



# Shenzhen Leadtek Electronics Co.,Ltd

PRODUCT SPECIFICATION

TFT-LCD MODULE

Module No: LTK123FHCGT17-V2

- ☒ Preliminary Specification
- ☐ Approval Specification

| Designed by | Checked by | Approved by |
|-------------|------------|-------------|
| jona        | tom        | lan         |

Final Approval by Customer

| Approved by | Comment |
|-------------|---------|
|             |         |

※The specification of “TBD” should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.





# Revision History

| Version | Contents                                                    | Date       | Note |
|---------|-------------------------------------------------------------|------------|------|
| V0      | New                                                         | 2023.07.05 |      |
| V1      | Optimize the display                                        | 2023.08.12 |      |
| V2      | Modify the backlight brightness as wall as drive parameters | 2023.10.15 |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
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|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |
|         |                                                             |            |      |



# 1. General Specifications

| No. | Item                  | Specification                     | Remark |
|-----|-----------------------|-----------------------------------|--------|
| 1   | LCD size              | 12.3 inch                         |        |
| 2   | Driver element        | a-Si TFT active matrix            |        |
| 3   | Resolution            | 1920RGB (W) x 720(H)              |        |
| 4   | Display mode          | Normally Black                    |        |
| 5   | Dot pitch             | 0.1520 (W) x 0.1520(H)            |        |
| 6   | Active area           | 292.03(W) x 109.51(H) mm          |        |
| 7   | CG+LCM Module size    | 335.50 (W) ×146.00(H) ×8.89(D) mm | Note   |
| 8   | View direction        | ALL                               |        |
| 9   | Color arrangement     | RGB-stripe                        |        |
| 10  | Interface             | LVDS                              |        |
| 11  | Lcm power consumption | ( 10.80 )                         | W      |
| 12  | Driver IC             | HX82102-A+HX8692-A*2              |        |
| 13  | Weight                | TBD                               |        |
| 14  | Surface treatment     | HC( Glare)                        |        |

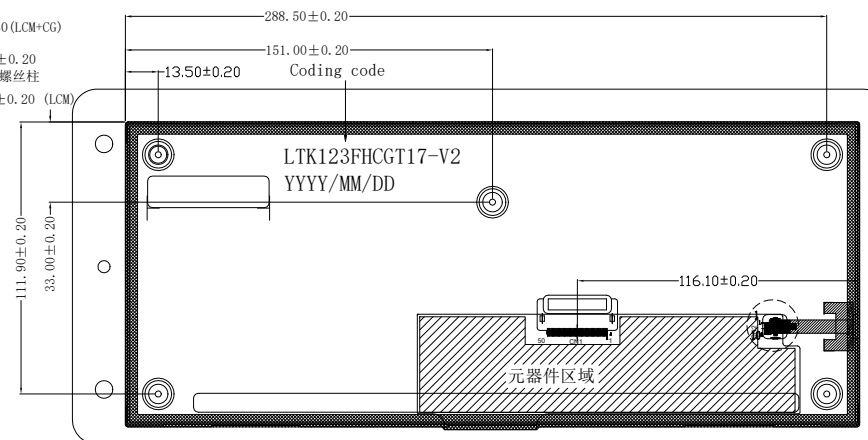
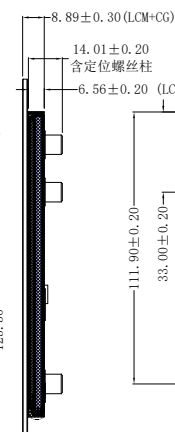
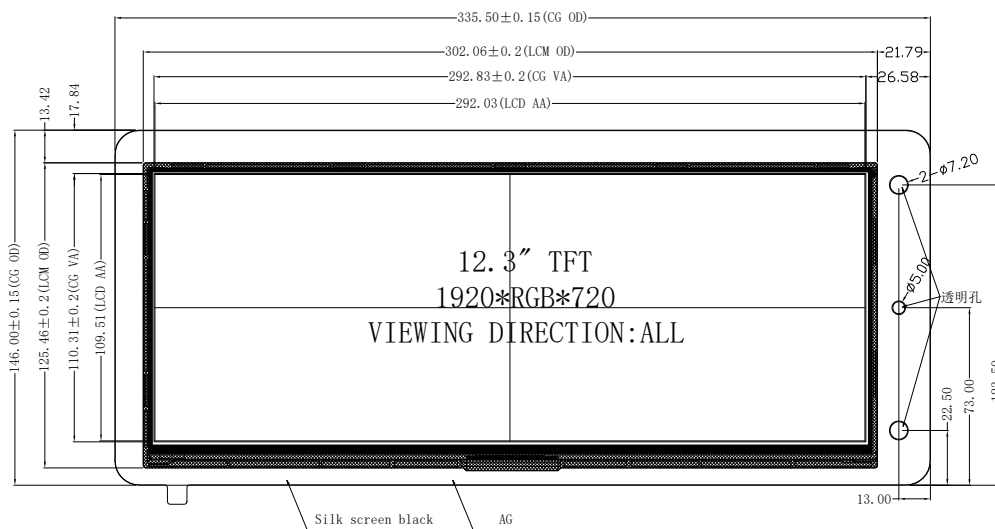
Note 1: Refer to Mechanical Drawing.

## 1.1 Mechanical Drawing

## Front View

## Side View

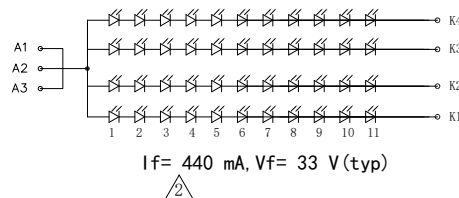
## Back View



1. Cover LENS material: Asahi, tempered glass with a warpage of  $\leq 0.3\text{mm}$ , Surface hardness  $\geq 6\text{H}$  (1000gf), CS>450Mpa, DOL>10um, 4PB>450Mpa;
2. The total thickness of ink is  $\leq 15\text{um}$ , and the total thickness of button screen printing ink is  $\leq 15\text{um}$ ;
3. Secondary black vision window with an external expansion of 0.7mm/four corner chamfer of 0.5mm;; Printing version  $\leq 3$ , using matte black ink with a surface energy of  $\geq 32$  dynes. The edges of the ink should not accumulate ink, and the base color area should not be transparent;
3. There should be no scratches or foreign objects, please pay attention to cleanliness,
4. Dropping condition: 130g/60cm, center point OK three times; High temperature and humidity conditions: +80 °C/RH95%/240h;
5. The key silk screen does not indicate a tolerance of  $\pm 0.03\text{mm}$ , while other dimensions do not indicate a tolerance of  $\pm 0.1\text{mm}$ . The marked size is the key controlled size;
6. Comply with ROHS standards;

## Notes:

1. Display : 12.3", TFT
2. Resolution: 1920xRGBx720
3. LCD Viewing Direction: ALL,
4. Drive IC: HX82102-A+HX8692-A
5. Display Mode: Normally Black/Transmissive
6. LCM Brightness: 1200cd/m<sup>2</sup> (TYP)  
LCM+CTP Brightness: 1000cd/m<sup>2</sup> (TYP), uniformity  $\geq 80\%$
7. unmark Tolerance:  $\pm 0.2$
8. OPERATING TEMP: -30° C ~ +85° C
9. STORAGE TEMP: -40° C ~ +90° C
10. Requirements on Environmental Protection: ROHS



| PIN | Definition | PIN | Definition |
|-----|------------|-----|------------|
| 1   | GND        | 26  | ERXCLKIN-  |
| 2   | NC/BIST    | 27  | ERXCLKIN+  |
| 3   | VCC        | 28  | ERXIN3-    |
| 4   | VCC        | 29  | ERXIN3+    |
| 5   | GND        | 30  | GND        |
| 6   | GND        | 31  | FAULT      |
| 7   | NC         | 32  | RESET      |
| 8   | NC         | 33  | STBYB      |
| 9   | GND        | 34  | NC         |
| 10  | ORXIN0-    | 35  | NC         |
| 11  | ORXIN0+    | 36  | NC         |
| 12  | ORXIN1-    | 37  | NC         |
| 13  | ORXIN1+    | 38  | GND        |
| 14  | ORXIN2-    | 39  | GND        |
| 15  | ORXIN2+    | 40  | NC         |
| 16  | ORXCLKIN-  | 41  | LEDA       |
| 17  | ORXCLKIN+  | 42  | LEDA       |
| 18  | ORXIN3-    | 43  | LEDA       |
| 19  | ORXIN3+    | 44  | NC         |
| 20  | ERXIN0-    | 45  | LEDK       |
| 21  | ERXIN0+    | 46  | LEDK       |
| 22  | ERXIN1-    | 47  | LEDK       |
| 23  | ERXIN1+    | 48  | LEDK       |
| 24  | ERXIN2-    | 49  | NTC A      |
| 25  | ERXIN2+    | 50  | NTC K      |



LEADTEK DISPLAY

LEADTEK COMPANY LIMITED

|     |                                                             |            |      |
|-----|-------------------------------------------------------------|------------|------|
| 2   | Modify the backlight brightness as well as drive parameters | 2023.09.14 | JACK |
| 3   | Optimize the display                                        | 2023.07.20 | IAN  |
| 4   | NEW                                                         | 2023.07.03 | IAN  |
| REV | DESCRIPTION                                                 | DATE       | NAME |

|              |               |           |         |       |       |
|--------------|---------------|-----------|---------|-------|-------|
| SCALE: 1/1   | UNIT: mm      | PAGE: 1/1 | Approve | Check | Drawn |
| Part No:     | LTK123FHCGT17 | VER: V2   | IAN     | JONA  | JACK  |
| Customer No: |               |           |         |       |       |

