

# SPECIFICATION OF LCD MODULE

MODULE NO: AFY800480A0-5.0N6NTM

Customer Approval:

☐ Accept

☐ Reject

| FUTURE FOCUS | SIGNATURE | DATE |
|--------------|-----------|------|
| PREPARED BY  |           |      |
| CHECKED BY   |           |      |
| APPROVED BY  |           |      |



**CONTENTS**

| List | Description                        | Page No. |
|------|------------------------------------|----------|
|      | NUMBER SYSTEM INTRODUCTION         | 4        |
| 1    | GENERAL SPECIFICATIONS             | 4        |
| 2    | BLOCK DIAGRAM                      | 5        |
| 3    | DIMENSIONAL OUTLINE                | 6        |
| 4    | PIN DESCRIPTION                    | 7        |
| 5    | ELECTRICAL CHARACTERISTICS         | 8        |
| 6    | INPUT SIGNAL TIMING                | 11       |
| 7    | OPTICAL CHARACTERISTICS            | 16       |
| 8    | RELIABILITY                        | 17       |
| 9    | SPECIFICATION OF QUALITY ASSURANCE | 17       |
| 10   | GENERAL PRECAUTION                 | 17       |
| 11   | LIMITED WARRANTY                   | 17       |
| 12   | PACKAGE                            | 18       |

## **NUMBER SYSTEM INTRODUCTION:**

AFY800480A0-5.0N6NTM-R:

**AF:** Orient Display TFT;

**Y:** JAZZ TFT;

**800480:** Length \* width pixel;

**A0:** Product Version;

**5.0:** Diagonal Dimension;

**N:** LCD Mode (N: TN; I: IPS; V: VA)

**6:** Viewing Direction (6-> 6:00; 12->12:00; Unavailable for IPS and VA);

**N:** Temperature Range (N: Normal; W: Wide);

**T:** Polarizer (T:Transmissive; F:Transflective);

**M:** Luminance (N: Normal <300 nit; M: Middle >=300 & <600 nit;

H: High >=600 nit);

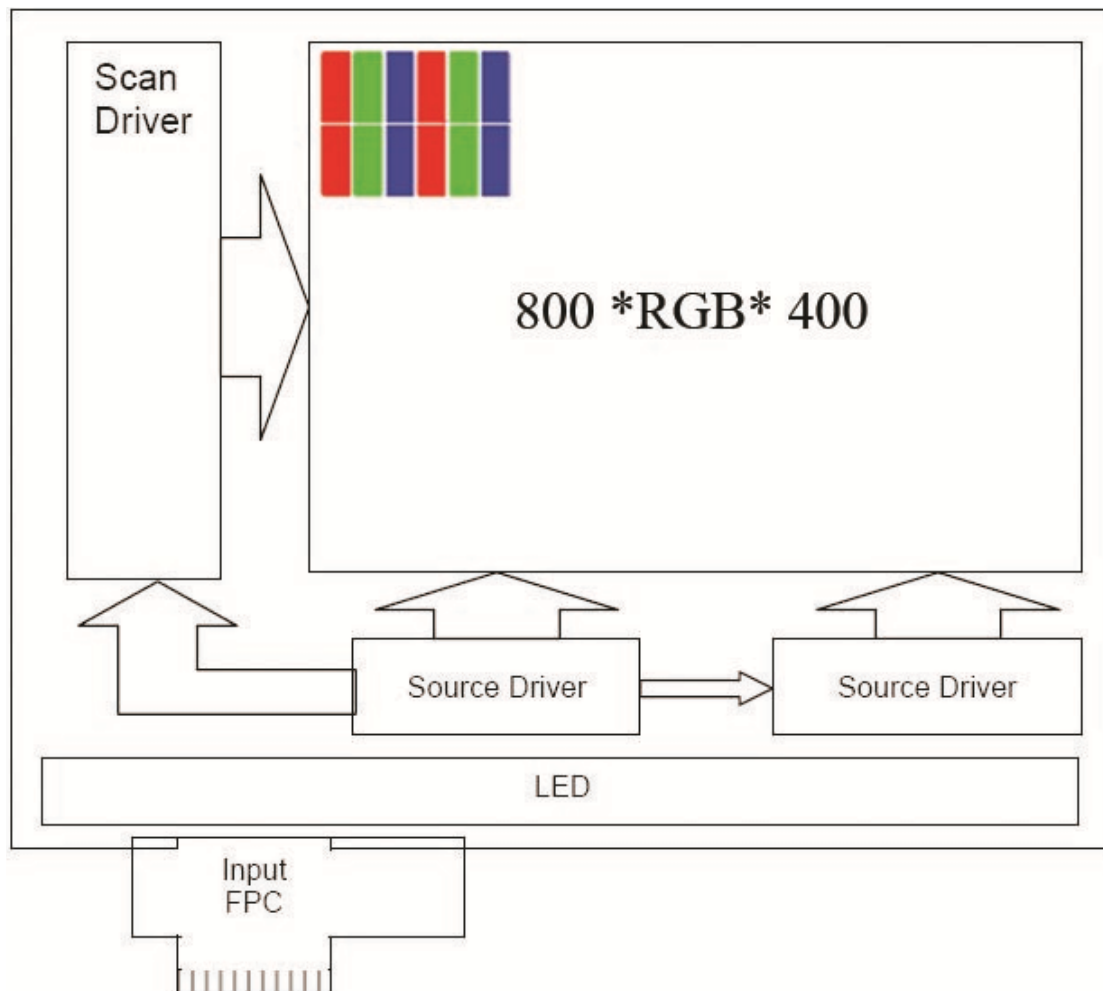
**R:** TP Option (R: Resistive TP; C: Capacitive TP; N: Without TP);

