

Specification for Approval

Customer: _____

Model Name: _____

| Supplier Approval | | | Customer approval |
|-------------------|-----------------|-------------|-------------------|
| R&D Designed | R&D Approved | QC Approved | |
| <i>Peter</i> | <i>Peng Jun</i> | | |



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1. LCM Specification

1.1 Description

AM-19201080-156B 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, 4 drives IC, 2 PCBAs and a LED-backlight unit. The active display area is 15.6 inches diagonally measured and the native resolution is 1920*RGB*1080.Features of this product are listed in the following table.

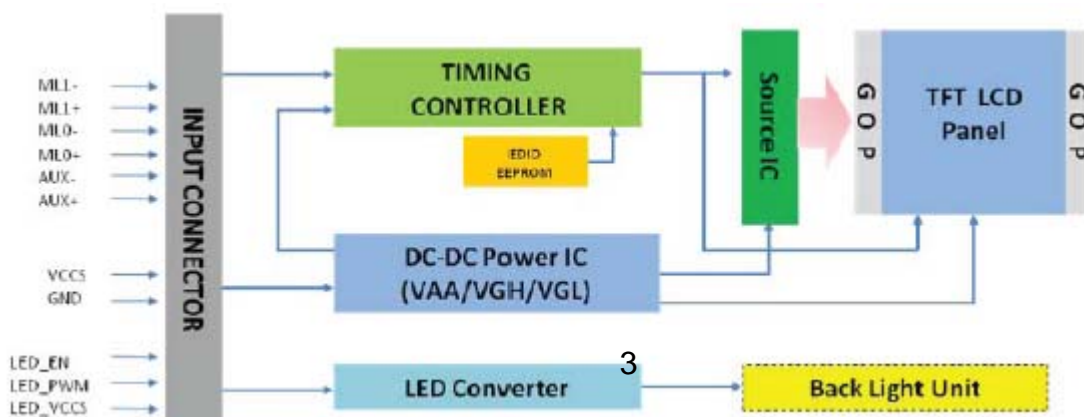
1.2 Functions & Features

Table 1.1 Module Functions & Features

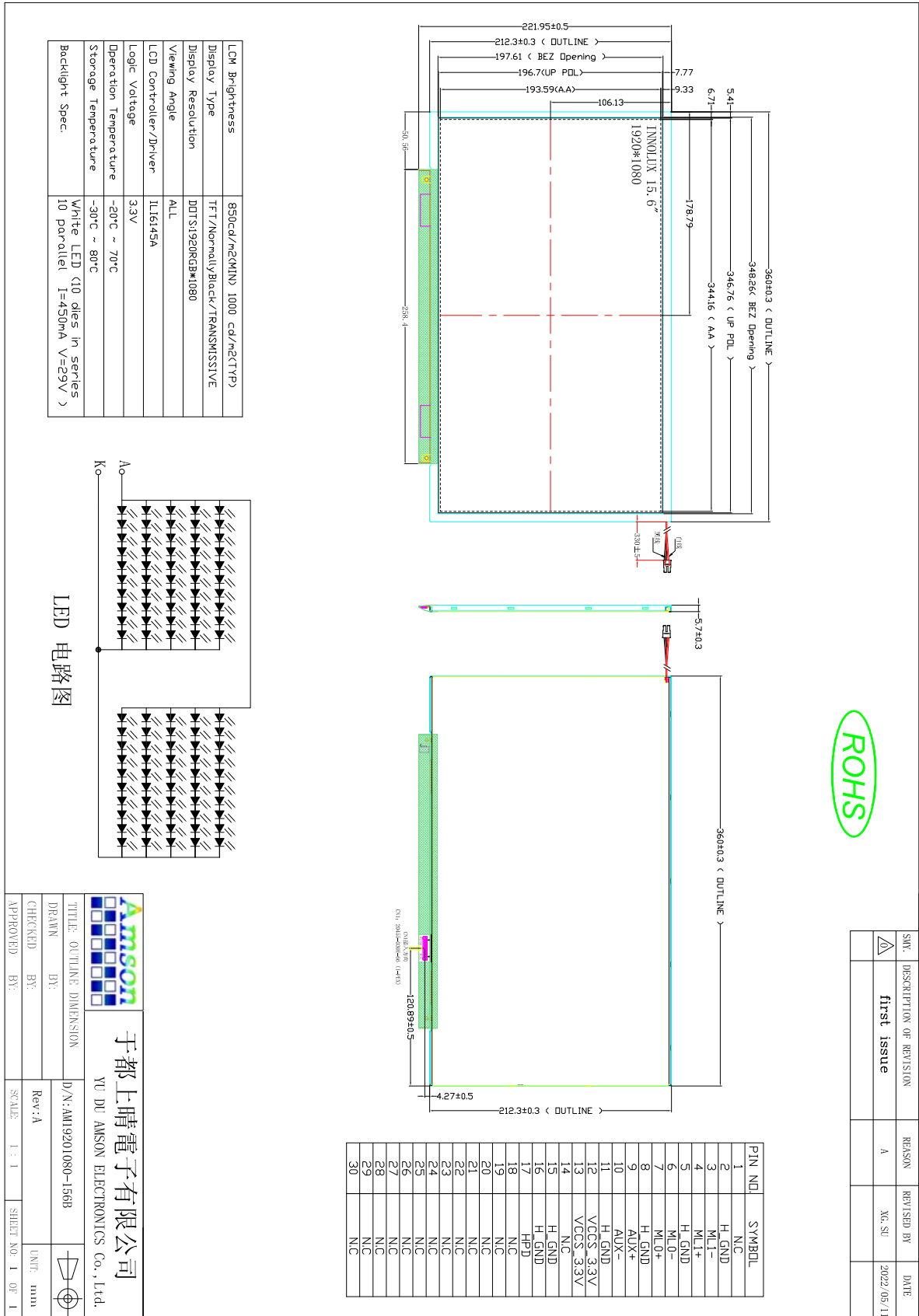
| Parameter | Value | Unit |
|-----------------------|--|-------------------|
| LCD Mode | TFT/Transmissive | - |
| Color Depth | 16.7M | - |
| Display Resolution | 1920RGB*1080 | pixels |
| Module Size | 360.0(H)*221.95(W)*5.70(T)(Exclude PCBA) | mm |
| Active Area (A.A) | 193.59(H)*344.16(W) | mm |
| Pixel Arrangement | RGB-stripe | - |
| Viewing Direction | ALL | |
| Display Mode | Normally Black | |
| LCD Controller/Driver | ILI6145A | - |
| IC Package Type | COG | - |
| Interface | 8Bit LVDS | - |
| Power Supply Voltage | 3.0~3.6 (Cell 0.9W max) | V |
| LCM Brightness | 1000 (Type.) | cd/m ² |
| Back-light | White LED*100 | PCS |

Note : The specified power consumption (with converter efficiency) is under the conditions at VCCS = 3.3 V, fv = 60 Hz, and Ta = 25 ± 2 °, whereas **Mosaic** pattern is displayed.

