



FORMIKE ELECTRONIC CO.,LTD

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH035ST18-F03 Version: 1.0

【 】 Preliminary Specification

【 ♦ 】 Finally Specification

| | |
|---------------------|-------|
| CUSTOMER'S APPROVAL | |
| SIGNATURE: | DATE: |
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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.



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2. GENERAL DESCRIPTION

2.1 Description

KWH035ST18-F03 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 KWH035ST18-F03

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 4.4 |
| Active Area(H x V mm) | 70.08 x 52.56 |
| With/Without TSP | With TSP |
| LED Numbers | 6 LEDS |
| Weight (g) | 40 |



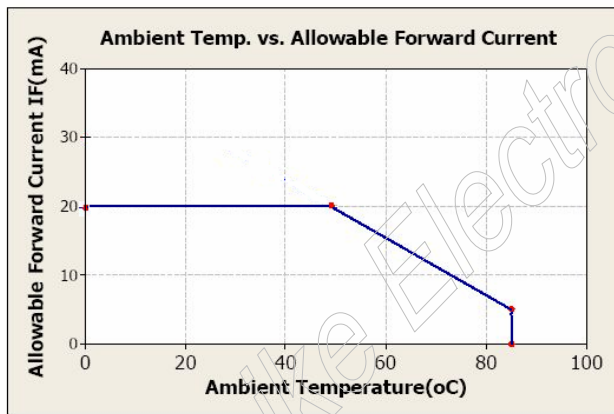
3. ABSOLUTE MAXIMUM RATINGS

| Item | Symbol | Condition | Min. | Max. | Unit | Remark |
|----------------------|------------------|-----------|------|---------|------|--------|
| Power Voltage | DVDD,AVDD | GND=0 | -0.3 | 5.0 | V | |
| Input Signal Voltage | V _{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

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

2.



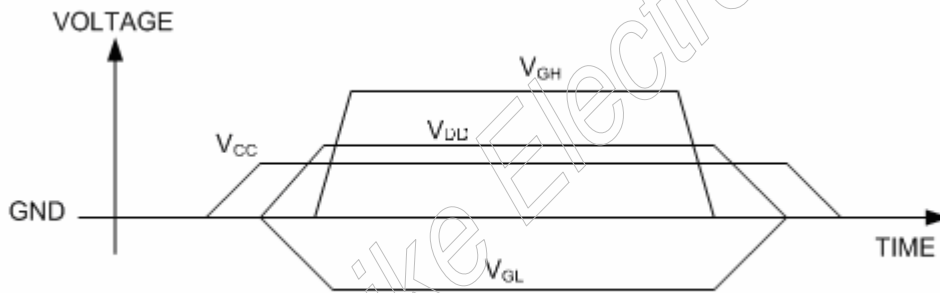
4.ELECTRICAL CHARACTERISTICS

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)

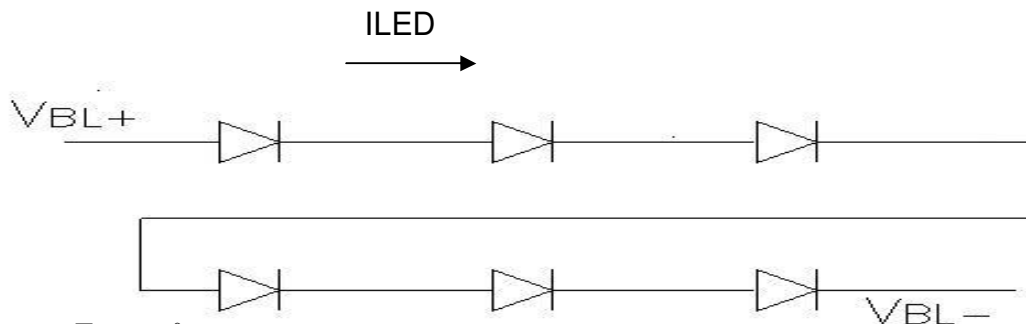
Note: Please power on following the sequece VCC → VDD



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, 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. $T_{hp} + T_{hb} = 204$, 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, 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

- CCIR601 (HS_POL=L in Register R2)

