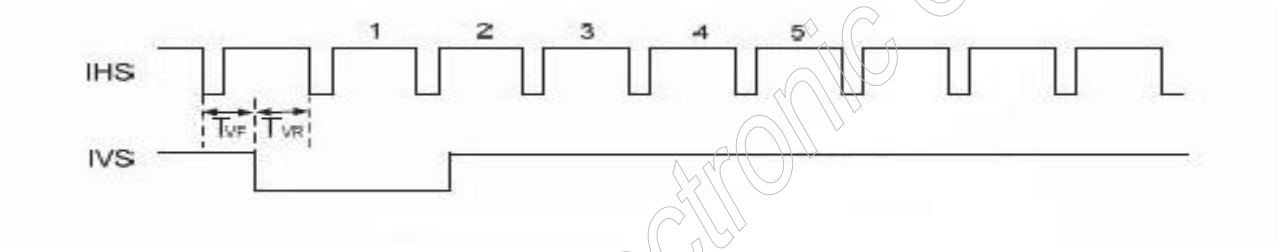


Figure6 CLK and IHS timing waveform

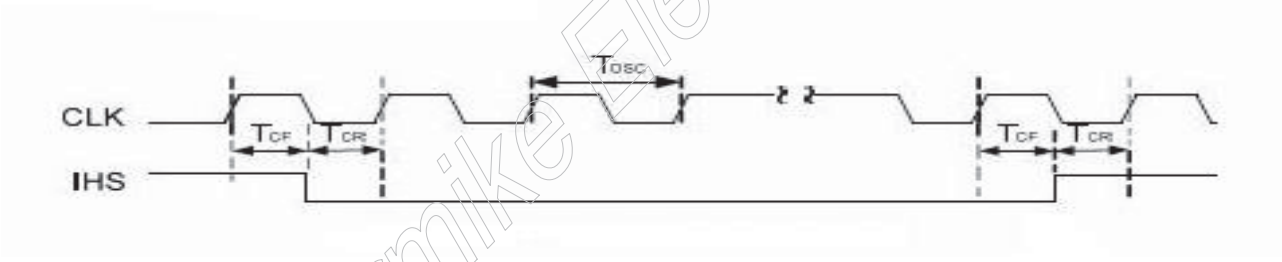
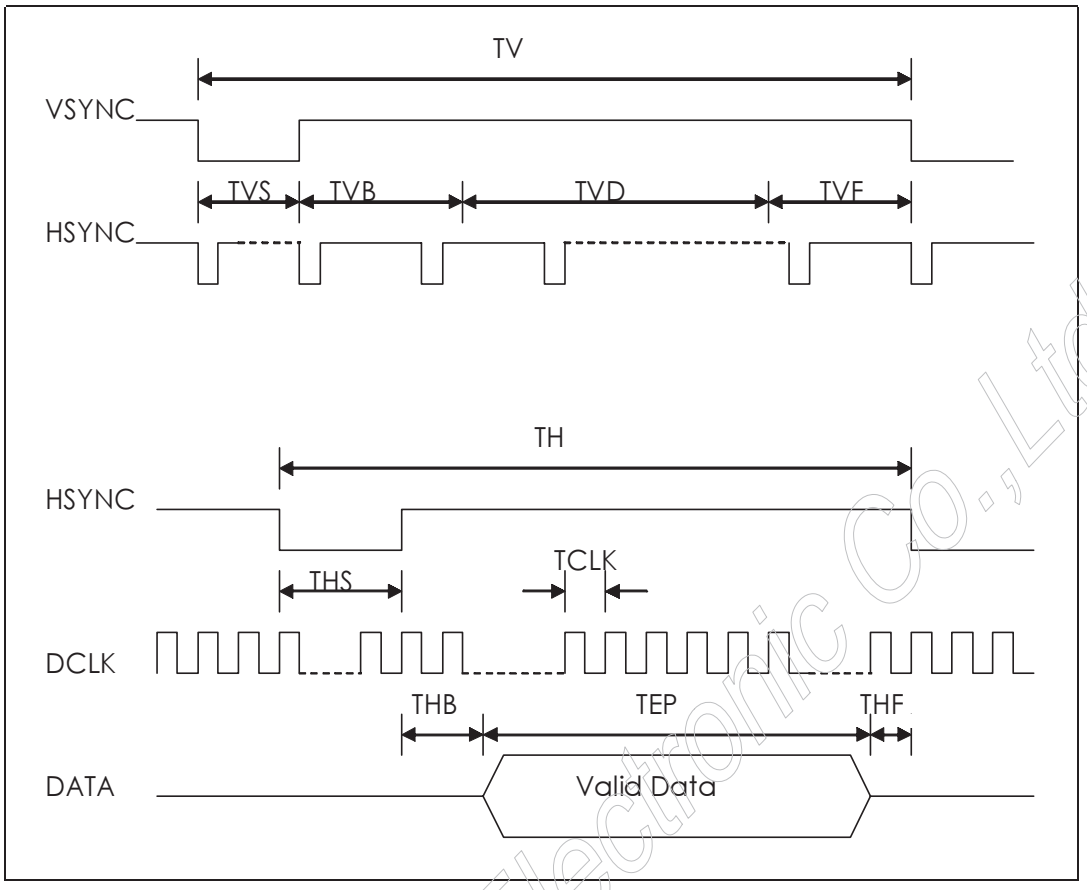
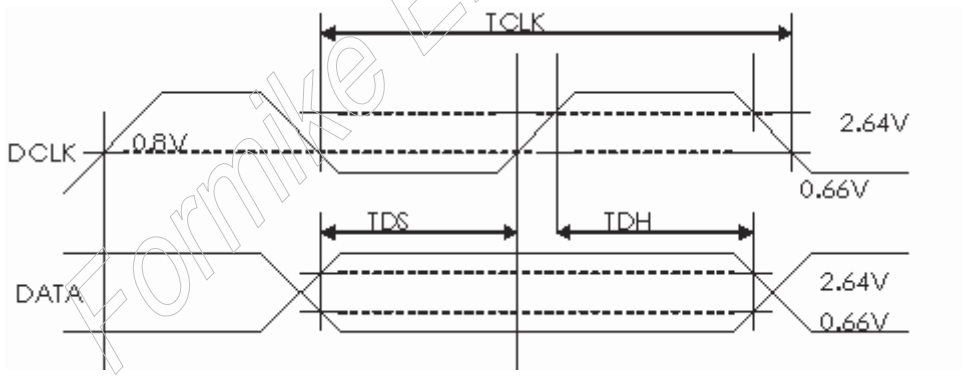


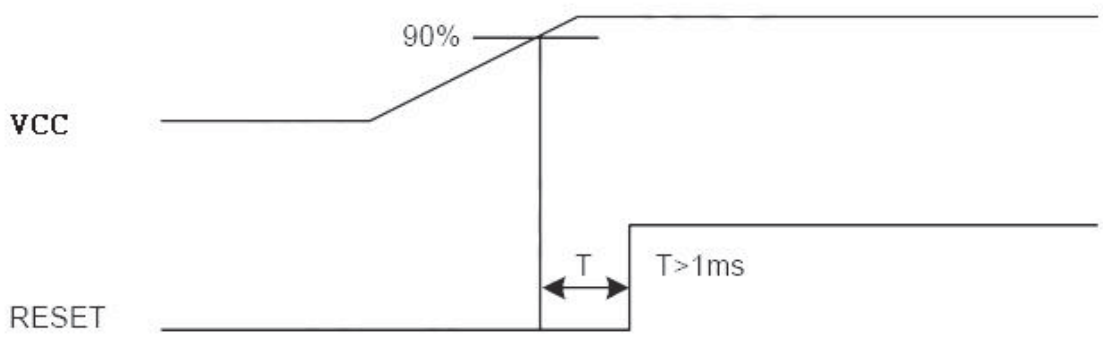
Figure7 IHS and IVS timing waveform





6.2 Reset Timing Chart

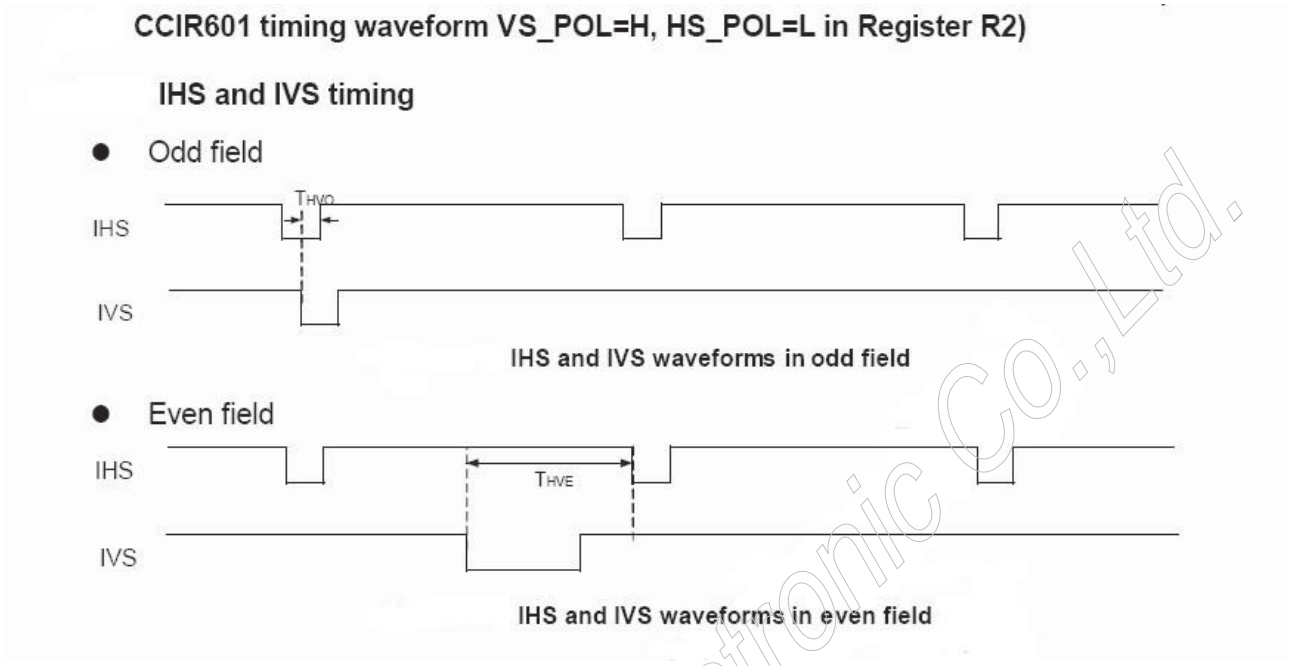
The RESET input must be held at least 1ms after power is stable



