



# FORMIKE ELECTRONIC CO.,LTD

## PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH035ST12-F01 V.1 Version: 1.0

【    】 Preliminary Specification

【 ♦  】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATE:

APPROVED BY	PM REVIEWD	PD REVIEWD	PREPARED BY
Kam	/	Stephen	Roy

**Prepared By :**

FORMIKE ELECTRONIC CO.,LTD

Address :Room 14H, HanKing Building, 23# DengLiang Road, NanShan District, ShenZhen, 518054, China.

TEL:(86) 755 88306921,88306931 FAX:(86) 755 88304615

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.



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### 1. Record of Revision

Version	Issued Date	Page	Content	Created or Modified by
1.0	2010.11.10	All	New Creation	Stephen
1.0	2011-2-1		Finaly Specifcation	Kam



## 2. GENERAL DESCRIPTION

### 2.1 Description

KWH035ST12-F01 V.1 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 ICs, FPC, and a backlight unit. The following table described the features of FORMIKE KWH035ST12-F01 V.1

### 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
Interface	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 3.3
Active Area( H x V mm)	70.08 x 52.56
With/Without TSP	Without TSP
LED Numbers	6 LEDS
Weight (g)	40



### 3. ABSOLUTE MAXIMUM RATINGS

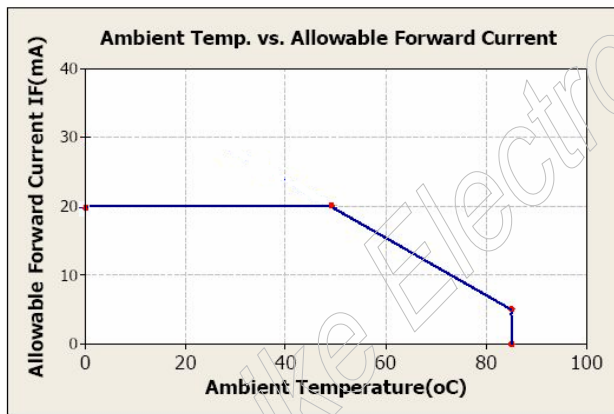
Item	Symbol	Condition	Min.	Max.	Unit	Remark
Power Voltage	DVDD,AVDD	GND=0	-0.3	5.0	V	
Input Signal Voltage	V <sub>in</sub>	GND=0	-0.3	VDD+0.3	V	NOTE
Logic Output Voltage	V <sub>OUT</sub>	GND=0	-0.3	VDD+0.3	V	NOTE

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

1. Temp. ≤ 60°C, 90% RH MAX.

Temp. > 60°C, Absolute humidity shall be less than 90% RH at 60°C

2.



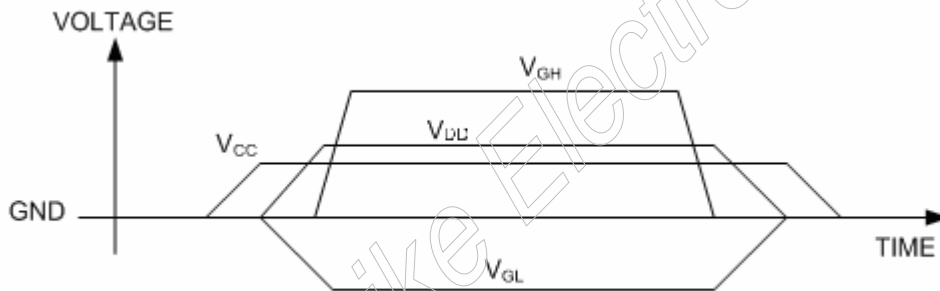
## 4.ELECTRICAL CHARACTERISTICS

### 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)

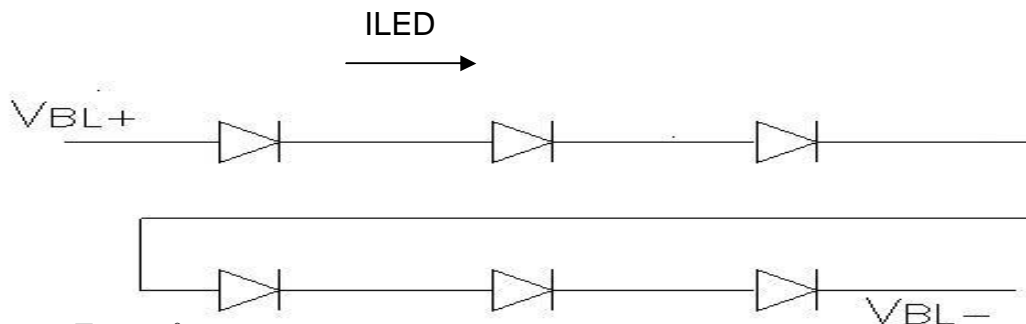
Note: Please power on following the sequence VCC → VDD



### 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°C

Note 3 : Brightness 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.  $T_{hp} + T_{hb} = 68$ , the user is make up by yourself.  
 2.  $T_v = T_{vs} + T_{vb} + T_{vd} + T_{vf}$ , the user is make up by yourself.  
 3. When SYNC mode is used, 1<sup>st</sup> data start from 68<sup>th</sup> 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.  $T_{hp} + T_{hb} = 204$ , the user is make up by yourself.  
 2.  $T_v = T_{vs} + T_{vb} + T_{vd} + T_{vf}$ , the user is make up by yourself.  
 3. When SYNC mode is used, 1<sup>st</sup> data start from 204<sup>th</sup> 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

- CCIR601 (HS\_POL=L in Register R2)

