

# Specifications for

## **Blanview TFT-LCD Monitor**

( 2.7" QVGA 240 x RGB x 320 Portrait)

Version 1.0

(Please be sure to check the specifications latest version. )

MODEL COM27H2P63ULC

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

# ORTUSTECH

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|      |             |      | First issue |



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## 1. Application

This Specification is applicable to 68.4mm (2.7 inch) Blanview TFT-LCD monitor for non-military use.

- ◎ TOPPAN PRINTING makes no warranty or assume no liability that use of this Product and/or any information including drawings in this Specification by Purchaser is not infringing any patent or other intellectual property rights owned by third parties, and TOPPAN PRINTING shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains TOPPAN PRINTING's confidential information and copy right, Purchaser shall use them with high degree of care to prevent any unauthorized use, disclosure, duplication, publication or dissemination of TOPPAN PRINTING's confidential information and copy right.
- ◎ If Purchaser intends to use this Products for an application which requires higher level of reliability and/or safety in functionality and/or accuracy such as transport equipment (aircraft, train, automobile, etc.), disaster-prevention/security equipment or various safety equipment, Purchaser shall consult TOPPAN PRINTING on such use in advance.
- ◎ This Product shall not be used for application which requires extremely higher level of reliability and/or safety such as aerospace equipment, telecommunication equipment for trunk lines, control equipment for nuclear facilities or life-support medical equipment.
- ◎ It must be noted as an mechanical design manner, especial attention in housing design to prevent arcuation/flexure or caused by stress to the LCD module shall be considered.
- ◎ TOPPAN PRINTING assumes no liability for any damage resulting from misuse, abuse, and/or miss-operation of the Product deviating from the operating conditions and precautions described in the Specification.
- ◎ It shall be mutually conferred if nonconforming defect which result from unspecified cause in this specification arises.
- ◎ If any issue arises as to information provided in this Specification or any other information, TOPPAN PRINTING and Purchaser shall discuss them in good faith and seek solution.
- ◎ TOPPAN PRINTING assumes no liability for defects such as electrostatic discharge failure occurred during peeling off the protective film or Purchaser's assembly process.
- ◎ This Product is compatible for RoHS(2.0) directive.

| Object substance                                   | Maximum content [ppm] |
|----------------------------------------------------|-----------------------|
| Cadmium and its compound                           | 100                   |
| Hexavalent Chromium Compound                       | 1000                  |
| Lead & Lead compound                               | 1000                  |
| Mercury & Mercury compound                         | 1000                  |
| Polybrominated biphenyl series (PBB series)        | 1000                  |
| Polybrominated biphenyl ether series (PBDE series) | 1000                  |
| Bis(2-ethylhexyl)phthalate series(DEHP series)     | 1000                  |
| Butyl benzyl phthalate series(BBP series)          | 1000                  |
| Dibutyl phthalate series(DBP series)               | 1000                  |
| Diisobutyl phthalate series(DIBP series)           | 1000                  |