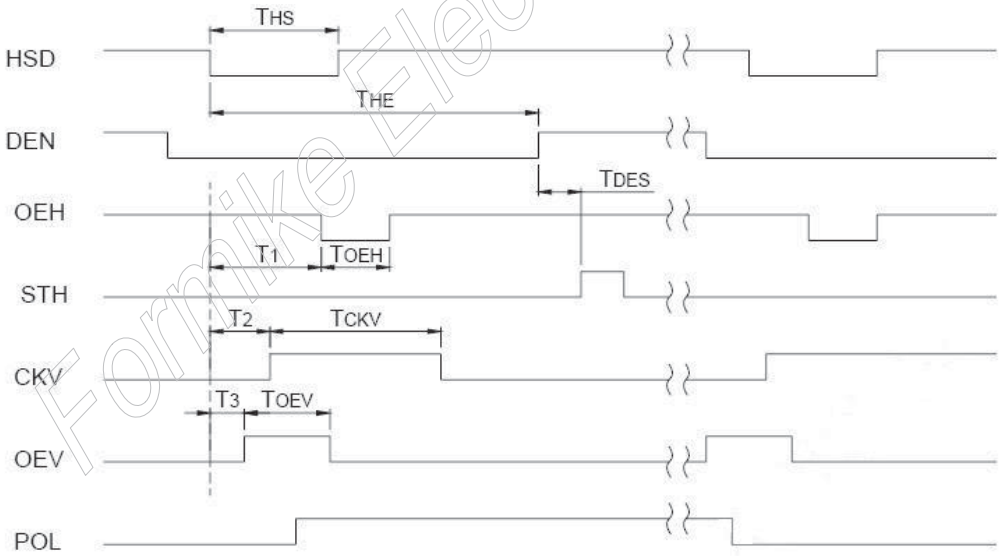
Reset timing

6.3 Digital RGB timing waveform

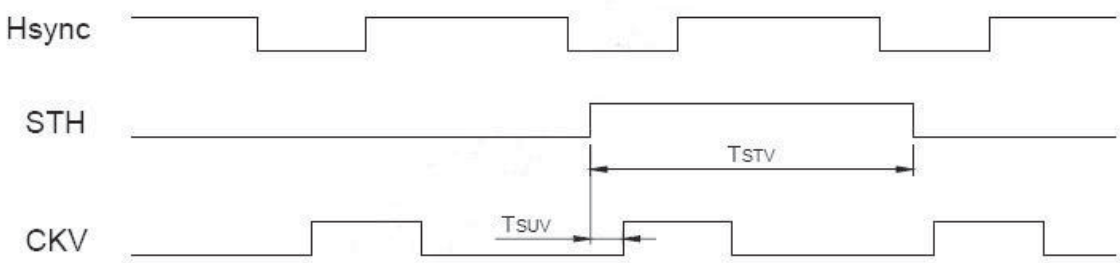
Hsync and Vsync timing



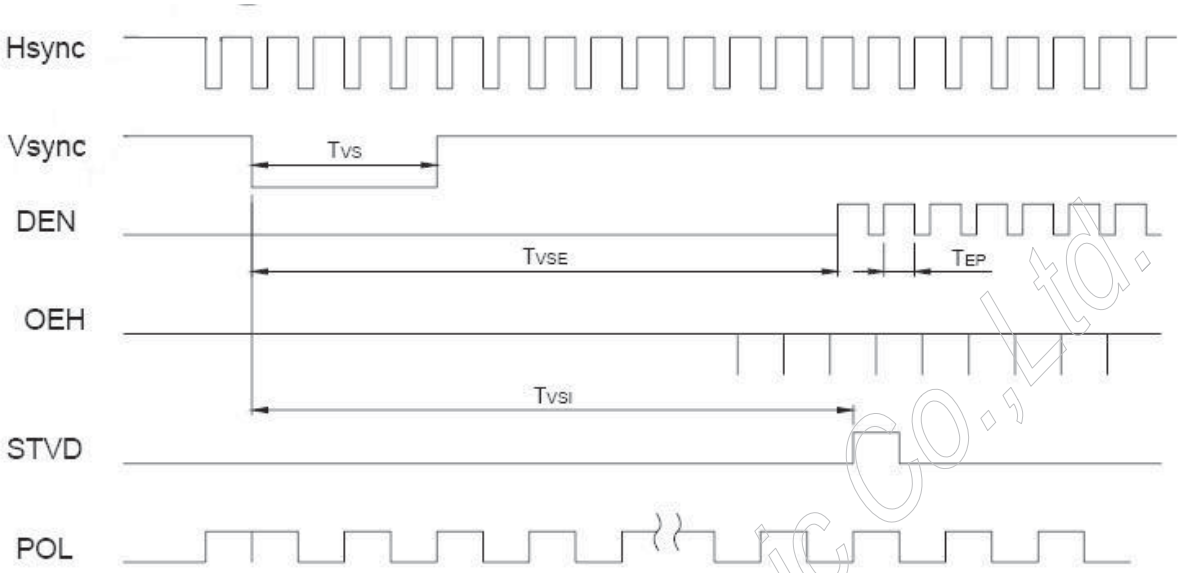
6.3.1 Hsync and horizontal control timing waveform



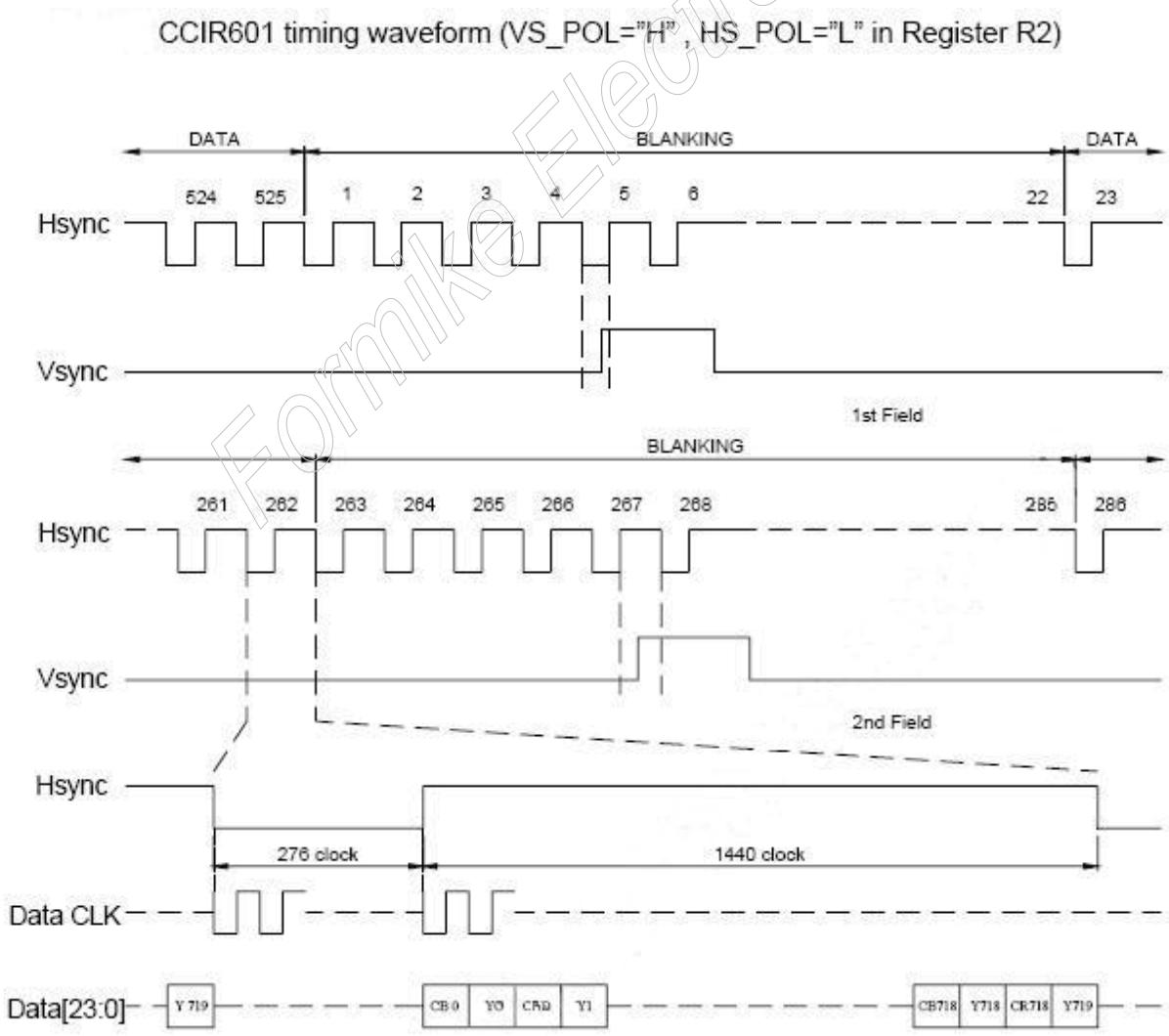
6.3.2 Hsync and vertical shift clock timing waveform