## 2. Pin Assignment

LCM- Connector is used for the module electronics interface. The recommended model is FH52 E — 50 (25) S B — 0.5 SH (##)manufactured by Aorara.

| Pin No. | Symbol    | I/O | Function                                              | Remark |
|---------|-----------|-----|-------------------------------------------------------|--------|
| 1       | GND       | P   | Ground                                                |        |
| 2       | BIST/NC   | --- | No connect                                            |        |
| 3       | VCC       | P   | Main Power Supply                                     |        |
| 4       | VCC       | P   | Main Power Supply                                     |        |
| 5       | GND       | P   | Ground                                                |        |
| 6       | GND       | P   | Ground                                                |        |
| 7       | NC        | --- | No connect                                            |        |
| 8       | NC        | --- | No connect                                            |        |
| 9       | GND       | P   | Ground                                                |        |
| 10      | ORXIN0-   | I   | Odd pixel negative LVDS differential data input(O0-)  |        |
| 11      | ORXIN0+   | I   | Odd pixel positive LVDS differential data input(O0+)  |        |
| 12      | ORXIN1-   | I   | Odd pixel negative LVDS differential data input(O1-)  |        |
| 13      | ORXIN1+   | I   | Odd pixel positive LVDS differential data input(O1+)  |        |
| 14      | ORXIN2-   | I   | Odd pixel negative LVDS differential data input(O2-)  |        |
| 15      | ORXIN2+   | I   | Odd pixel positive LVDS differential data input(O2+)  |        |
| 16      | ORXCLKIN- | I   | Odd pixel negative LVDS differential CLK input(OCLK-) |        |
| 17      | ORXCLKIN+ | I   | Odd pixel positive LVDS differential CLK input(OCLK+) |        |
| 18      | ORXIN3-   | I   | Odd pixel negative LVDS differential data input(O3-)  |        |
| 19      | ORXIN3+   | I   | Odd pixel positive LVDS differential data input(O3+)  |        |
| 20      | ERXIN0-   | I   | Even pixel negative LVDS differential data input(E0-) |        |
| 21      | ERXIN0+   | I   | Even pixel positive LVDS differential data input(E0+) |        |
| 22      | ERXIN1-   | I   | Even pixel negative LVDS differential data input(E1-) |        |
| 23      | ERXIN1+   | I   | Even pixel positive LVDS differential data input(E1+) |        |
| 24      | ERXIN2-   | I   | Even pixel negative LVDS differential data input(E2-) |        |

|    |           |     |                                                        |  |
|----|-----------|-----|--------------------------------------------------------|--|
| 25 | ERXIN2+   | I   | Even pixel positive LVDS differential data input(E2+)  |  |
| 26 | ERXCLKIN- | I   | Even pixel negative LVDS differential CLK input(ECLK-) |  |
| 27 | ERXCLKIN+ | I   | Even pixel positive LVDS differential CLK input(ECLK+) |  |
| 28 | ERXIN3-   | I   | Even pixel negative LVDS differential data input(E3-)  |  |
| 29 | ERXIN3+   | I   | Even pixel positive LVDS differential data input(E3+)  |  |
| 30 | GND       | P   | Ground                                                 |  |
| 31 | FAULT     | --- | FAULT signal output(normal=H, abnormal=L)              |  |
| 32 | RESETB    | I   | Global reset pin, active low.                          |  |
| 33 | STBYB     | I   | Standby mode setting pin, active low.                  |  |
| 34 | NC        | I   | No connect                                             |  |
| 35 | NC        | I   | No connect                                             |  |
| 36 | NC        | I   | No connect                                             |  |
| 37 | NC        | I   | No connect                                             |  |
| 38 | GND       | P   | Ground                                                 |  |
| 39 | GND       | P   | Ground                                                 |  |
| 40 | NC        | -I  | No connect                                             |  |
| 41 | LEDA      | P   | LED ANODE (A)                                          |  |
| 42 | LEDA      | P   | LED ANODE (A)                                          |  |
| 43 | LEDA      | P   | LED ANODE (A)                                          |  |
| 44 | NC        | I   | No connect                                             |  |
| 45 | LEDK1     | P   | LED CATHODE(K1)                                        |  |
| 46 | LEDK2     | P   | LED CATHODE(K2)                                        |  |
| 47 | LEDK3     | P   | LED CATHODE(K3)                                        |  |
| 48 | LEDK4     | P   | LED CATHODE(K4)                                        |  |
| 49 | NTC_A     | P   | NTC ANODE                                              |  |
| 50 | NTC_K     | P   | NTC CATHODE                                            |  |

I: input; O: output; P: Power or Ground(0V).

## 3. Operation Specifications

### 3.1. Absolute Maximum Ratings

(Note 1)

| Item                  | Symbol          | Values |      | Unit | Remark |
|-----------------------|-----------------|--------|------|------|--------|
|                       |                 | Min.   | Max. |      |        |
| Power voltage         | VCC             | -0.3   | 4.0  | V    | TA=25℃ |
| Operation Temperature | T <sub>OP</sub> | -30    | 85   | ℃    |        |
| Storage Temperature   | T <sub>ST</sub> | -40    | 90   | ℃    |        |

Note1 : The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

### 3.2. Typical Operation Conditions

Test condition: GND=0V, TA=25 °C

| Item                      | Symbol          | Values  |      |         | Unit | Remark |
|---------------------------|-----------------|---------|------|---------|------|--------|
|                           |                 | Min.    | Typ. | Max.    |      |        |
| Digital Operating voltage | VCC             | 3.0     | 3.3  | 3.6     | V    |        |
| High Level Input Voltage  | V <sub>IH</sub> | 0.7 VCC | -    | VCC     | V    |        |
| Low Level Input Voltage   | V <sub>IL</sub> | 0       | -    | 0.3 VCC | V    |        |

### 3.3. Current Consumption

#### 3.3.1 Current for LCD Driver

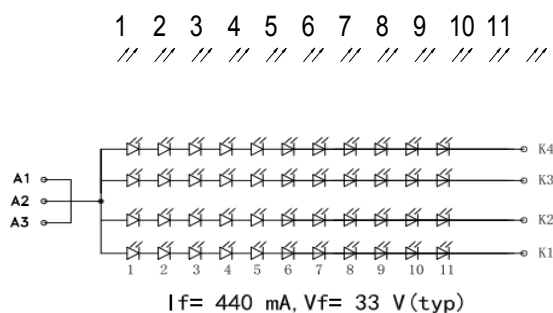
| Item                    | Symbol | Values |       |      | Unit | Remark   |
|-------------------------|--------|--------|-------|------|------|----------|
|                         |        | Min.   | Typ.  | Max. |      |          |
|                         | Ivcc   | -      | 120   | 250  | mA   | VCC=3.3V |
| Total Power Consumption | LCD    | -      | 0.396 |      | W    |          |

#### 3.3.2 Current for LED Driver

| Item                      | Symbol         | Values |       |      | Unit | Remark |
|---------------------------|----------------|--------|-------|------|------|--------|
|                           |                | Min.   | Typ.  | Max. |      |        |
| Voltage for LED Backlight | V <sub>L</sub> | 31.9   | 33    | -    | V    | Note 1 |
| Current for LED Backlight | I <sub>L</sub> | -      | 440   | -    | mA   |        |
| BL Power Consumption      | BL             | -      | 10.80 | -    | W    |        |
| LED life time             | -              | 50,000 | -     | -    | Hrs  | Note 2 |

Note1: V<sub>L</sub>=33V, I<sub>L</sub>=440mA (Backlight circuit:11series connection, 4 parallel connection), the ambient temperature is 25℃.

#### LED CIRCUIT DIAGRAM



#### NTC CIRCUIT DIAGRAM

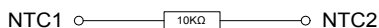


Fig. 3-1 LED test circuit diagram

Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and 1/2 rated current. The LED lifetime could be decreased if operating I<sub>L</sub> is larger than 320 mA.