## 2. Outline Specifications

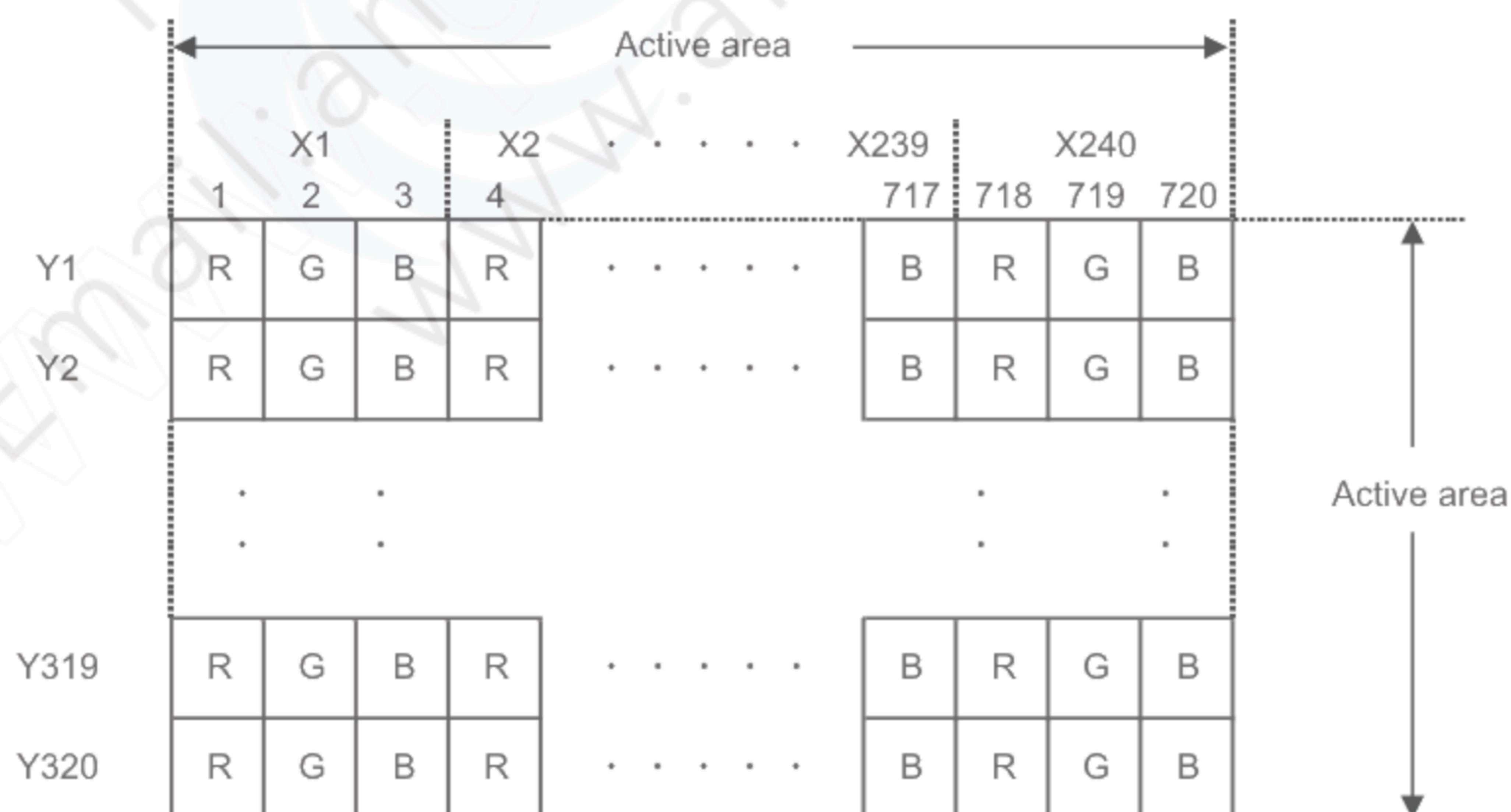
### 2.1 Features of the Product

- 2.7 inch diagonal display, 720 [H] x 320 [V] dots. 240RGB x 320 pixel.
- 6-bit / 262,144 colors.
- Single power supply operation of 3.0V.
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- Long life & High bright white LED back-light.
- Blanview TFT-LCD, improved outdoor visibility.

|               | Indoor     |                                    | Outdoor    |                                    |
|---------------|------------|------------------------------------|------------|------------------------------------|
|               | Visibility | Power Efficiency<br>(Battery Life) | Visibility | Power Efficiency<br>(Battery Life) |
| Transmissive  | Good       | Good                               | Fair       | Poor                               |
| Transflective | Fair       | Poor                               | Good       | Good                               |
| Blanview      | Good       | Good                               | Good       | Good                               |

### 2.2 Display Method

| Items               | Specifications                                         | Remarks                    |
|---------------------|--------------------------------------------------------|----------------------------|
| Display type        | VA type 262,144 colors<br>Blanview, Normally Black     |                            |
| Driving method      | a-Si TFT Active matrix<br>Line-scanning, Non-interlace |                            |
| Dot arrangement     | RGB stripe arrangement                                 | Refer to "Dot arrangement" |
| Signal input method | 6-bit Data : Paralell interface                        |                            |
| Backlight type      | Long life & High bright white LED                      |                            |
| NTSC ratio          | 50%                                                    |                            |