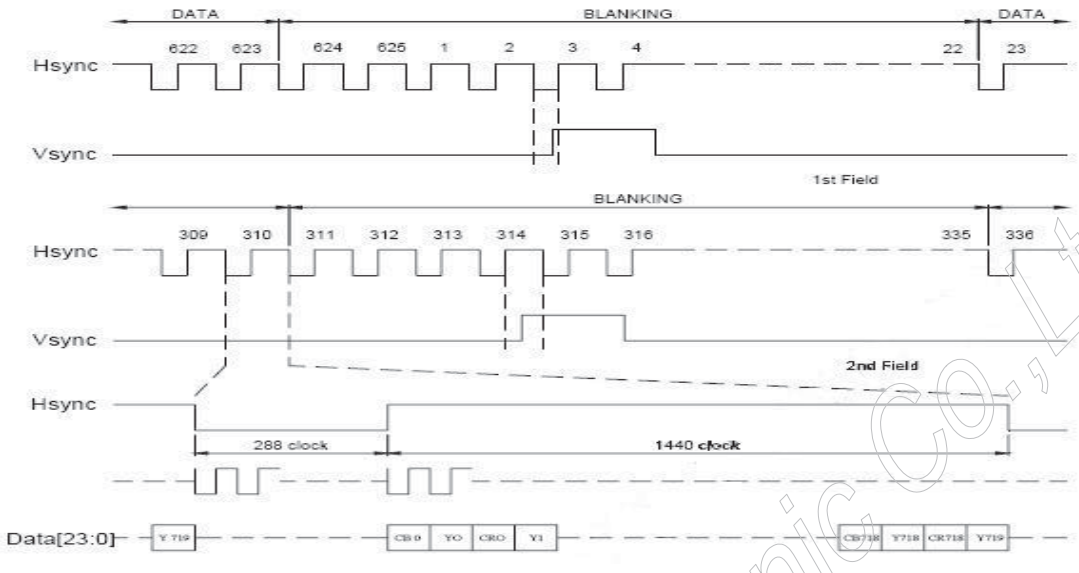
6.3.3 Hsync and vertical control timing waveform