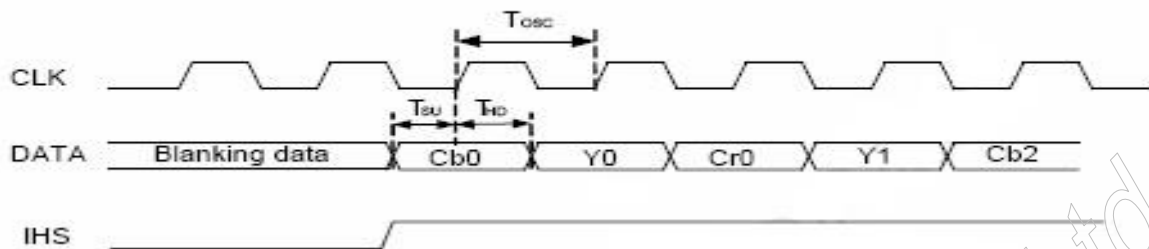


Figure1 CLK,DATA and HIS waveforms in CCIR601

- CCIR656

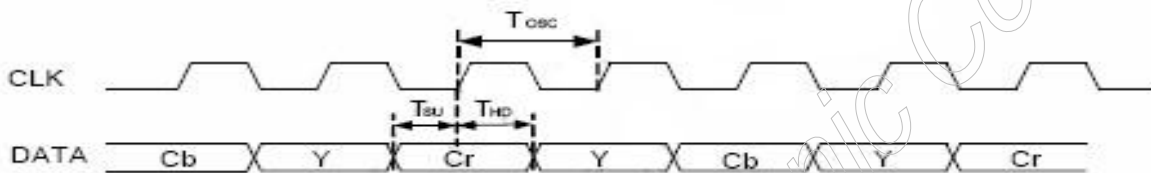


Figure2 CLK and DATA waveforms in CCIR656

- Digital Serial RGB

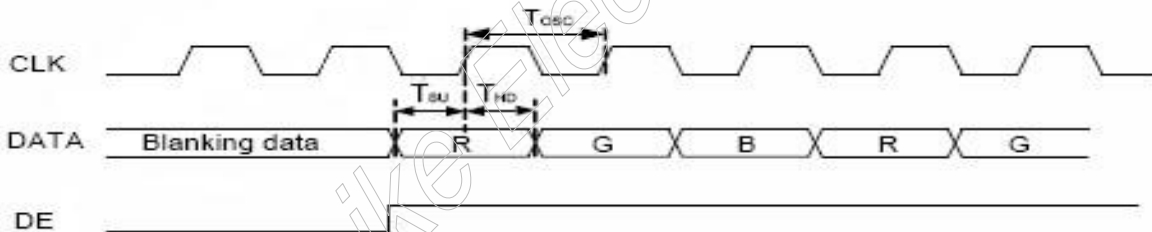


Figure3 CLK, DATA and DE waveforms in Digital Serial RGB

- Digital Parallel RGB

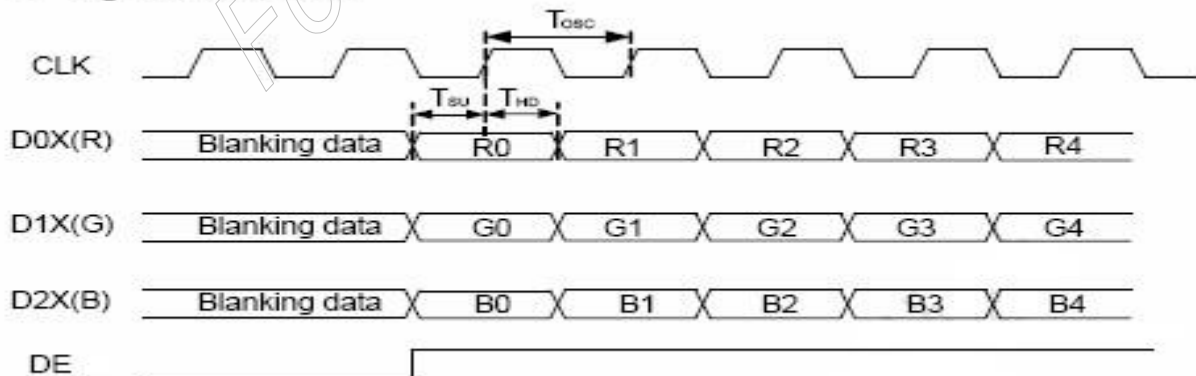


Figure4 CLK, DATA and DE waveforms in Digital Parallel RGB

### 6.1.1 Standby ON/OFF Control

KWH035ST12-F01 V.1 has a power ON/OFF sequence control function. When STB pin is pulled L, blank data is outputted for 5-frames first, from the falling edge of the following VSYNC signal. The blank data would be gray level 255 for normally white LC.