## **1. GENERAL SPECIFICATIONS**

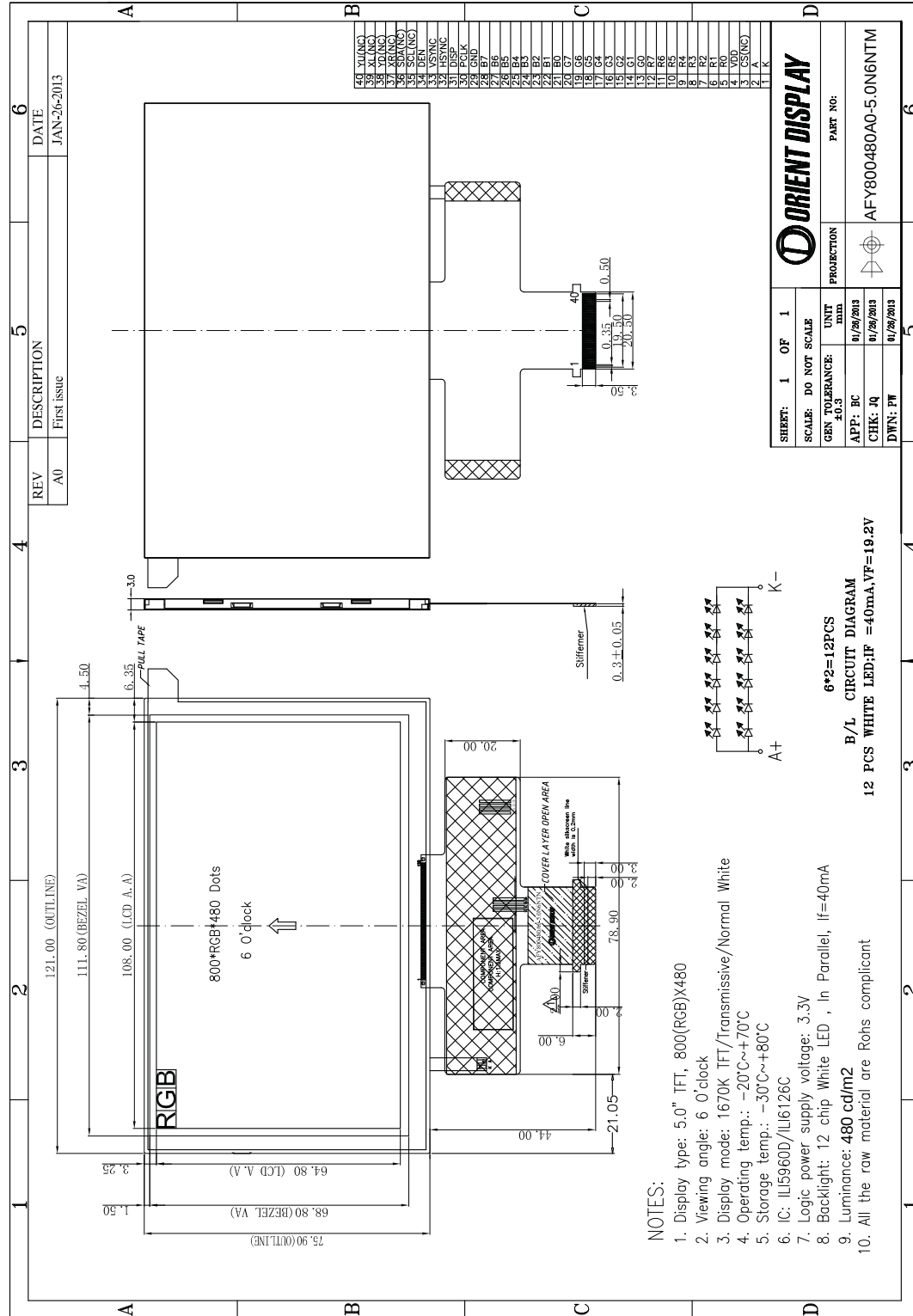
| ITEM                           | SPECIFICATION               | UNIT |
|--------------------------------|-----------------------------|------|
| OUTLINE DIMENSIONS             | 121.0(W) X75.9 (H) X 3.0(D) | mm   |
| DISPLAY SIZE                   | 5.0                         | inch |
| DOT PITCH                      | 0.135mmX0.135mm             | mm   |
| NUMBER OF DOTS                 | 800* ( RGB ) *480           | -    |
| DRIVER IC                      | ILI5960D / ILI6126C         | -    |
| LCD TYPE                       | TFT(262K) TRANSMISSIVE      | -    |
| INTERFACE                      | RGB 24 BITS                 |      |
| BACKLIGHT TYPE                 | LED White                   | -    |
| VIEWING DIRECTION              | 6 O'clock                   | -    |
| GRAY SCALE INVERSION DIRECTION | 6 O'clock                   |      |

**\*See attached drawing for details.**

## 2. BLOCK DIAGRAM

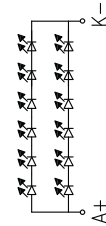


### 3. DIMENSIONAL OUTLINE



#### NOTES:

1. Display type: 5.0" TFT, 800(RGB)x480
2. Viewing angle: 6 O'clock
3. Display mode: 1670K TFT/Transmissive/Normal White
4. Operating temp.: -20°C~+70°C
5. Storage temp.: -30°C~+80°C
6. IC: ILI5960D/ILI6126C
7. Logic power supply voltage: 3.3V
8. Backlight: 12 chip White LED, in Parallel, If=40mA
9. Luminance: 480 cd/m2
10. All the raw material are Rohs compliant



6\*2=12PCS  
B/L CIRCUIT DIAGRAM  
12 PCS WHITE LED, IF = 40mA, VF = 19.2V

#### 4. PIN DESCRIPTION

| NO. | PIN NAME | Type | Description                     |
|-----|----------|------|---------------------------------|
| 1   | LED-     | P    | Power supply for LED (Cathode)  |
| 2   | LED+     | P    | Power supply for LED (Anode)    |
| 3   | CS (NC)  | -    | No connection                   |
| 4   | VDD      | P    | Power voltage                   |
| 5   | R0       | I    | RED data signal(LSB)            |
| 6   | R1       | I    | RED data signal                 |
| 7   | R2       | I    | RED data signal                 |
| 8   | R3       | I    | RED data signal                 |
| 9   | R4       | I    | RED data signal                 |
| 10  | R5       | I    | RED data signal                 |
| 11  | R6       | I    | RED data signal                 |
| 12  | R7       | I    | RED data signal(MSB)            |
| 13  | G0       | I    | GREEN data signal(LSB)          |
| 14  | G1       | I    | GREEN data signal               |
| 15  | G2       | I    | GREEN data signal               |
| 16  | G3       | I    | GREEN data signal               |
| 17  | G4       | I    | GREEN data signal               |
| 18  | G5       | I    | GREEN data signal               |
| 19  | G6       | I    | GREEN data signal               |
| 20  | G7       | I    | GREEN data signal(MSB)          |
| 21  | B0       | I    | BLUE data signal(LSB)           |
| 22  | B1       | I    | BLUE data signal                |
| 23  | B2       | I    | BLUE data signal                |
| 24  | B3       | I    | BLUE data signal                |
| 25  | B4       | I    | BLUE data signal                |
| 26  | B5       | I    | BLUE data signal                |
| 27  | B6       | I    | BLUE data signal                |
| 28  | B7       | I    | BLUE data signal(MSB)           |
| 29  | GND      | P    | Ground(0V)                      |
| 30  | DOTCLK   | I    | Pixel clock signal              |
| 31  | DISP     | I    | Display on/ off                 |
| 32  | HSYNC    | I    | Horizontal synchronizing signal |
| 33  | VSYNC    | I    | Vertical synchronizing signal   |
| 34  | DE       | I    | Data enable                     |
| 35  | SCL (NC) | -    | No connection                   |
| 36  | SDA (NC) | -    | No connection                   |
| 37  | XR (NC)  | -    | No connection                   |
| 38  | YD (NC)  | -    | No connection                   |
| 39  | XL (NC)  | -    | No connection                   |
| 40  | YU (NC)  | -    | No connection                   |