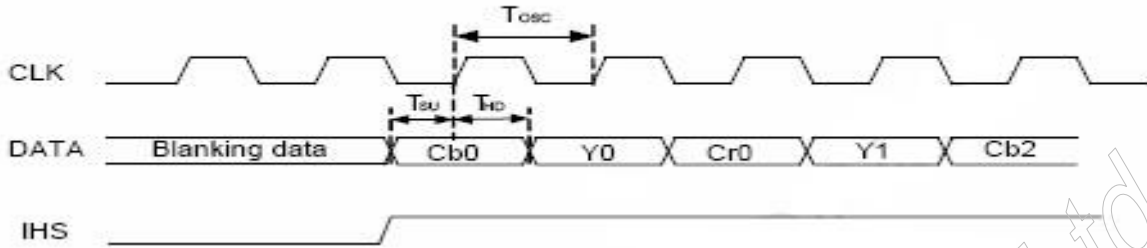


Figure1 CLK,DATA and HIS waveforms in CCIR601

- CCIR656

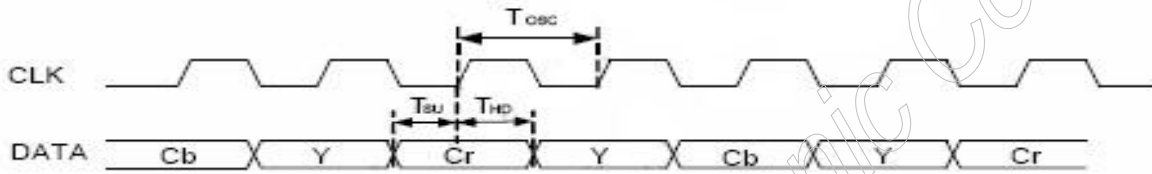


Figure2 CLK and DATA waveforms in CCIR656

- Digital Serial RGB

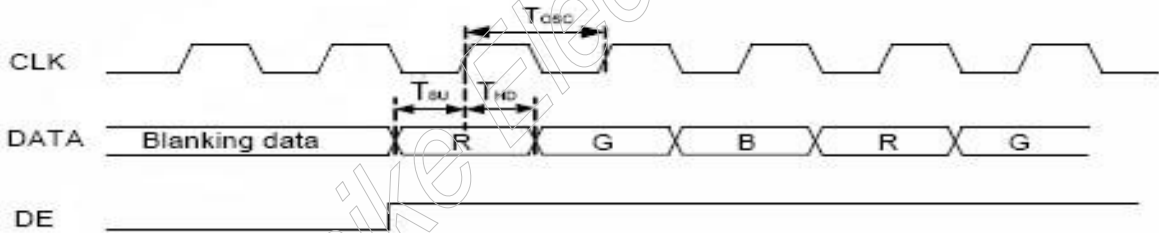


Figure3 CLK, DATA and DE waveforms in Digital Serial RGB

- Digital Parallel RGB

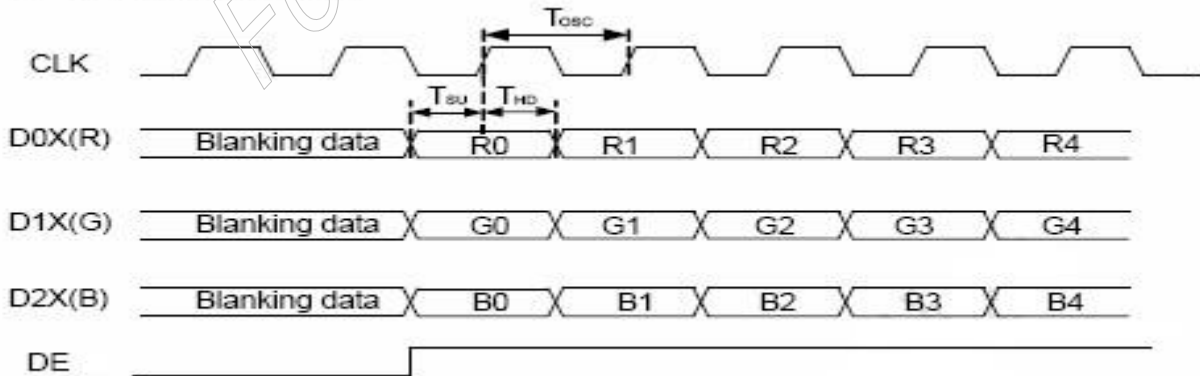


Figure4 CLK, DATA and DE waveforms in Digital Parallel RGB

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.