1.3 Function Block Diagram



2. Mechanical Specification



3. Pin Descriptions

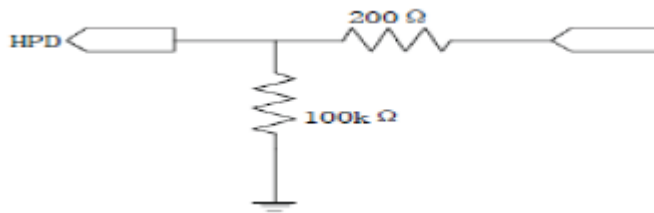
3.1 Input CONN Pin Assignment

Input Connector (I-pex 20455-040E-12) is used for the module electronics interface

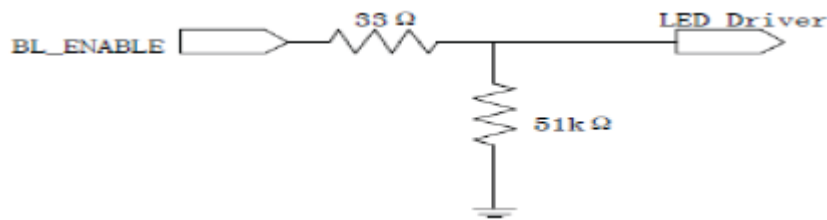
| Pin No. | Symbol | I/O | Functional | Remark |
|---------|-----------|-----|-------------------------------------|--------|
| 1 | GND | P | System ground. | |
| 2 | RXEIN0- | I | - LVDS differential data input | |
| 3 | RXEIN0+ | I | + LVDS differential data input | |
| 4 | GND | P | System ground. | |
| 5 | RXEIN1- | I | - LVDS differential data input | |
| 6 | RXEIN1+ | I | + LVDS differential data input | |
| 7 | GND | P | System ground. | |
| 8 | RXEIN2- | I | - LVDS differential data input | |
| 9 | RXEIN2+ | I | + LVDS differential data input | |
| 10 | GND | P | System ground. | |
| 11 | RXECLKIN- | I | - LVDS differential clock input | |
| 12 | RXECLKIN+ | I | + LVDS differential clock input | |
| 13 | GND | P | System ground. | |
| 14 | RXEIN3- | I | - LVDS differential data input | |
| 15 | RXEIN3+ | I | + LVDS differential data input | |
| 16 | GND | P | System ground. | |
| 17 | RXOIN0- | I | - LVDS differential data input | |
| 18 | RXOIN0+ | I | + LVDS differential data input | |
| 19 | GND | P | System ground. | |
| 20 | RXOIN1- | I | - LVDS differential data input | |
| 21 | RXOIN1+ | I | + LVDS differential data input | |
| 22 | GND | P | System ground. | |
| 23 | RXOIN2- | I | - LVDS differential data input | |
| 24 | RXOIN2+ | I | + LVDS differential data input | |
| 25 | GND | P | System ground. | |
| 26 | RXOCLKIN- | I | - LVDS differential clock input | |
| 27 | RXOCLKIN+ | I | + LVDS differential clock input | |
| 28 | GND | P | System ground. | |
| 29 | RXOIN3- | I | - LVDS differential data input | |
| 30 | RXOIN3+ | I | + LVDS differential data input | |
| 31-33 | GND | P | System ground. | |
| 34 | BL_ENABLE | P | Off: 0V ; ON: 3.3V | |
| 35 | BL_PWM_DM | P | BL Brightness Control, Typ.: 20K Hz | |
| 36-37 | BL_PWR | P | BL Power Input 11-15V, Typ:12V | |
| 38-39 | VDD | P | Power for Analog Circuit , 3.3V | |
| 40 | GND | P | System ground. | |

I: Input, O: Output, P: Power

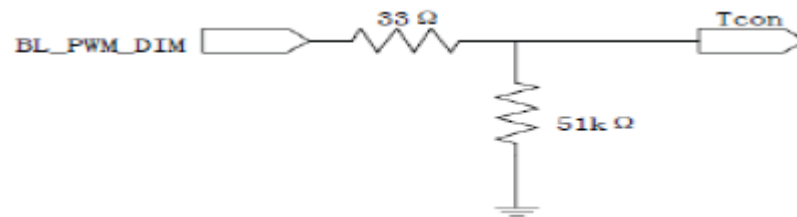
Note 3.1.1 Output circuit is as below:



Note 3.1.2 Input circuit is as below:

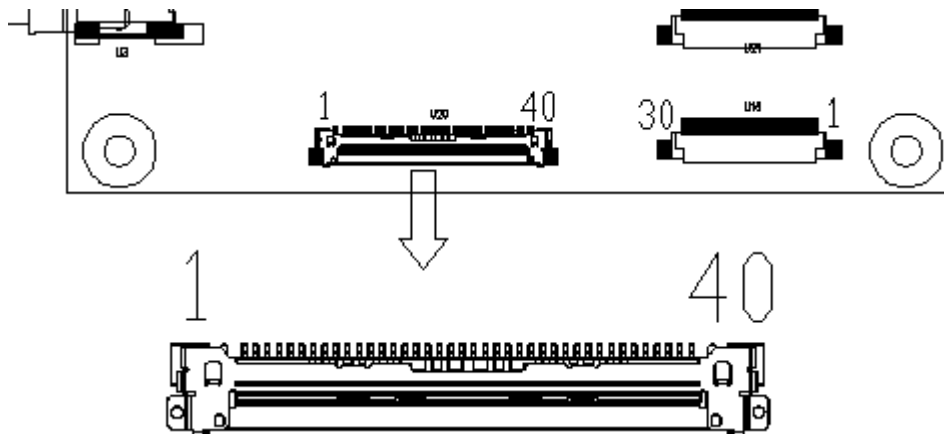


Note 3.1.3 Input circuit is as below:



3.2 CONN PIN1 Location

Input CONN is on bottom side of PCBA, pin 1 location shows as following figure.



4. Electrical Units

4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on Table 4.1. When used out of the absolute maximum ratings, the LCM may be permanently damaged. Using the LCM within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LCM will malfunction and cause poor reliability.

Table 4.1 Module Absolute Maximum Ratings

| Item | Symbol | Unit | Value | Note |
|--------------------------|-----------|-------|--------------|------|
| Power Supply Voltage (1) | Vdd | V | -0.3 to +4.0 | |
| Power Supply Voltage (2) | VGH ~ VSS | V | * | |
| Power Supply Voltage (3) | VSS ~ VGL | V | * | |
| Operating Temperature | Top | °C | -20 to +70 | |
| Storage Temperature | Tst | °C | -30 to +80 | |
| Operating Humidity | Hop | %(RH) | 10~85 | |

(VSS=0V)

4.2 LCD Electrical characteristics (Ta=25°C)

| Item | Symbol | Min. | Type | Max. | Unit. | Note |
|-----------------------|--------|------|------|------|-------|-----------|
| Power supply voltage | VDD | 3.0 | 3.3 | 3.6 | V | GND=0 |
| | Vrp | | 50 | 150 | mV | Vcc=+3.3V |
| | Irush | 0 | | 1.5 | A | GND=0 |
| | IDD | - | 212 | 364 | mA | AGND=0 |
| | Irush | | | 1.0 | A | |
| Operation Temperature | Top | -20 | | 70 | °C | |
| Storage Temperature | Tst | -30 | | 80 | °C | |