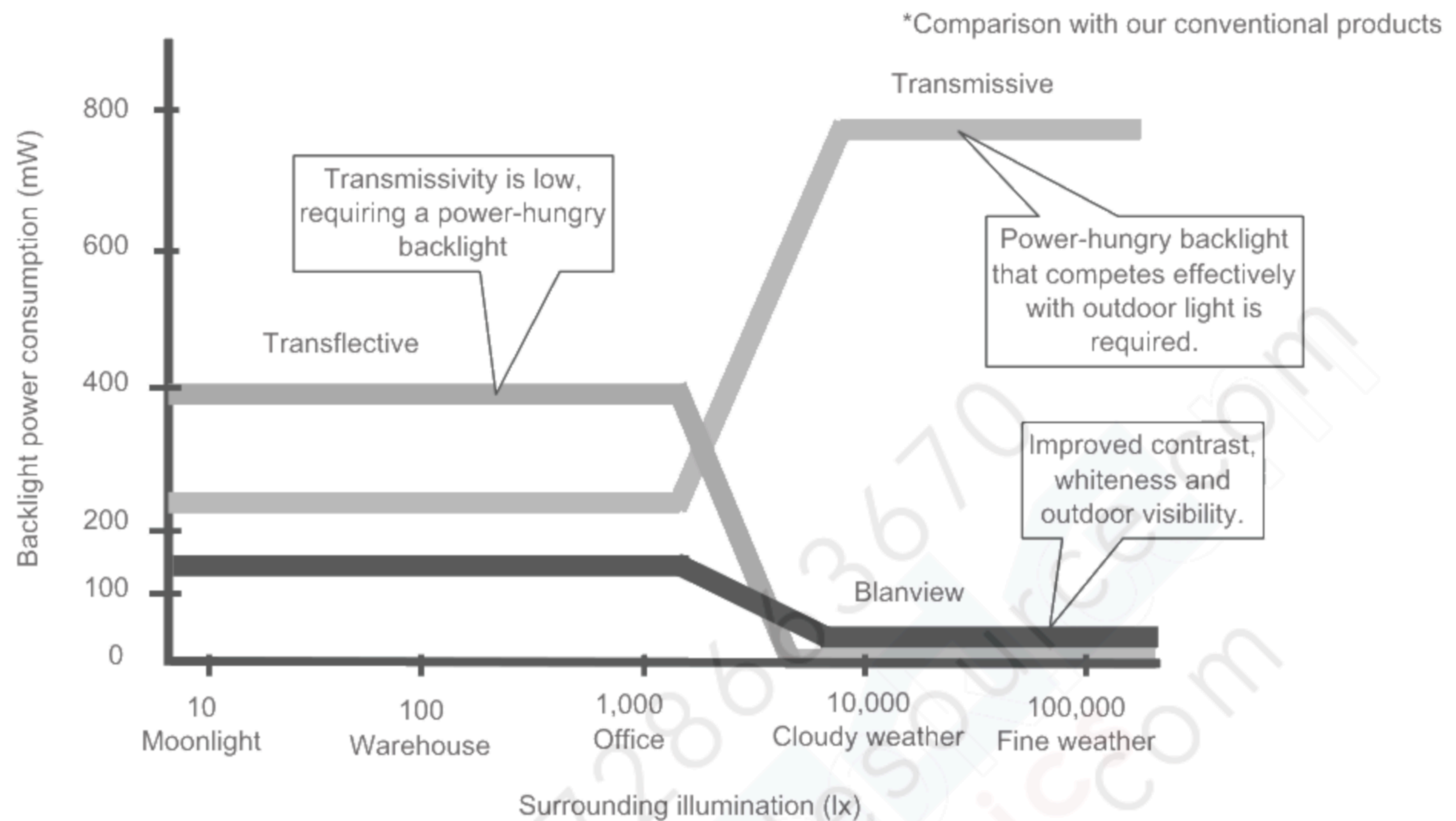


Dot arrangement (FPC cable placed lower side)



## &lt;Features of Blanview&gt;

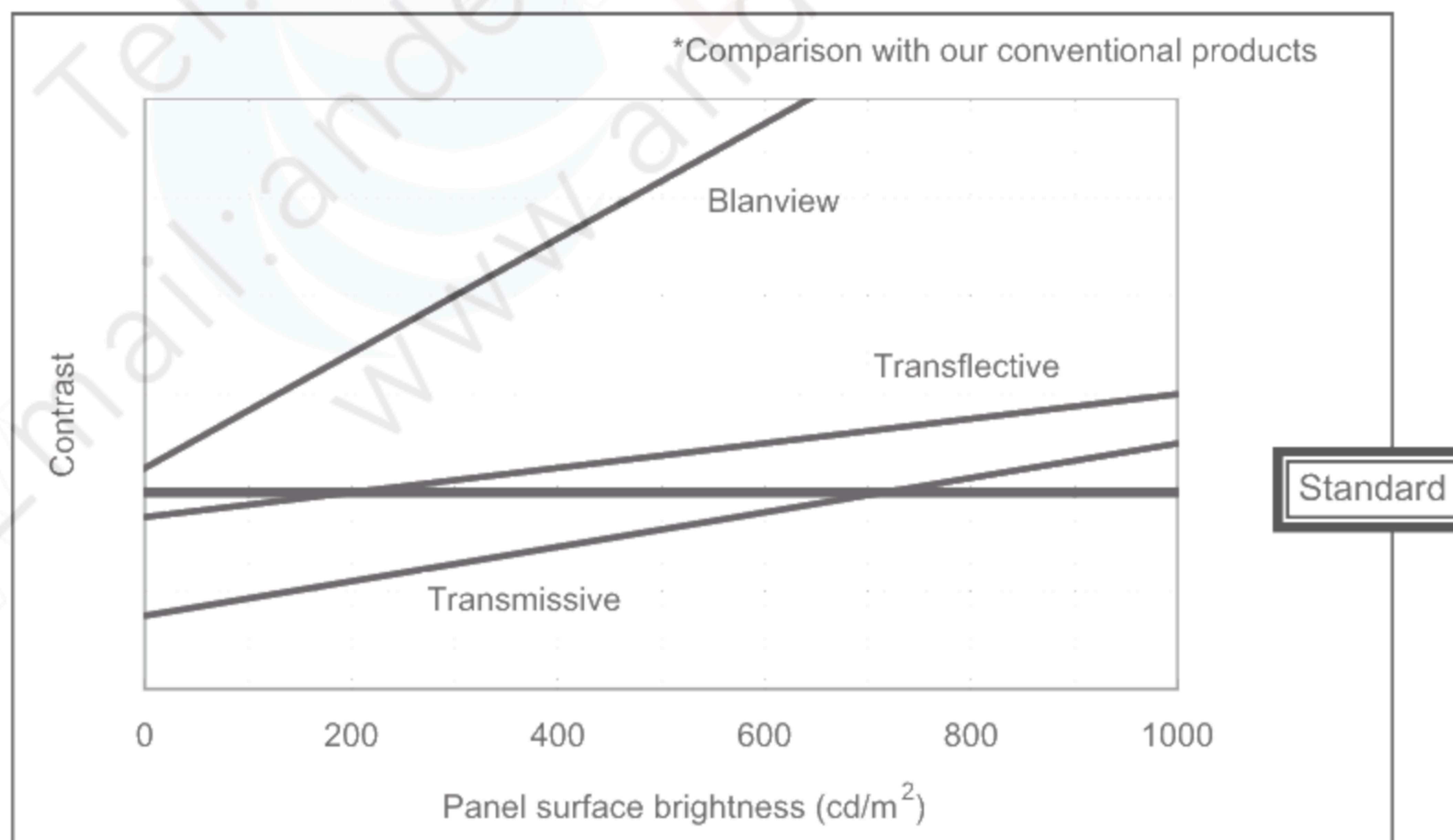
- Backlight power consumption required to assure visibility. (equivalent to 3.5"QVGA )



- Contrast characteristics under 100,000lx. (same condition as direct sunlight.)

With better contrast (higher contrast ratio), Blanview TFT-LCD has the best outdoor visibility in three different types of TFT-LCD.