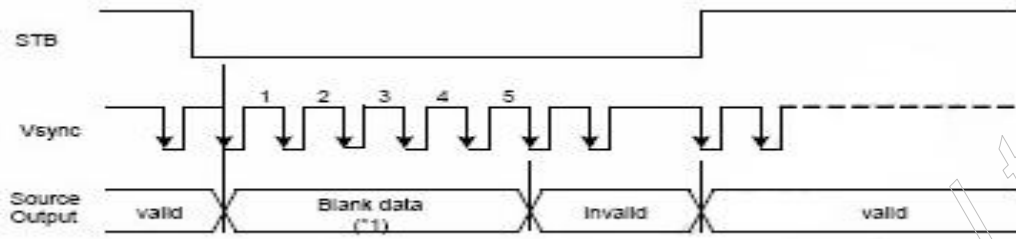


Figure5 Standby ON/OFF Control

### 6.1.2 Clock and Sync waveform

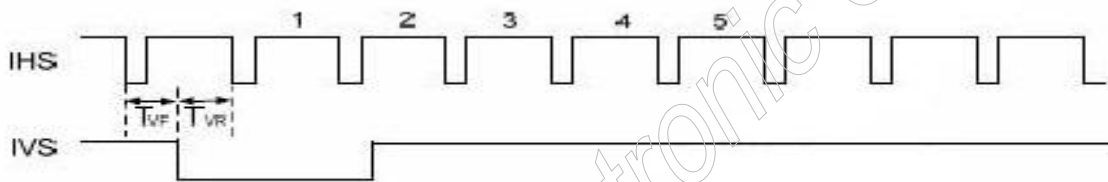


Figure6 CLK and IHS timing waveform

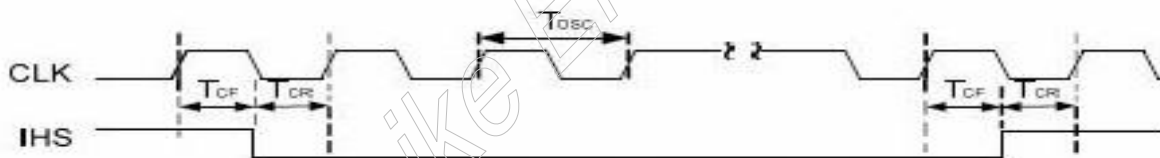
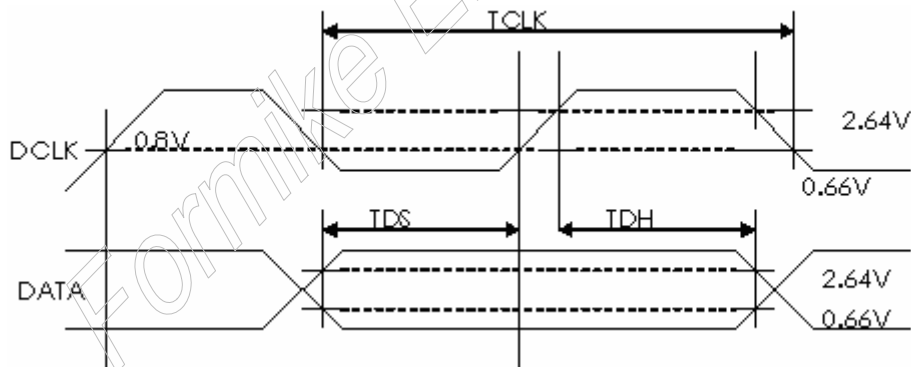
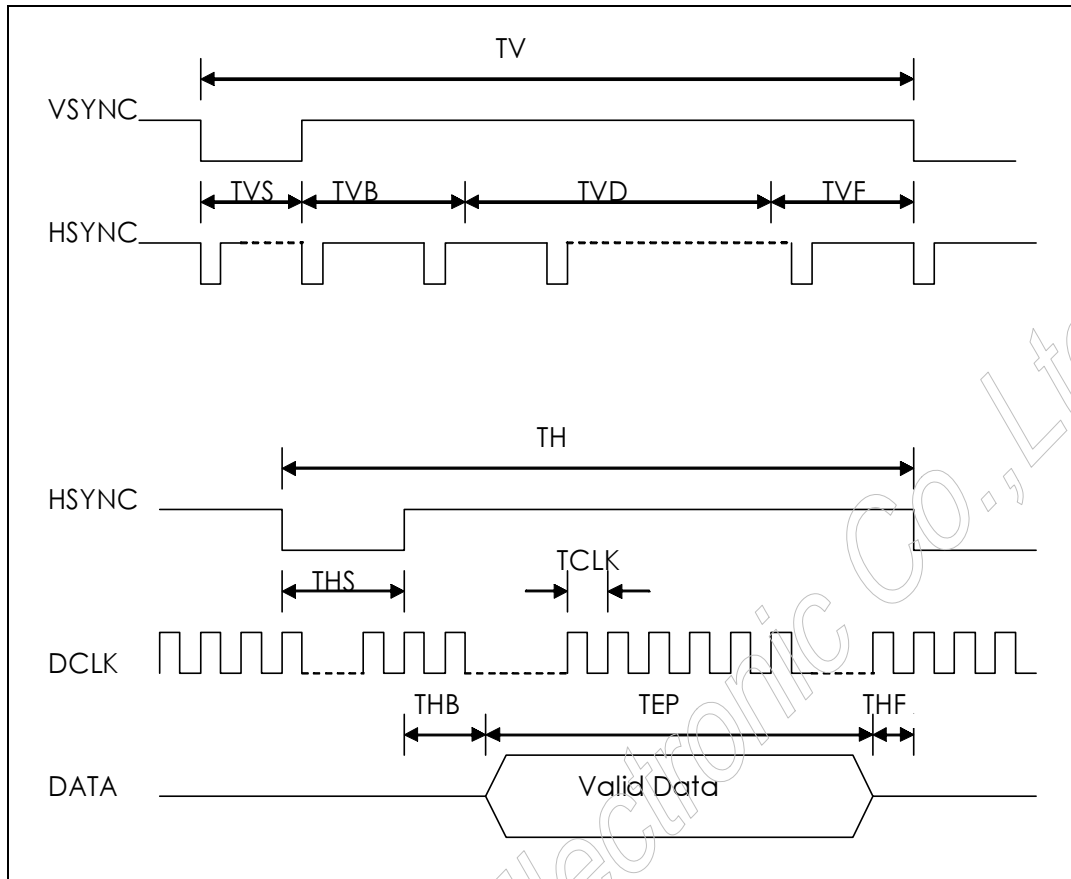
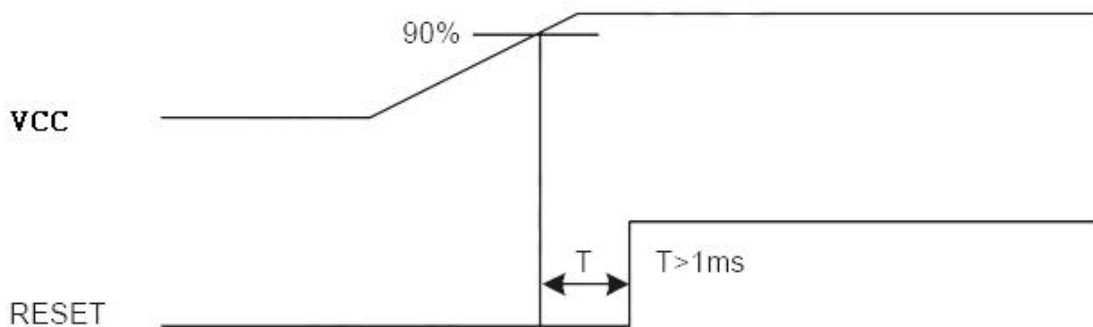


Figure7 IHS and IVS timing waveform



### 6.2 Reset Timing Chart

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



Reset timing

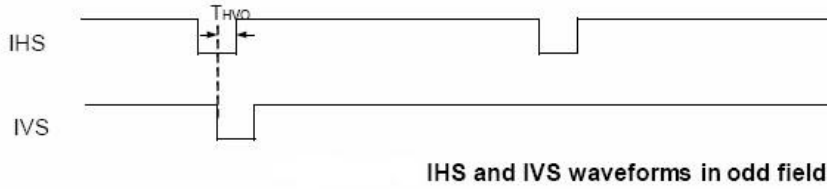
### 6.3 Digital RGB timing waveform

Hsync and Vsync timing

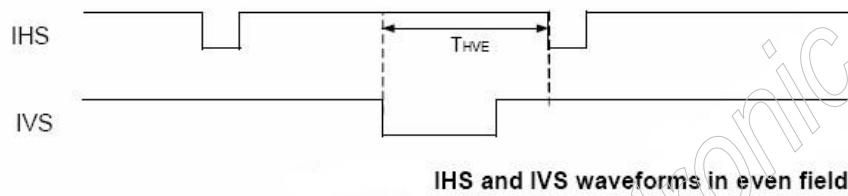
#### CCIR601 timing waveform VS\_POL=H, HS\_POL=L in Register R2)