4.3 Back-light Specification

Table 4.3 Back-light Characteristics

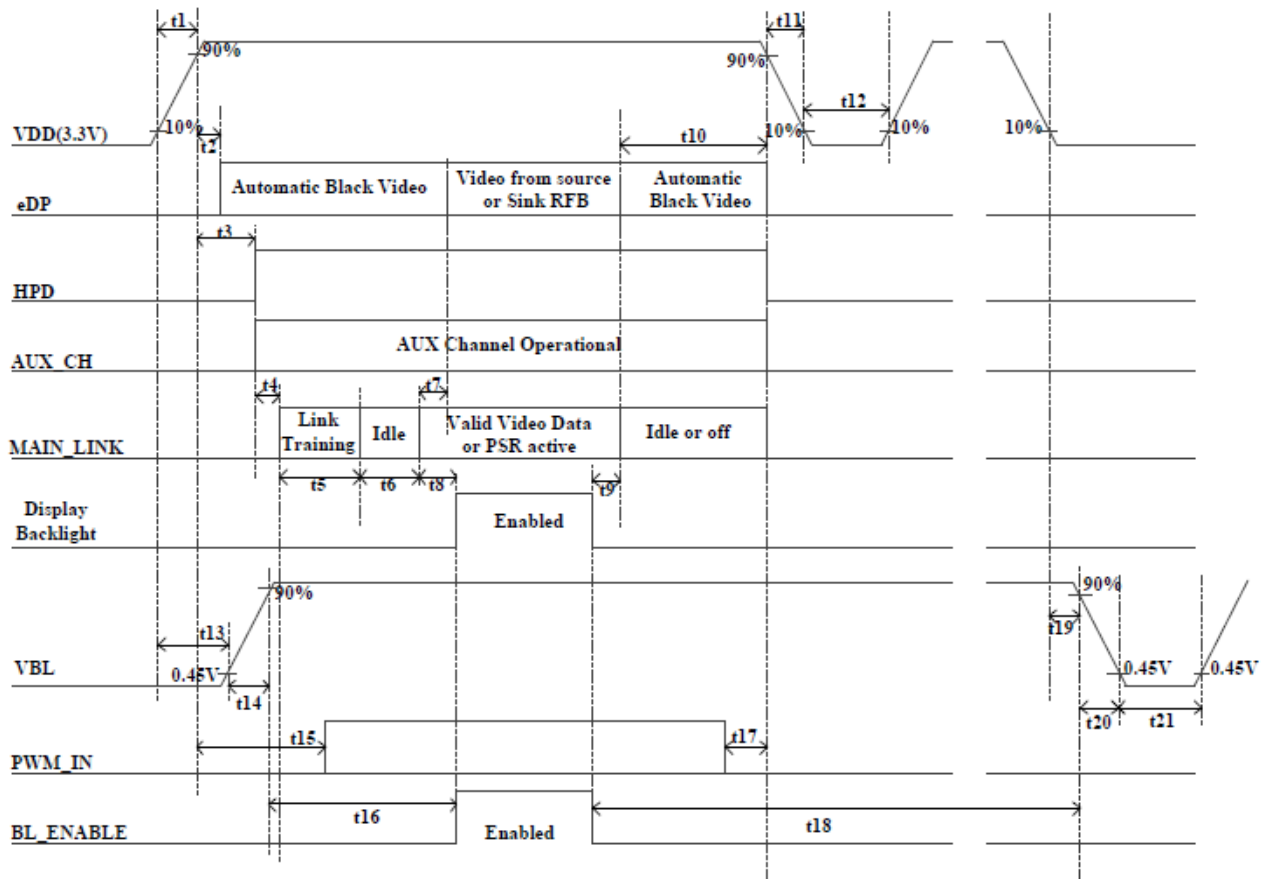
| Item | Symbol | Conditions | Min. | Type. | Max. | Unit |
|---------------------------------------|--------|-------------------------------|-------|-------|------|-----------------------|
| Supply Voltage | VF | Only Backlight | - | 29 | 33 | V |
| Supply Current | IF | | 450 | | | mA |
| Average Brightness | IV | Backlight Current IF=450mA | 19300 | 22700 | - | Cd/ m ² |
| CIE Color Coordinate (Without LCD) | X | Backlight Current IF=450mA | 0.29 | 0.32 | 0.35 | - |
| | Y | | 0.33 | 0.36 | 0.39 | |
| Uniformity | B | Backlight Current IF=450mA | -- | 70% | - | % |
| Color | White | | | | | |

Note: 10 LEDs in series 10 parallel connection.

LCM Brightness: 1000cd/m² (Type.)

5. AC Characteristics

5.1 By after LVDS invert to Edp



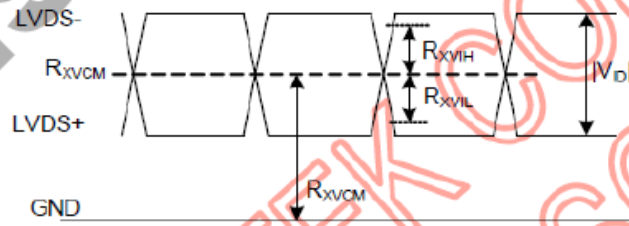
[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

| Symbol | Min | Max | Unit | Note |
|--------|-----|-----|------|---------|
| t1 | 0.5 | 10 | ms | |
| t2 | 0 | 100 | ms | |
| t3 | 0 | 100 | ms | |
| t4 | - | - | ms | |
| t5 | - | - | ms | |
| t6 | - | - | ms | |
| t7 | 0 | 50 | ms | |
| t8 | | | ms | |
| t9 | | | ms | |
| t10 | 0 | 500 | ms | |
| t11 | 1 | 50 | ms | [Note1] |
| t12 | 500 | - | ms | |
| t13 | - | - | ms | |
| t14 | 0.5 | 10 | ms | |
| t15 | 100 | | ms | |
| t16 | - | - | ms | |
| t17 | 0 | - | ms | |
| t18 | - | - | ms | |
| t19 | - | - | ms | |
| t20 | 0.1 | - | ms | |
| t21 | 100 | | ms | |

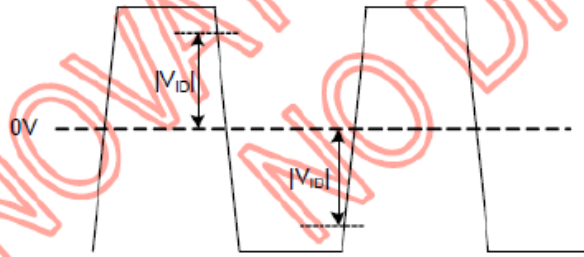
5.2 Switching characteristics for LVDS Receiver

| Item | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|--|------------|------|------|----------------------|------|---------------|
| Differential Input High Threshold | R_{xVTH} | +100 | | +300 | mV | |
| Differential Input Low Threshold | R_{xVTL} | -300 | | -100 | mV | |
| Differential input common mode voltage | R_{xVCM} | 1.0 | 1.2 | 1.7- $ V_{ID} /2$ | V | |
| Input leakage Current | I_{IN} | -10 | | 10 | uA | RX+/-, RXC+/- |
| Differential input Voltage | $ V_{ID} $ | 200 | | 600 | mV | |