Note: I: input, O: output, P: Power

## 5. ELECTRICAL CHARACTERISTICS

### 5.1 Absolute Maximum Ratings

| Item                  | Symbol | Values |     | Unit | Remark |
|-----------------------|--------|--------|-----|------|--------|
|                       |        | Min    | Max |      |        |
| Power Supply for Pump | VDD    | -0.3   | 4.5 | V    |        |

Note: Stresses beyond those given in the Absolute Maximum Rating table may cause operational errors or damage to the device. For normal operational conditions see AC/DC Electrical Characteristics

### 5.2 DC Characteristics

#### 5.2.1 Operating Conditions

| Item                       | Symbol      | Values |     |       | Unit | Conditions |
|----------------------------|-------------|--------|-----|-------|------|------------|
|                            |             | Min    | Typ | Max   |      |            |
| Charge Pump Supply Voltage | PVDD        | 3      | 3.3 | 3.6   | V    | PWR_SEL=H  |
| Digital Supply Voltage     | VDD         | 3      | 3.3 | 3.6   | V    | PWR_SEL=H  |
| Digital Interface Supply   | VDDIO       | 1.65   | 1.8 | VDD   | V    |            |
| Digital Input Voltage      | Di          | 0      | -   | VDDIO | V    |            |
| OTP Supply Voltage         | V_OTP       | 7.4    | 7.5 | 7.6   | V    |            |
| VCOM AC Voltage            | VCOMH-VCOML | 3.46   | -   | 6.2   | V    |            |

#### 5.2.2 DC Characteristics for Digital Circuit

| Item                      | Symbol | Values    |      |           | Unit | Conditions |
|---------------------------|--------|-----------|------|-----------|------|------------|
|                           |        | Min       | Typ  | Max       |      |            |
| Low Level Input Voltage   | Vil    | GND       | -    | 0.3xVDDIO | v    |            |
| High Level Input Voltage  | Vih    | 0.7xVDDIO | -    | VDDIO     | uA   |            |
| High Level Output Voltage | Voh    | VDDIO-0.4 | -    | VDDIO     | ohm  |            |
| Low Level Output Voltage  | Vol    | GND       | -    | GND+0.4   | uA   |            |
| Input Leakage Current     | Iil    |           |      | ±1.0      |      |            |
| Pull High/Low Resistor    | Rp     | -         | 100K | -         | ohm  |            |

#### 5.2.3 DC Characteristics for Analog Circuit

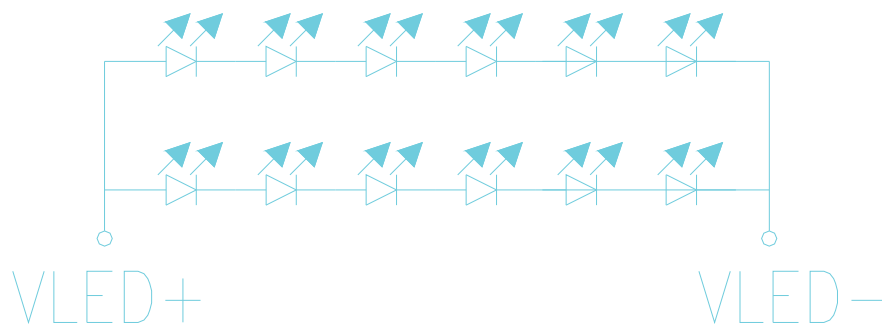
VDDIO=1.8V, VDD = 3.3V, AVDD = 6V, AGND = 0V, TA = -20°C to 80°C

| Item                           | Symbol            | Values |     |      | Unit | Conditions                    |
|--------------------------------|-------------------|--------|-----|------|------|-------------------------------|
|                                |                   | Min    | Typ | Max  |      |                               |
| Analog Supply Voltage          | VDD2              |        | 5   |      | V    |                               |
| Positive High-voltage power    | VGH               | 9      | 15  | 16   | V    | No Load. By VGH_SEL setting.  |
| Negative High-voltage power    | VGL               | -11    | -10 | -7   | V    | No Load. By VGL_SEL setting.  |
| VCOMH Output Level             | VCOMH             | 3.26   |     | 5.8  | V    | By VCOMH setting.             |
| VCOML Output Level             | VCOML             | -2     |     | -0.2 | V    | By VCOML setting              |
| Output Voltage Deviation       | Vod               | -      | ±20 | ±35  | mV   | VO = 0.15V ~ 0.5V, 3.45V~3.8V |
|                                |                   | -      | ±15 | ±20  |      | VO = 0.5V ~ 3.45V             |
| Output Dynamic Range           | Vdr               | 0.2    | -   | 5.3  |      | MVA Mode                      |
|                                |                   | 0.15   |     | 4.8  |      | TN Mode                       |
| VCOM Low Level Output Current  | IOLFRP            |        | -10 |      | mA   | VCOM AC output = 0.5V         |
| VCOM High Level Output Current | IOHFRP            |        | -10 |      | mA   | VCOM AC output = 5.7V         |
| Analog Standby Current         | I <sub>last</sub> | -      | -   | 20   | uA   |                               |
| Analog Operation Current       | IDD               | -      | 5.0 | -    | mA   | Without panel loading         |

### 5.3 DC Backlight Unit

| Item                       | Symbol          | Min   | Typ   | Max   | Unit              | Remark        |
|----------------------------|-----------------|-------|-------|-------|-------------------|---------------|
| Average luminous Intensity | I <sub>v</sub>  |       | 480   |       | cd/m <sup>2</sup> | IF=40mA       |
| Chromaticity Coordinates   | X               | 0.234 | 0.284 | 0.334 |                   | IF=40mA       |
|                            | Y               | 0.273 | 0.323 | 0.373 |                   | IF=40mA       |
| Forward Voltage            | V <sub>F</sub>  |       | 19.2  | 20.4  | V                 | IF=40mA       |
| Reverse Current            | I <sub>R</sub>  |       |       | 50    | μA                | VR=20V, 1LED  |
| Luminous Tolerance         | IV-M            | 80    |       |       | %                 | (MIN/MAX)×100 |
| Power Dissipation          | P <sub>d</sub>  | 768   |       |       | mW                |               |
| Peak Forward Current       | I <sub>fp</sub> | 100   |       |       | mA                |               |
| Reverse Voltage            | V <sub>R</sub>  | 5     |       |       | V                 |               |