6.3.4 CCIR601 timing waveform

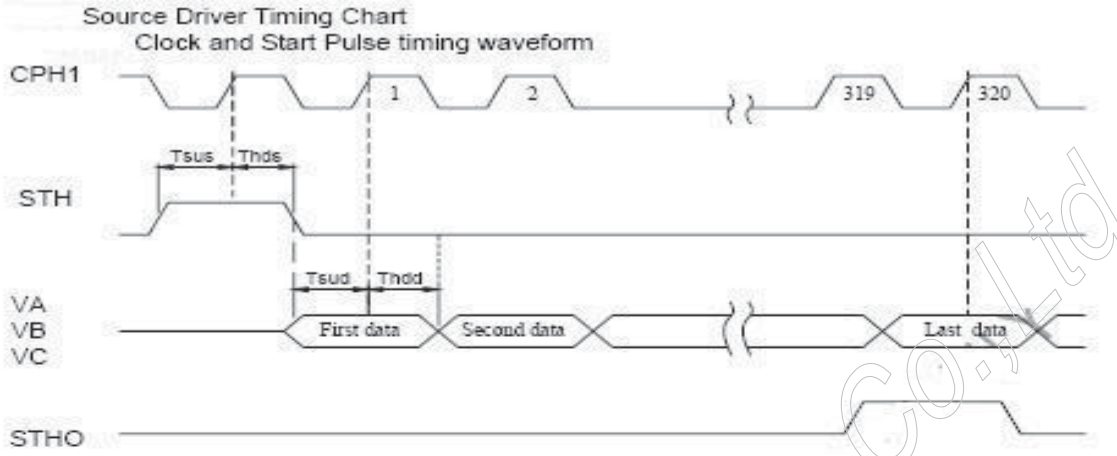


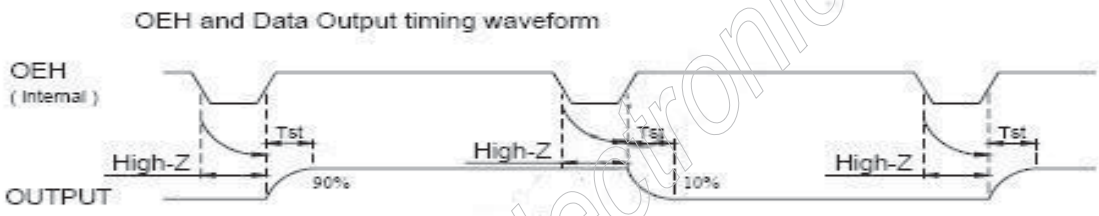
ITU-BT.601 NTSC Input Timing



ITU-BT 601 PAL Input Timing

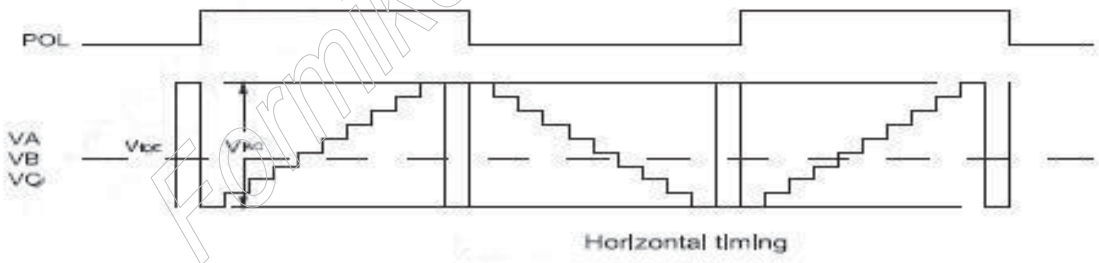
6.3.5 Source Driver Timing Chart





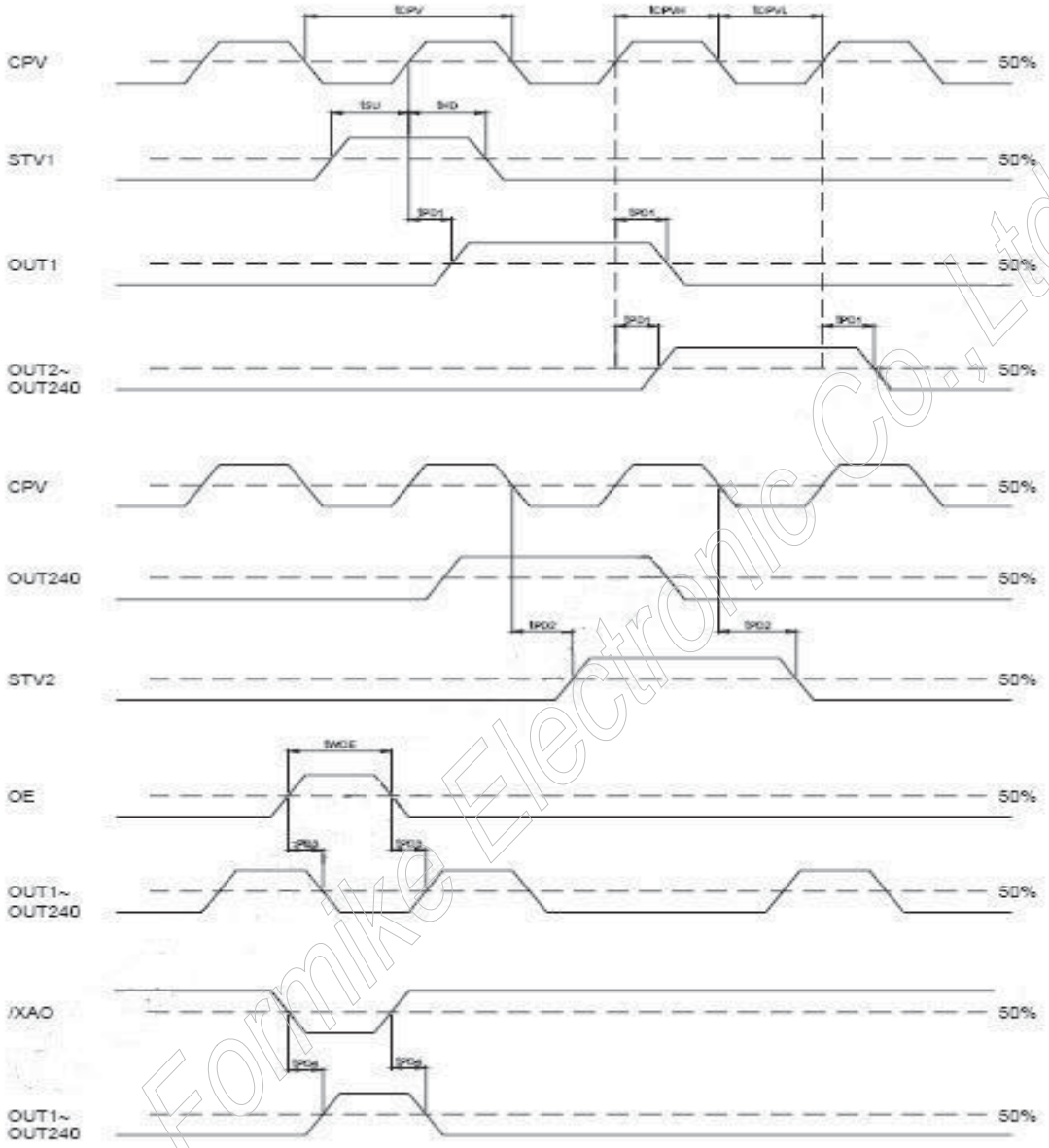
Analog video signal characteristics

PARAMETER	Symbol	Min.	Typ.	Max.	Unit
Video signal amplitude (VA, VB, VC)	V_{IAC}	-	3.81	-	V
	V_{IDC}	-	2.385	-	V



Horizontal timing

6.3.6 Gate Driver Timing Chart



7. OPTICAL CHARACTERISTIC

Ta=25±2℃, ILED=20mA

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response time		Tr	θ=0°、Φ=0°	-	10		ms	Note 3,5
		Tf		-	15		ms	
Contrast ratio		CR	At optimized viewing angle	300	400	-	-	Note 4,5
Color Chromaticity	White	Wx	θ=0°、Φ=0	0.26	0.29	0.32		Note 2,6,7
		Wy		0.31	0.34	0.37		
	Red	Rx	θ=0°、Φ=0					
		Ry						
	Green	Gx	θ=0°、Φ=0					
		Gy						
	Blue	Bx	θ=0°、Φ=0					
		By						
Viewing angle	Hor.	ΘR	CR≧10	(60)	(70)		Deg.	Note 1
		ΘL		(60)	(70)			
	Ver.	ΦT		(40)	(50)			
		ΦB		(66)	(70)			
Brightness		-	-	170	210	-	cd/m²	Center of display

Ta=25±2℃, I_L=20mA

Note 1: Definition of viewing angle range

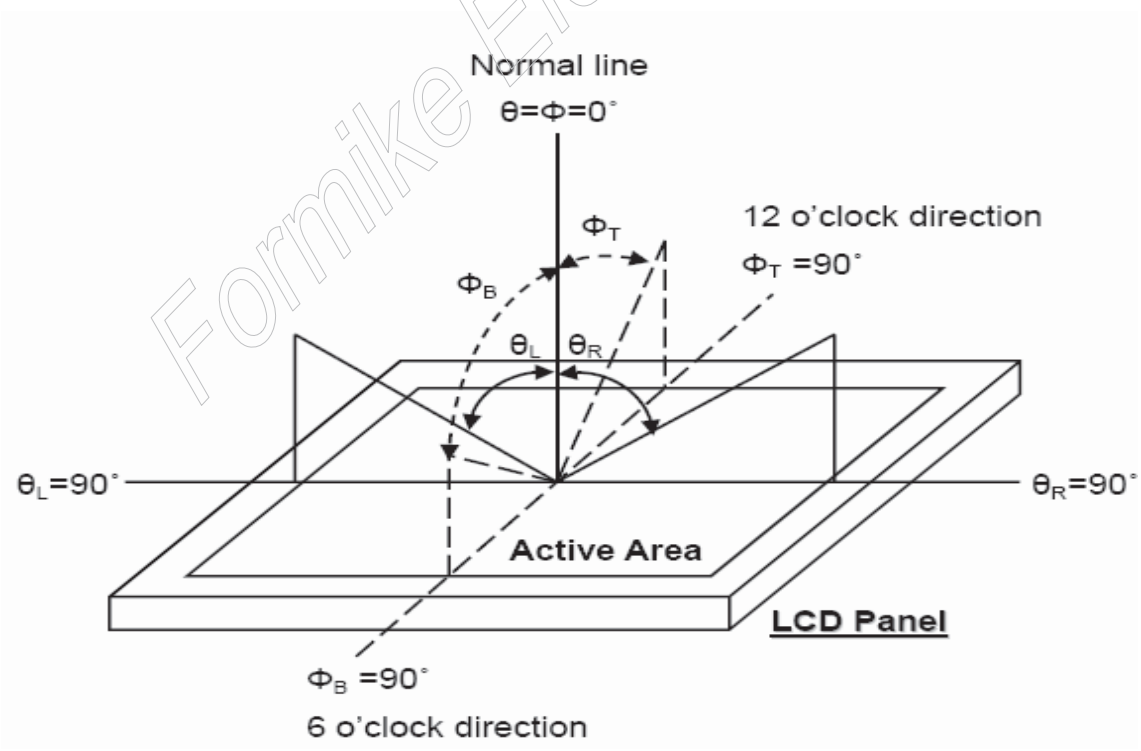


Fig. 7-1 Definition of viewing angle

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.

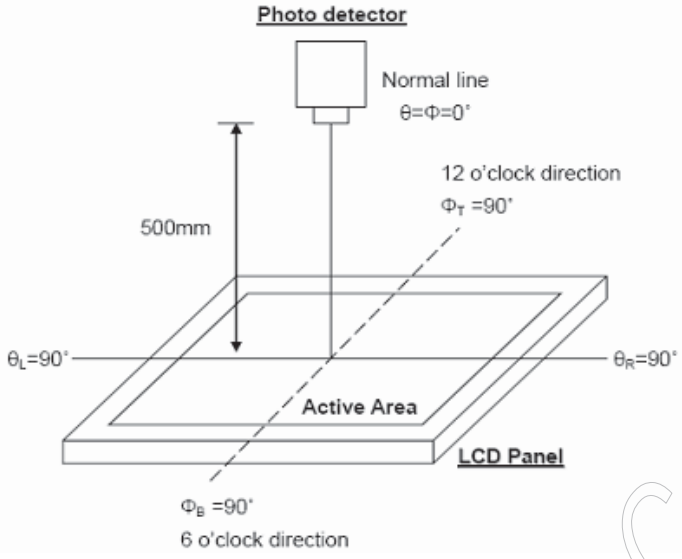


Fig. 7-2 Optical measurement system setup

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% .

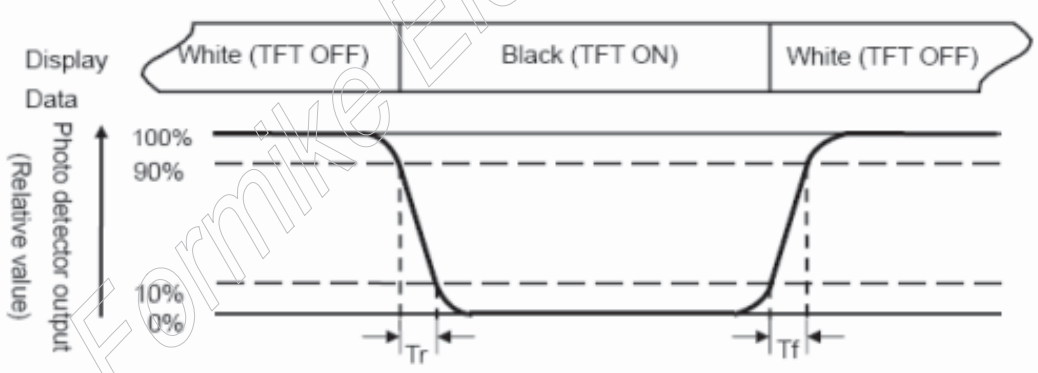


Fig. 3-3 Definition of response time

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.