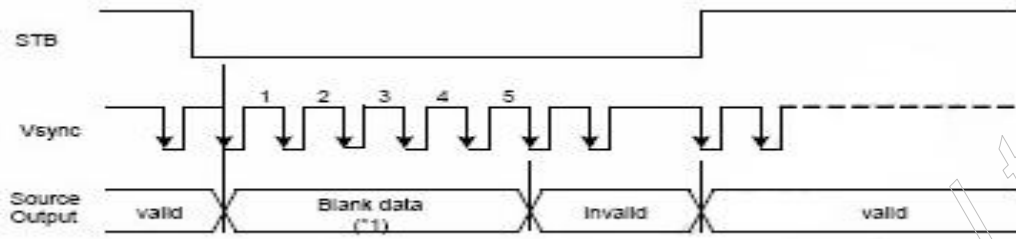


Figure5 Standby ON/OFF Control

6.1.2 Clock and Sync waveform

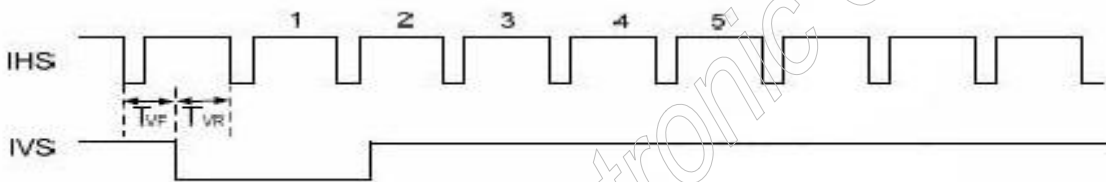


Figure6 CLK and IHS timing waveform

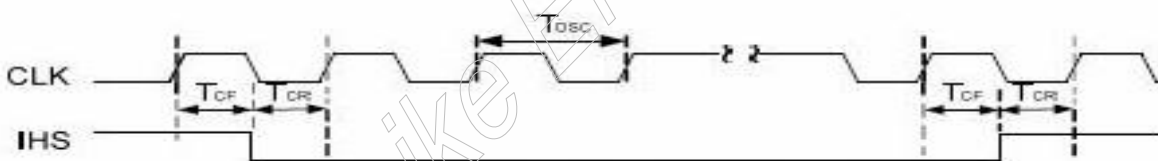
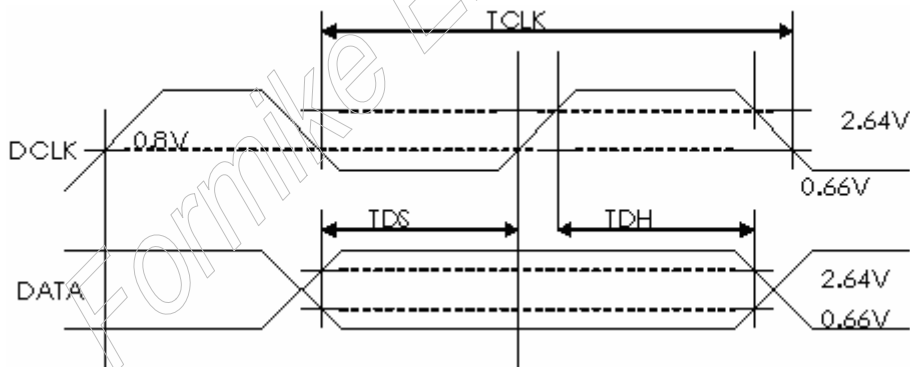
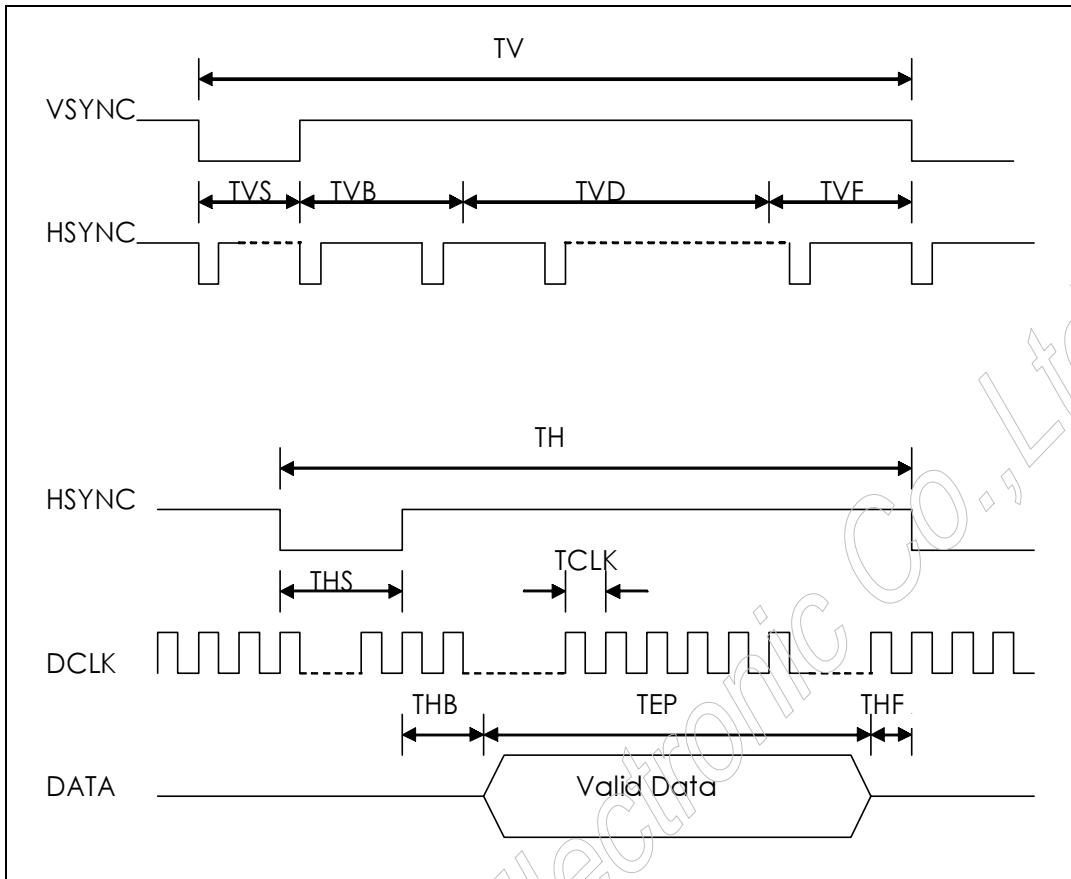
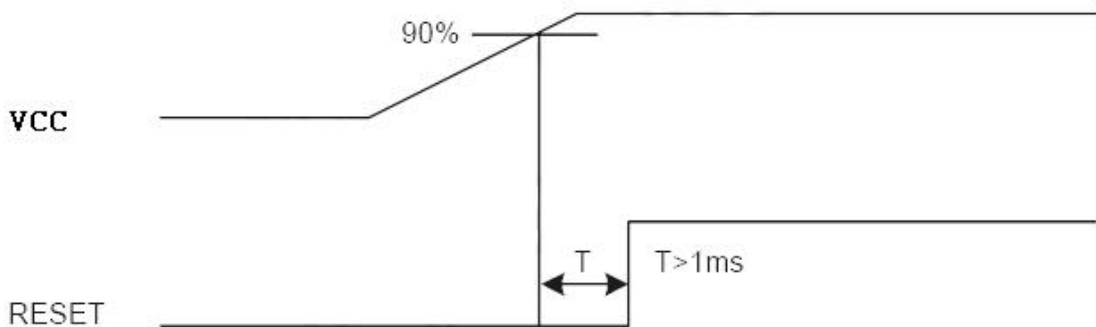


Figure7 IHS and IVS timing waveform



6.2 Reset Timing Chart

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



Reset timing

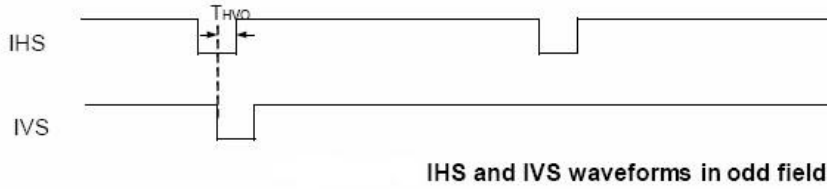
6.3 Digital RGB timing waveform

Hsync and Vsync timing

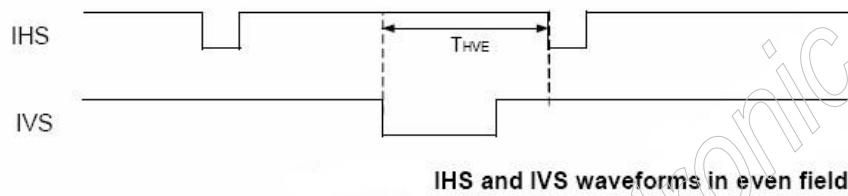
CCIR601 timing waveform VS_POL=H, HS_POL=L in Register R2)