### 5.3.1 Internal Circuit Diagram



40mA 19.2V

### 5.4 POWER ON/OFF SEQUENCE

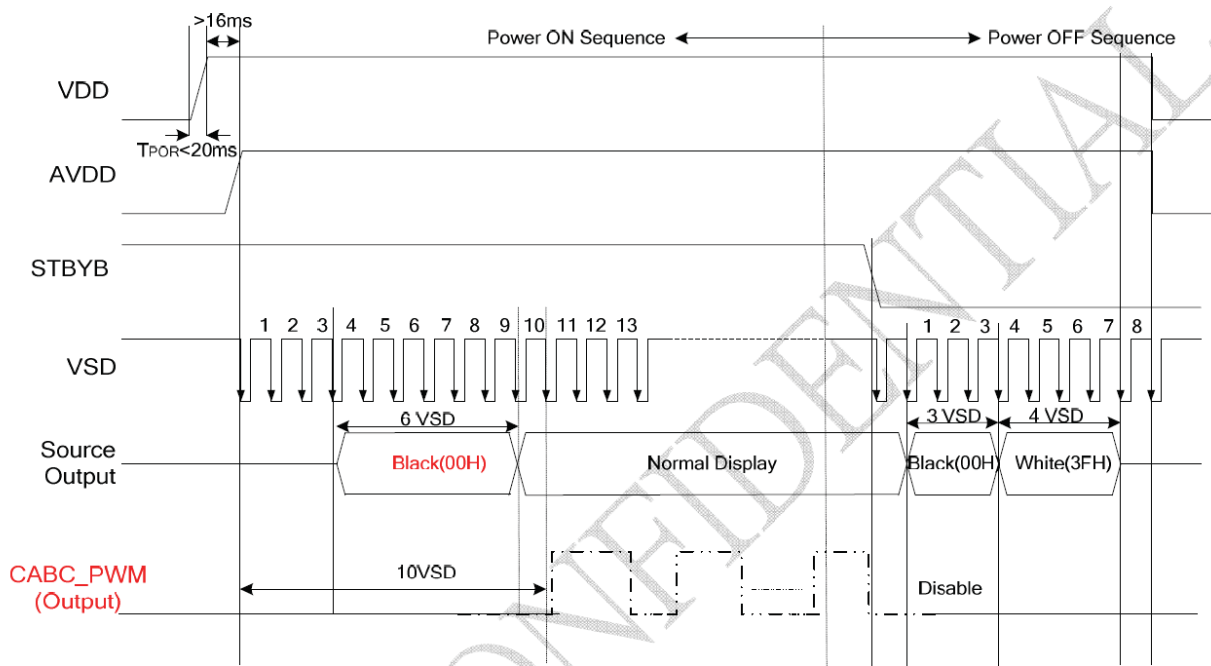
To prevent the device damage from latch up, the power ON/OFF sequence shown below must be followed.

Power ON: VDD, DGND → AVDD, AGND → V1 to V14

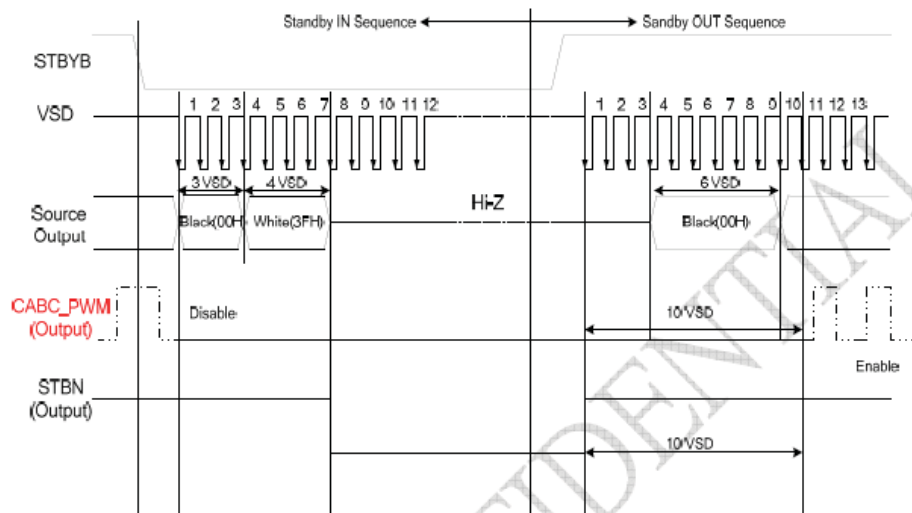
Power OFF: V1 to V14 → AVDD, AGND → VDD, DGND

In order to prevent ILI6126 from power ON reset fail, the rising time ( $t_{POR}$ ) of the digital power supply VDD should be maintained within given specifications. The power ON/OFF timing sequence is illustrated as below:

**REV=L & NBWB=H**



## 5.5 Standby On/Off Control



## 6. INPUT SIGNAL TIMING

### 6.1 AC Characteristics

A.1: HV Mode

Horizontal input timing

| Parameter                 | Symbol | Value |      |      | Unit | Note                       |
|---------------------------|--------|-------|------|------|------|----------------------------|
| Horizontal display area   | thd    | 800   |      |      | DCLK |                            |
| DCLK frequency            | fclk   | Min.  | Typ. | Max. | --   |                            |
|                           |        | -     | 33.3 | 50   | MHz  |                            |
| 1 Horizontal Line         | th     | 908   | 928  | 1010 | DCLK | thb+thpw=88 DCLK is fixed. |
| HSD pulse width           | thpw   | 4     | 48   | 64   |      |                            |
| HSD Back Porch (Blanking) | thb    | 20    | 40   | 84   |      |                            |
| HSD Front Porch           | thfp   | 20    | 40   | 122  |      |                            |