##### IHS and IVS timing

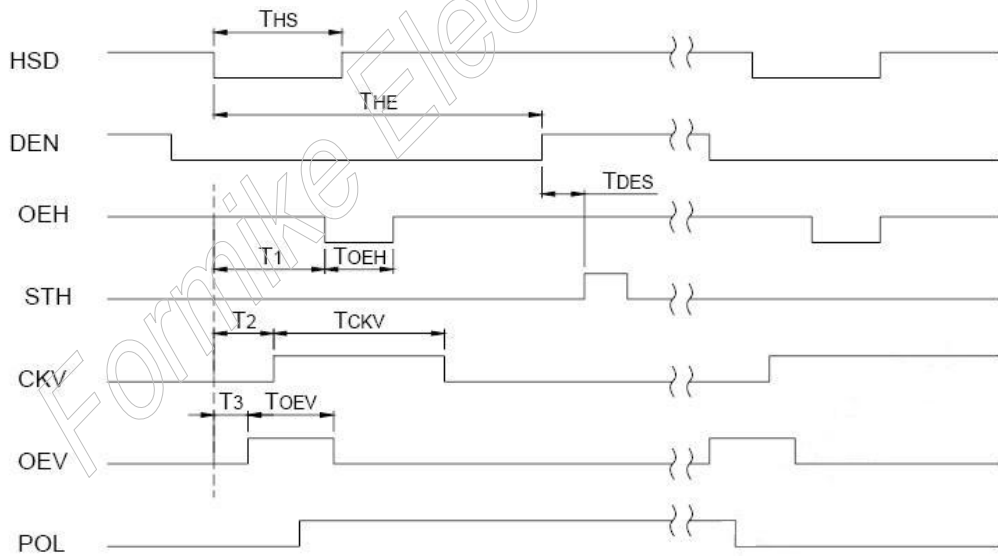
- Odd field



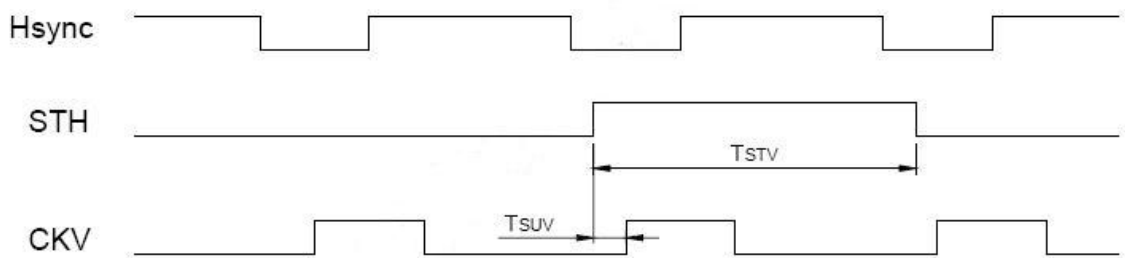
- Even field



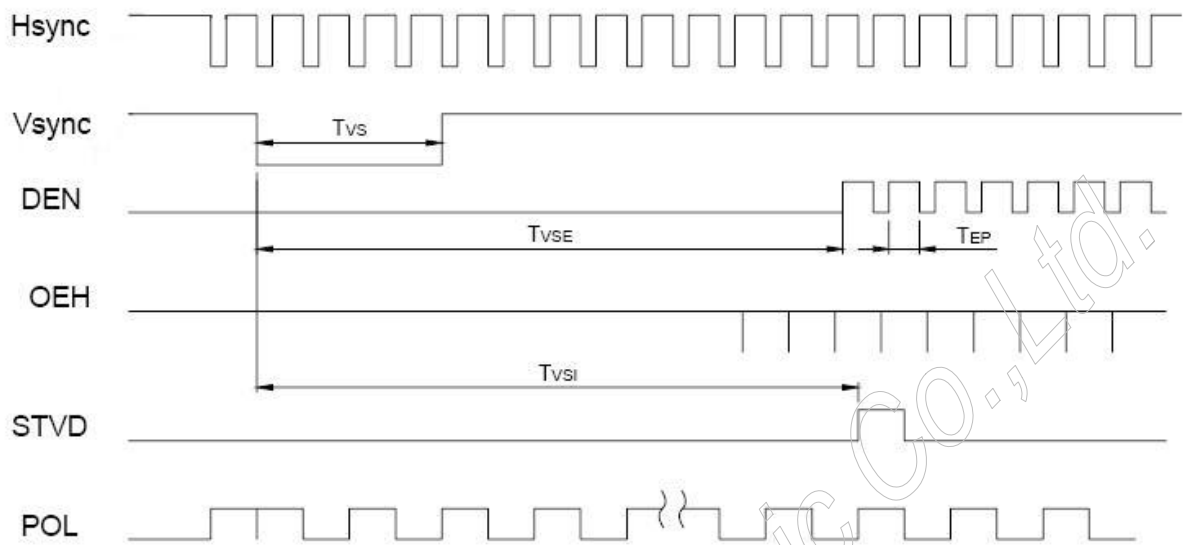
#### 6.3.1 Hsync and horizontal control timing waveform