IHS and IVS timing

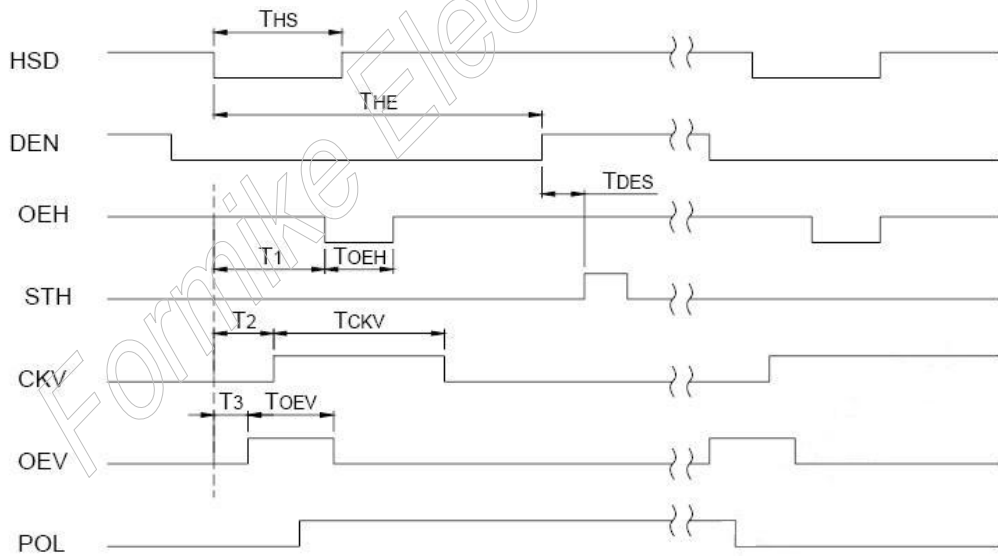
- Odd field



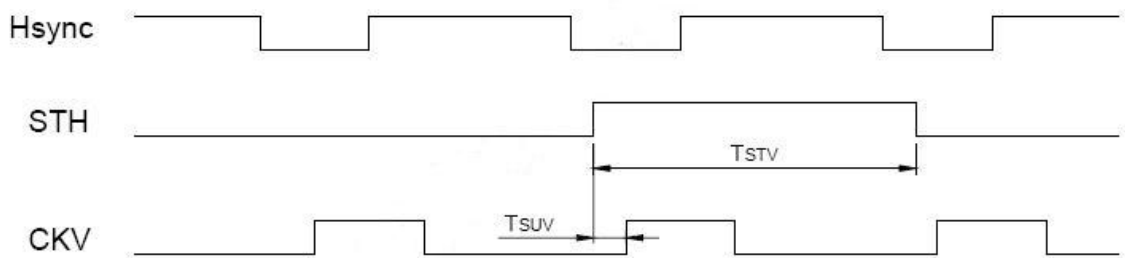
- Even field



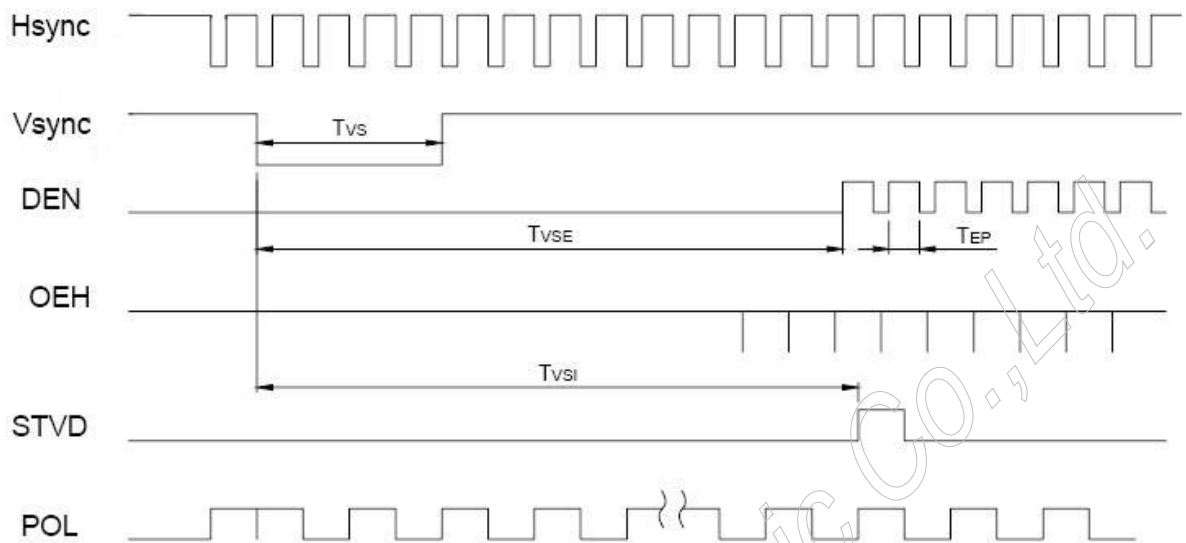
6.3.1 Hsync and horizontal control timing waveform