Vertical input timing

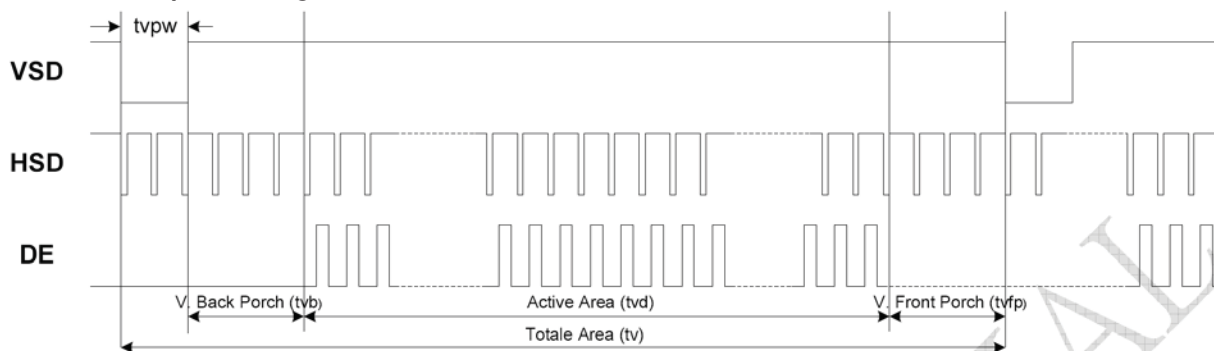
| Parameter                 | Symbol | Value |      |      | Unit | Note                 |
|---------------------------|--------|-------|------|------|------|----------------------|
|                           |        | Min.  | Typ. | Max. |      |                      |
| Vertical display area     | tvd    | 480   |      |      | H    |                      |
| VSD period time           | tv     | 515   | 525  | -    | H    |                      |
| VSD pulse width           | tpw    | 1     | 3    | 31   | H    | tpw+tvb=32H is fixed |
| VSD Back Porch (Blanking) | tvb    | 1     | 29   | 31   | H    |                      |
| VSD Front Porch           | tvfp   | 3     | 13   | -    | H    |                      |

A.2: DE Mode

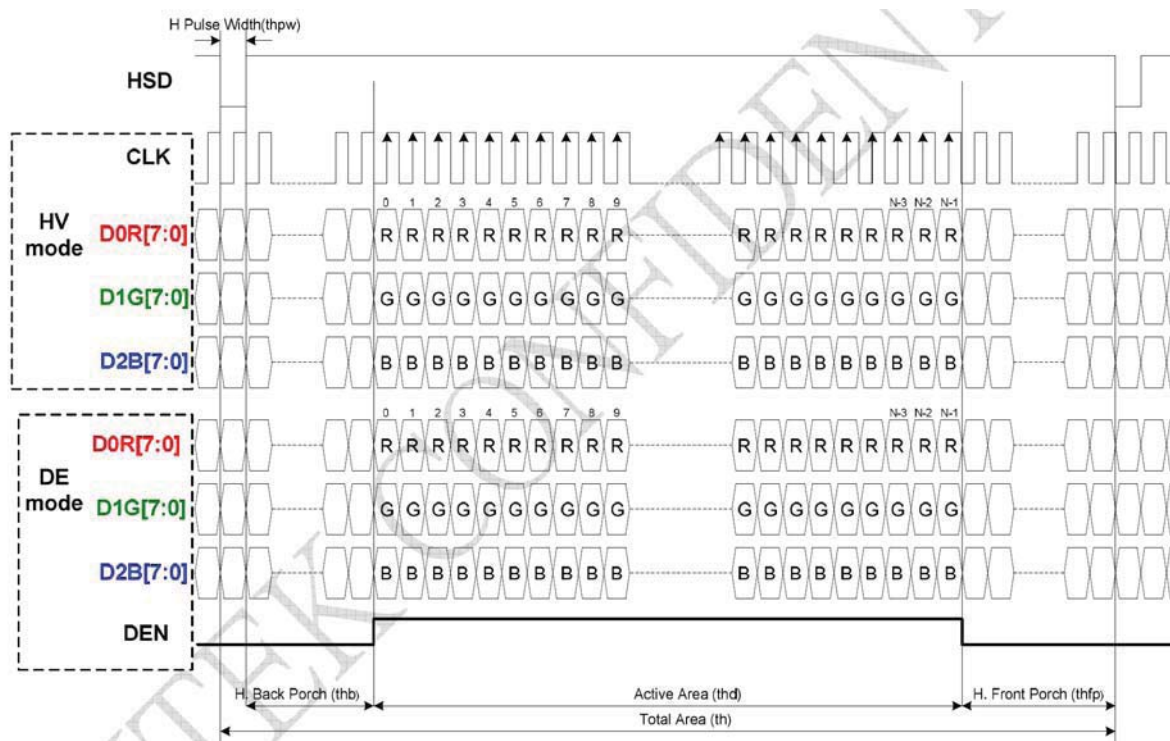
| Parameter         | Symbol                 | Spec |      |      | Unit |
|-------------------|------------------------|------|------|------|------|
|                   |                        | Min. | Typ. | Max. |      |
| CLK frequency     | fclk                   | -    | 33.3 | 50   | MHz  |
| DE H period       | thpw+thb+thd+thfp = th | 920  | 1000 | 1010 | DCLK |
| DE H-Display Area | thd                    | 800  |      |      | DCLK |
| DE H-Blanking     | th-thd                 | 120  | 200  | 210  | DCLK |
| DE V period       | tpw+tvb+tvd+tvfp       | 500  | 512  | -    | DCLK |
| DE V-Display Area | tvd                    | 480  |      |      | th   |
| DE V-Blanking     | tv-tvd                 | 20   | 32   | -    | th   |