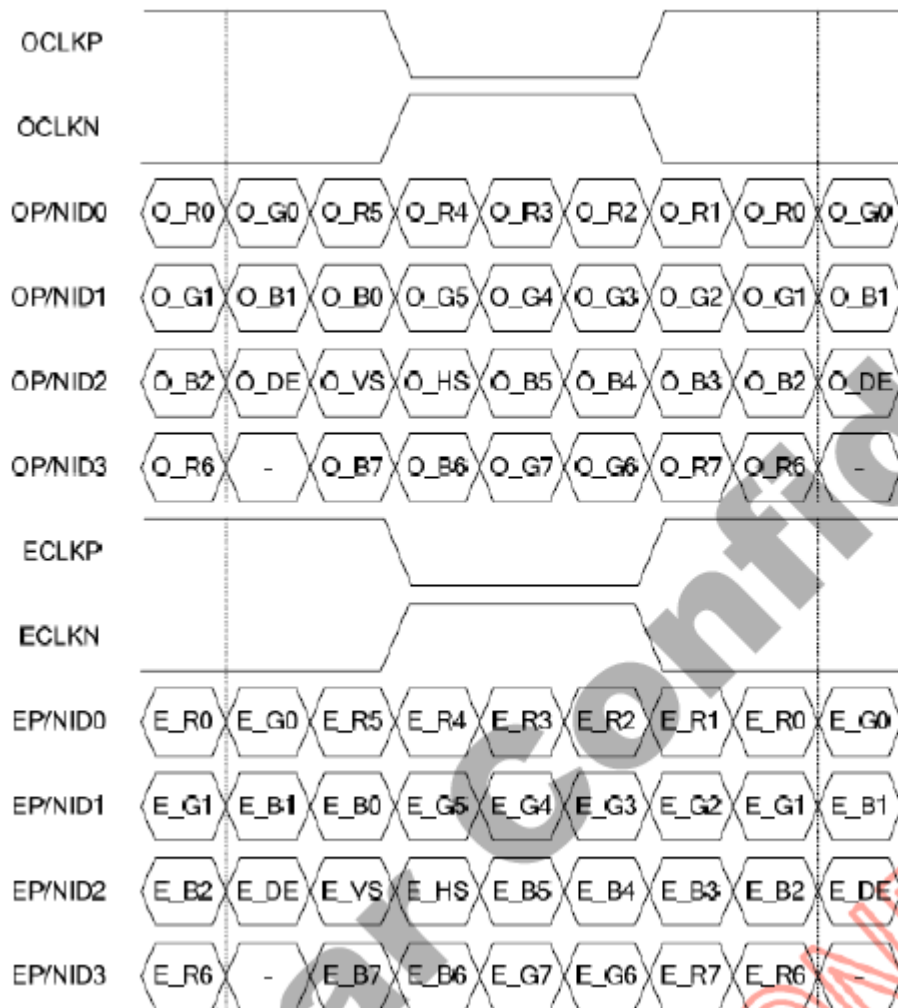
Single-end Signal



Differential Signal



5.3 8Bits LVDS input



5.4 Interface timing (DE mode)

The input signal timing specifications are shown as the following table and timing diagram.

Refresh rate 60Hz

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|-----------------------------------|--------|--------|--------|--------|------|------|
| DCLK | Frequency | 1/Tc | 151.6 | 152.84 | 154.04 | MHz | - |
| DE | Vertical Total Time | TV | 1128 | 1132 | 1136 | TH | - |
| | Vertical Active Display Period | TVD | 1080 | 1080 | 1080 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 52 | TV-TVD | TH | - |
| | Horizontal Total Time | TH | 2240 | 2250 | 2260 | Tc | - |
| | Horizontal Active Display Period | THD | 1920 | 1920 | 1920 | Tc | - |
| | Horizontal Active Blanking Period | THB | TH-THD | 330 | TH-THD | Tc | - |

Refresh rate 50Hz (Power Saving Mode)

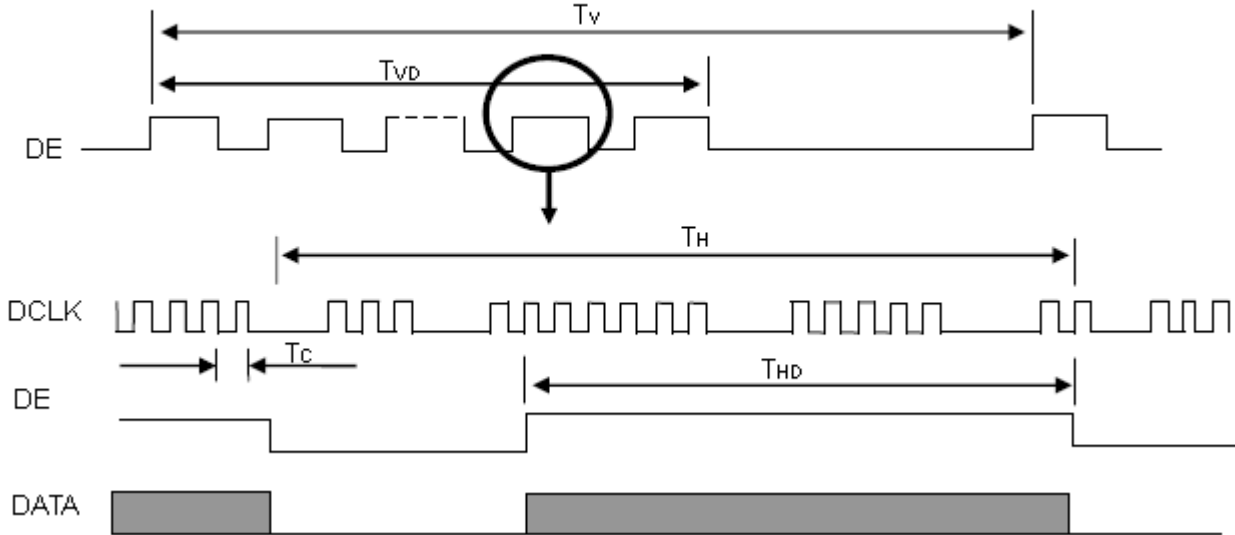
| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|-----------------------------------|--------|--------|--------|--------|------|------|
| DCLK | Frequency | 1/Tc | 126.35 | 127.35 | 128.35 | MHz | - |
| DE | Vertical Total Time | TV | 1128 | 1132 | 1136 | TH | - |
| | Vertical Active Display Period | TVD | 1080 | 1080 | 1080 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 52 | TV-TVD | TH | - |
| | Horizontal Total Time | TH | 2240 | 2250 | 2260 | Tc | - |
| | Horizontal Active Display Period | THD | 1920 | 1920 | 1920 | Tc | - |
| | Horizontal Active Blanking Period | THB | TH-THD | 330 | TH-THD | Tc | - |

Refresh rate 50Hz (Power Saving Mode)

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|--------|-----------------------------------|--------|--------|--------|--------|------|------|
| DCLK | Frequency | 1/Tc | 121.3 | 122.26 | 123.22 | MHz | - |
| DE | Vertical Total Time | TV | 1128 | 1132 | 1136 | TH | - |
| | Vertical Active Display Period | TVD | 1080 | 1080 | 1080 | TH | - |
| | Vertical Active Blanking Period | TVB | TV-TVD | 52 | TV-TVD | TH | - |
| | Horizontal Total Time | TH | 2240 | 2250 | 2260 | Tc | - |
| | Horizontal Active Display Period | THD | 1920 | 1920 | 1920 | Tc | - |
| | Horizontal Active Blanking Period | THB | TH-THD | 330 | TH-THD | Tc | - |

Note (1) The panel can operate at 60Hz normal mode and power saving mode, respectively. All reliability tests are based on specific timing of 60Hz refresh rate. We can only assure the panel's electrical function at power saving mode.