Below chart shows contrast value against panel surface brightness. (Horizontal: Panel surface brightness/ Vertical: Contrast value) LCD panel has enough outdoor visibility above our Standard line. (TOPPAN PRINTING criteria)





## 3. Dimensions and Shape

## 3.1 Dimensions

| Items                             | Specifications                | Unit | Remarks                               |
|-----------------------------------|-------------------------------|------|---------------------------------------|
| Outline dimensions                | 47.00[H] × 66.00[V] × 2.89[D] | mm   | exclude FPC and components on the FPC |
| Active area                       | 41.04[H] × 54.72[V]           | mm   | 68.4mm diagonal                       |
| Number of dots                    | 720[H] × 320[V]               | dot  |                                       |
| Dot pitch                         | 57.0[H] × 171.0[V]            | um   |                                       |
| Surface hardness of the polarizer | 2                             | H    |                                       |
| Weight                            | 19.0                          | g    | Include FPC cable                     |







### 3.3 Serial № print (S-print)

#### 1) Display Items

S-print indicates the least significant digit of manufacture year (1digit), manufacture month with below alphabet (1letter), model code (5characters), serial number (6digits).

#### \* Contents of Display

|   |   |       |       |
|---|---|-------|-------|
| * | * | ***** | ***** |
| — | — | —     | —     |
| a | b | c     | d     |

|   |                                                 |                                                   |                                  |                                  |
|---|-------------------------------------------------|---------------------------------------------------|----------------------------------|----------------------------------|
|   | Contents of display                             |                                                   |                                  |                                  |
| a | The least significant digit of manufacture year |                                                   |                                  |                                  |
| b | Manufacture month                               | Jan-A<br>Feb-B<br>Mar-C<br>Apr-D                  | May-E<br>Jun-F<br>Jul-G<br>Aug-H | Sep-I<br>Oct-J<br>Nov-K<br>Dec-L |
| c | Model code                                      | 27GSC (Made in Japan)<br>27GTC (Made in Malaysia) |                                  |                                  |
| d | Serial number                                   |                                                   |                                  |                                  |

#### \* Example of indication of Serial № print (S-print)

##### •Made in Japan

9J27GSC000125

means "manufactured in October 2019, 2.7" GS type, C specifications, serial number 000125"

##### •Made in Malaysia

9J27GTC000125

means "manufactured in October 2019, 2.7" GT type, C specifications, serial number 000125"

#### 2) Location of Serial № print (S-print)

Refer to 3.2 "Outward Form".

#### 3)Others

Please note that it is likely to disappear with an organic solvent about the Serial print.



## 4. Pin Assignment

| No. | Symbol | Function                                                                                       | I/O |
|-----|--------|------------------------------------------------------------------------------------------------|-----|
| 1   | VSS    | GND                                                                                            | P   |
| 2   | VSS    | GND                                                                                            | P   |
| 3   | VDD    | Power supply                                                                                   | P   |
| 4   | VDD    | Power supply                                                                                   | P   |
| 5   | VSS    | GND                                                                                            | P   |
| 6   | RESETB | Reset signal (Lo-active)                                                                       | I   |
| 7   | HSYNC  | Horizontal synchronization signal (Negative polarity)                                          | I   |
| 8   | VSYNC  | Vertical synchronizing signal (Negative polarity)                                              | I   |
| 9   | CLK    | Display clock (Falling read)                                                                   | I   |
| 10  | VSS    | GND                                                                                            | P   |
| 11  | D00    | Display data (B) input                                                                         | I   |
| 12  | D01    | It becomes black display in 00h.<br>D00:LSB D05:MSB<br><br>gamma conversion internally driver. | I   |
| 13  | D02    |                                                                                                | I   |
| 14  | D03    |                                                                                                | I   |
| 15  | D04    |                                                                                                | I   |
| 16  | D05    |                                                                                                | I   |
| 17  | D10    | Display data (G) input                                                                         | I   |
| 18  | D11    | It becomes black display in 00h.<br>D10:LSB D15:MSB<br><br>gamma conversion internally driver. | I   |
| 19  | D12    |                                                                                                | I   |
| 20  | D13    |                                                                                                | I   |
| 21  | D14    |                                                                                                | I   |
| 22  | D15    |                                                                                                | I   |
| 23  | D20    | Display data (R) input                                                                         | I   |
| 24  | D21    | It becomes black display in 00h.<br>D20:LSB D25:MSB<br><br>gamma conversion internally driver. | I   |
| 25  | D22    |                                                                                                | I   |
| 26  | D23    |                                                                                                | I   |
| 27  | D24    |                                                                                                | I   |
| 28  | D25    |                                                                                                | I   |
| 29  | VSS    | GND                                                                                            | P   |
| 30  | DE     | Input data valid signal (Hi-active)                                                            | I   |
| 31  | STBYB  | Standby control signal (Lo:Standby, Hi:Normal-operation)                                       | I   |
| 32  | TEST1  | MODE1 (GND connection)                                                                         | I   |
| 33  | NC     | OPEN                                                                                           | -   |
| 34  | NC     | OPEN                                                                                           | -   |
| 35  | NC     | OPEN                                                                                           | -   |
| 36  | NC     | OPEN                                                                                           | -   |
| 37  | TEST2  | MODE2 (GND connection)                                                                         | I   |
| 38  | BLH    | LED drive power source. (Anode side)                                                           | P   |
| 39  | BLL    | LED drive power source. (Cathode side)                                                         | P   |

## Note :

- Recommended connector : Hirose FH23 series "FH23-39S-0.3SHW(05) "
  - Terminal arrangement, please refer to "outline specification drawings".
  - FPC of the terminal has been decorated with gold-plated.
- Connector contact terminals is recommended the use of gold-plated products.