## 6.2 AC Timing Diagram

### 6.2.1 Vertical Input Timing



### 6.2.2 Horizontal Input Timing



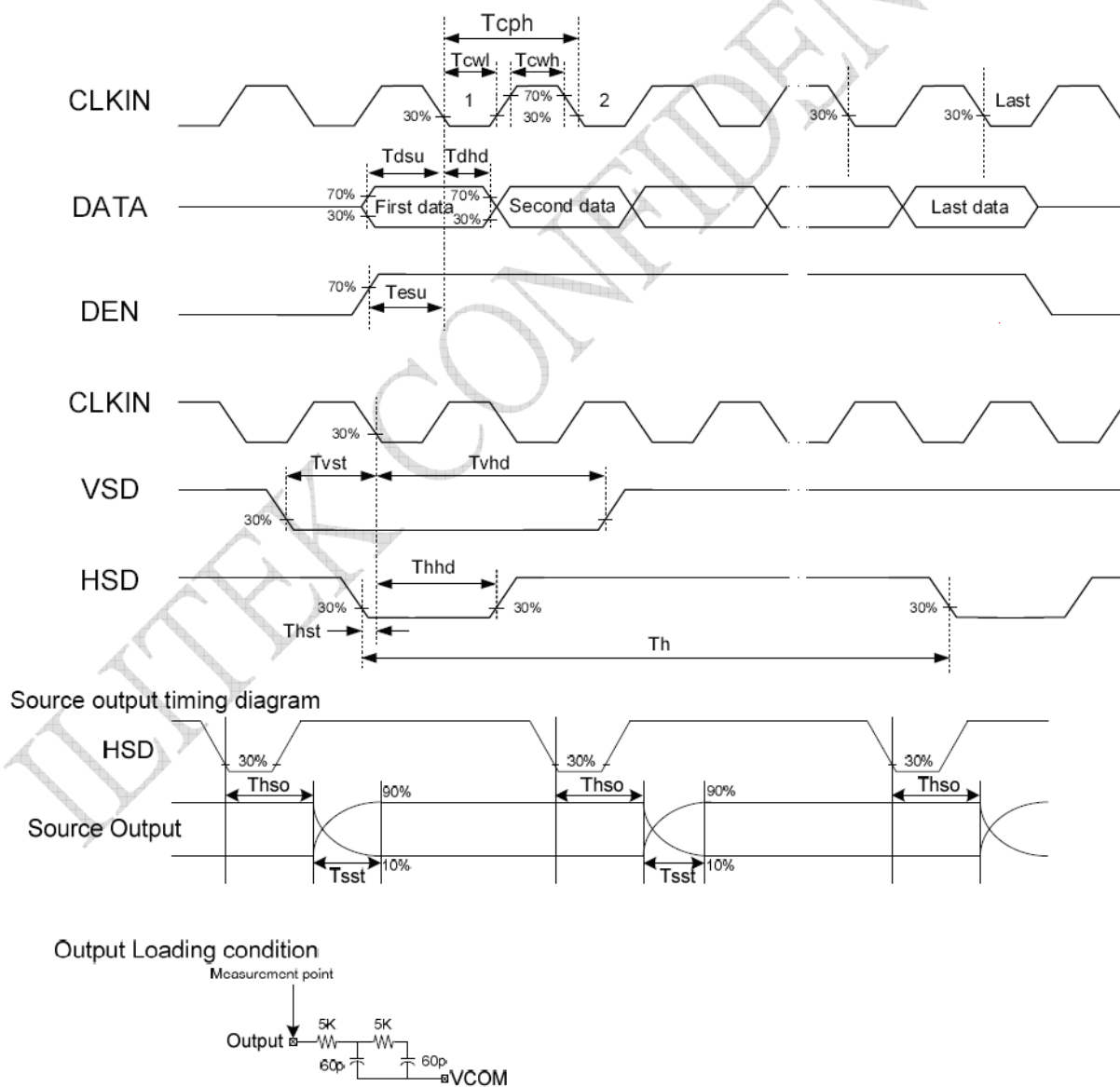
### 6.2.3 AC Electrical Characteristics

| Parameter              | Symbol | Min. | Typ. | Max. | Unit | Conditions                                     |
|------------------------|--------|------|------|------|------|------------------------------------------------|
| VDD Power On Slew rate | TPOR   | -    | -    | 20   | ms   | From 0V to 90% VDD                             |
| RSTB pulse width       | Trst   | 10   | -    | -    | us   | CLKIN = 45MHz                                  |
| CLKIN cycle time       | Tcph   | 20   |      |      | ns   |                                                |
| CLKIN pulse duty       | Tcwh   | 40   | 50   | 60   | %    |                                                |
| VSD setup time         | Tvst   | 8    | -    | -    | ns   |                                                |
| VSD hold time          | Tvhd   | 8    | -    | -    | ns   |                                                |
| HSD setup time         | Thst   | 8    | -    | -    | ns   |                                                |
| HSD hold time          | Thhd   | 8    | -    | -    | ns   |                                                |
| Data set-up time       | Tdsu   | 8    | -    | -    | ns   | D0R[7:0], D1G[7:0], D2B[7:0] to CLKIN          |
| Data hold time         | Tdhd   | 8    | -    | -    | ns   | D0R[7:0], D1G[7:0], D2B[7:0] to CLKIN          |
| DE setup time          | Tesu   | 8    | -    | -    | ns   |                                                |
| DE hold time           | Tehd   | 8    | -    | -    | ns   |                                                |
| Output stable time     | Tsst   | -    | -    | 6    | us   | 10% to 90% target voltage. CL=120pF, R=10K ohm |