### 3.3.3 Backlight NTC Resistor

Murata NTC Specification NCP15XH103F03RC

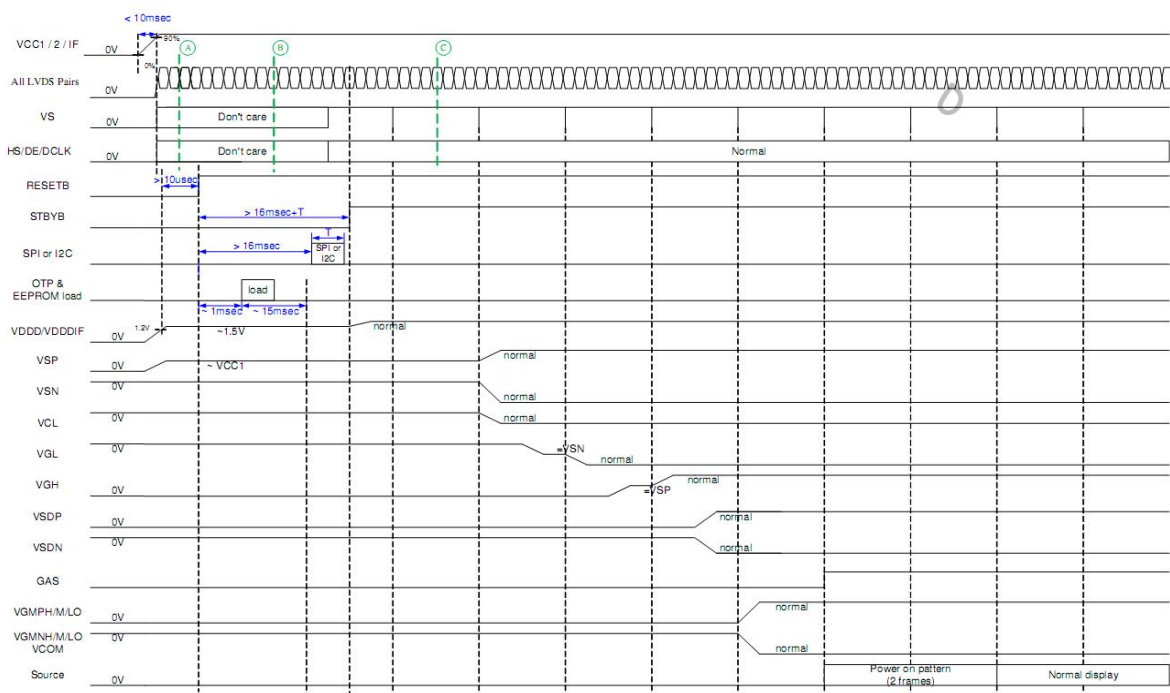
R25 10k ohm  $\pm 1\%$

B(25/50) 3380K  $\pm 1\%$

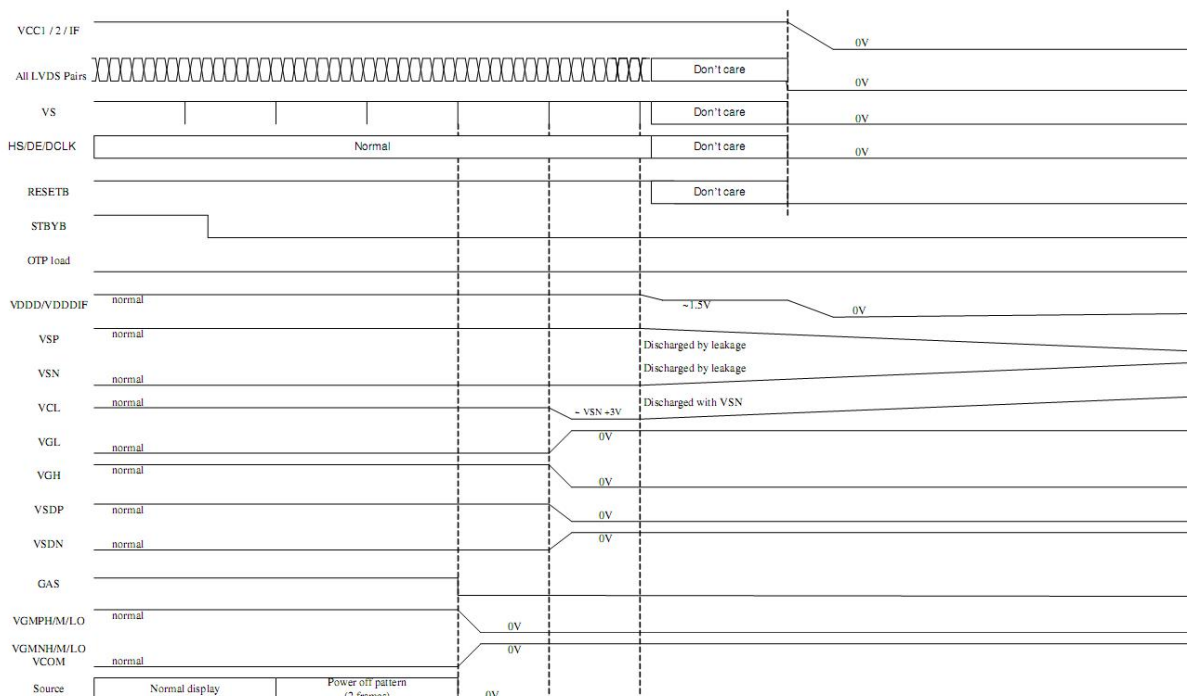
| TEMP.    | R-low    | R-center | R-high   |
|----------|----------|----------|----------|
| (deg. C) | (k ohm)  | (k ohm)  | (k ohm)  |
| -40      | 188.0202 | 195.652  | 203.5731 |
| -35      | 142.7877 | 148.171  | 153.7418 |
| -30      | 109.5221 | 113.3471 | 117.294  |
| -25      | 84.8227  | 87.5588  | 90.3741  |
| -20      | 66.2694  | 68.2367  | 70.2554  |
| -15      | 52.2283  | 53.6496  | 55.104   |
| -10      | 41.4765  | 42.5062  | 43.557   |
| -5       | 33.1462  | 33.8922  | 34.6515  |
| 0        | 26.678   | 27.2186  | 27.7675  |
| 5        | 21.6294  | 22.0211  | 22.4175  |
| 10       | 17.643   | 17.9255  | 18.2107  |
| 15       | 14.4712  | 14.6735  | 14.8772  |
| 20       | 11.9371  | 12.0805  | 12.2244  |
| 25       | 9.9      | 10       | 10.1     |
| 30       | 8.2162   | 8.3145   | 8.4132   |
| 35       | 6.8534   | 6.9479   | 7.043    |
| 40       | 5.7443   | 5.8336   | 5.9238   |
| 45       | 4.8333   | 4.9169   | 5.0015   |
| 50       | 4.0833   | 4.1609   | 4.2395   |
| 55       | 3.4634   | 3.535    | 3.6076   |
| 60       | 2.9486   | 3.0143   | 3.0812   |
| 65       | 2.5259   | 2.5861   | 2.6476   |
| 70       | 2.1724   | 2.2275   | 2.2839   |
| 75       | 1.8741   | 1.9245   | 1.9761   |
| 80       | 1.6225   | 1.6685   | 1.7157   |
| 85       | 1.4101   | 1.4521   | 1.4952   |
| 90       | 1.2296   | 1.268    | 1.3074   |
| 95       | 1.0746   | 1.1096   | 1.1456   |
| 100      | 0.9419   | 0.9738   | 1.0067   |
| 105      | 0.8288   | 0.858    | 0.8881   |
| 110      | 0.7313   | 0.758    | 0.7856   |
| 115      | 0.6471   | 0.6715   | 0.6968   |
| 120      | 0.574    | 0.5964   | 0.6196   |
| 125      | 0.5106   | 0.5311   | 0.5524   |