6.3.2 Hsync and vertical shift clock timing waveform

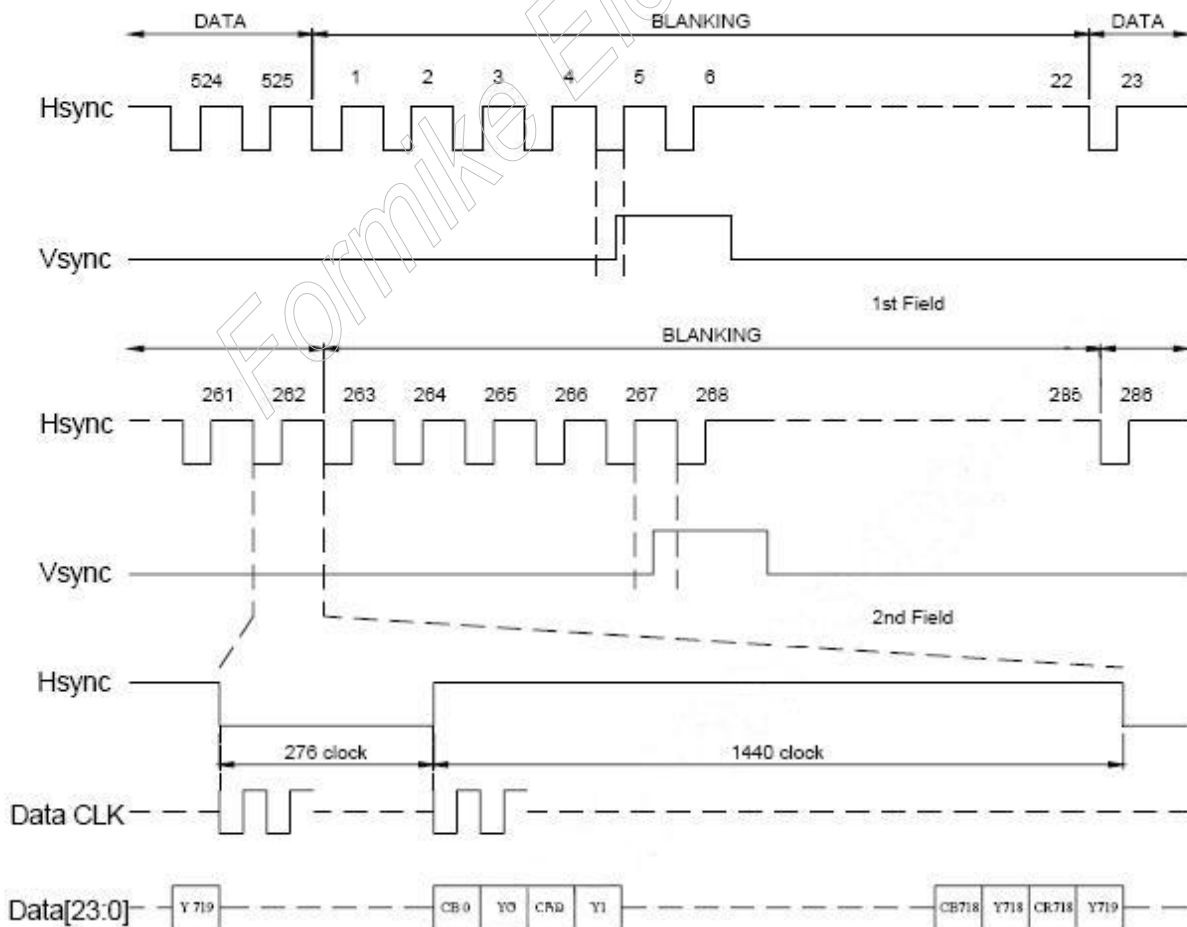


6.3.3 Hsync and vertical control timing waveform

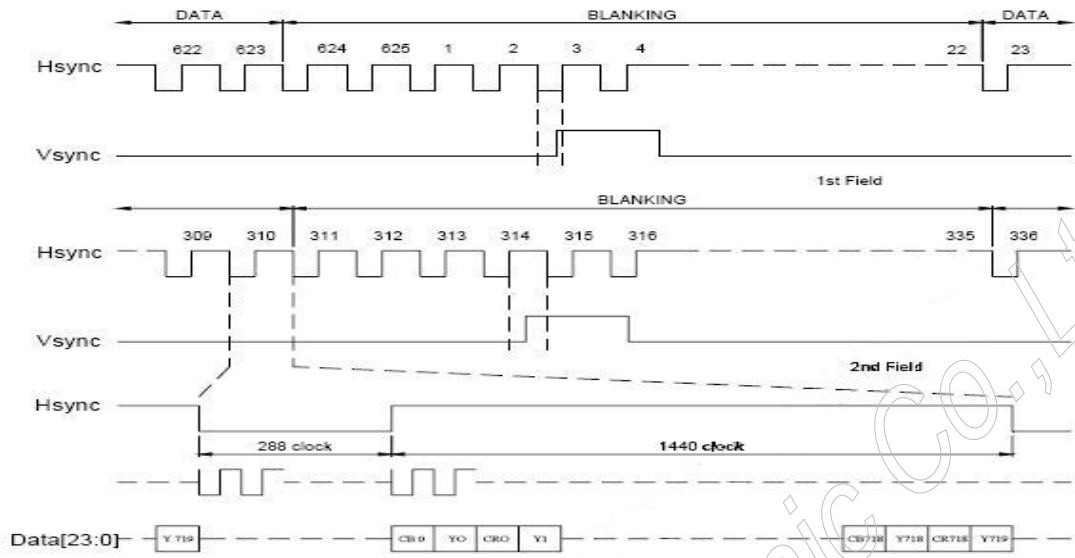


6.3.4 CCIR601 timing waveform

CCIR601 timing waveform (VS_POL="H", HS_POL="L" in Register R2)