## 5. Absolute Maximum Rating

VSS=0V

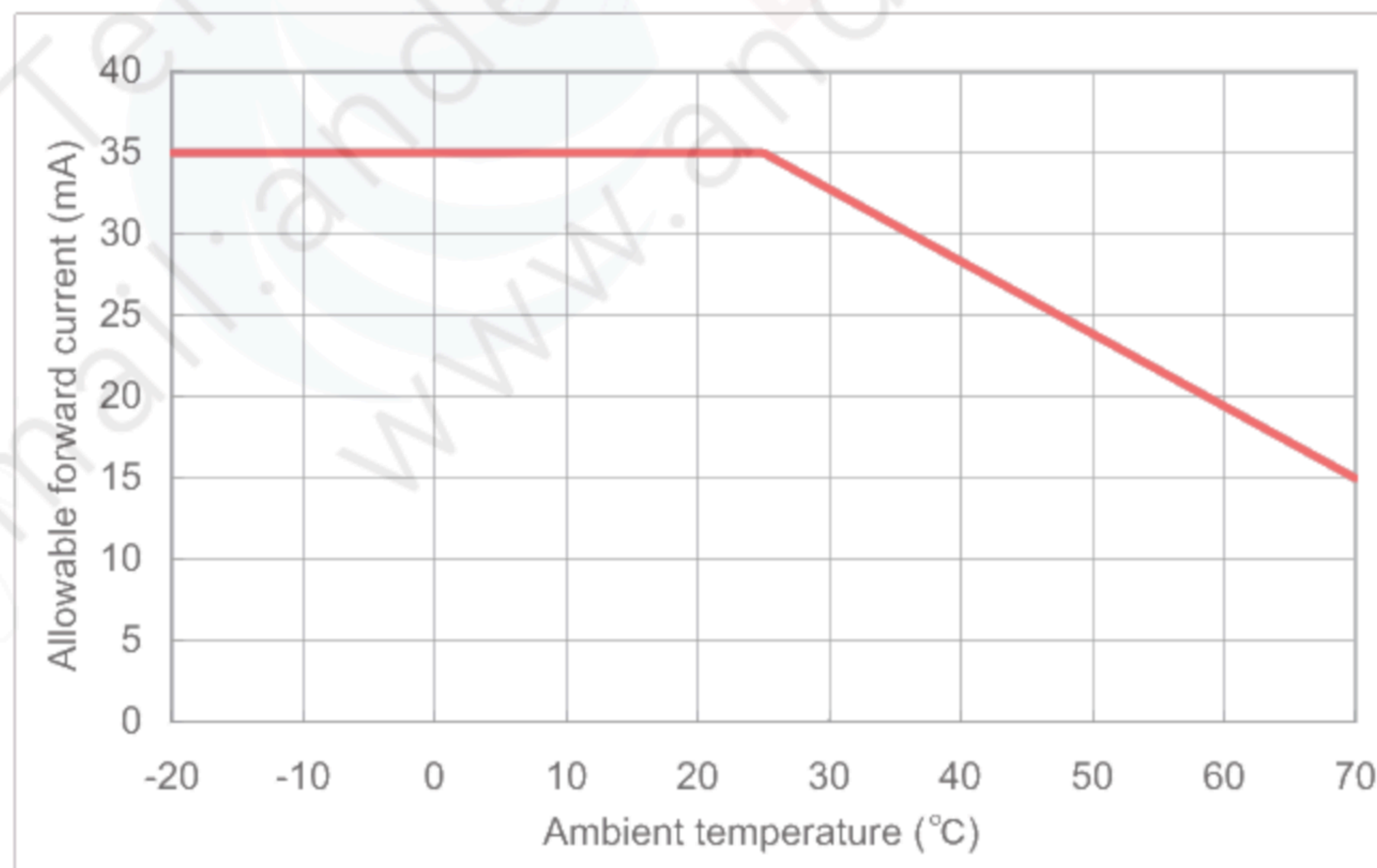
| Item                      | Symbol | Condition                                                  | Rating |         | Unit | Applicable terminal                                                              |
|---------------------------|--------|------------------------------------------------------------|--------|---------|------|----------------------------------------------------------------------------------|
|                           |        |                                                            | MIN    | MAX     |      |                                                                                  |
| Supply voltage            | VDD    | Ta=25°C                                                    | -0.3   | 4.6     | V    | VDD                                                                              |
| Input voltage for logic   | VI     |                                                            | -0.3   | VDD+0.3 | V    | CLK, VSYNC, HSYNC, DE, D[05:00], D[15:10], D[25:20], STBYB, RESETB, TEST1, TEST2 |
| LED Forward current       | IL     | Ta = 25°C                                                  | —      | 35      | mA   | BLH - BLL                                                                        |
|                           |        | Ta = 70°C                                                  | —      | 15      |      |                                                                                  |
| Storage temperature range | Tstg   |                                                            | -30    | 80      | °C   |                                                                                  |
| Storage atmospheric range | Hstg   | 40°C90%RH or less of moisture content with no condensation |        |         |      |                                                                                  |

## 6. Recommended Operating Conditions

VSS=0V

| Item                          | Symbol | Condition | Rating                                                     |     |     | Unit | Applicable terminal                                                                |
|-------------------------------|--------|-----------|------------------------------------------------------------|-----|-----|------|------------------------------------------------------------------------------------|
|                               |        |           | MIN                                                        | TYP | MAX |      |                                                                                    |
| Supply voltage                | VDD    |           | 2.7                                                        | 3.0 | 3.6 | V    | VDD                                                                                |
| Input voltage for logic       | VI     |           | 0                                                          | —   | VDD | V    | CLK,VSYNC,HSYNC,DE,<br>D[05:00],D[15:10],D[25:20],<br>STBYB,RESETB,<br>TEST1,TEST2 |
| Operational temperature range | Top    | *note     | -20                                                        | +25 | +70 | °C   | LCD Panel surface temperature                                                      |
| Operating humidity range      | Hop    | Ta≤40°C   | 20                                                         | —   | 85  | %    |                                                                                    |
|                               |        | Ta> 40°C  | 40°C85%RH or less of moisture content with no condensation |     |     |      |                                                                                    |

note : The maximum value of LED Forward current "IL", do not exceed the following allowable current value.