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

8. INTERFACE

8.1 Pin Description

Pin	Symbol	I/O	Description	Remark
1	VBL-	I	Backlight LED Ground	
2	VBL-	I	Backlight LED Ground	
3	VBL+	I	Backlight LED Power	
4	VBL+	I	Backlight LED Power	
5	Y+		Touch panel pin for Y+.	
6	X+		Touch panel pin for X+.	
7	NC		Not Use	
8	/RESET	-	Hardware Reset	
9	SPENA	I	Not Use	
10	SPCLK	I	Not Use	
11	SPDAT	I	Not Use	
12	B0	I	Blue Data Bit 0	
13	B1	I	Blue Data Bit 1	
14	B2	I	Blue Data Bit 2	
15	B3	I	Blue Data Bit 3	
16	B4	I	Blue Data Bit 4	
17	B5	I	Blue Data Bit 5	
18	B6	I	Blue Data Bit 6	
19	B7	I	Blue Data it 7	
20	G0	I	Green Data Bit0	
21	G1	I	Green Data Bit1	
22	G2	I	Green Data Bit2	
23	G3	I	Green Data Bit3	
24	G4	I	Green Data Bit4	
25	G5	I	Green Data Bit5	
26	G6	I	Green Data Bit6	
27	G7	I	Green Data Bit7	
28	R0	I	Red Data Bit0 /DX0	Note 4
29	R1	I	Red Data Bit1 /DX1	Note 4
30	R2	I	Red Data Bit2 /DX2	Note 4
31	R3	I	Red Data Bit3 /DX3	Note 4
32	R4	I	Red Data Bit4 /DX4	Note 4
33	R5	I	Red Data Bit5 /DX5	Note 4
34	R6	I	Red Data Bit6 /DX6	Note 4
35	R7	I	Red Data Bit7 /DX7	Note 4

36	HSYNC	I	Horizontal Sync Input	
37	VSYNC	I	Vertical Sync Input	
38	DCLK	I	Dot Data Clock	
39	NC		Not Use	
40	NC		Not Use	
41	Vcc	I	Digital Power	
42	Vcc	I	Digital Power	
43	Y-		Touch panel pin for Y-.	
44	X-		Touch panel pin for X-.	
45	NC		Not Use	
46	NC	-	Not Use	
47	NC		Not Use	
48	IF2	I	Control the input data format /floating	Note 1
49	IF1	I	Control the input data format	Note 1,5
50	IF0	I	Control the input data format	Note 1,5
51	NC		Not Use	
52	DE	I	Data Enable Input	Note 2
53	GND	I	Ground	
54	GND	I	Ground	

Note:

1. The mode control (IF2) not use ,it can't control CCIR601 interface , If not use CCIR601 ,it can floating.
2. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used.Suggest used SYNC mode!!
3. usually pull high.
4. IF select serial RGB or CCIR601/656 input mode is selected,only DX0-DX7 used,and the other short to GND, Only selected serial RGB、CCIR601/656 interface,DX BUS will enable,Digital input mode DX0 is LSB and DX7 is MSB.
5. Control the input

IF2-0: Define the input interface mode.

IF2	IF1	IF0	Format	Operating Frequency
0	0	0	Parallel-RGB data format (only support stripe type color filter)	6.5MHz
0	0	1	Serial-RGB data format	19.5MHz
0	1	0	CCIR 656 data format (640RGB)	24.54MHz
0	1	1	CCIR 656 data format (720RGB)	27MHz
1	0	0	YUV mode A data format (Cr-Y-Cb-Y)	24.54MHz
1	0	1	YUV mode A data format (Cr-Y-Cb-Y)	27MHz
1	1	0	YUV mode B data format (Cb-Y-Cr-Y)	27MHz
1	1	1	YUV mode B data format (Cb-Y-Cr-Y)	24.54MHz

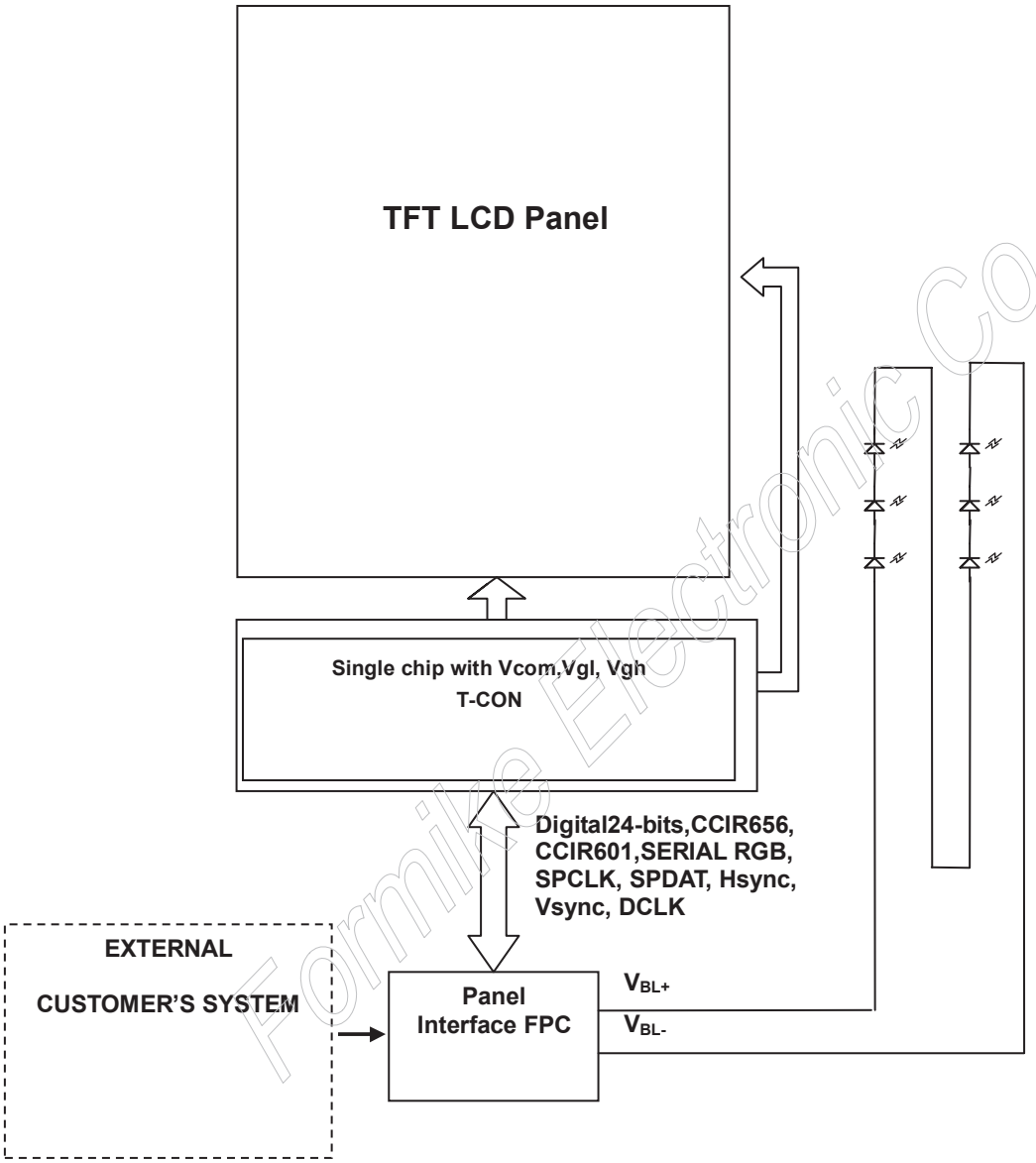
Input format	DOTCLK Freq (MHz)	Display Data	Active Area (DOTCLK)
YUV mode	24.54	640	1280
	27	720	1440

Mode	D[23:16]	D[15:8]	D[7:0]	IHS	IVS	DEN
ITU-R BT 656	D[23:16]	GND	GND	NC	NC	NC
ITU-R BT 601	D[23:16]	GND	GND	IHS	IVS	NC
8 bit RGB	D[23:16]	GND	GND	IHS	IVS	NC for HV Mode
						DEN for DEN Mode
24 bit RGB	R[7:0]	G[7:0]	B[7:0]	IHS	IVS	NC for HV Mode
						DEN for DEN Mode

8.2 Basic Display Color and Gray Scale

Color		Input Color Data																							
		Red								Green								Blue							
		MSB							LSB	MSB							LSB	MSB							LS
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Mak enta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Red(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) Brik ht	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green	Green(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255)Brik ht	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Blue	Blue(0) Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		1	1	1	1	1	0
	Blue(255) Brik ht	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		1	1	1	1	1	1