## 3.4. Power Sequence

### a. Power on:



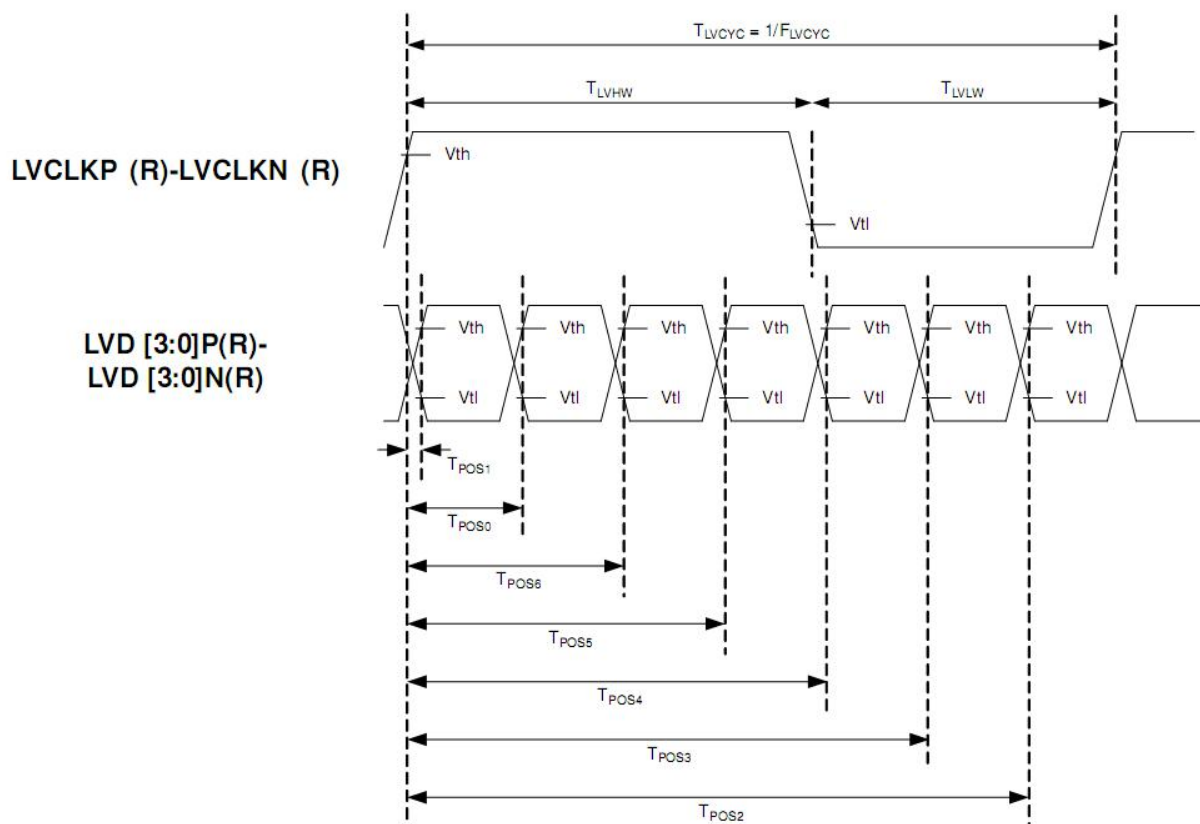
### b. Power off



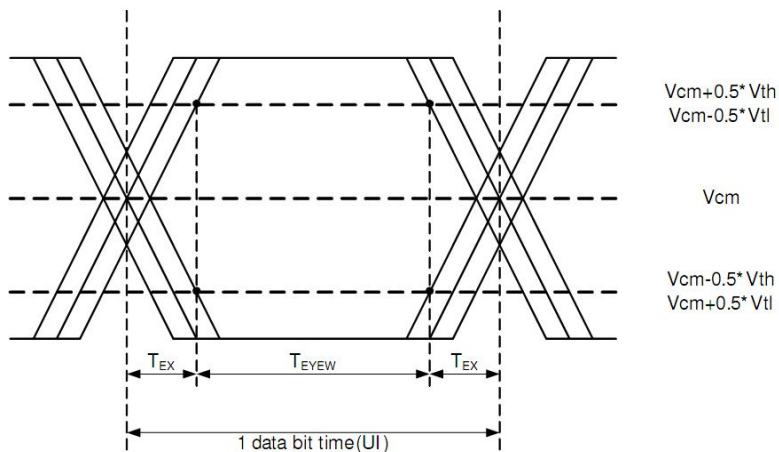
## 3.5. LVDS Signal Timing Characteristics

### 3.5.1. AC Electrical Characteristics

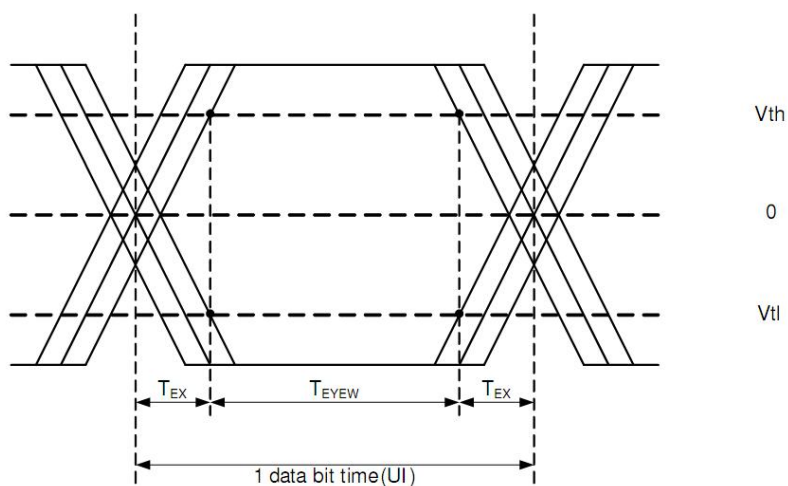
| Parameter         | Symbol          | Spec. |      |      | Unit   |
|-------------------|-----------------|-------|------|------|--------|
|                   |                 | Min.  | Typ. | Max. |        |
| Clock frequency   | FLVCYC          | 20    | -    | 85   | MHz    |
| Clock period      | TLVCYC          | 11.76 | -    | -    | ns     |
| 1 data bit time   | UI              | -     | 1/7  | -    | TLVCYC |
| Clock high time   | TLVCH           | 3.9   | 4    | 4.1  | UI     |
| Clock low time    | TLVCL           | 2.9   | 3    | 3.1  | UI     |
| Position 1        | TPOS1           | -0.2  | 0    | 0.2  | UI     |
| Position 0        | TPOS0           | 0.8   | 1    | 1.2  | UI     |
| Position 6        | TPOS6           | 1.8   | 2    | 2.2  | UI     |
| Position 5        | TPOS5           | 2.8   | 3    | 3.2  | UI     |
| Position 4        | TPOS4           | 3.8   | 4    | 4.2  | UI     |
| Position 3        | TPOS3           | 4.8   | 5    | 5.2  | UI     |
| Position 2        | TPOS2           | 5.8   | 6    | 6.2  | UI     |
| Input eye width   | TEYEW           | 0.6   | -    | -    | UI     |
| Input eye border  | T <sub>EX</sub> | -     | -    | 0.2  | UI     |
| LVDS wake up time | TENLVDS         | -     | -    | 150  | us     |



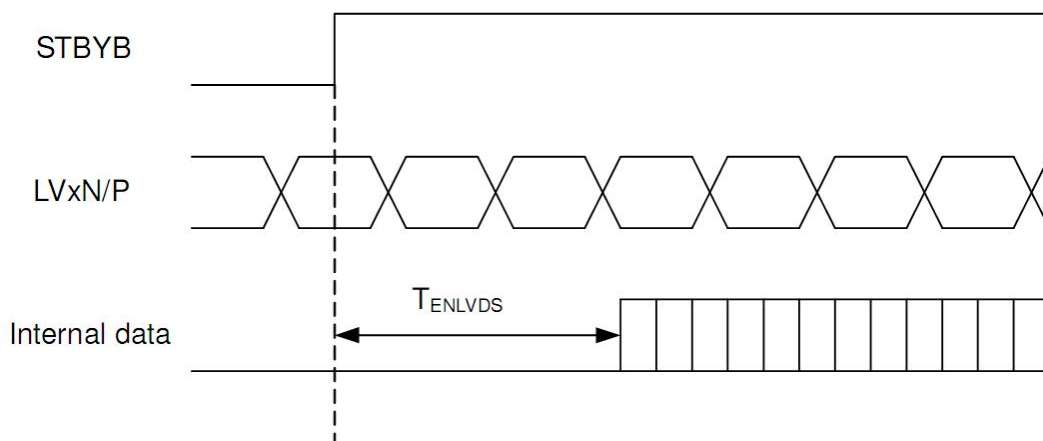
**Single-ended:**  
LVD [3:0]P,  
LVD [3:0]N



**Differential:**  
LVD [3:0]P-LVD [3:0]N



LVDS input eye diagram



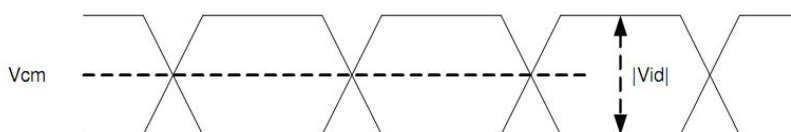
The LVDS receiver can support spread spectrum clock (SSC). Limitation is listed as below.

| Parameter            | Symbol            | Condition                                                | Spec. |      |     | Unit |
|----------------------|-------------------|----------------------------------------------------------|-------|------|-----|------|
|                      |                   |                                                          | Min.  | Typ. | Max |      |
| Modulation Frequency | SSC <sub>MF</sub> | LVDS clock frequency center at 80MHz                     | -     | -    | 200 | KHz  |
|                      |                   | LVDS clock frequency center at 60MHz                     | -     | -    | 150 | KHz  |
|                      |                   | LVDS clock frequency center at 40MHz                     | -     | -    | 100 | KHz  |
|                      |                   | LVDS clock frequency center at 20MHz                     | -     | -    | 50  | KHz  |
| Modulation Rate      | SSC <sub>MR</sub> | LVDS clock frequency + SSCMR in the range of 20MHz~85Mhz | -     | -    | ±3  | %    |

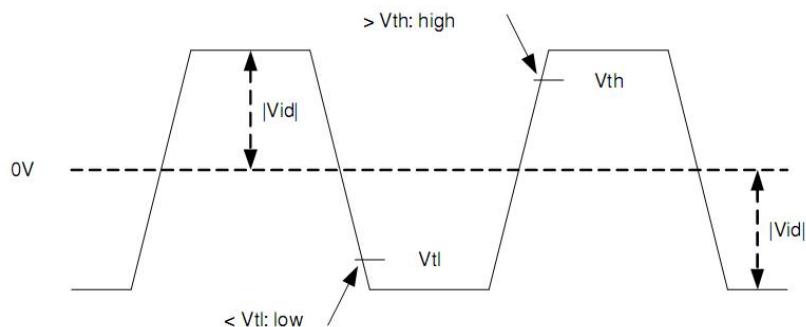
### 3.5.2. DC Electrical Characteristics

| Parameter                                 | Symbol              | Condition             | Spec. |      |                          | Unit |
|-------------------------------------------|---------------------|-----------------------|-------|------|--------------------------|------|
|                                           |                     |                       | Min.  | Typ. | Max.                     |      |
| Differential input high Threshold voltage | V <sub>th</sub>     | V <sub>cm</sub> =1.2V | -     | -    | +0.1                     | V    |
| Differential input low threshold voltage  | V <sub>tl</sub>     | -                     | -0.1  | -    | -                        | V    |
| Differential input common Mode voltage    | V <sub>CM</sub>     | -                     | 1     | 1.2  | 1.7- V <sub>id</sub>  /2 | V    |
| LVDS input voltage                        | V <sub>INLV</sub>   | -                     | 0.7   |      | 1.7                      | V    |
| Differential input voltage                | V <sub>id</sub>     | -                     | 0.1   | -    | 0.6                      | V    |
| Differential input leakage Current        | I <sub>lvleak</sub> | -                     | -10   | -    | +10                      | μA   |