INPUT SIGNAL TIMING DIAGRAM

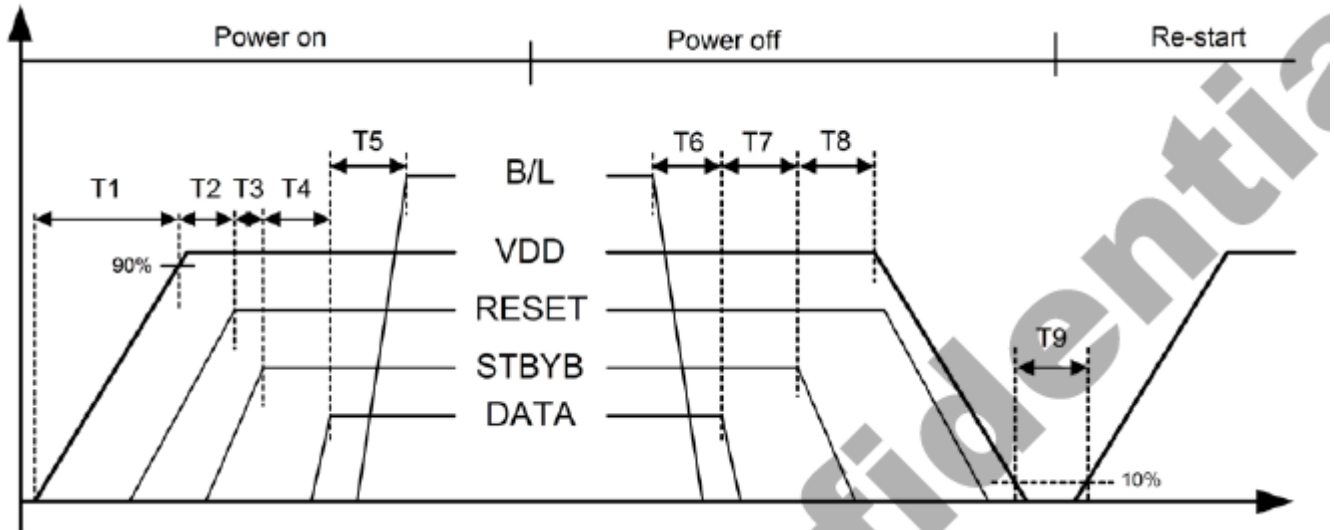


5.5 Input signal, basic display colors and gray scale of each color

| Color | Data Signal | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|---------------|-----|-----|-----|-----|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|
| | Red | | | | | | | | Green | | | | | | | | Blue | | | | | | | |
| | 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 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 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 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | 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 |
| Gray Scale | 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 |
| | 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 |
| | 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 |
| | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | Of | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Red | 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 |
| | 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 |
| | Red(255) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale | 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 |
| | 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 |
| | 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 |
| | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | Of | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Green | 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 |
| | Green(254) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale | 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 |
| | Blue(1) | 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 | 1 | 0 |
| | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| | Of | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Blue | Blue(253) | 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 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue(255) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Note (1) 0: Low Level Voltage, 1: High Level Voltage

6. Power On/Off Sequence



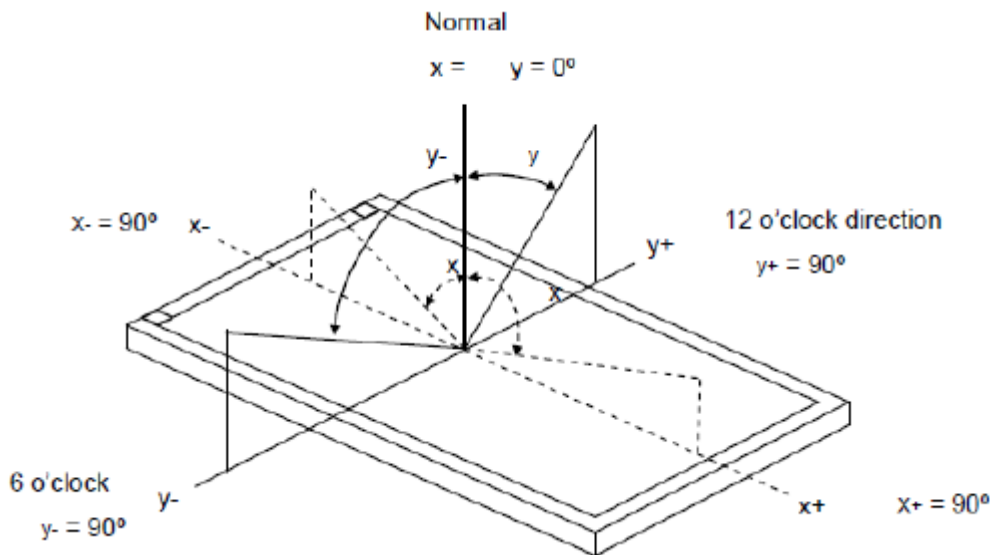
| Item | Min. | Typ. | Max. | Unit |
|------|------|------|------|------|
| T1 | 0.5 | -- | 20 | ms |
| T2 | 1 | -- | -- | ms |
| T3 | 1 | -- | -- | ms |
| T4 | 200 | -- | -- | ms |
| T5 | 50 | -- | -- | ms |
| T6 | 50 | -- | -- | ms |
| T7 | 16 | -- | -- | ms |
| T8 | 16 | -- | -- | ms |
| T9 | 1000 | -- | -- | ms |

7. Optical Specifications

The relative measurement methods of optical characteristics are shown

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Note | | | | | | |
|---|----------------------|--------------------------------------|---|------------|-------|------------|---------|------------------------------------|------|------|---|---|---------------------|
| Color Chromaticity (CIE 1931) FOG Only with C-light | Red | Rx | $\theta_x=0^\circ, \theta_y=0^\circ$ R=G=B=255 Gray scale | Typ - 0.03 | 0.658 | Typ + 0.03 | - | C Light Source (1),(5) (6),(7),(8) | | | | | |
| | | Ry | | | 0.328 | | | | | | | | |
| | Green | Gx | | | 0.275 | | | | | | | | |
| | | Gy | | | 0.574 | | | | | | | | |
| | Blue | Bx | | | 0.143 | | | | | | | | |
| | | By | | | 0.092 | | | | | | | | |
| | White | Wx | | | 0.314 | | | | | | | | |
| | | Wy | | | 0.361 | | | | | | | | |
| | Color gamut | C.G | | | | | | | 64 | 69 | - | % | |
| | Center Transmittance | T% | | | | | | | 3.83 | 4.39 | - | % | INX BLU (1),(4),(6) |
| Contrast Ratio | CR | | 800 | 1000 | - | - | (2) | | | | | | |
| Response Time | T_R+T_F | $\theta_x=0^\circ, \theta_y=0^\circ$ | - | 25 | 30 | ms | (3),(6) | | | | | | |
| Viewing Angle | Horizontal | x + | CR>10 | 80 | - | - | Deg. | (1),(5),(6) | | | | | |
| | | x - | | 80 | - | - | | | | | | | |
| | Vertical | y + | | 80 | - | - | | | | | | | |
| | | y - | | 80 | - | - | | | | | | | |