#### 6.3.2 Hsync and vertical shift clock timing waveform

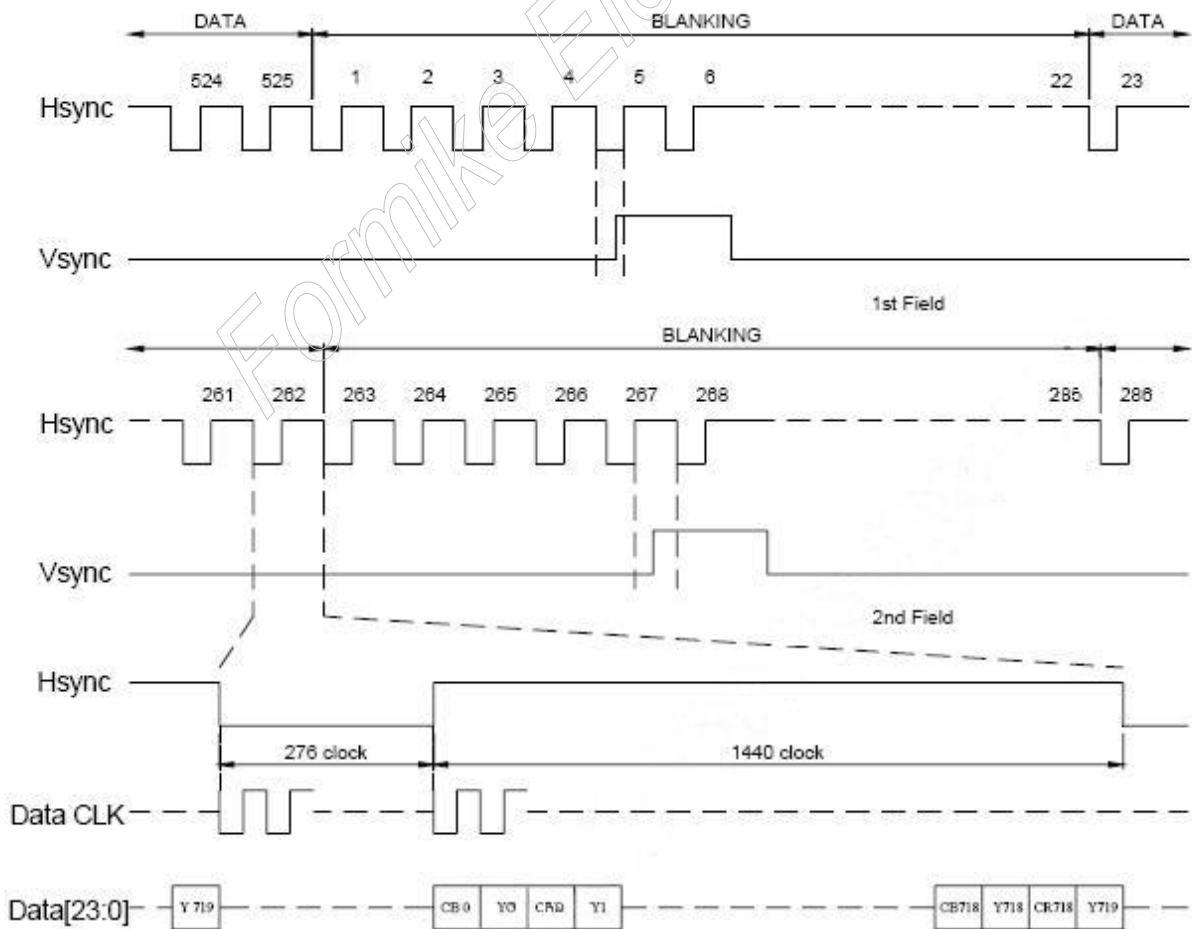


### 6.3.3 Hsync and vertical control timing waveform

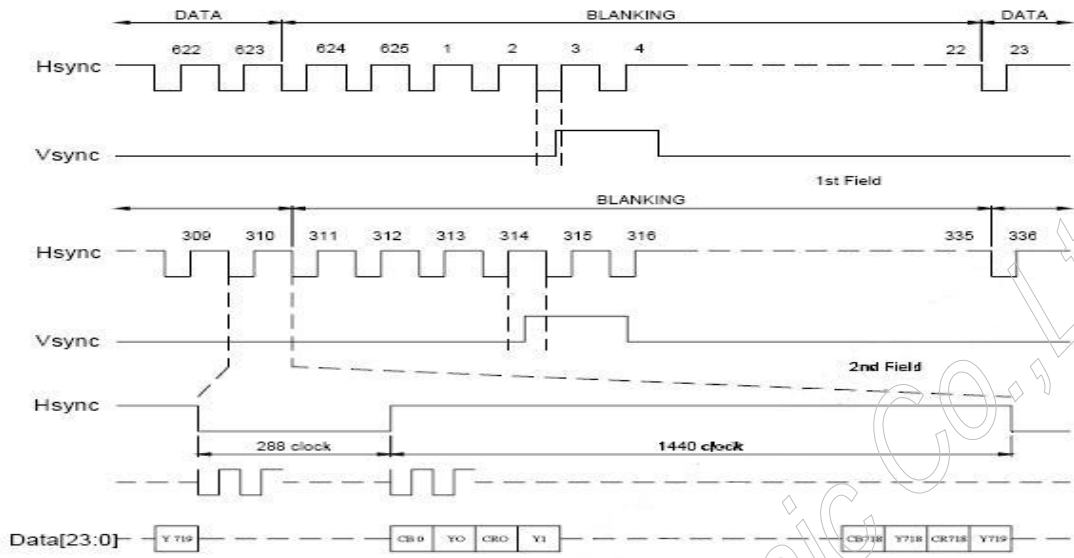


### 6.3.4 CCIR601 timing waveform

CCIR601 timing waveform (VS\_POL="H", HS\_POL="L" in Register R2)



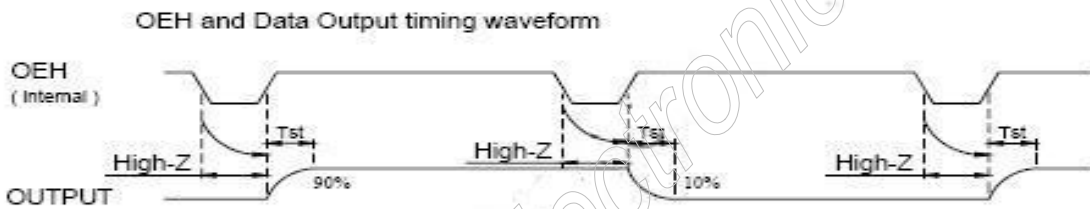
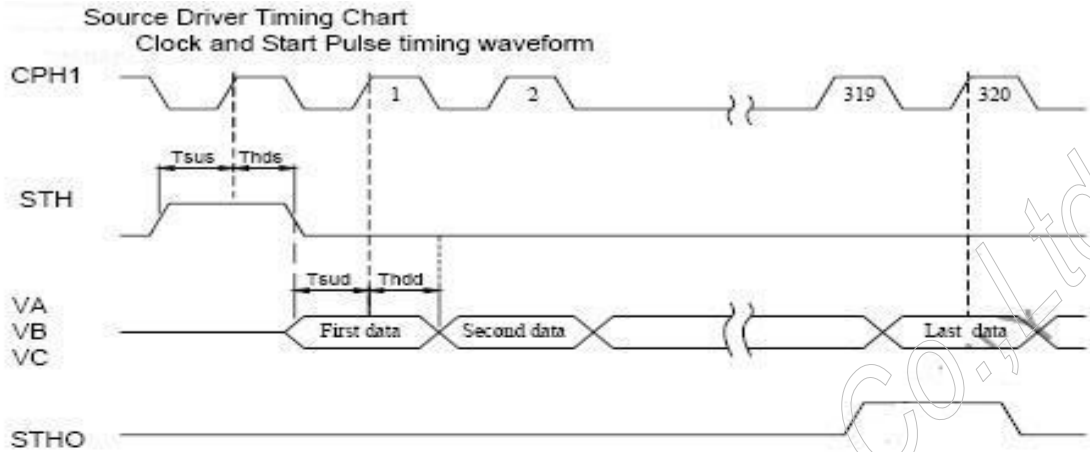
ITU-BT.601 NTSC Input Timing



ITU-BT 601 PAL Input Timing

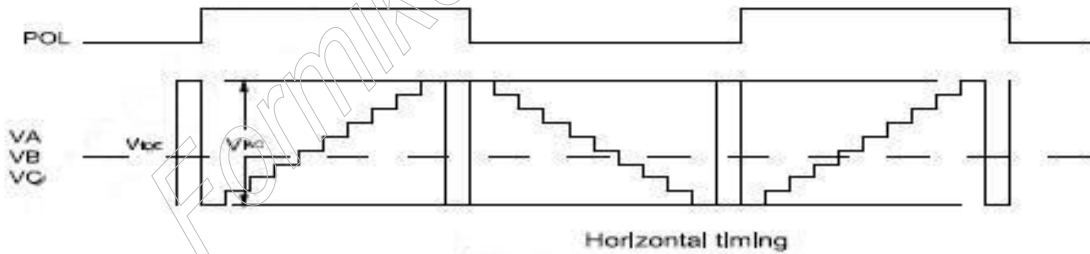
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### 6.3.5 Source Driver Timing Chart