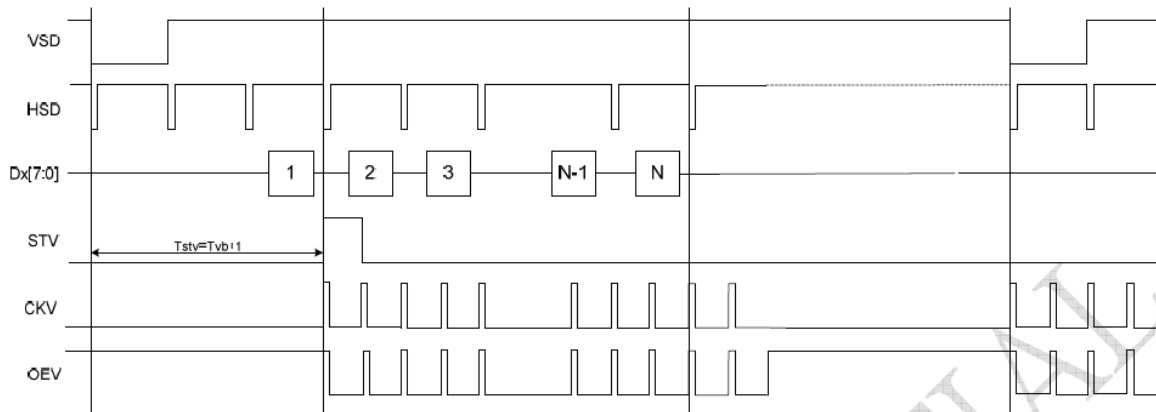
### 6.3 Parallel RGB Data Format

#### Parallel RGB Input Timing Table

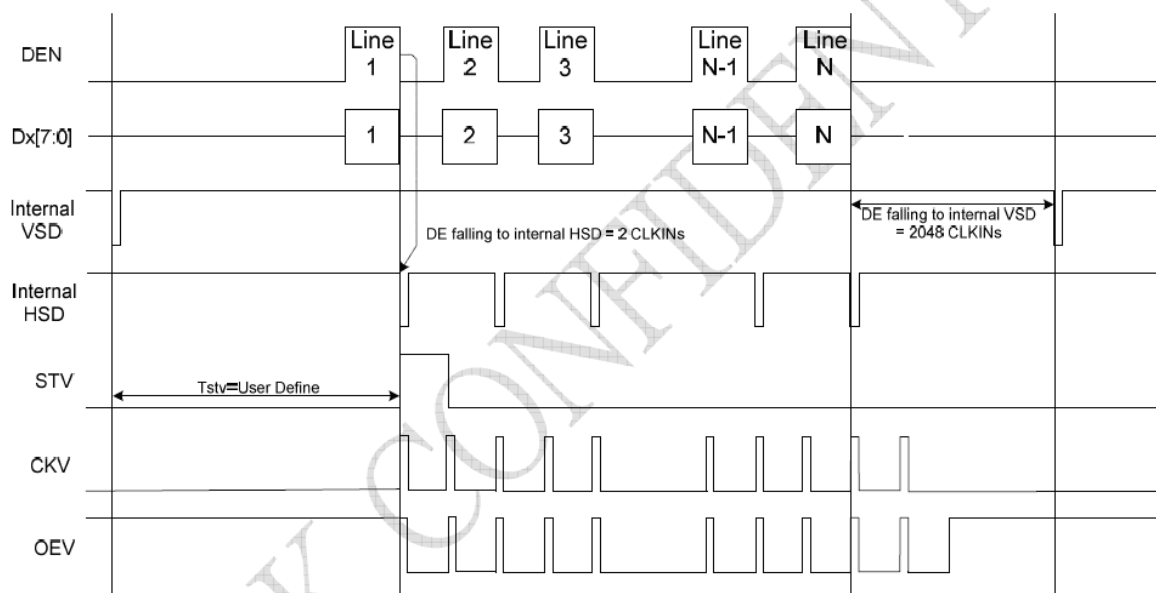
| Parameter                      | Symbol | Min. | Typ. | Max. | Unit  | Conditions       |
|--------------------------------|--------|------|------|------|-------|------------------|
| CLKIN Frequency                | Fclk   | -    | 33   | 50   | MHz   | VDD = 2.7V ~3.6V |
| CLKIN Cycle Time               | Tclk   | 20   | 30   | -    | ns    |                  |
| CLKIN Pulse Duty               | Tcwh   | 40   | 50   | 60   | %     | Tclk             |
| Time from HSD to Source Output | Thso   | -    | 64   | -    | CLKIN |                  |
| Time from HSD to LD            | Thld   | -    | 64   | -    | CLKIN |                  |
| Time from HSD to STV           | Thstv  | -    | 2    | -    | CLKIN |                  |
| Time from HSD to CKV           | Thckv  | -    | 20   | -    | CLKIN |                  |
| Time from HSD to OEV           | Thoev  | -    | 4    | -    | CLKIN |                  |
| LD Pulse Width                 | Twld   | -    | 10   | -    | CLKIN |                  |
| CKV Pulse Width                | Twckv  | -    | 66   | -    | CLKIN |                  |
| OEV Pulse Width                | Twoev  | -    | 92   | -    | CLKIN |                  |



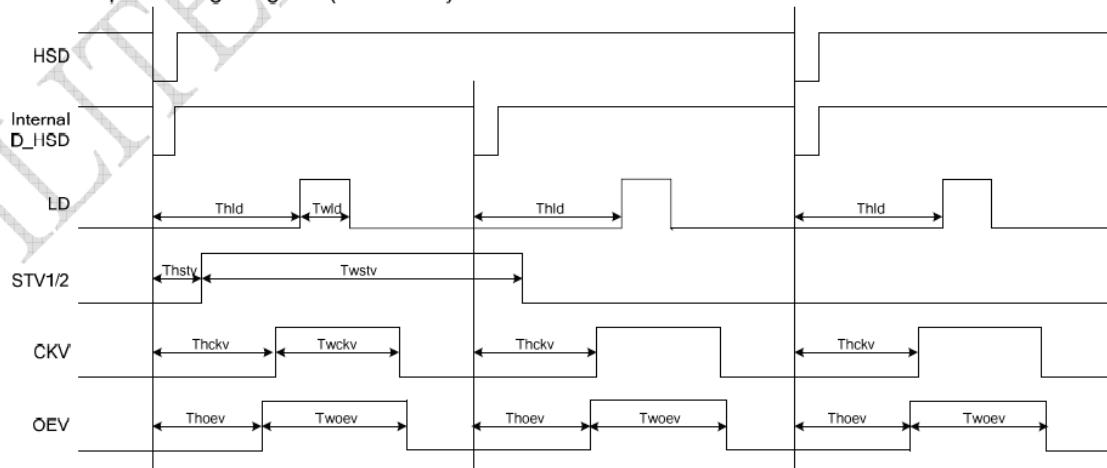
Vertical Timing Diagram of HV Mode (Dual Gate)



Vertical Timing Diagram of DE Mode (Dual Gate)



Gate Output Timing Diagram (Dual Gate)



## 6.4 Controller Information

IC: ILI5960D, ILI6126C

Please download IC specification at <http://www.orientdisplay.com/pdf/ILI5960D.pdf>

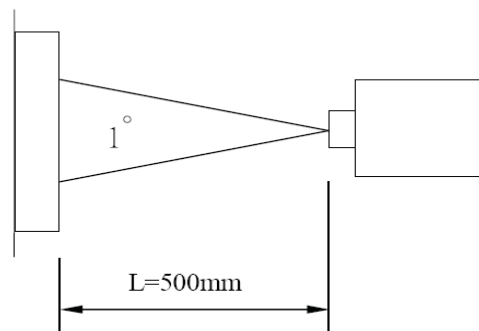
& <http://www.orientdisplay.com/pdf/ILI6126C.pdf>

## 7. OPTICAL CHARACTERISTICS

| ITEM                      |       | SYMBOL      | CONDITION  | MIN.  | TYP.  | MAX.  | UNIT | REMARK |
|---------------------------|-------|-------------|------------|-------|-------|-------|------|--------|
| Transmittance             |       | T           |            | 3.3   | 3.97  |       | %    |        |
| Contrast Ratio            |       | CR          | *1)        |       | 350   | -     | --   | Note 3 |
| Response Time             |       | Tr+ Tf      | *3)        | -     | 20    |       | ms   | Note 4 |
| Viewing Angle             | U     | θ*2)        | CR ≥ 10    | 45    | 50    | -     |      | Note 5 |
|                           | D     |             |            | 55    | 60    | -     |      |        |
|                           | L     | ψ*2)        |            | 60    | 65    | -     |      |        |
|                           | R     |             |            | 60    | 65    | -     |      |        |
| Color Filter Chromaticity | White | x<br>y<br>Y | θ = φ = 0° | 0.297 | 0.317 | 0.337 |      | Note 6 |
|                           |       |             |            | 0.304 | 0.324 | 0.344 |      |        |
|                           |       |             |            | 27.5  | 30.5  | 33.5  |      |        |
|                           | Red   | x<br>y<br>Y | θ = φ = 0° | 0.613 | 0.633 | 0.653 |      |        |
|                           |       |             |            | 0.321 | 0.341 | 0.361 |      |        |
|                           |       |             |            | 18.3  | 21.3  | 24.3  |      |        |
|                           | Green | x<br>y<br>Y | θ = φ = 0° | 0.304 | 0.324 | 0.344 |      |        |
|                           |       |             |            | 0.531 | 0.551 | 0.571 |      |        |
|                           |       |             |            | 48.4  | 52.4  | 56.4  |      |        |
|                           | Blue  | x<br>y<br>Y | θ = φ = 0° | 0.133 | 0.153 | 0.173 |      |        |
|                           |       |             |            | 0.123 | 0.143 | 0.163 |      |        |
|                           |       |             |            | 14.8  | 17.8  | 20.8  |      |        |
|                           | NTSC  |             |            | -     | 50%   | -     |      |        |

Note 1.Ambient condition :  $25^\circ\text{C} \pm 2^\circ\text{C}$  ,  $60 \pm 10\% \text{RH}$  , under 10 Lux in the darkroom .