## 7. Characteristics

## 7.1 DC Characteristics

## 7.1.1 Display section

(Unless otherwise noted, Ta=25°C, VDD=3.0V, VSS=0V)

| Item                 | Symbol | Condition                         | Rating  |     |         | Unit | Applicable terminal                          |
|----------------------|--------|-----------------------------------|---------|-----|---------|------|----------------------------------------------|
|                      |        |                                   | MIN     | TYP | MAX     |      |                                              |
| Input Signal Voltage | VIH    |                                   | 0.7×VDD | —   | VDD     | V    | CLK, VSYNC, HSYNC, DE, STBYB, RESETB         |
|                      | VIL    |                                   | 0       | —   | 0.3×VDD | V    | D[05:00], D[15:10], D[25:20]<br>TEST1, TEST2 |
| Operating Current    | IDD    | fCLK=6.25MHz<br>Color bar display | —       | 9.2 | 18.4    | mA   | VDD                                          |

## 7.1.2 Backlight section

| Item                  | Symbol | Condition                  | Rating |        |      | Unit | Applicable terminal |
|-----------------------|--------|----------------------------|--------|--------|------|------|---------------------|
|                       |        |                            | MIN    | TYP    | MAX  |      |                     |
| Forward current       | IL25   | Ta=25°C                    | —      | 7.0    | 35.0 | mA   | BLH — BLL           |
|                       | IL70   | Ta=70°C                    | —      | —      | 15.0 | mA   |                     |
| Forward voltage       | VL     | Ta=25°C, IL=7.0mA          | —      | 8.0    | 8.5  | V    |                     |
| Estimated Life of LED | LL     | Ta=25°C, IL=7.0mA<br>*note | —      | 50,000 | —    | hr   |                     |

note :

- The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
  - This figure is given as a reference purpose only, and not as a guarantee.
  - This figure is estimated for an LED operating alone.
- As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

## 7.2 AC Characteristics

(Unless otherwise noted, Ta=25°C, VDD=3.0V, VSS=0V)

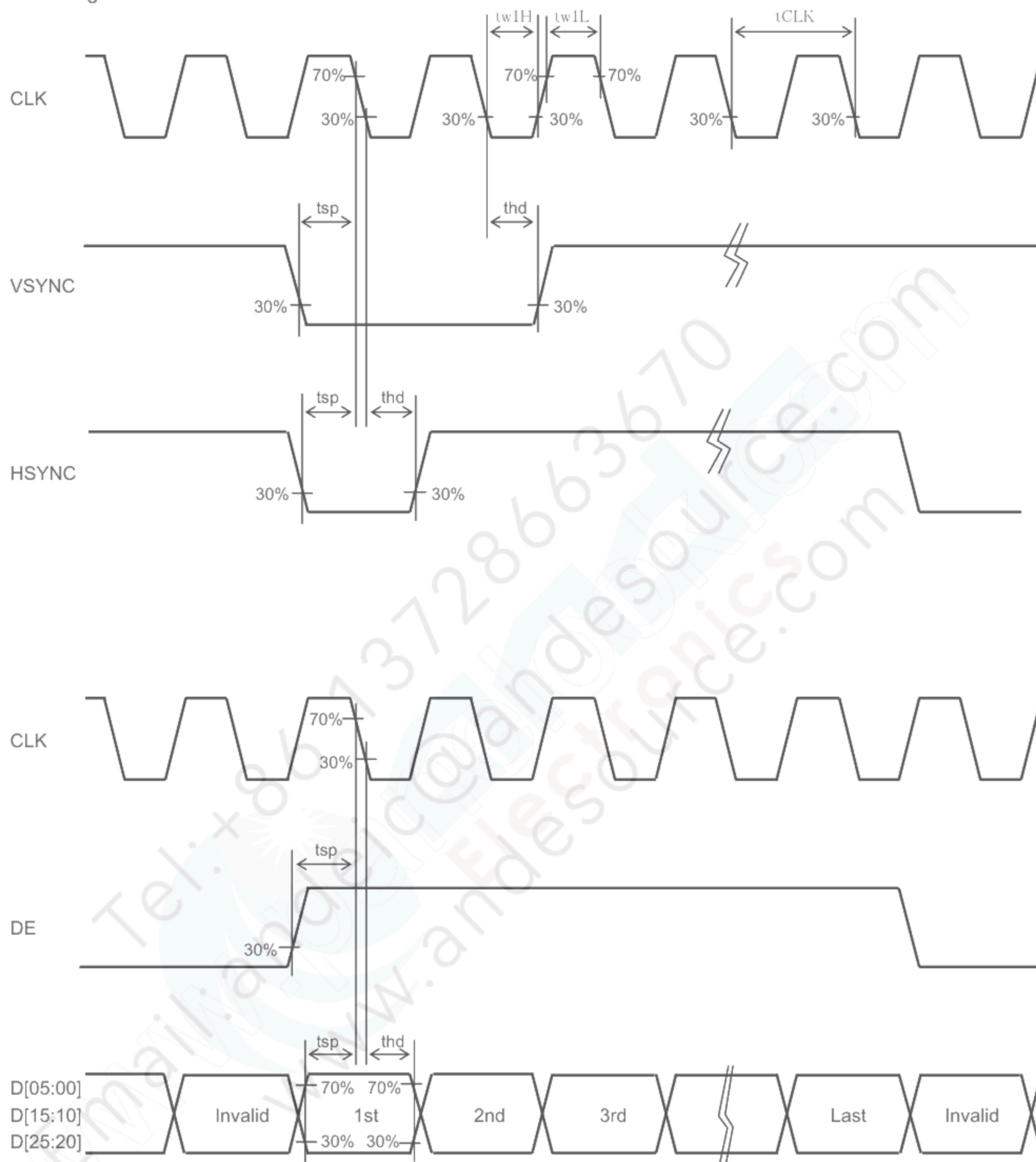
| Item             | Symbol | Condition                     | Rating |     |     | Unit | Applicable terminal          |
|------------------|--------|-------------------------------|--------|-----|-----|------|------------------------------|
|                  |        |                               | MIN    | TYP | MAX |      |                              |
| CLK frequency    | fCLK   |                               | 4.4    | 5.6 | 7.0 | MHz  | CLK                          |
| CLK Lo period    | tw1L   | 0.3×VDD or less of the period | 15     | —   | —   | ns   | CLK                          |
| CLK Hi period    | tw1H   | 0.7×VDD or less of the period | 15     | —   | —   | ns   | CLK                          |
| Input setup time | tsp    |                               | 15     | —   | —   | ns   | HSYNC, VSYNC, CLK, DE        |
| Input hold time  | thd    |                               | 15     | —   | —   | ns   | D[05:00], D[15:10], D[25:20] |