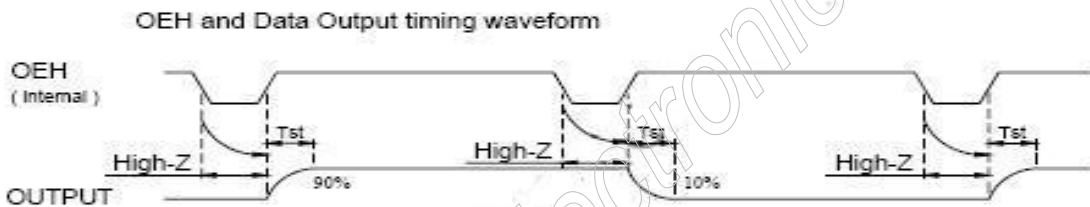
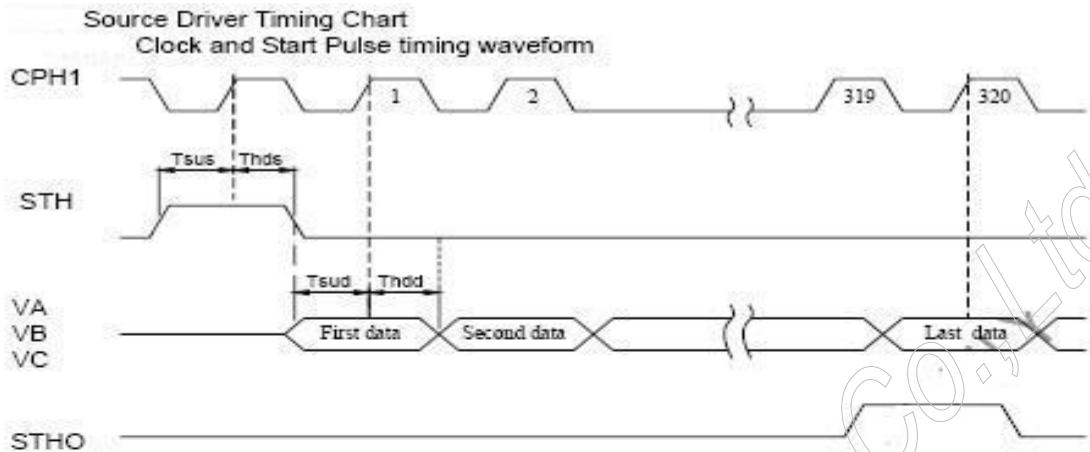
ITU-BT.601 NTSC Input Timing



ITU-BT 601 PAL Input Timing

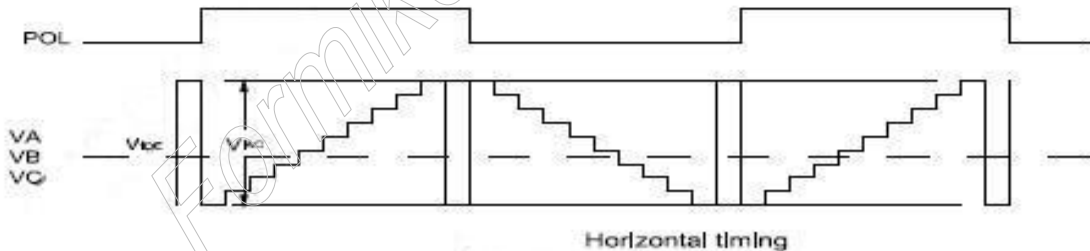
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6.3.5 Source Driver Timing Chart



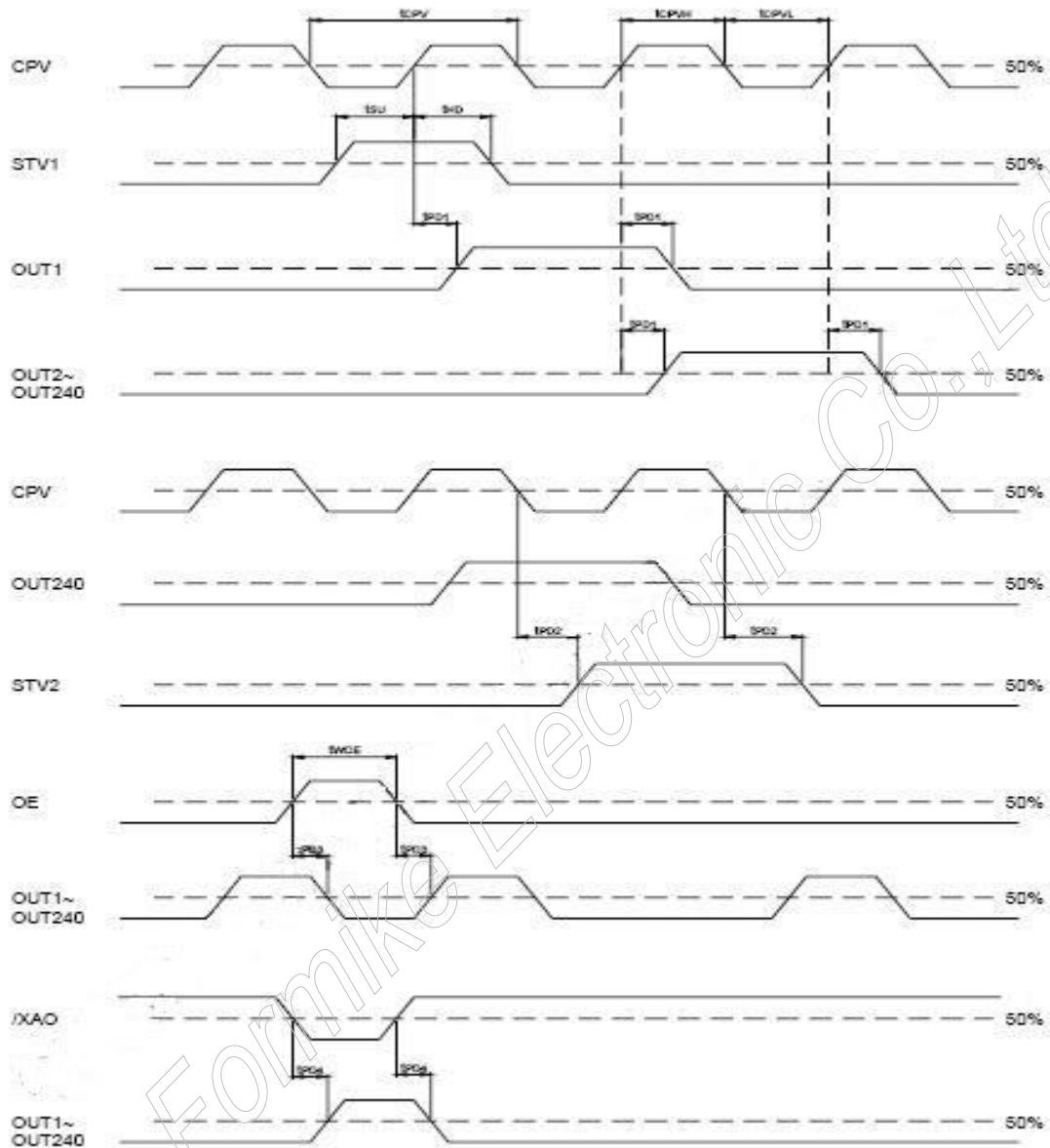
Analog video signal characteristics

| 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. | Θ_R | $CR \geq 10$ | (50) | (60) | | Deg. | Note 1 |
| | | Θ_L | | (50) | (60) | | | |
| | Ver. | Φ_T | | (40) | (50) | | | |
| | | Φ_B | | (45) | (55) | | | |
| Brightness | - | - | 200 | 250 | - | cd/m ² | Center of display | |