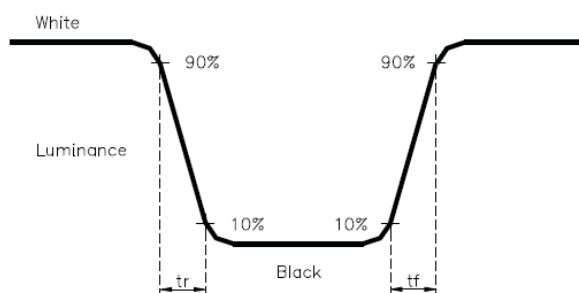
Note 2.Measure device : BM-5A (TOPCON) , viewing cone= $1^\circ$  ,  $I_L=20\text{mA}$  .



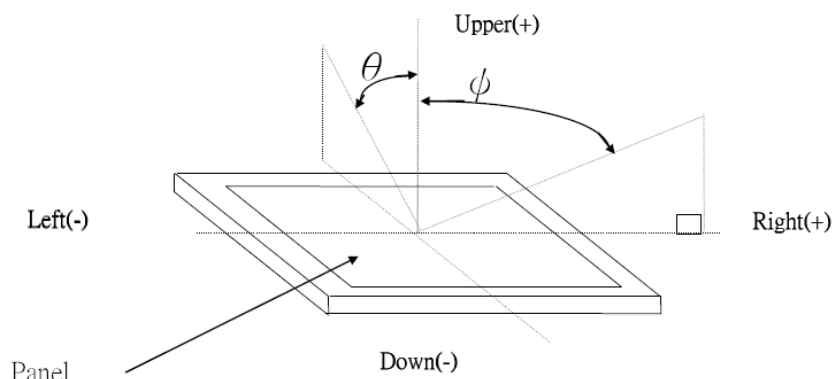
Note 3. Definition of Contrast Ratio :

CR = White Luminance (ON) / Black Luminance (OFF)

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle( $\theta$ ,  $\psi$ ) :



Note 6. Light source: C light.

## 8. RELIABILITY

Please download details at <http://www.orientdisplay.com/Reliability.html>

## 9. SPECIFICATION OF QUALITY ASSURANCE

Please download details at <http://www.orientdisplay.com/Delivery-TFT.html>

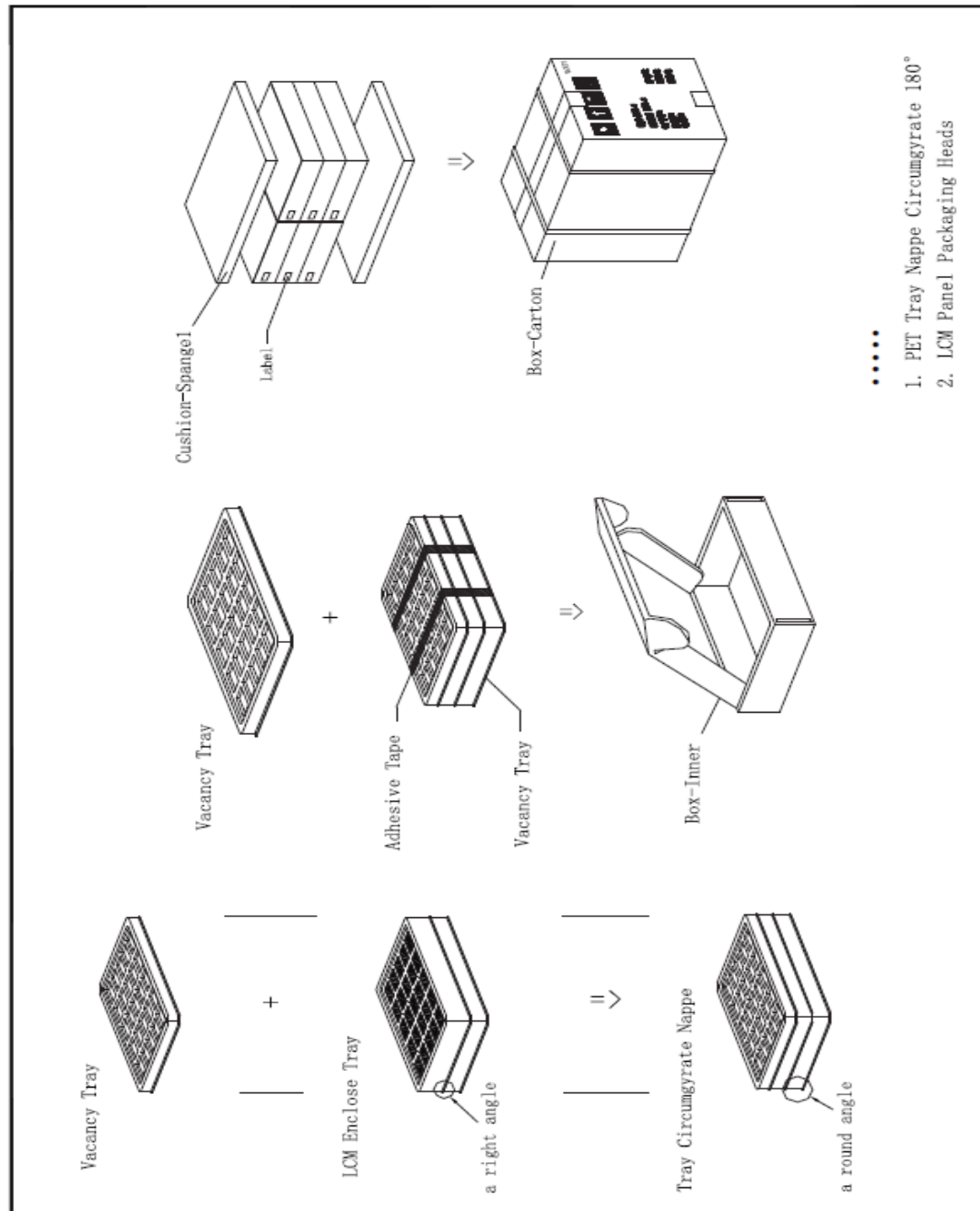
## 10. GENERAL PRECAUTIONS

Please download details at <http://www.orientdisplay.com/General-Precautions.html>

## 11. LIMITED WARRANTY

Please download details at <http://www.orientdisplay.com/Warranty.html>

## 12. PACKAGE



Orient Display Corporation reserves the right to change this specification.