Note (1) Definition of Viewing Angle (θ_x, θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

$$CR = CR (5)$$

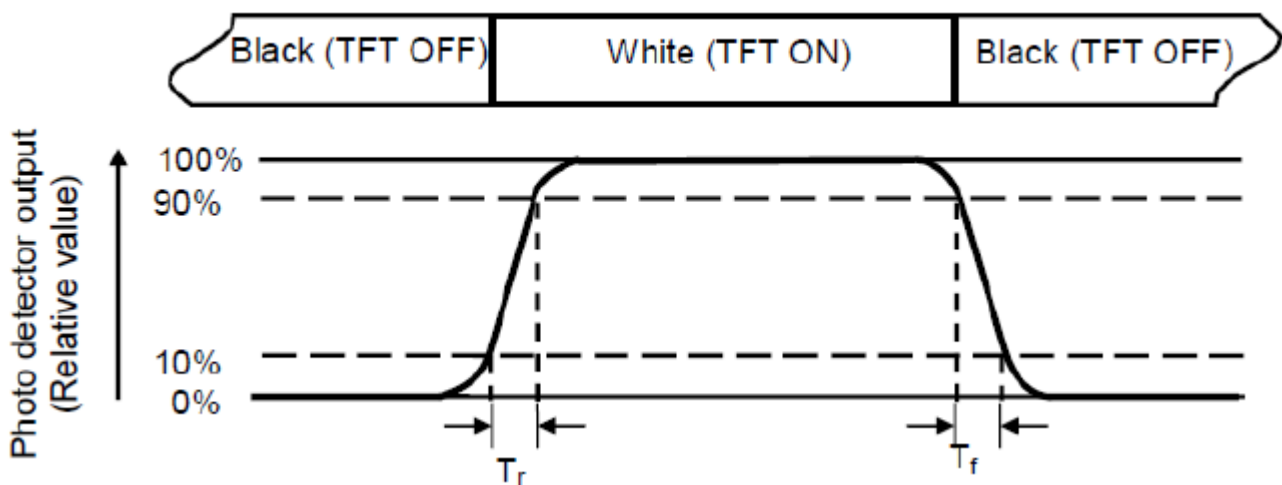
CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

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 10% to 90%. And fall time (T_f) is the time between photo detector output intensity changed from 90% to 10%.

RT = RT (5)

RT (X) is corresponding to the Response Time of the point X at Figure in Note (6).



Note (4) Definition of Luminance of White (L_c):

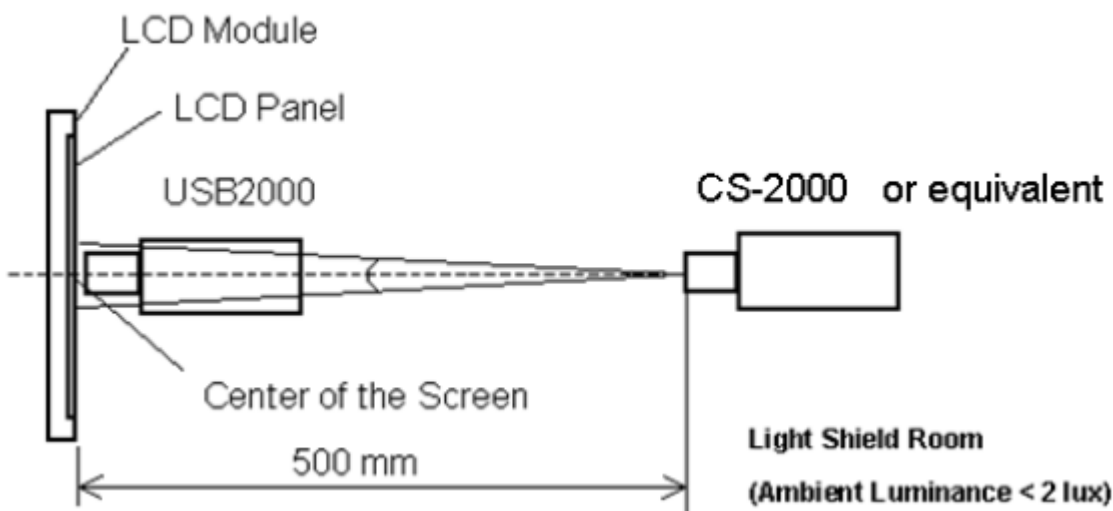
Measure the luminance of gray level 255 at center point

$LC = L$ (5)

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (6).

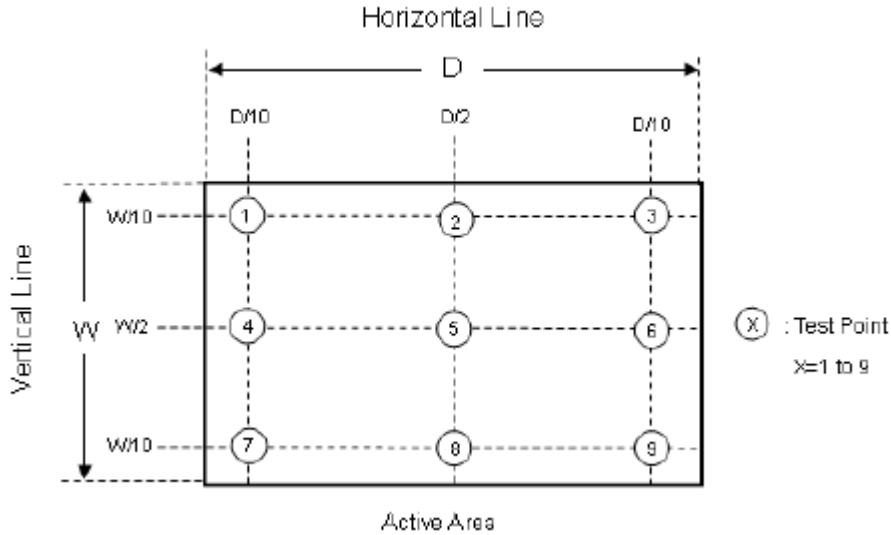
Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 40 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 40 minutes in a windless room.



Note (6) Definition of White Variation ($_W$):

Measure the luminance of gray level 255 at 9 points



Note (7) The listed optical specifications refer to the initial value of manufacture, but the condition of the specifications after long-term operation will not be warranted.