Ta=25±2°C, IL=20mA

Note 1: Definition of viewing angle

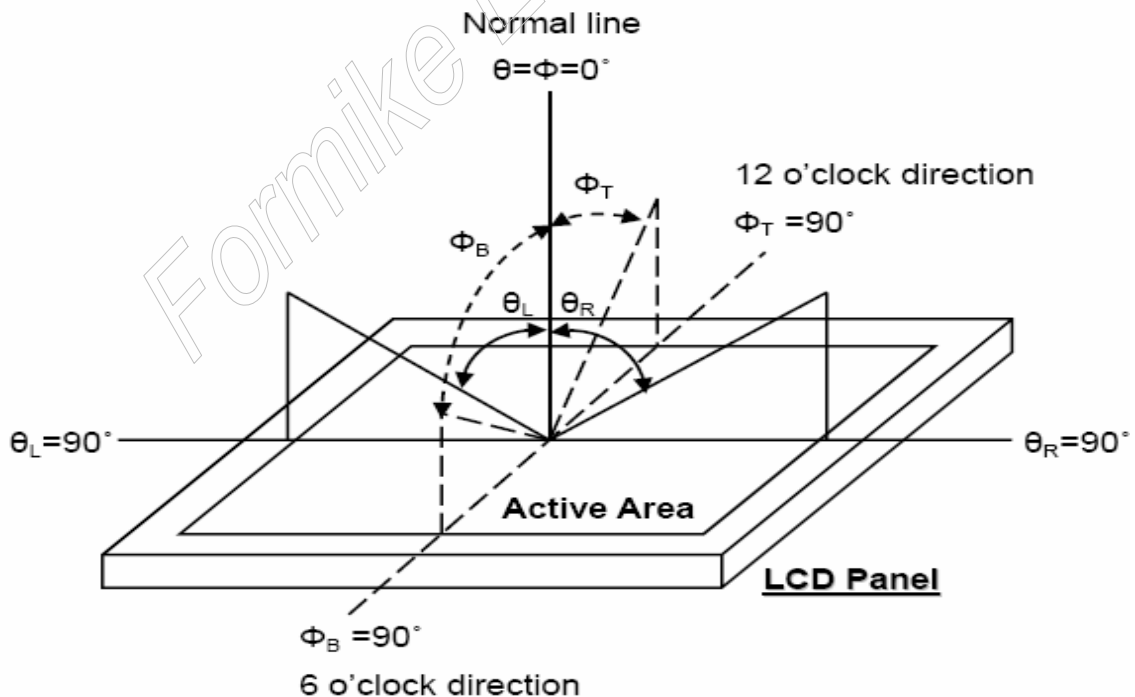


Fig. 7-1 Definition of viewing angle

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.

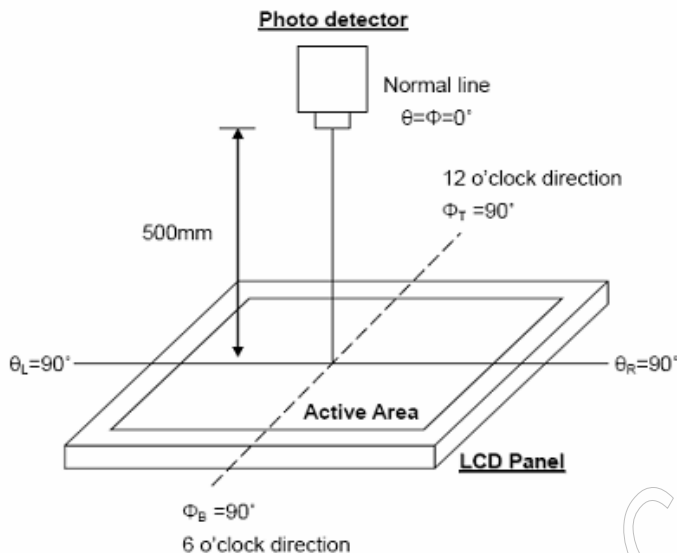


Fig. 7-2 Optical measurement system setup

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%.

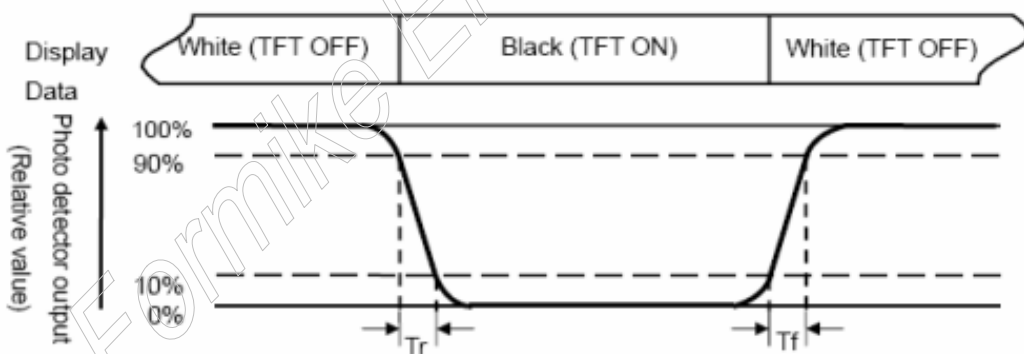


Fig. 3-3 Definition of response time

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 | Y1 | I | Top electrode , | |
| 6 | X1 | I | Right electrode | |
| 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 | Y2 | I | Bottom electrode | |
| 44 | X2 | I | Left electrode | |
| 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 |