9. BLOCK DIAGRAM



10. QUALITY ASSURANCE

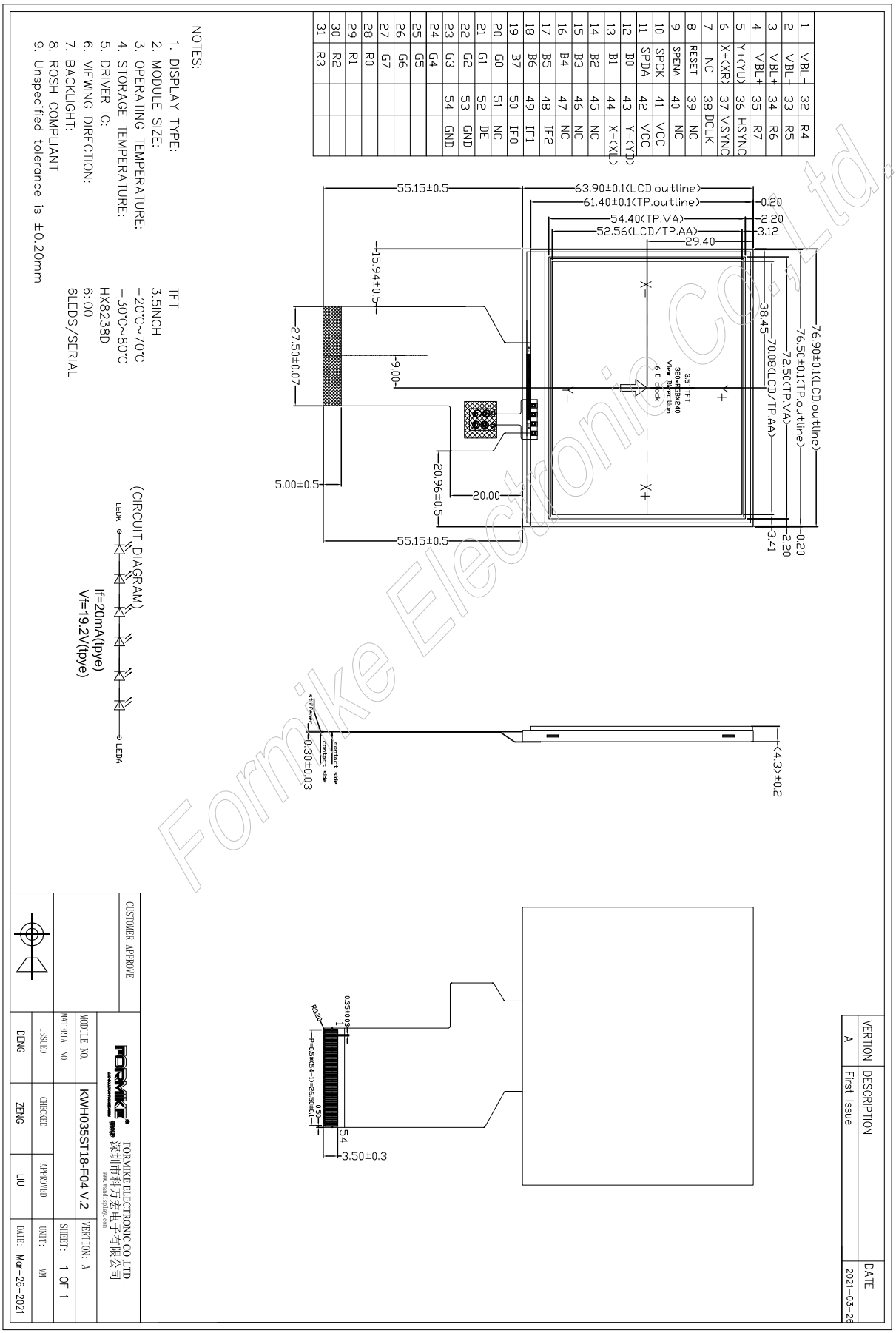
No.	Test Items	Test Condition	REMARK
1	High Temperature Storage Test	Ta=80℃ Dry 240h	
2	Low Temperature Storage Test	Ta=-30℃ Dry 240h	
3	High Temperature Operation Test	Ta=70℃ Dry 240h	
4	Low Temperature Operation Test	Ta=-20℃ Dry 240h	
5	High Temperature and High Humidity Operation Test	Ta=60℃ 90%RH 240h	
6	Electro Static Discharge Test	Contact/Air: ±6KV/±8KV 150PF330Ω	
7	Shock Test (non-operating)	Shock Level : 100G Waveform : Half Sinusoidal Wave Shock Time : 6ms Number of Shocks : 3 times for each ±X, ±Y, ±Z direction	
8	Vibration Test (non-operating)	Frequency range: 10Hz ~ 550Hz Stoke : 1.3mm Sweep : 1.5G, 33.3~400Hz Vibration : Sinusoidal Wave, 1Hrs for X,YZ direction.	
9	Thermal Shock Test	-20℃(0.5h) ~ 70℃(0.5h) / 100 cycles	

***** Ta= Ambient Temperature

Note:

1. The test samples have recovery time for 2 hours at room temperature before the function check. In the standard conditions, there is no display function NG issue occurred.
2. All the cosmetic specifications are judged before the reliability stress.

11.Mechanical Drawing



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.

Doc No.: IQM-201506002SA
Date: Dec 1st, 2015
Version: 5.0

INSPECTION CRITERIA

TFT LCD Module

Apply to ⩽ 4.3inch

Customer Approved	
Signature:	**Date: (MM/DD/YY)**

- This inspection criteria is subject to change without notice, please contact with FORMIKE before design or place order.
- Once signature is seen as agree and accept to all inspection criteria. Further mass production will subject to it.

FORMIKE ELECTRONIC CO., LTD

Approved	Checked	Issued
LD	ZL	CS

FORMIKE ELECTRONIC CO., LTD
Flat 401-403, Block B, iPARK Building, No.26 Dengliang Road, Nanshan District, Shenzhen 518054, China.

TEL: (86) 755 88306921,88306931 FAX: (86) 755 88304615
Http:// www.wandisplay.com

1. 检测标准 Incoming Inspection

合约双方同意此检测标准为 TFT LCD（以下被称为“模组”）检测中的唯一也是最终标准。除“模组”本身不良，科万宏公司不再对第三方的任何品质不良问题或遗失等负有任何责任或义务，包括意外附带损失，产品责任，其它间接损失等。

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. Except Modules itself, Formike shall be under no liability or obligation whatsoever for any defect or loss caused by the third party, including incidental loss, products liability or other consequential loss and so on.

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2. 责任 Liability

2.1 检测期限 Inspection Deadline

客户应在发货地点或模组到达目的地日起20个自然日内在交货目的地检测模组。

The customer should inspect the Modules either at the delivery point or within twenty (20) calendar days after modules arrival at the Delivery Destination.

2.2 拒收通知 Notification of Rejection

当模组不能达到AQL（合格质量水平）且无法通过验收，客户可以拒绝一个或一个以上的不良或不合格的模组。在这种情况下，客户应当在收到产品后的3个工作日内通过文件或邮件给到科万宏拒绝通知，否则，该批产品被视为已符合AQL并验收合格。

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. 检测规格 Inspection Specifications

双方共同认定检测应该包含并遵循如下列明的检测规格，包括：

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

3.1 范围 Scope

3.2 抽样检验方法 Sampling Plan

3.3 面板检测条件 Panel Inspection Condition

3.4 显示质量 Display Quality

3.5 机构规格 Mechanics Specifications

3.6 存储处理说明 Notification for Storage Handling

4. 质量保证 Quality Warranty

4.1. 自出货日起提供十二（12）个月的质量保证期，质量保证不包括客户责任不良品。

The period is within 12 months since the date of shipping out under normal using and storage conditions. The warranty will be avoided in case of defect induced by customer.

4.2. 科万宏有权选择对确认为科万宏责任的不良品进行更换，重工，或扣款，前提条件为

（1）客户在保质期限内立即就不良或非符合标准的产品通知了科万宏公司。

（2）符合以下指明的规格或条件。

（3）符合科万宏公司关于模组补货，重工，或退货的程序。

Formike replace, rework or refund to customer for the defective or non-conforming Modules at Formike option only when Formike confirm that it is Formike responsibility, also 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 procedure for modules replacement, reworking and/or return.

4.3. 补货或返工的模组保质期应当是剩余的期限。

The warranty period for the modules replaced or reworked shall be the remaining term for such Modules.

4.4. 当客户发现不良品时，科万宏有权要求其退回科万宏指定的地址作进一步分析，并且由客户支付退回产品的费用。

When customers found defective or non-conforming, Formike has the right to require customers to send them back on customer's expenses to Formike specified address for further analysis.

4.5. 有限保修

(1) 科万宏的模组不是消费性产品，但有可能补用于客户的消费性产品或部件，因此科万宏不会保证模组或部件适用于任何特定用途。

(2) 科万宏对于维修或换货是有限责任，条款列于以下

附带损失或间接损失，事故，损害，损毁对任何对个人，使用者包括第三方的个人或使用者，科万宏不会负责任何责任，除非另有科万宏与客户的书面协议。科万宏只会对按照科万宏检验标准检验而发现电性不良或外观不良模组进行更换或维修。

(3) 如果不按照科万宏指定的对液晶显示屏的预防操作，将不会给予任何的保证

(4)所退回的模组必须妥善包装，并且详细列出不良明细

Limited Warranty

5. 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.

(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

(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.

(4) In returning the Moudules, they must be properly packaged; there should be detailed description of the failures or defect.

5. 如上设定的保证和解决办法为唯一的并替代了其他所有的保证，条文或条件，表述或暗指，不管是事实上还是法定的。此外，包括担保或适销性和特殊目的的适用性都会被明确否认。科万宏公司就此作出的所有保证，仅仅适用于客户，不延伸到任何第三方。

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 warranties herein apply only to the customer and are not to be extended to any third party.

Tems 规格：

1. 范围 Scope

1.1 显示屏质量评估 Display Quality Evaluation

1.2 结构规格 Mechanics Specification

2. 抽样计划 Sampling Plan

除非特别说明，抽样计划都应该遵循MIL-STD-105E

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

2.1 批量大小:每次发货的数量为一批 （不同产品则为不同批次）

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

2.2 抽样类型: 一般检验，单次抽样 Sampling type: Normal inspection, single sampling.

2.3 抽样级别: 二级（II级）Sampling level: Level II.

2.4 AQL: 可接受品质标准Acceptable Quality Level

项目 Item	重大缺陷Major	轻微缺陷Minor
外观Appearance	1.0%	1.5%
电性Electrical	0.65	1.0%

3. 不良级别分类 Classification of defects：

3.1 重大缺陷 Major defect

任何缺陷可能导致故障,或减少产品的可用性的。例子: 电讯故障、产品变形等。

Any defect may result in functional failure, or reduce the usability of product for its purpose. For Example：Electrical failure, deformation and etc.

3.2 轻微缺陷 Minor defect

不减低产品预期的可使用性，如：点不良

A defect that is not to reduce the usability of product for its intended purpose and un-uniformity, dot defect and etc..