**Single-ended:**  
LVCLKP(R),  
LVCLKN(R),  
LVD[3:0]P(R),  
LVD[3:0]N(R)



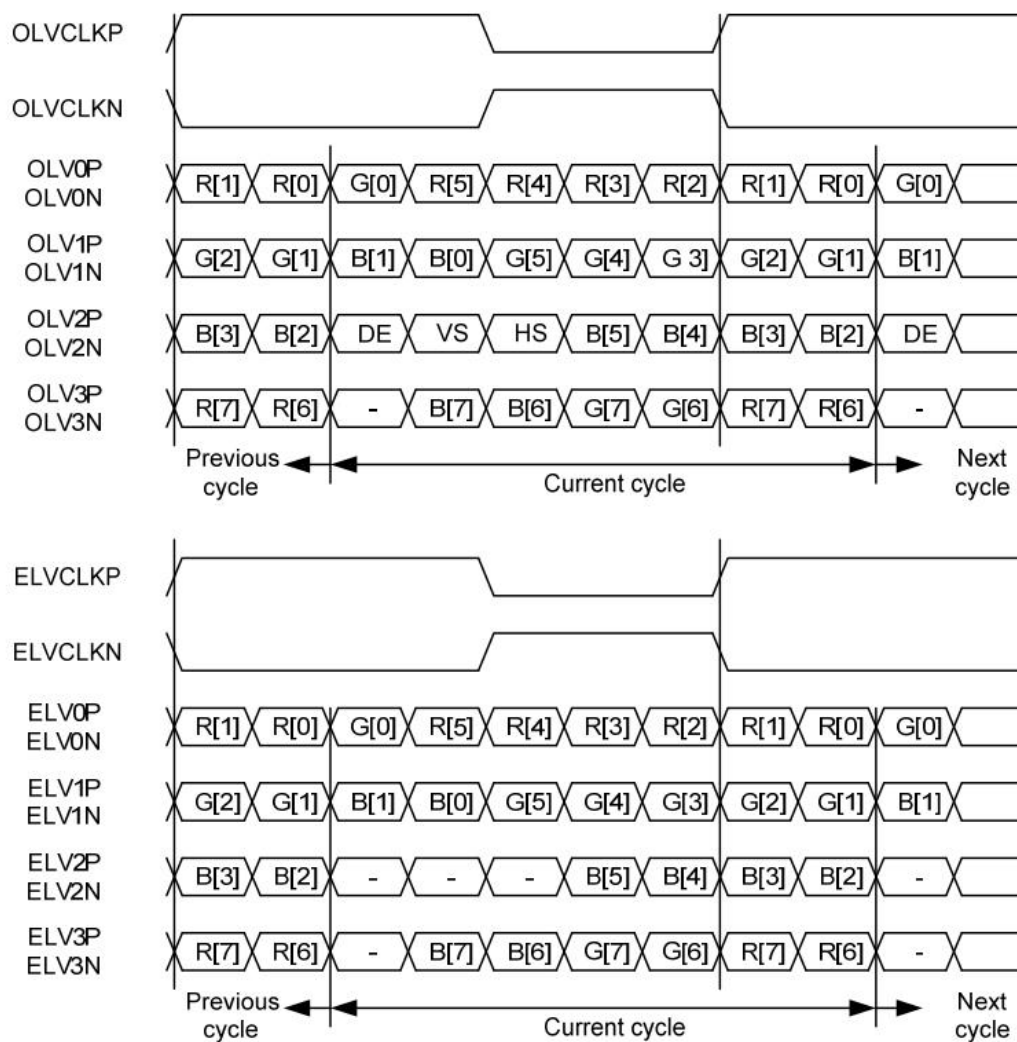
**Differential:**  
LVCLKP(R)-LVCLKN(R),  
LVD[3:0]P(R)-  
LVD[3:0]N(R)



### 3.5.3. Timing Controller

| Item                  | Symbol | 1920xRGBx720<br>(Two Port) |      |      | Unit | Remark              |
|-----------------------|--------|----------------------------|------|------|------|---------------------|
|                       |        | Min.                       | Typ. | Max. |      |                     |
| DCLK frequency        | Fclk   | 43.1                       | 44.1 | 70.1 | MHz  | Frame rate<br>=60Hz |
| Hsync period time     | Th     | 1002                       |      |      | DCLK |                     |
| Horizontal valid data | thd    | 1920                       |      |      | DCLK |                     |
| Hsync pulse Width     | thpw   | 10                         | 12   | 255  | DCLK |                     |
| Hsync back porch      | thbp   | 5                          | 16   | 255  | DCLK |                     |
| Hsync front porch     | thfp   | 24                         | 26   | 260  | DCLK |                     |
| Vsync period time     | Tv     | 733                        |      |      | H    |                     |
| Vertical valid data   | tvd    | 720                        |      |      | H    |                     |
| Vsync pulse width     | tpw    | 1                          | 3    | 20   | H    |                     |
| Vsync back porch      | tvbp   | 2                          | 5    | 255  | H    |                     |
| Vsync front porch     | tvfp   | 5                          | 8    | 260  | H    |                     |

### 3.5.4. LVDS Data Input Format



2-port LVDS signals, VESA format, 8-bit mode

## 4. Optical Specifications

| Item                                                                              | Symbol | Condition          | Specification |       |        | Unit | Remark           |
|-----------------------------------------------------------------------------------|--------|--------------------|---------------|-------|--------|------|------------------|
|                                                                                   |        |                    | Min.          | Typ.  | Max.   |      |                  |
| Response time                                                                     | Tr+Tf  | $\theta = 0^\circ$ | -             |       | 22     | ms   | Note 1           |
| Contrast ratio                                                                    | CR     | $\theta = 0^\circ$ | 1100          | 1300  | -      |      | Note 2           |
| Viewing angle                                                                     | Top    | $CR \geq 10$       | -             | 80    | -      | deg. | Note 3           |
|                                                                                   | Bottom |                    | -             | 80    | -      |      |                  |
|                                                                                   | Left   |                    | -             | 80    | -      |      |                  |
|                                                                                   | Right  |                    | -             | 80    | -      |      |                  |
| Color chromaticity<br>( CF only with OC, light<br>source is C light, CIE<br>1931) | Wx     | $\theta = 0^\circ$ | -0.015        | 0.309 | +0.015 | CIE  | Note 4<br>Note 5 |
|                                                                                   | Wy     |                    |               | 0.332 |        |      |                  |
|                                                                                   | Rx     |                    |               | 0.639 |        |      |                  |
|                                                                                   | Ry     |                    |               | 0.232 |        |      |                  |
|                                                                                   | Gx     |                    |               | 0.286 |        |      |                  |
|                                                                                   | Gy     |                    |               | 0.622 |        |      |                  |
|                                                                                   | Bx     |                    |               | 0.135 |        |      |                  |
|                                                                                   | By     |                    |               | 0.106 |        |      |                  |
| Color Gamut<br>(CF only, Base on C<br>Light)                                      | NTSC   | CIE1931            | -             | 72    | -      | %    |                  |
| Cross talk                                                                        | Ct     | $\theta = 0^\circ$ | -             | -     | 2%     | %    | Note 6,7         |
| Transmittance                                                                     | Trans  | $\theta = 0^\circ$ | 2.89          | 3.4   | -      | %    |                  |

## Note 1: Definition of viewing angle range

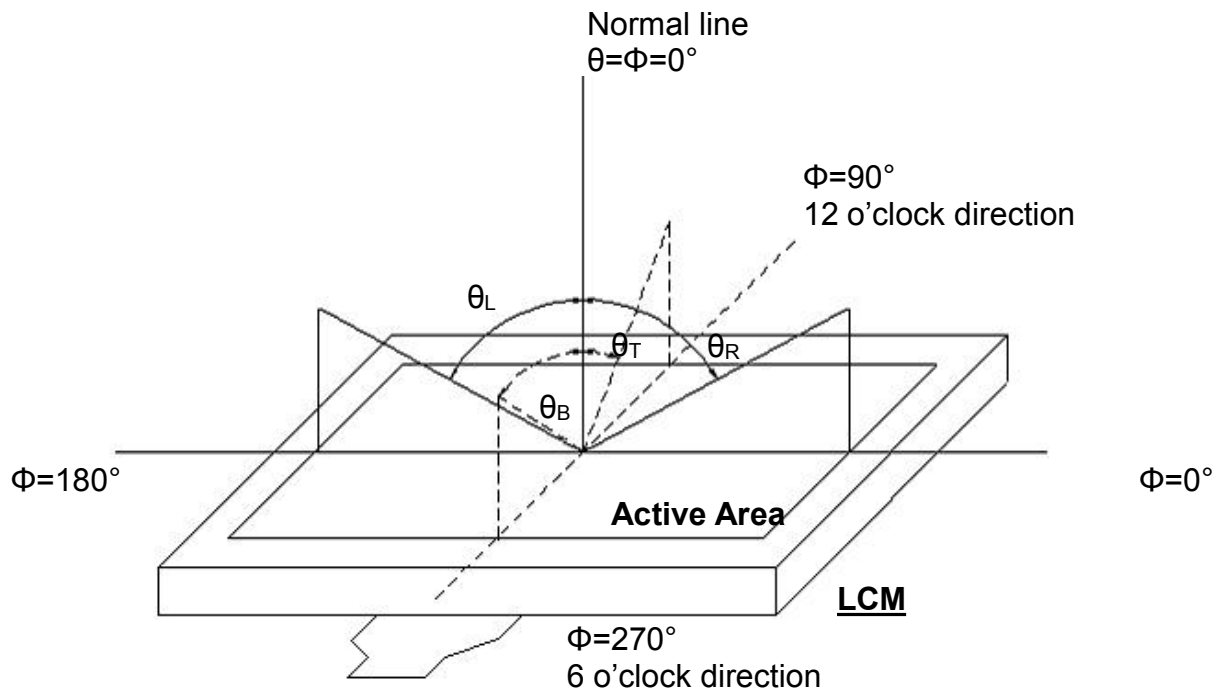


Fig. 4-2 Definition of viewing angle

## Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm, Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/ Field of view: 1° /Height: 500mm.) or CA-210.