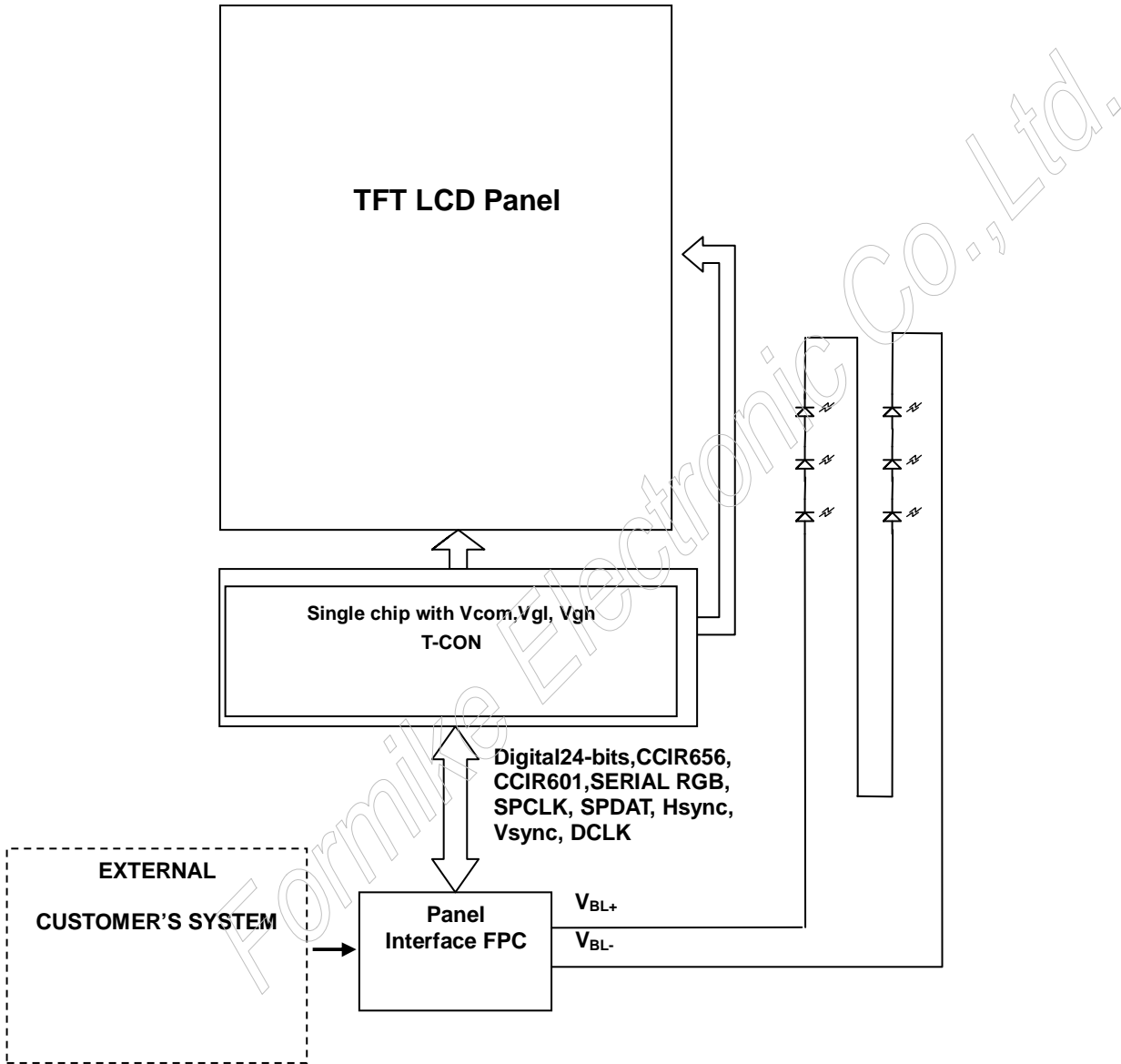
| Mode | D[23:16] | D[15:8] | D[7:0] | IHS | IVS | DEN |
|--------------|----------|---------|--------|-----|-----|------------------------------------|
| ITU-R BT 656 | D[23:16] | GND | GND | NC | NC | NC |
| ITU-R BT 601 | D[23:16] | GND | GND | IHS | IVS | NC |
| 8 bit RGB | D[23:16] | GND | GND | 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 |
| | 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 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 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 | 1 | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | Blue(255) Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 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 | |

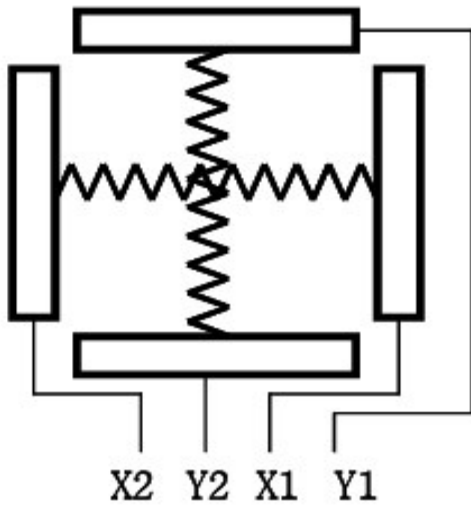
***** Ta= Ambient Temperature

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.

12. TOUCH SCREEN

12.1 Block diagram



Top View

X : Upper electrode
Y : Lower electrode

12.2 Absolute maximum ratings

| Item | Symbol | Condictions | Specifications | Unit |
|----------------|--------|-------------|----------------|------|
| Supply voltage | | | DC 5.0 | V |



13 PRECAUTIONS FOR USE

13.1. 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.

13.2. 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.

13.3. 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 $\pm 0.1\text{mm}$.

13.4. 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.

13.5.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.

13.6.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.