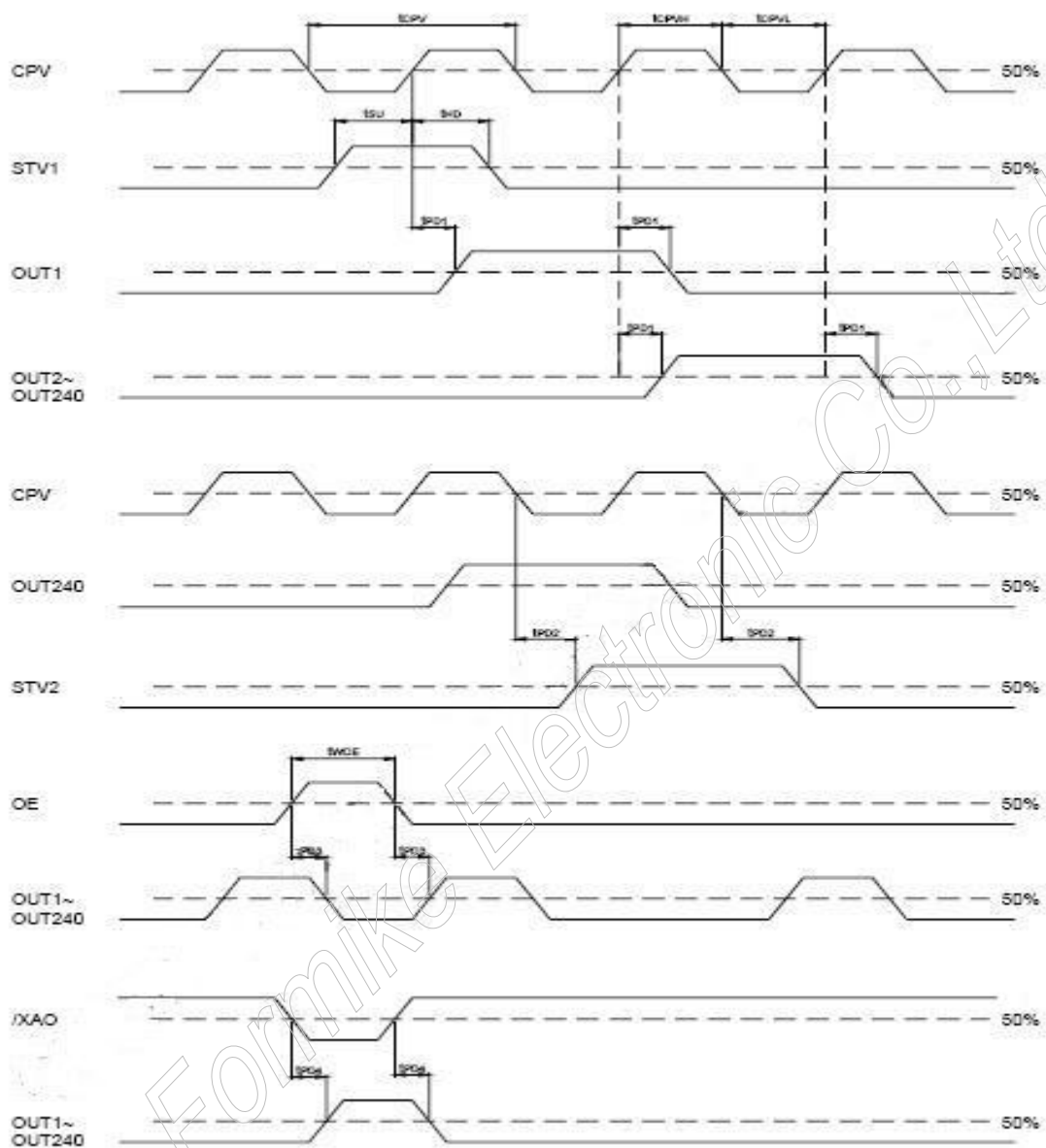
Analog video signal characteristics

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





### 6.3.6 Gate Driver Timing Chart





### 7. OPTICAL CHARACTERISTIC

Ta=25±2°C, ILED=20mA

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Response time	Tr	$\theta = 0^\circ, \Phi = 0^\circ$	-	10		ms	Note 3,5	
	Tf		-	15		ms		
Contrast ratio	CR	At optimized viewing angle	300	400	-	-	Note 4,5	
Color Chromaticity	White	Wx	$\theta = 0^\circ, \Phi = 0^\circ$	(0.26)	(0.31)	(0.36)		Note 2,6,7
		Wy		(0.28)	(0.33)	(0.38)		
	Red	Rx	$\theta = 0^\circ, \Phi = 0^\circ$					
		Ry						
	Green	Gx	$\theta = 0^\circ, \Phi = 0^\circ$					
		Gy						
Blue	Bx	$\theta = 0^\circ, \Phi = 0^\circ$						
	By							
Viewing angle	Hor.	$\Theta R$	$CR \geq 10$	(50)	(60)	Deg.	Note 1	
		$\Theta L$		(50)	(60)			
	Ver.	$\Phi T$		(40)	(50)			
		$\Phi B$		(45)	(55)			
Brightness	-	-	200	250	-	cd/m <sup>2</sup>	Center of display	