判断重大缺陷和轻微缺陷将依据不良级别分类

The criteria on major or minor judgment will be according with the classification of defects.

4. 显示屏检测条件 Panel Inspection Condition

4.1 环境Environment:

室温Room Temperature: 25±5°C.

湿度Humidity: 50±20% RH.

照明Illumination: 300 ~ 700 Lux.

4.2 检测距离Inspection Distance: 35±5 cm

4.3 检测角度Inspection Angle:

±15° to the front surface of display panel in vertical direction

±15° to the front surface of display panel in horizontal direction

4.4 检测时间Inspection time

可察觉的测试时间:最多10秒 Perceptibility Test Time: 10 seconds max.

5. 结构规格 Mechanics specifications

关于模组的外观尺寸，细节请参考产品规格书。

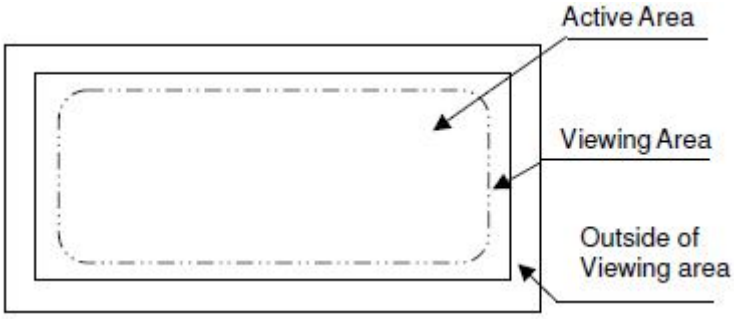
As for the outside dimensions of the Modules, please refer to product specifications for more details.

6. 检验区域定义 Definition Of Inspection Area

Active Area: AA

Viewing Area: A

Outside of viewing area: B



7. 存储处理的说明 Notification for Storage Handling

7.1 存储 Storage:

7.1.1 存储环境需遵循产品规格，否则模组可能被毁坏。

Enviroment condition must be within the product specifications, otherwise the Module might be damaged.

7.1.2 叠放的层数应在科万宏公司指导下进行。

Pile of stacking shall follow the instruction of Formike.

7.2 操作方法 Handling :

7.2.1 不可扭曲或弯折模组。

Twisting or Bending of the Module is prohibited.

7.2.2 除非有科万宏的指导，所有化学品都不宜用在模块上

All chemicals are unfit for use unless otherwise instructed by Fomike.

7.2.3 插塞或拔取: 插塞或拔取模组前先要保证电源关掉。

Plugging in & unplugging:

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

7.2.4 ESD protection: 没有合适的接地线情况下，禁止接触模组。

The Module must not be touched without proper grounding.

7.2.5 高压: 没有保护的情况下，模组背部禁止接触。

High Voltage: The rear side of Module must not be touched without protection

7.2.6 上电时序: 请遵循科万宏公司说明。

Power on sequence: Shall follow the instruction of FORMIKE

8. 检验标准 Inspection criterion

8.1 贴合 Bonding

8.1.1 贴合的范围 Range of Bonding:

(i) Touch screen bonded with LCD

(ii) PMMA/PC bonded with LCD

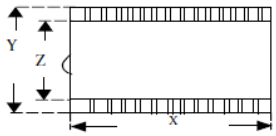
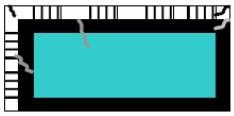
(iii) Cover glass bonded with touch sensor

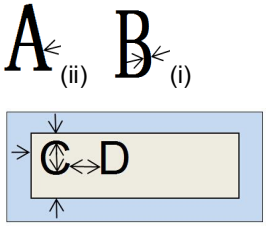
8.1.2 贴合检验定义 Definition of inspection of Bonding:

所有的以下列明的不良只针对产品正面，对产品背面不良，只要在正常安装或使用后正面不可视均为良品

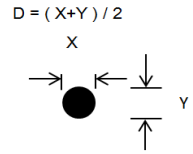
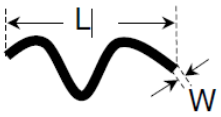
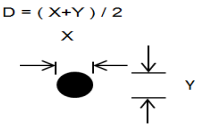
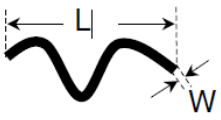
Stated below is only for bad products surface, the defects is allowed that the reverse side of products as long as invisible after installing or using the product.

8.1.3 外观检验标准（目检） Visual inspection criterion in cosmetic / appearance

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

● PMMA/PC/GLASS defect			
No	**Item**	**Criteria**	**Remark**
1	Crack (Minor)	➢ Any crack that is not to reduce the usability of product for its intended purpose is ignore. ➢ After the installation of the product are invisible is allowed	 For cover PMMA / PC / glass only
2	Color (Minor)	Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed	For cover PMMA / PC / glass only
3	Silk-screen (Minor) Including: ■ Color ■ Pattern ■ Font	➢ Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed ➢ Tolerances of sizes and position ±0.15mm are allowed. It is shown in (i), (ii) & (iii), other tolerances are according to drawing	 (iii)

4	Ink Peeling/scratches (Minor) (Surface)	➢ Any defect in Area A & B that are not to reduce the usability of product for its intended purpose is ignore. ➢ Any defect on A & B area has been repaired and it is invisible on surface is acceptable ➢ Area AA is not allowed	

● **Bonding defect**			
No	**Item**	**Criteria**	**Remark**
1	Foreign Spot (Minor) Including: ■ Black spot, ■ White spot ■ Pin hole ■ Particle	➢ D≤0.15mm，Ignore ➢ 0.15mm<D≤0.3mm，N≤3 ➢ 0.3mm<D≤0.35mm，N≤1 ➢ D>0.35mm, 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≤0.03mm，Ignore ➢ 0.03mm<W≤0.05mm, L≤5mm, N≤3 ➢ 0.05mm<W≤0.08mm, L≤4mm, N≤1 ➢ 0.08mm<W≤0.1mm, L≤3mm, N≤1 ➢ W>0.1mm, N=0 ➢ Ignore if out of Area AA	L: Length, W: Width 
3	Polarizer Dent/Air Bubble (Minor)	➢ D≤0.2mm，Ignore ➢ 0.2mm<D≤0.3mm，N≤3 ➢ 0.3mm<D≤0.5mm，N≤1 ➢ D>0.5mm, N=0 ➢ Distance≥5mm	D =(X+Y)/2, X: Length, Y: Width 
4	Polarizer Scratches (Minor)	➢ W≤0.03mm，Ignore ➢ 0.03mm<W≤0.05mm, L≤5mm, N≤3 ➢ 0.05mm<W≤0.08mm, L≤4mm, N≤1 ➢ W>0.08mm, N=0	L: Length, W: Width 
5	Inside Dirt (Minor)	➢ Visible inside dirt would be judged as Line 1 & 2 as above ➢ Erasable dirt is ignore	
6	Adhesive/OCA (Minor)	It is not allowed if the adhesive overflow to the Viewing Area or its boundary due to the adhesive is not placed correctly	
7	OCA Bubble (Minor)	➢ Judged as Line 1 as above. ➢ 5% OCA bubble of delivery is allowed and acceptable.	
8	Surfacing(Minor)	Conform to approved sample or judged by Formike QA standard level.	

● 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	

Notes:

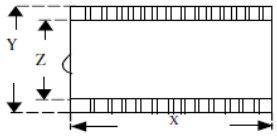
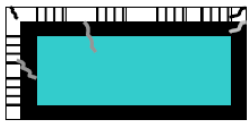
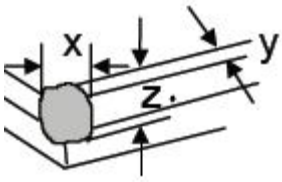
1. If any specific defect is not included in the above defect table, this defect should be judged by Formike.
2. W：Width, L：Length D：Average Diameter N：Count.

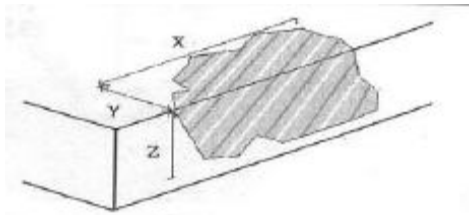
8.1.4 贴合的电讯检验标准请参考各自贴合的液晶屏

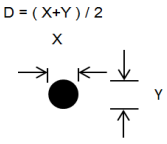
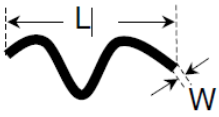
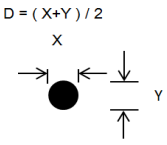
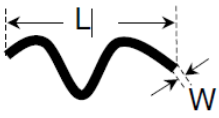
Visual inspection criterion in electrical display of bonding refer to each display.