Note (8) Definition of color gamut (C.G%):

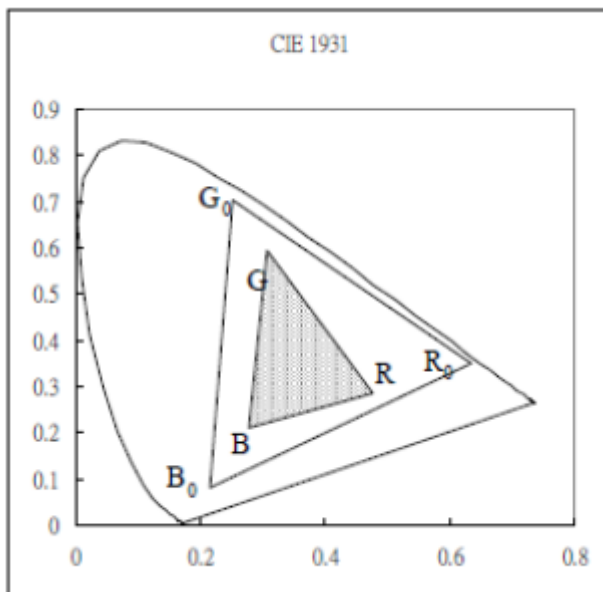
$$C.G\% = R G B / R_0 G_0 B_0 \cdot 100\%$$

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 255 gray levels of red, green, and blue, respectively.

$R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

$R G B$: area of triangle defined by R, G, B



8. Reliability Test Items

| No. | Test Item | Test Condition | Check Time |
|-----|---------------------------|----------------|------------|
| 1 | High temp storage | T=80°C | 96Hrs |
| 2 | Low temp storage | T=-30°C | 96Hrs |
| 3 | High temp operation | T=70°C | 96Hrs |
| 4 | Low temp operation | T=-20°C | 96Hrs |
| 5 | High temp & high humidity | T=50°C H=90% | 96Hrs |

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.

Note 2: After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

Note 3: Under no condensation of dew.

9. Handling Precautions

9.1 Safety

The liquid crystal in the LCD is poisonous. Keep away from your mouth and eyes. If the liquid crystal contacts with your skin, mouse or clothes, use soap to wash it off immediately.

9.2 Handling

- i. The LCD panel is made of very thin glass. Mechanical impact or extrusion to the surface should be prevented.
- ii. The polarizer attached on the display is very easy to be damaged, handle it with special attention.
- iii. To avoid contamination on the display surface, do not touch the display surface with bare hands.
- iv. The transparent electrodes may be disconnected if you use the LCD panel under dew-condensing environment.
- v. The characteristics of the semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs. To prevent such malfunctioning of the ICs, make sure the application and the mounting of the panel are designed so that the IC is not exposed to light.

9.3 Static Electricity

Ground soldering iron tips, tools and testers when you operate. Also ground your body when handling the products and store the products in an anti-electrostatic container.

9.4 Storage

Store the products in a dark place where the temperature is within the range of $25\pm 10^{\circ}\text{C}$ and with low humidity (60%RH or less). Do not store the LCD product in an atmosphere containing organic solvents or corrosive gases.

9.5 Cleaning

Do not wipe the polarizer with dry cloth, as it might cause scratching. Wipe the polarizer with a soft cloth soaked with petroleum IPA. Other chemical might damage the panel.