Ta=25±2°C, IL=20mA

Note 1: Definition of viewing angle

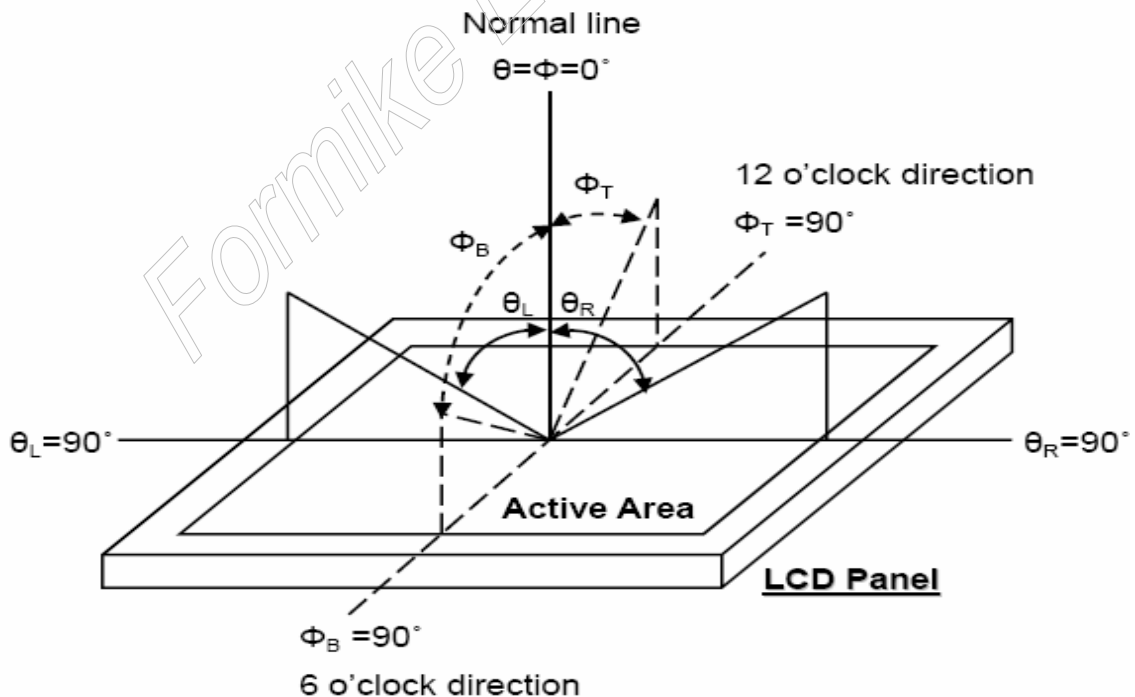


Fig. 7-1 Definition of viewing angle

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.

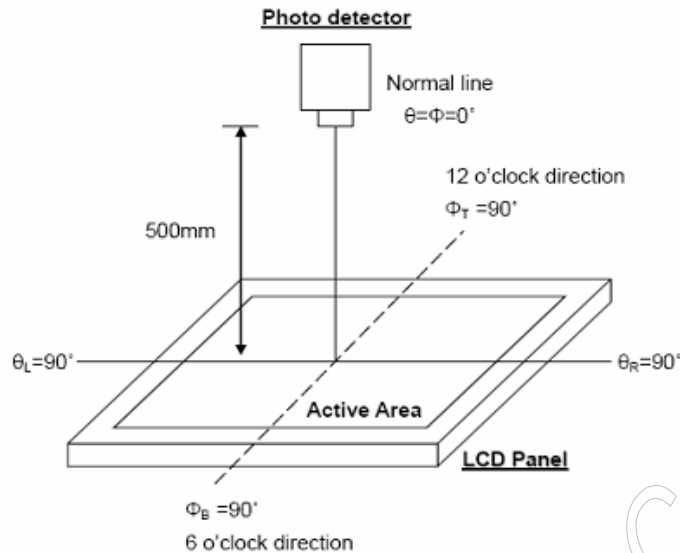


Fig. 7-2 Optical measurement system setup

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,  $T_r$ , is the time between photo detector output intensity changed from 90% to 10%. And fall time,  $T_f$ , is the time between photo detector output intensity changed from 10% to 90%.

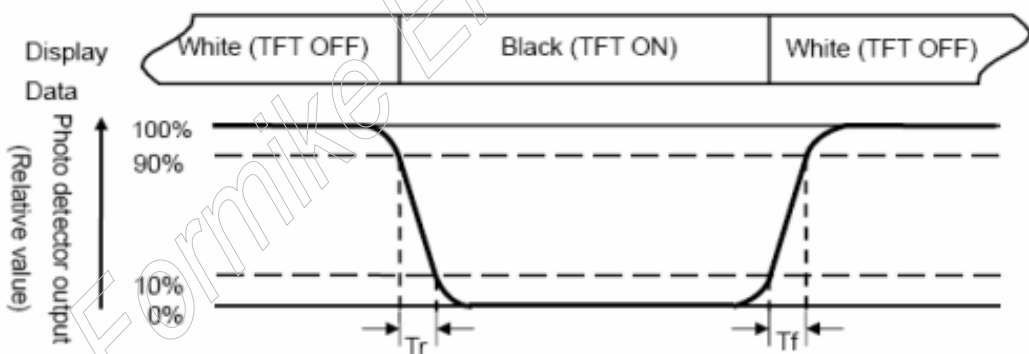


Fig. 3-3 Definition of response time

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  $V_i = V_{i50} \pm 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

“±” 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) =  $\frac{\text{Brightness (min)}}{\text{Brightness (max)}} \times 100\%$

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## 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	NC		Not Use	
6	NC		Not Use	
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 Bit 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	NC		Not Use	
44	NC		Not Use	
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

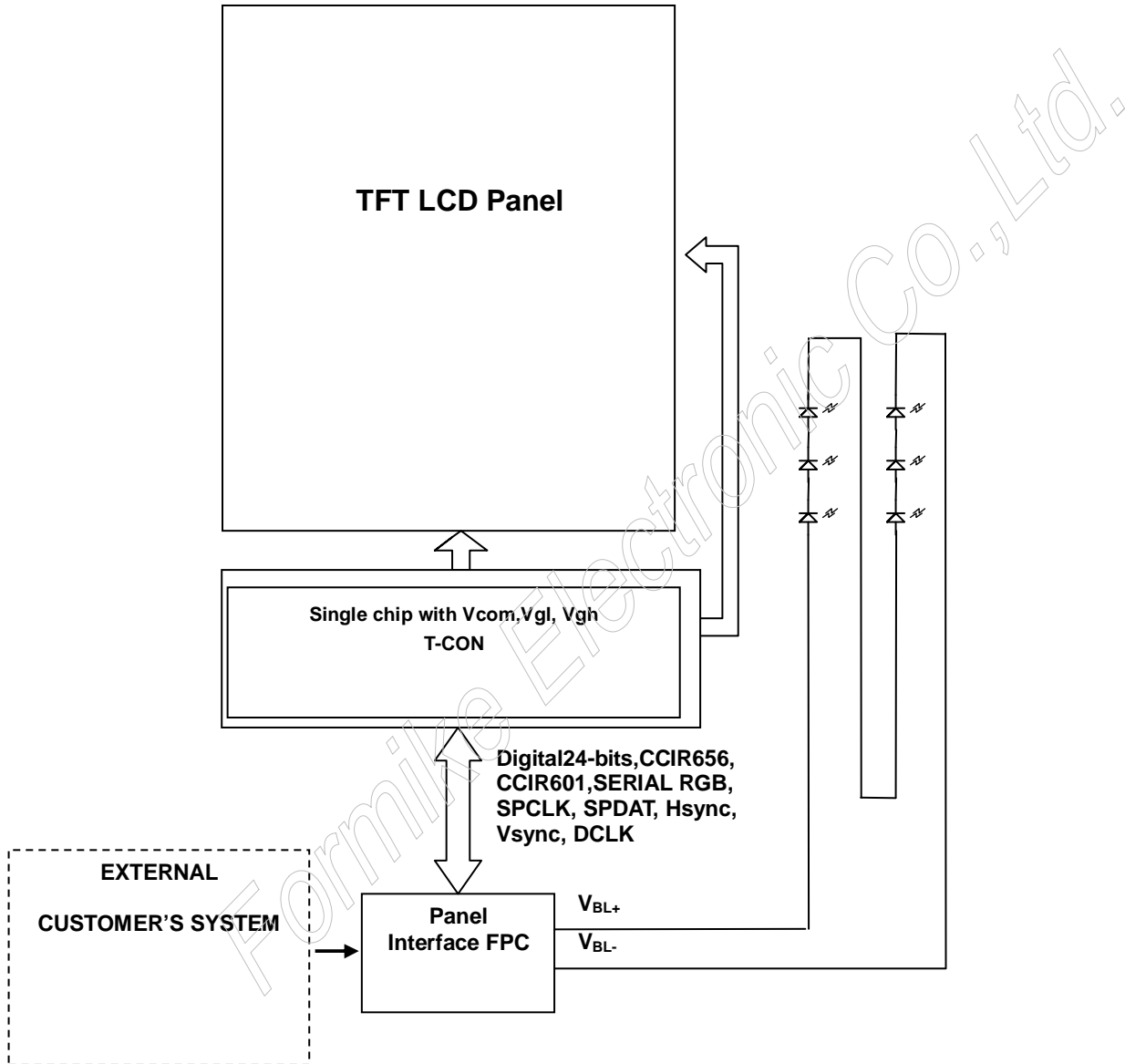
Mode	D[23:16]	D[15:8]	D[7:0]	IHS	IVS	DEN
ITU-R BT 656	D[23:16]	GND	GND	NC	NC	NC
ITU-R BT 601	D[23:16]	GND	GND	IHS	IVS	NC
8 bit RGB	D[23:16]	GND	GND	IHS	IVS	NC for HV Mode DEN for DEN Mode
24 bit RGB	R[7:0]	G[7:0]	B[7:0]	IHS	IVS	NC for HV Mode DEN for DEN Mode