8.2 TFT 检测标准 TFT Inspection Criteria

8.2.1 外观检验标准（目检） 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 ≤3 mm Y ≤3 mm Z≤ T Ignore	 T: Glass thickness Z: Thickness X: Length Y: Width

4	Side (Minor)	X ≤5mm Y ≤3 mm Z≤ T Ignore	 T: Glass thickness Z: Thickness X: Length Y: Width

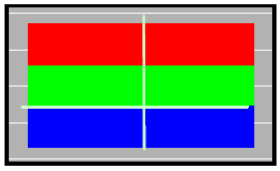
● **TFT defect in appearance**			
No	**Item**	**Criteria**	**Remark**
1	Foreign Spot (Minor) Including: ■ Black spot, ■ White spot ■ Pin hole ■ Foreign particle	➢ D≤0.15mm，Ignore ➢ 0.15mm<D≤0.3mm，N≤3 ➢ 0.3mm<D，N=0 ➢ Distance≥5mm ➢ Ignore if out of Area AA	D =(X+Y)/2, X: Length, Y: Width 
2	Foreign Line(Minor) Including: ■ Black line ■ White line ■ Bright line	➢ W≤0.03mm，Ignore ➢ 0.03mm<W≤0.05mm, L≤4mm, N≤3 ➢ 0.05mm<W≤0.08mm, L≤4mm, N≤1 ➢ W>0.08mm, N=0 ➢ Ignore if out of Area AA	L: Length, W: Width 
3	Polarizer Dent/Air Bubble (Minor)	➢ D≤0.2mm，Ignore ➢ 0.2mm<D≤0.3mm，N≤3 ➢ 0.3mm<D≤0.5mm，N≤1 ➢ D>0.5mm, N=0 ➢ Distance≥5mm	D =(X+Y)/2, X: Length, Y: Width 
4	Polarizer Scratches (Minor)	➢ W≤0.03mm，Ignore ➢ 0.03mm<W≤0.05mm, L≤4mm, N≤3 ➢ 0.05mm<W≤0.08mm, L≤4mm, N≤1 ➢ W>0.08mm, 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	

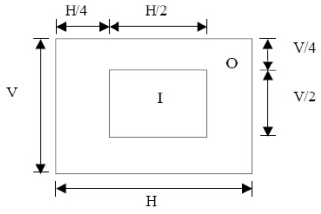
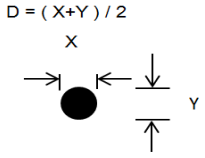
2	Backlight (Minor)	➢ Power up is allowed. ➢ Breaking off is not allowed. ➢ The scratch which may causes a problem in practical use is not allowed	
3	Bezel (Minor)	➢ Erasable dirt is ignore	

8.2.2 电讯检验标准（目检） 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**

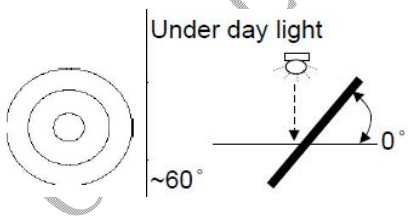
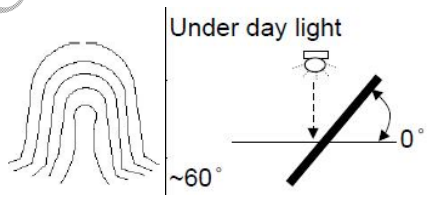
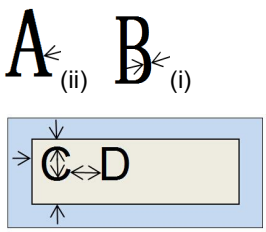
No	Item	Criteria	Remark
1	Bright / Dark dot	Items / Area I / Area O / Total Bright: 1 / 1 / 1 Dark: 1 / 3 / 3 Bright & Dark: 2 / 3 / 4 2 adjacent dots: 0 / 0 / 0 Minimum Distance ≥ 5mm	 1.1sub-pixel: 1R or 1G or 1B 2.Point defect area≥1/2 sub pixel
2	Tiny bright dot	Visible through 6% ND filter ➢ D≤0.15mm，Ignore ➢ 0.15mm<D≤0.3mm，N≤3 ➢ 0.3mm<D≤0.35mm，N≤1 ➢ D>0.35mm, N=0 ➢ Distance≥5mm Ignore if out of Area AA	D =(X+Y)/2, X: Length, Y: Width 

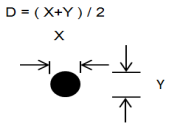
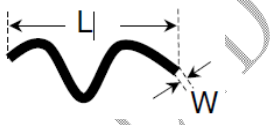
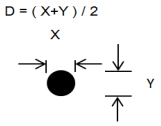
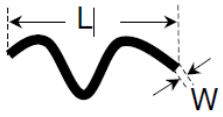
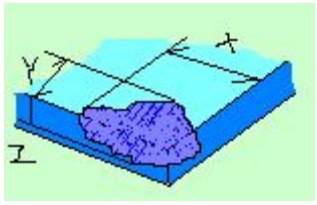
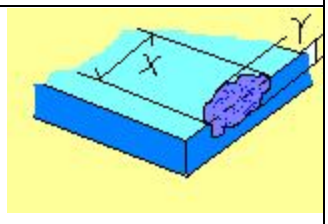
4	Mura/Waving/ Hot spot	Not visible through 6% ND filter in 50% gray or judge by limit sample if necessary	

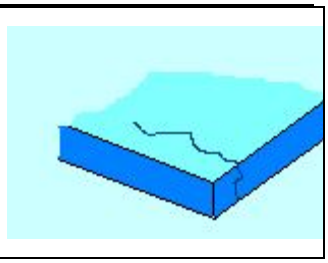
* Note:

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.

8.3. 触模屏标准 Touch screen criteria

No	Item	Criteria	Remark
1	Newton's ring (regular) (Minor)	➢ ≤1/4 of the whole area of touch screen and it is not to reduce the usability of product for its intended purpose is allowed ➢ >1/4 of the whole area of touch screen and it is reduce the usability of product for its intended purpose is not allowed	
2	Newton's ring (irregular) (Minor)	➢ ≤1/3 of the whole area of touch screen and it is not to reduce the usability of product for its intended purpose is acceptable ➢ >1/3 of the whole area of touch screen ➢ and it is reduce the usability of product for its intended purpose is not allowed	
3	Color (Minor)	Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed	For cover PMMA / PC / glass which are with printing only
4	Silk-screen (Minor) Including: ■ Color ■ Pattern ■ Font	➢ Conform to approved sample or judged by Formike QA standard level. Slightly color difference in different lots is allowed ➢ Tolerances of sizes and position ±0.15mm are allowed. It is shown in (i), (ii) & (iii), other tolerances are according to drawing	 (iii) For cover PMMA / PC / glass which are with printing only
5	Ink Peeling/scratches (Minor) (Surface)	➢ Any defect in Area A & B that are not to reduce the usability of product for its intended purpose is ignore. ➢ Any defect on A & B area has been repaired and it is invisible on surface is acceptable ➢ Area AA is not allowed	For cover PMMA / PC / glass which are with printing only

6	Foreign Spot (Minor) Including: ■ Black spot, ■ White spot ■ Pin hole ■ Foreign particle	➢ D≤0.15mm，Ignore ➢ 0.15mm<D≤0.3mm，N≤3 ➢ 0.3mm<D，N=0 ➢ Distance≥5mm ➢ Ignore if out of Area AA	D =(X+Y)/2, X: Length, Y: Width 
7	Foreign Line(Minor) Including: ■ Black line ■ White line ■ Bright line	➢ W≤0.03mm，Ignore ➢ 0.03mm<W≤0.05mm, L≤4mm, N≤3 ➢ 0.05mm<W≤0.08mm, L≤4mm, N≤1 ➢ W>0.08mm, N=0 ➢ Ignore if out of Area AA	L: Length, W: Width 
8	Inside Dirt (Minor)	➢ Visible inside dirt would be judged as Line 1 & 2 as above ➢ Erasable dirt is ignore	
9	Dent/Air Bubble (Minor)	➢ D≤0.2mm，Ignore ➢ 0.2mm<D≤0.3mm，N≤3 ➢ 0.3mm<D≤0.5mm，N≤1 ➢ D>0.5mm, N=0 ➢ Distance≥5mm	D =(X+Y)/2, X: Length, Y: Width 
10	Scratches (Minor)	➢ W≤0.03mm，Ignore ➢ 0.03mm<W≤0.05mm, L≤4mm, N≤3 ➢ 0.05mm<W≤0.08mm, L≤4mm, N≤1 ➢ W>0.08mm, N=0 ➢ Ignore if out of Area AA	L: Length, W: Width 
11	Glass defect (Corner) (Minor)	Corner ➢ X ≤ 4.0mm, ➢ Y ≤ 3.0mm ➢ Z ≤ T Ignore if they do not affect the function	 T:thickness of glass, X: Length, Y: Width of thickness
12	Glass defect (edges) (Minor)	Edges ➢ X ≤ 5.0mm, ➢ Y ≤ 2.0mm ➢ Z ≤ T Ignore if they do not affect the function	 T:thickness of glass, X: Length, Y: Width of thickness

13	Glass defect (area AA & A) (Major)	Not allowed	

Notes:

1. If any specific defect is not included in the above defect table, this defect should be judged by Formike.
2. W：Width, L：Length D：Average Diameter N：Count.

9. Others.

Issues that are not defined in the INSPECTION CRITERIA shall be discussed and agreed with both parties. The final result is subject to FORMIKE

10. Revised Record

Version	Revise record	Issued	date
1.0	First issue	May Zeng	Feb. 20th, 2010.
2.0	Adding bonding standard	CS	June. 1st, 2015
3.0	Revise Doc No. completed the standard	CS	July. 1st, 2015
4.0	Revise page 2 & 3	CS	Oct 10th , 2015
5.0	Revised line 1 in page 2/13 & line 4.4 in page 4/13	CS	Dec. 1st, 2015