note :

- All timing is specified in 30-70% of VDD.
- Tf / tf of the input signal is specified in the 15ns or less.



## 8. Switching waveform





## 9. Input timing

## 9.1 Input timing characteristics

(Unless otherwise noted, Ta=25°C,VDD=3.0V,VSS=0V)

| Item                      | Symbol | Rating |      |     | Unit | Applicable terminal                    |
|---------------------------|--------|--------|------|-----|------|----------------------------------------|
|                           |        | MIN    | TYP  | MAX |      |                                        |
| CLK frequency             | fCLK   | 4.4    | 5.6  | 7.0 | MHz  | CLK                                    |
| VSYNC frequency<br>*note  | fVSYNC | 54     | 60   | 66  | Hz   | VSYNC                                  |
| VSYNC signal period       | tv     | 324    | 325  | 348 | H    | VSYNC,HSYNC                            |
| VSYNC pulse width         | tw2H   | 1      | —    | —   | H    | VSYNC,HSYNC                            |
| Vertical back porch       | tvb    | 2      | —    | 14  | H    | VSYNC,HSYNC,D[05:00],D[15:10],D[25:20] |
| Vertical display period   | tvdP   | —      | 320  | —   | H    | VSYNC,HSYNC,D[05:00],D[15:10],D[25:20] |
| HSYNC frequency           | fHSYNC | —      | 19.5 | —   | kHz  | HSYNC                                  |
| HSYNC signal period       | th     | —      | 287  | 402 | CLK  | HSYNC,CLK                              |
| HSYNC pulse width         | tw3H   | 1      | —    | -   | CLK  | HSYNC,CLK                              |
| Horizontal back porch     | thb    | 2      | —    | 14  | CLK  | HSYNC,CLK,D[05:00],D[15:10],D[25:20]   |
| DE pulse width            | tw4H   | —      | 240  | —   | CLK  | DE,CLK                                 |
| Horizontal display period | thdp   | —      | 240  | —   | CLK  | D[25:00],CLK                           |

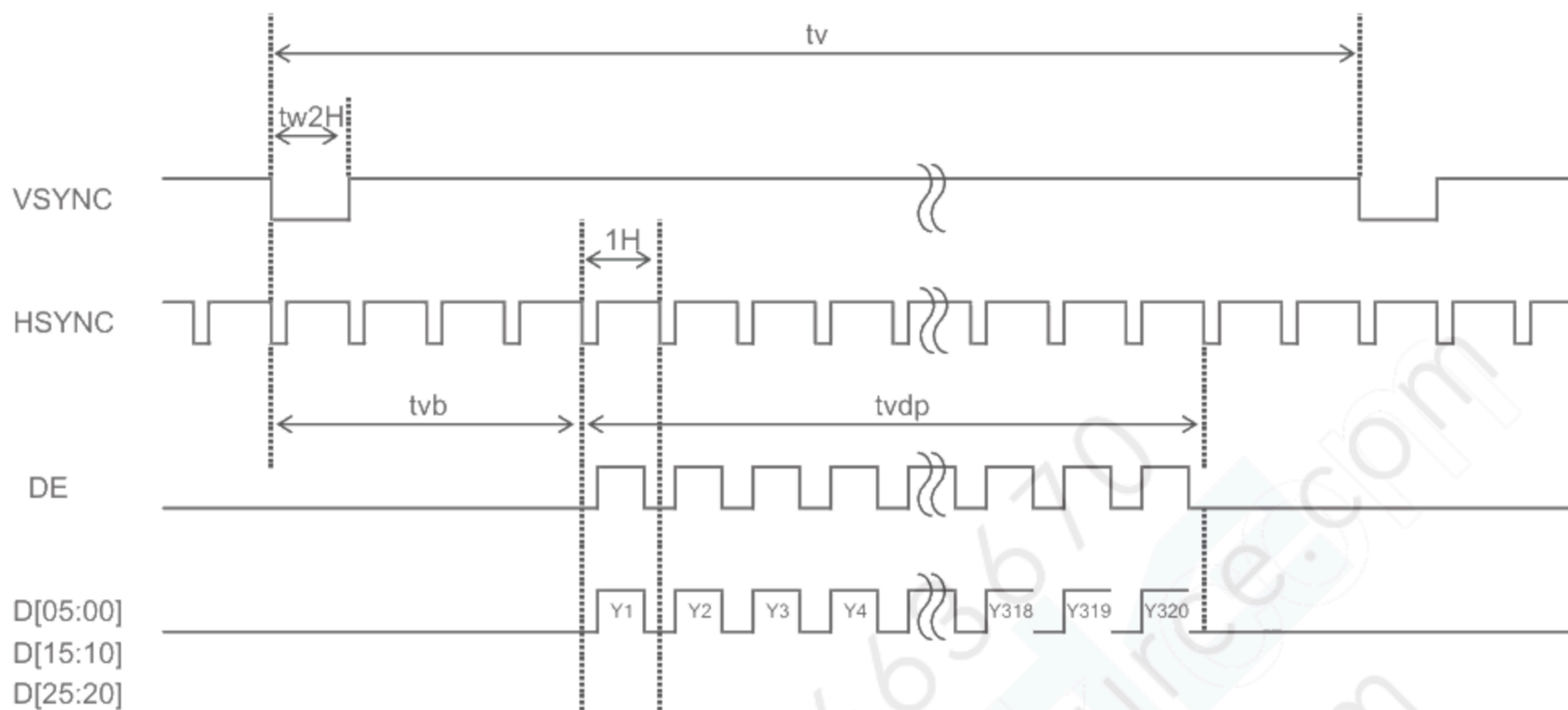
note : Characteristic of this item is the recommended standard.