### 8.2 Basic Display Color and Gray Scale

Color		Input Color Data																							
		Red								Green								Blue							
		MSB				LSB				MSB				LSB				MSB				LSB			
		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
	Magenta	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255) Bright	1	1	1	1	1	1	1	0	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	1	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	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(255) Bright	0	0	0	0	0	0	0	1	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	0	1
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	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	1	0
	Blue(255) Bright	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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°C Dry 240h	
2	Low Temperature Storage Test	Ta=-30°C Dry 240h	
3	High Temperature Operation Test	Ta=70°C Dry 240h	
4	Low Temperature Operation Test	Ta=-20°C Dry 240h	
5	High Temperature and High Humidity Operation Test	Ta=60°C 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°C (0.5h) ~ 70°C (0.5h) / 100 cycles	

\*\*\*\*\* Ta= Ambient Temperature

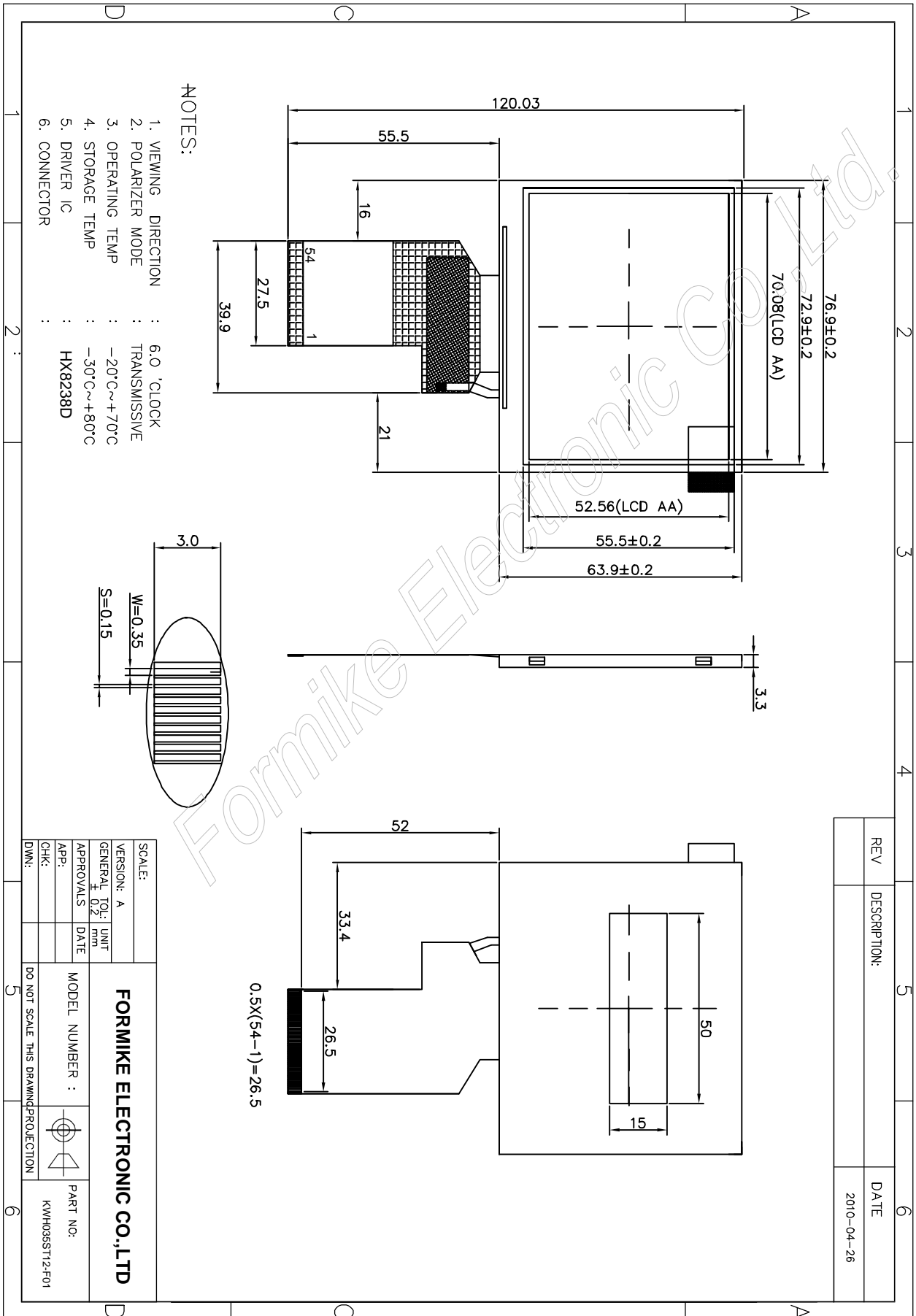
Note:

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  $23\pm 5^{\circ}\text{C}$  and the humidity is below  $50\pm 20\%\text{RH}$ .
- (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  $\pm 0.1\text{mm}$ .

### 12.4.Precautions For Operation

- (1) Viewing angle varies with the change of liquid crystal driving voltage ( $V_0$ ). Adjust  $V_0$  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.