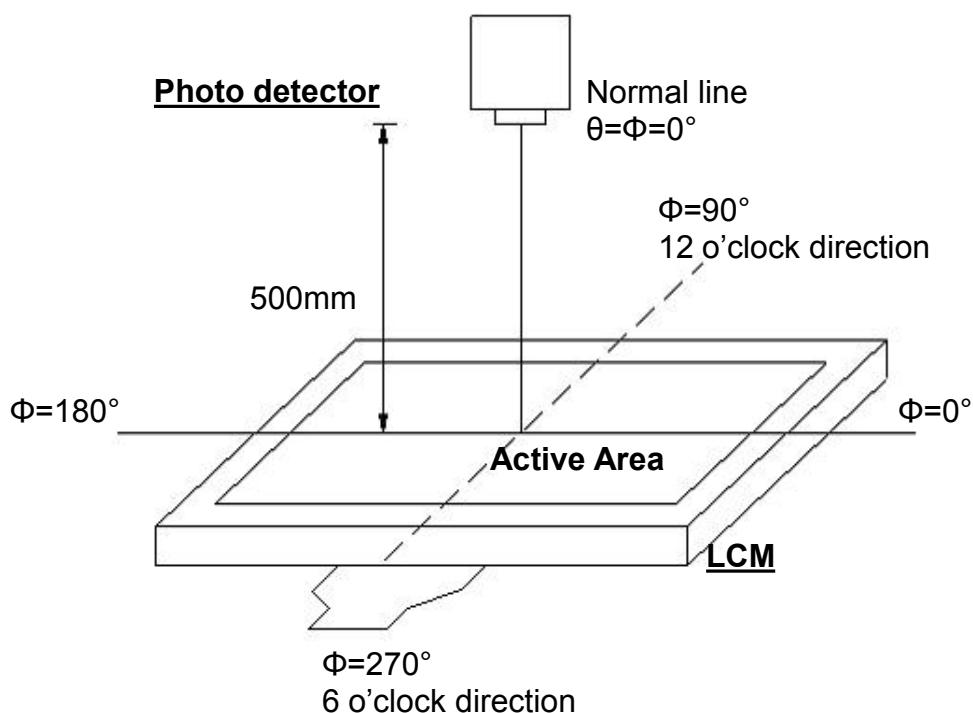


Fig. 4-3 Optical measurement system setup

### 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 ( $T_{ON}$ ) is the time between photo detector output intensity changed from 90% to 10%. And fall time ( $T_{OFF}$ ) is the time between photo detector output intensity changed from 10% to 90%.

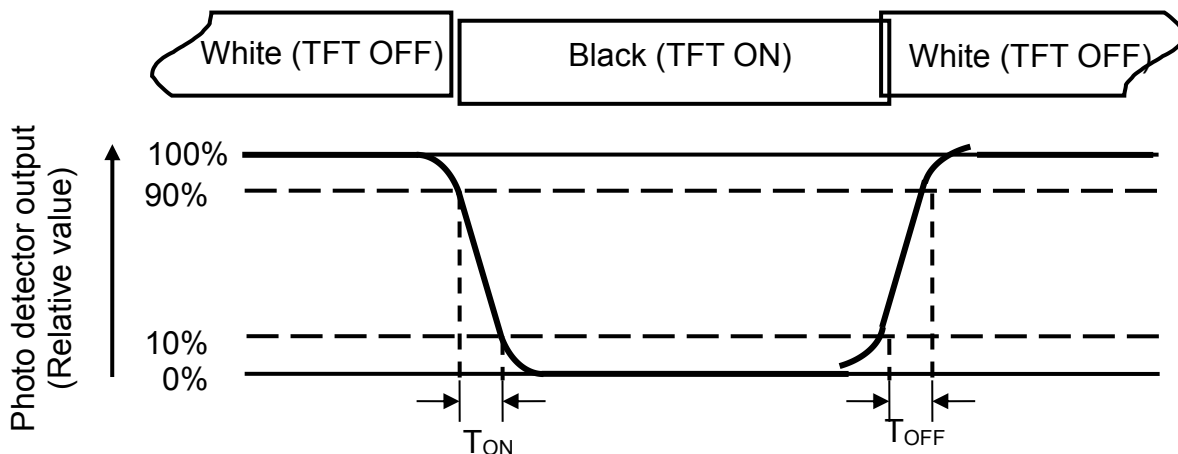


Fig. 4-4 Definition of response time

### Note 4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

### Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is  $I_L=320\text{mA}$ .

### Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas(Refer to Fig. 4-4).

Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{\min}}{B_{\max}}$$

L-----Active area length      W----- Active area width

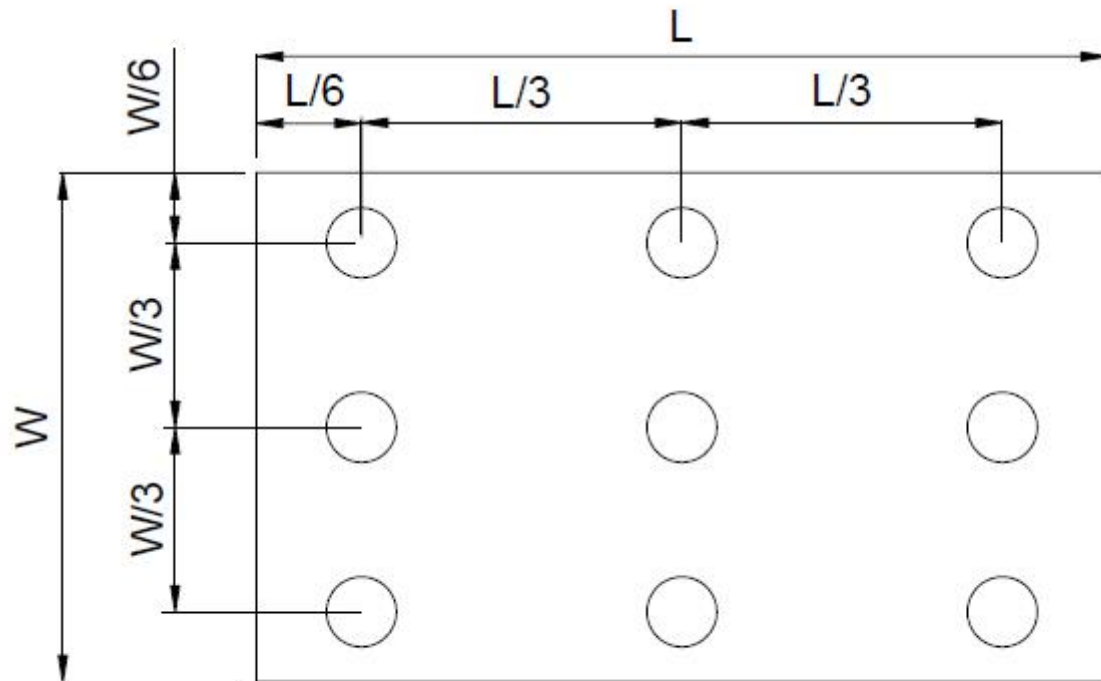


Fig. 4-4 Definition of measuring points

B<sub>MAX</sub>: The measured maximum luminance of all measurement position.

B<sub>MIN</sub>: The measured minimum luminance of all measurement position.

## 5. Reliability Test Items

| Item                                     | Test Conditions                                                                                                                                | Criterion |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| High Temperature Storage                 | Ta = 90℃ 120hrs                                                                                                                                | A,B,C,D,E |
| Low Temperature Storage                  | Ta = -40℃ 120hrs                                                                                                                               | A,B,C,D,E |
| High Temperature Operation               | Ts = 85℃ 120hrs                                                                                                                                | A,B,C,D,E |
| Low Temperature Operation                | Ta = -30℃ 120hrs                                                                                                                               | A,B,C,D,E |
| Operate at High Temperature and Humidity | +60℃, 90%RH 120hrs                                                                                                                             | A,B,C,D,E |
| Thermal Shock<br>(Non operation)         | -20℃/30 min ~ +70℃/30 min for a total 100 cycles, Start with cold temperature and end with high temperature.                                   | A,B,C,D,E |
| Vibration Test                           | Sweep:10Hz~55Hz~10Hz 2G<br>2 hours for each direction of X. Y. Z.<br>(6 hours for total)                                                       | A,B,C,D,E |
| Package Vibration Test                   | Random Vibration :<br>0.015G*G/Hz from 5-200HZ, -6dB/Octave<br>from 200-500HZ<br>2 hours for each direction of X. Y. Z.<br>(6 hours for total) | A,B,C,D,E |
| Package Drop Test                        | Height:60 cm<br>1 corner, 3 edges, 6 surfaces                                                                                                  | A,B,C,D,E |
| Electro Static Discharge                 | Contact=+/-8KV,<br>Air=+/-15KV,(R=330R,C=150pF), 1<br>sec,9point,10times/point;                                                                | A,B,C,D,E |

※Criterion:

A.LCM each function is OK,.

B.LCM appearance inspection without abnormalities (Including scratch, damage, corrosion and serious deformation)

C.LCM brightness above the Min. value of Spec.