10. QC

10.1 目的

制定 15.6 寸模组产品出货检验标准，明确检验内容和规范；

10.2 范

适用于深光电有限公司, 使用原装模组、FOG 或自购 LCD 所生产的模组、FOG 出货；

10.3 定义

黑白点：显示的点是黑色或者白色，当对比变化时，这些缺陷大小或强度上没有变化；

亮点：显示中的点（子像素），显示区域显示为明亮，大小大于 1/2dot，通过 5% 的 ND 卡黑色画面下可见；

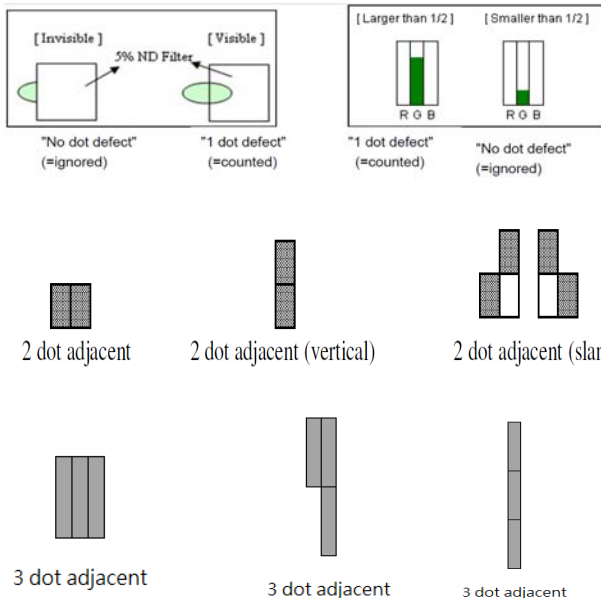
碎亮点：黑画面下看到的发亮的，大小小于 1/2dot 的点；

暗点：显示中的点（子像素），大小大于 1/2dot，红绿画面的显示区域显示为黑色；

Mura：相对于显示区域的部分背景亮度，部分区域更暗或者更亮的现象（显示画面不均匀）；

二连点：两个相邻的 dot 点；

三连点：三个相邻的 dot 点；



10.4 检验条件

10.4.1 环境要求：温度：25±5℃、湿度：30%–70%RH；

10.4.2 外观检验灯光：20w 荧光灯或等效照度；

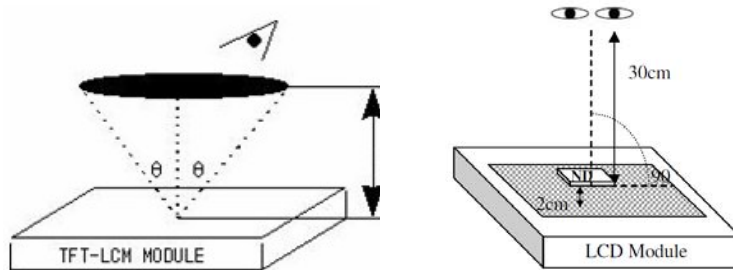
10.4.3 检验 离：30cm；

10.4.4 电性检验照度要求：100-200Lux；

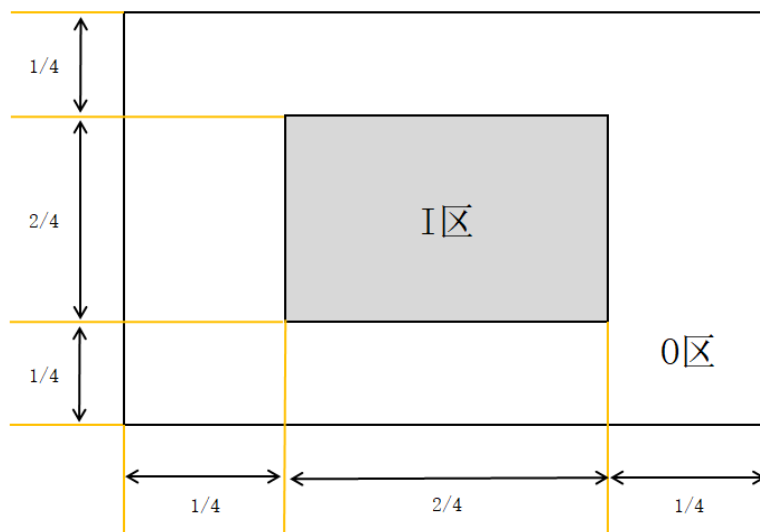
10.4.5 外观检验照度要求：500-700Lux；

10.4.6 ND 卡检验要求：ND 放于 cell 表面 2cm 处，从 30cm 离检验；

10.4.7 检验角度：做 直方向 $\pm 45^\circ$ ，水平方向 $\pm 45^\circ$ 夹角检验；



10.4.8 显示区域划分：将显示区长度和宽度方向 匀分为 4 等分，中间 2/4 区域为 I 区， 周为 0 区，见下：



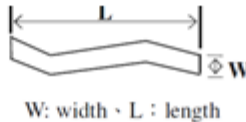
10.5 电性检测

| 检验项目 | 检验标准 | | | | | | | | | | | | | | | | | | | | | | | |
|--------------|--|----------------------|----------------------|--|-----|--------------|---|-----|--------------|---|------|----|------------|------|----|------------|-----|----|------|--|--|----|--|--|
| | A0 规 | | | A1 规 | | | A2 规 | | | A3 规 | | | A4 规 | | | B 规 | | | | | | | | |
| | I 区 | O 区 | 总数 | I 区 | O 区 | 总数 | I 区 | O 区 | 总数 | I 区 | O 区 | 总数 | I 区 | O 区 | 总数 | I 区 | O 区 | 总数 | | | | | | |
| 亮点 | N≤0 | | | N≤2 | | | N≤4 | | | N≤5 | | | N≤10 | | | 不计 | | | | | | | | |
| 二道亮点 | N≤0 | | | N≤0 | | | N≤1 | | | D5W | | | N≤5 | | | N≤10 | | | 不计 | | | | | |
| 三道亮点 | N≤0 | | | N≤0 | | | N≤0 | | | 5mm | | | N≤5 | | | N≤10 | | | 不计 | | | | | |
| 暗点 | N≤1 | N≤3, D5 W 10mm | N≤3, D5 W 10mm | N≤4, D5 W 10mm | | N≤5, D5 W | N≤7 | | N≤7, D5 W | | N≤10 | | | N≤20 | | | 不计 | | | | | | | |
| 二道暗点 | N≤0 | | | N≤1 | | | 10mm | | | N≤2, D5 ≥5mm | | | 5mm | | | N≤7 | | | N≤20 | | | 不计 | | |
| 三道暗点 | N≤0 | | | N≤0 | | | 10mm | | | N≤1 | | | 5mm | | | N≤7 | | | N≤20 | | | 不计 | | |
| 亮点+暗点 | N≤0, D5 ≥10mm | | | N≤5, D5 ≥10mm | | | N≤7, D5 ≥5mm | | | / | | | / | | | / | | | / | | | | | |
| 脏亮点 | 10%ND 遮挡不可见, 无视 | | | 5%ND 遮挡不可见, 无视 | | | 不计 (漏测且不可) | | | 不计 (漏测且不可) | | | 不计 (漏测且不可) | | | 不计 (漏测且不可) | | | 不计 | | | | | |
| 点状异物点 黑白点 | D≤0.15mm, 数量 N 不计; 0.15mm<D≤0.3mm, N≤3; 同径≥10mm; 0.3mm<D≤0.4mm, N≤1 | | | D≤0.3mm, 数量 N 不计; 0.3mm<D≤0.8mm, N≤3; 同径≥10mm; | | | D≤0.3mm, 数量 N 不计; 0.3mm<D≤0.8mm, N≤3; 同径≥10mm; 0.8mm<D≤1.2mm, N≤4; | | | 不计 | | | 不计 | | | 不计 | | | | | | | | |
| 线状异物 | W≤0.1mm, L≤0.3mm, 不计; W≤0.1mm, L≤2mm, N≤2, D5 ≥10mm; | | | W≤0.1mm, 不计; 0.1mm<W≤0.2mm, 0.5mm<L≤4mm, N≤3; | | | W≤0.1mm, 不计; 0.1mm<W≤0.3mm, 0.5mm<L≤5mm, N≤3; | | | W≤0.1mm, 不计; 0.1mm<W≤0.5mm, 0.5mm<L≤4mm, N≤5; | | | 不计 | | | 不计 | | | | | | | | |
| POL 气泡 | D≤0.2mm, 不计; 0.2mm<D≤0.8mm, N≤2, D5 ≥10mm 线状按线状异物判定 | | | 线状及点状不良参照异物 标准; 边缘气泡不进入 3M 区 1/2 为 OK | | | 线状及点状不良参照异物 标准; 边缘气泡不进入显示区为 OK | | | 不计 | | | 5%ND 遮挡不可见 | | | 不计 | | | | | | | | |
| Mura | 1. 全视角判定, 距离 50mm-80mm 不可见为 OK 2. 制程 mura 按 10%ND 遮挡 不可见为 OK | | | RGB 和灰阶漏固不可见, 漏 固固可见, 不计 | | | 5%ND 遮挡不可见 | | | 5%ND 遮挡不可见 | | | 不影响电性 OK | | | 不计 | | | | | | | | |
| 功能缺陷 | 显示异常、断线(横线、竖线等)、无品、等影响功能的不良不可有 | | | | | | | | | | | | | | | | | | | | | | | |

10.6 外观检验

| 检验项目 | 图示 | 检验标准 | | | | | |
|-------------|----|--|------|------|--------------------------------------|------|-----|
| | | A0 规 | A1 规 | A2 规 | A3 规 | A4 规 | B 规 |
| FAD 区角落破损 | | I≤1.5mm, Y≤1.5mm, Z≤T, N≤2 不伤及线路, 显示正常 | | | 不伤及线路, 显示正常 | | |
| FAD 区边缘破损 | | Y≤0.5, I≤2.0, Z≤T, N≤2 不伤及线路, 显示正常 | | | 不伤及线路, 显示正常 | | |
| 非 FAD 区角落破损 | | I≤1.5mm, Y≤1.5mm, Z≤T, N≤2, 不伤及线路, 显示正常 | | | 不伤及线路, 显示正常 | | |
| 非 FAD 区边缘破损 | | I≤1.5mm, Y≤0.5mm, Z≤T, N 不计, 不伤及线路, 显示正常 | | | 不伤及线路, 显示正常 | | |
| 表面点 | 无图 | D≤0.3mm, 数量 N 不计; 0.3mm<D≤0.8mm, N≤3, 间距≥10mm; | | | 不计 | | |
| 表面划伤 | 无图 | W≤0.1mm, 不计; 0.1mm<W≤0.2mm, 0.8mm<L≤4mm, N≤3; | | | 不计 | | |
| FPC/PCB | 无图 | 1. 定位孔破损不可有 2. FPC 死折不可有 3. 元件脱落不可有 4. 元件虚焊、溢锡等焊接不良不可有 5. 金手指断、裂不可有 6. 元件卡不到位不可有 7. FPC 翘起对位偏移不可有 8. FPC 上双面胶脱落或异常不可有 9. 指套不能松动, 不影响插拔 | | | 1. 元件脱落, 不可有 2. 元件虚焊、溢锡等焊接不良, 不可有 | | |
| 保护膜 | 无图 | 1. 划伤不可有, 其他划伤、印记等无视 2. 易撕胶按图粘贴附 | | | 有保护膜 | | |
| 裂纹 | | 不可有 | | | | | |

- 1. W : Width
- 2. L : Length
- 3. D : Average Diameter
- 4. N : Count



10.7 质 期限

10.7.1 修 12 个月 (如有合同, 以合同为准)。