D. Luminance uniformity above the Min. value of Spec.

E. Color chromaticity within tolerance range

## 6. Package Drawing

**TBD**

## 7. General Precautions

### 7.1. Safety

Liquid crystal is poisonous. Do not put it in your mouth. If liquid crystal touches your skin or clothes, wash it off immediately by using soap and water.

### 7.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.

2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.

3. To avoid contamination on the display surface, do not touch the module surface with bare hands.

4. Keep a space so that the LCD panels do not touch other components.

5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.

6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.

7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

### 7.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.

2. Do not apply voltage which exceeds the absolute maximum rating value.

### 7.4. Storage

1. Store the module in a dark room where must keep at  $25\pm 10^{\circ}\text{C}$  and 65%RH or less.

2. Do not store the module in surroundings containing organic solvent or corrosive gas.

3. Store the module in an anti-electrostatic container or bag.

### 7.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.

2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.



深圳市丽台电子有限公司

Shenzhen Leadtek Electronics Co.,Ltd

# Quality inspection standards

## 品质允收标准

MODEL No. / 产品型号: Applies 12.3 inches or more TFT-LCDPanel UPDATED DATE / 生效日期: 2022-05-20VERSION / 版本: A0

Customer Signature/客户签字: \_\_\_\_\_

**RECORD OF REVISION/修订履历:**

| Version<br>版本 | Revision Record<br>修订内容 | Compile<br>修订者 | Date of Revision<br>修订日期 |
|---------------|-------------------------|----------------|--------------------------|
| V0            | 首发/Starting             | Green          | 2022.05.20               |
|               |                         |                |                          |
|               |                         |                |                          |
|               |                         |                |                          |
|               |                         |                |                          |
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|               |                         |                |                          |
|               |                         |                |                          |
|               |                         |                |                          |
|               |                         |                |                          |
|               |                         |                |                          |

## 1.Scope 1适用范围

This document shall be applied to 10 inches or more TFT-LCD Panel.

本文件适用于10 寸及以上 TFT-LCD Panel.

## 2.Inspection and Environment onditions/检查条件与环境

### 2. 1 Inspection Conditions 检查条件:

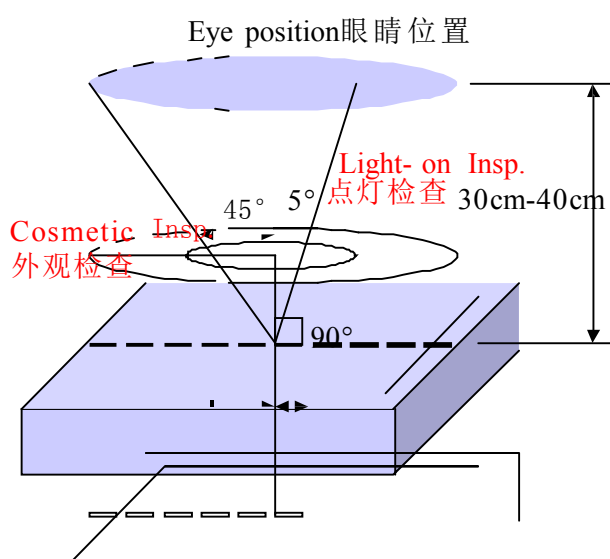
(1) Inspection Distance检测距离: 35 cm $\pm$ 5cm

(2) Each picture /每个画面: 2~3 secs/秒, Cosmetic Insp./外观10~12 secs/秒

(3) View Angle观看角度:

Light-on Inspection Angle点灯检验角度 :  $\pm 45^\circ$

Cosmetic Inspection Angle外观检验角度 :  $\pm 45^\circ$



(Perpendicular to LCD panel surface垂直于液晶显示表面)

### 2.2 Environment Conditions环境条件:

|                            |                               |                                  |
|----------------------------|-------------------------------|----------------------------------|
| Ambient Temperature<br>温度  |                               | 25 $^\circ$ C $\pm$ 5 $^\circ$ C |
| Ambient Humidity<br>湿度     |                               | 55 $\pm$ 5%RH                    |
| Ambient Illumination<br>亮度 | Cosmetic Inspection<br>外观检验   | 800-1000 Lux                     |
|                            | Functional Inspection<br>点灯检验 | 200~300Lux                       |

### 2.3 Sampling Conditions 抽样条件:

(1) Lot Size : Quantity of shipment lot per model/.

批量: 单次运送单一机型数量

- (2) Sampling Method :  
抽样方法:

| Sampling Plan<br>抽样计划 |                      | GB2828/2003                                     |
|-----------------------|----------------------|-------------------------------------------------|
|                       |                      | Normal Inspection, Single Sampling<br>正常检验、单次抽样 |
|                       |                      | General II Inspection<br>普通二级                   |
| AQL                   | Major Defect<br>主要缺点 | 0.25                                            |
|                       | Minor Defect<br>次要缺点 | 0.65                                            |

- (3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.  
主缺(MA)及次缺(MI)定义于”3.检查标准”

### 3.Terms and Definitions/术语和定义

#### 3.1 Classification of defects缺陷的分类:

Major defects: A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the product for its intended purpose.

主要缺陷：会导致产品功能失效或减少产品可用性的缺陷。

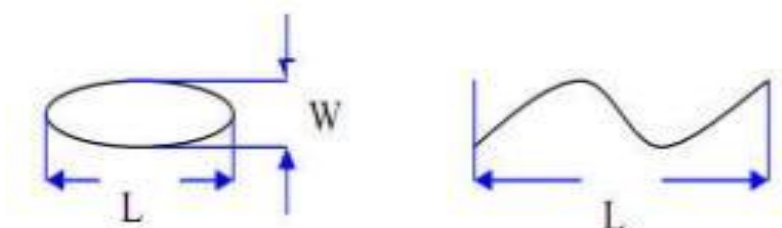
Minor defects: A minor defect either is a defect that is not likely to reduce materially the usability of the product for its intended purpose, or is a departure from an established having little bearing on the effective use or operation of the product.

次要缺陷：不会导致产品功能失效，不会减少产品的有效使用和操作。

- 3.2 Extraneous substances that can be wiped out ,like Finger point,Particles are not considered as a defect . 可以被擦拭干净的表面物质不视为缺陷 (如手指印，尘粒) 。

- 3.3 Defects on the Black Matraix(outside of Active Area) are not considered as a defect . BM 区域 (AA 区以外) 的缺陷不视为缺陷。

- 3.4 Size of circular defect,is defined by diameter”D” 。 The defect average diameter  $D=1/2(W+L)$  圆形缺陷的大小是由直径 D 定义的。缺陷的平均直径  $D=1/2(W+L)$



3.5 When defect size  $L \geq 2W$ , the defect count as liner type defect. Size of linear defect is defined by length(L) and the maximum width(W).

当缺陷尺寸  $L \geq 2W$  时，被视为线状缺陷。线状缺陷是由长度 (L) 和最大宽度 (W) 定义的。3.6 Mura criteria :judged by ND filter6%,and can't be seen under at ND filter 6% .

3.6 MURA 判断标准：使用 ND6%判定，且透过 ND6%，遮住不可见。

3.7 Dot defect is defined as the defective area of the dot is larger than 50% of the dot area and is visible through 6% ND filter

DOT 定义为点缺陷面积大于 50% DOT 面积, 且透过 ND6%遮住是可见的。

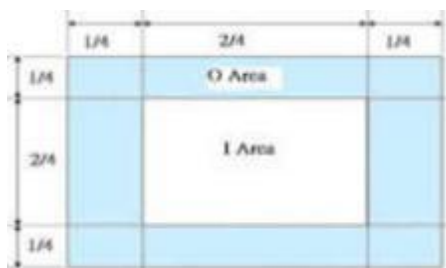
The drawing of 1/2 area sub-pixel definition: The 1/2 area sub-pixel can be defined as below one or more of specific shapes

1/2 面积的子像素定义绘图：1 / 2 面积的子像素可以定义为如下一个或多个特定形状图：



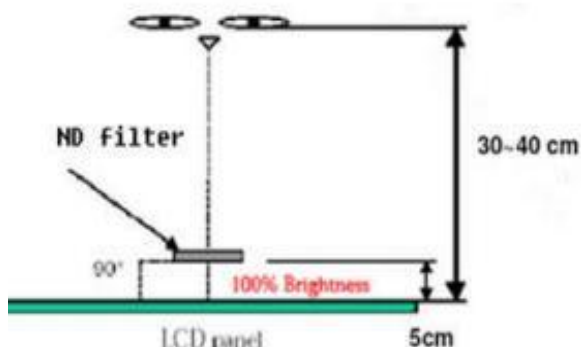
3.8 A dot defect that is smaller than the defined dot defect will be treated as small bright dot. 细碎亮点：小于“DOT 定义”的点缺陷视为细碎亮点。

I 区与 O 区比例：1： 2： 1



3.9 Inspection method of ND Filter - holding ND filter in front of the panel around 5cm and examine the panel from 35±5 cm in the front view for 2~3 second.

ND 卡的检查方法：在面板上方大约 5CM 处握住 ND 卡，眼睛距离面板 30-40CM，通过 2~3 秒观察。



## 4. Inspection Criteria 检验标准

### 4.1 Appearance Inspection specification 外观检查规格:

| Judge area<br>区域             | Judge item<br>项目                 | Specification inspection<br>检查规格                                           | Judge criterion |       |
|------------------------------|----------------------------------|----------------------------------------------------------------------------|-----------------|-------|
|                              |                                  |                                                                            | Major           | Minor |
| Silicone<br>硅胶               | Silicone spread<br>硅胶涂布          | The height can't over C/F , color filter , or gommu<br>高度不能过超 C/F          |                 | MI    |
|                              | Silicone residue<br>硅胶残余         | Can't cover polarizer, FPC ...etc.<br>不能覆盖 POL, FPC 等                      |                 | MI    |
| LCD<br>玻璃                    | Wire(on Array)<br>线路             | No damage<br>不能损伤                                                          | MA              |       |
|                              | Edge<br>边缘                       | No extended crack<br>不可有延伸性裂纹                                              | MA              |       |
| PCBA<br>Connector<br>FPC/FFC | Appearance<br>外观                 | Scratch or damage result in copper expose is not allowed<br>划伤或损伤不允许导致出现露铜 |                 | MI    |
|                              | Component<br>零件                  | No damage<br>不能损伤                                                          | MA              |       |
|                              | Connection status<br>连接状况        | Need correct connection<br>需要正确连接                                          | MA              |       |
|                              | Broken<br>破裂                     | Not allowable<br>不允许                                                       | MA              |       |
|                              | Folding sign<br>对位记号折叠           | Not allowable<br>不允许                                                       | MA              |       |
| POL<br>偏光片                   | Scract on the polarizer<br>偏光片划伤 | 1.W≤0.10mm; L≤5mm, Ignore (忽略)                                             |                 | MI    |
|                              |                                  | 2.0.10mm<W≤0.20mm ; L≤5mm ; N≤4 ; DS≥10mm                                  |                 |       |
|                              |                                  | 3.0.20mm<W; 5mm<L , Not allowable不允许                                       |                 |       |

| Judge area<br>区域 | Judge item<br>项目                  | Specification inspection<br>检查规格                                                             | Judge criterion |       |
|------------------|-----------------------------------|----------------------------------------------------------------------------------------------|-----------------|-------|
|                  |                                   |                                                                                              | Major           | Minor |
| POL<br>偏光片       | Dent on the<br>polarizer<br>偏光片凹痕 | 1.D<0.30mm, Ignore (忽略)                                                                      |                 | MI    |
|                  |                                   | 2.0.30mm<D≤0.50mm; N≤4; DS≥10mm                                                              |                 |       |
|                  |                                   | 3.0.50mm<D, Not allowable不允许                                                                 |                 |       |
|                  | POL Linear bubble<br>线状气泡         | 1.W≤0.10mm; L≤5mm, Ignore (忽略)                                                               |                 | MI    |
|                  |                                   | 2.0.10mm<W≤0.20mm; L≤5mm; N≤4; DS≥10mm                                                       |                 |       |
|                  |                                   | 3.0.20mm<W; 5mm<L, Not allowable不允许                                                          |                 |       |
|                  | POL dot bubble<br>点状气泡            | 1.D<0.30mm, Ignore (忽略)                                                                      |                 | MI    |
|                  |                                   | 2.0.30mm<D≤0.50mm; N≤4; DS≥10mm                                                              |                 |       |
|                  |                                   | 3.0.50mm<D, Not allowable不允许                                                                 |                 |       |
|                  | POL edge bubble<br>片边缘气泡          | 1. The display area is 1/2BM outside, Not allowable<br>显示区往外 1/2BM 区域内, 不允许                  |                 | MI    |
|                  |                                   | 2. The display area is outside the outer 1/2BM area,<br>Not allowable<br>显示区往外1/2BM区域以外, 不管控 |                 |       |

| Judge area<br>区域 | Judge item<br>项目                       | Specification inspection<br>检查规格                                                                                                                                | Judge criterion |       |
|------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------|
|                  |                                        |                                                                                                                                                                 | Major           | Minor |
| TP&CG            | Foreign Material in spot shape<br>点状异物 | 1.D≤0.30mm; Ignored (忽略)<br>2.0.30mm<D≤0.50mm; N≤4; DS≥10mm<br>3.D>0.50mm; Not allowable不允许                                                                     |                 | MI    |
|                  | Fisheye/bubbles<br>鱼眼/气泡               | 1.D≤0.30mm; Ignored (忽略)<br>2.0.30mm<D≤0.50mm; N≤4; DS≥10mm<br>3.D>0.50mm; Not allowable不允许                                                                     |                 | MI    |
|                  | Scratches on the surface<br>表面划伤       | 1.W≤0.10mm; Ignored (忽略)<br>2.0.10mm<W≤0.20mm, L≤5mm; N≤4; DS≥10mm<br>3.W>0.20mm, L>5mm; Not allowable不允许                                                       |                 | MI    |
|                  | Collapse corner、Crash edge<br>崩角、崩边    | Product front:/产品正面:<br>collapse corners, collapsed edges are not allowed<br>崩角、崩边不允许;<br><br>Product back/产品背面:<br>X≤0.5, Y≤0.5, Z≤1/2T; N≤4; DS≥10mm          | MA              |       |
|                  | Printed fonts/LOGO<br>丝印/LOGO          | Printed fonts/LOGO clarity、complete、content right<br>字体/LOGO丝印清晰、完整、内容正确                                                                                        |                 | MI    |
|                  | Broken<br>破损                           | Not allowable不允许                                                                                                                                                | MA              |       |
|                  | Dirty surfaces<br>表面脏污                 | Dirt cannot be wiped, Not allowable<br>不可擦拭的脏污, 不允许                                                                                                             |                 | MI    |
|                  | IR hole<br>IR孔                         | Black spots/黑点:<br>W≤0.15mm, N≤2, Not visible against a black background/黑色背景下不可见                                                                               |                 | MI    |
|                  |                                        | IR hole Scratches:<br>1.W<0.05mm, Ignored (忽略)<br>(Dense points Not allowable 不允许密集);<br>2.0.05mm<W≤0.07mm; L≤2mm; N≤2;<br>3.W>0.07mm, L>2mm, Not allowable 不允许 |                 | MI    |

## 4.2 Electrical Inspection specification 电性检查规格:

| Item<br>项目                                                        | Judgment Criteria<br>判定标准                                                                                                                   | Judge criterion |       |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------|
|                                                                   |                                                                                                                                             | Major           | Minor |
| LCD Bright /Dark dot<br>玻璃亮点/暗点                                   | 1.D $\leq$ 0.30mm, Ignored (忽略), Not dense (不可密集)<br>2.0.30mm<D $\leq$ 0.50mm ; N $\leq$ 4 ; DS $\geq$ 10mm<br>3.D>0.50mm , Not allowed/不允许 |                 | MI    |
| Mura                                                              | Invisible through 6% ND filter, 200~300Lux<br>透过ND6% 遮住 , 目测不可见即为OK, 200~300Lux                                                             |                 | MI    |
| Small bright dot<br>细碎亮点                                          | Not allowed if it can be observed<br>through ND Filter6%<br>透过ND6%目测看得见, 不允许                                                                |                 | MI    |
| ZBD Rate<br>玻璃亮点比率                                                | 90:10                                                                                                                                       |                 | MI    |
| Light Leakage<br>漏光                                               | Invisible through 6% ND filter, OK<br>透过ND6%遮住目测不可见即为OK<br>If necessary,set up set up Limit Sample.<br>如果有必要, 可制订限度样品                       |                 | MI    |
| Bubble in Cell (LC<br>Bubble/Actice Area)<br>CELL气泡<br>(AA区LCD气泡) | Eyes should not find it .<br>目视观察不可见, 视为 OK                                                                                                 | MA              |       |

| Item<br>项目                                          | Judgment Criteria<br>判定标准                                                                                                                                                                 | Judge criterion |       |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------|
|                                                     |                                                                                                                                                                                           | Major           | Minor |
| Foreign Material in spot<br>shape<br>点状异物           | 1. $D \leq 0.30\text{mm}$ , Ignored (忽略)<br>2. $0.30\text{mm} < D \leq 0.50\text{mm}$ ; $N \leq 4$ ; $DS \geq 10\text{mm}$<br>3. $D > 0.50\text{mm}$ , Not allowable/不允许                  |                 | MI    |
| Foreign Material in line<br>or spiral shape<br>线状异物 | 1. $W \leq 0.10\text{mm}$ , Ignored (忽略)<br>2. $0.10\text{mm} < W \leq 0.20\text{mm}$ ; $L \leq 5\text{mm}$ ; $N \leq 4$<br>3. $W > 0.20\text{mm}$ ; $L > 5\text{mm}$ , Not allowable/不允许 |                 | MI    |
| White dot in back-light<br>白点                       | 1. $D \leq 0.30\text{mm}$ , Ignored (忽略)<br>2. $0.30\text{mm} < D \leq 0.50\text{mm}$ ; $N \leq 4$ ; $DS \geq 10\text{mm}$<br>3. $D > 0.50\text{mm}$ , Not allowed/不允许                    |                 | MI    |
| TP no touch<br>无触摸                                  | Not allowable<br>不允许                                                                                                                                                                      | MA              |       |
| Abnormal Disply<br>显示异常                             | Not Allowed<br>不允许                                                                                                                                                                        | MA              |       |
| NO display<br>无显示                                   | Not Allowed<br>不允许                                                                                                                                                                        | MA              |       |
| Line Defect<br>缺线                                   | Not Allowed<br>不允许                                                                                                                                                                        | MA              |       |
| Angle of view error<br>视角错误                         | Not Allowed<br>不允许                                                                                                                                                                        | MA              |       |
| Tect crostalk<br>不消失的残影                             | Not Allowed<br>不允许                                                                                                                                                                        | MA              |       |