When used in outside this property, Please use after confirming a sufficient display quality, etc.

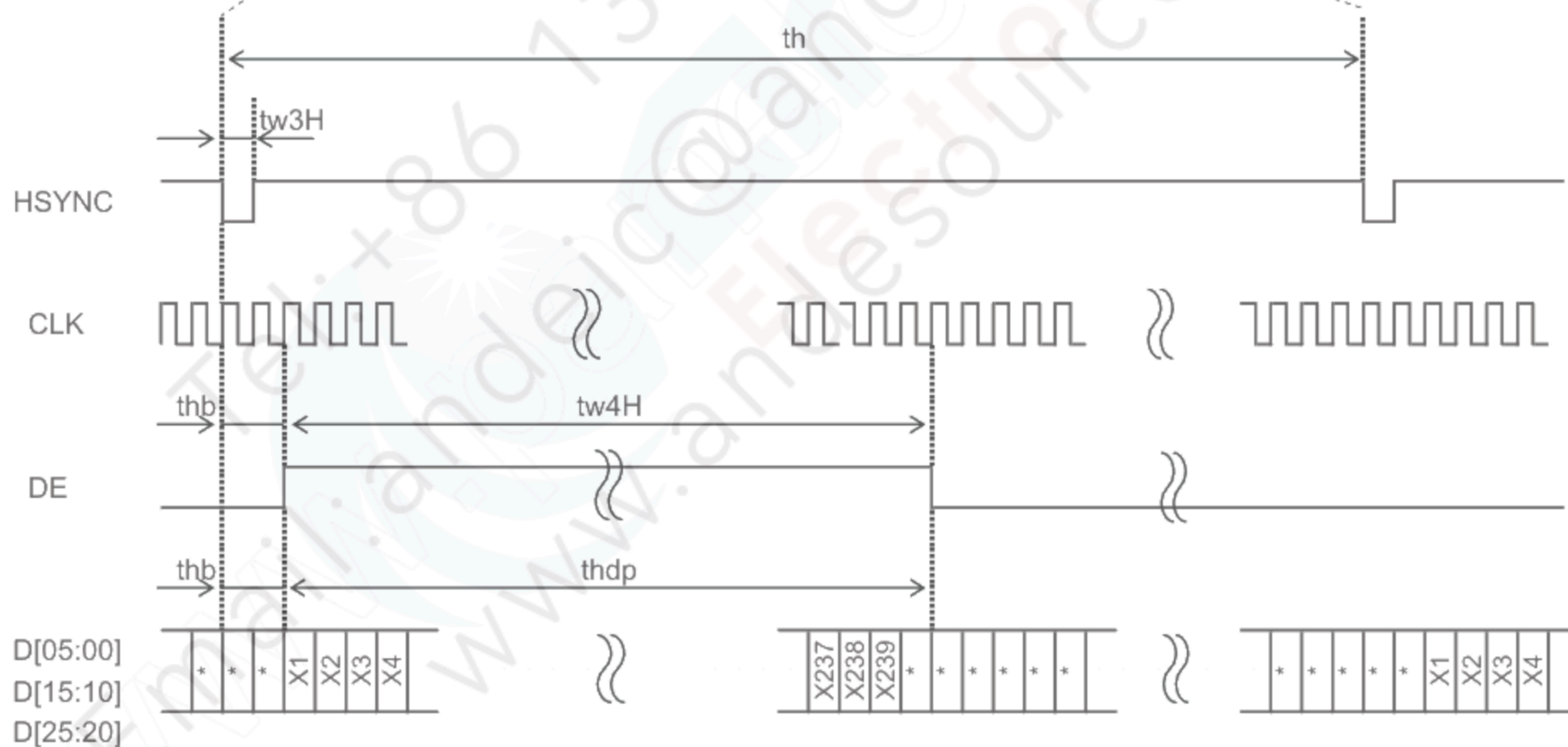


## 9.2 Input timing chart

## I . Vertical drive timing



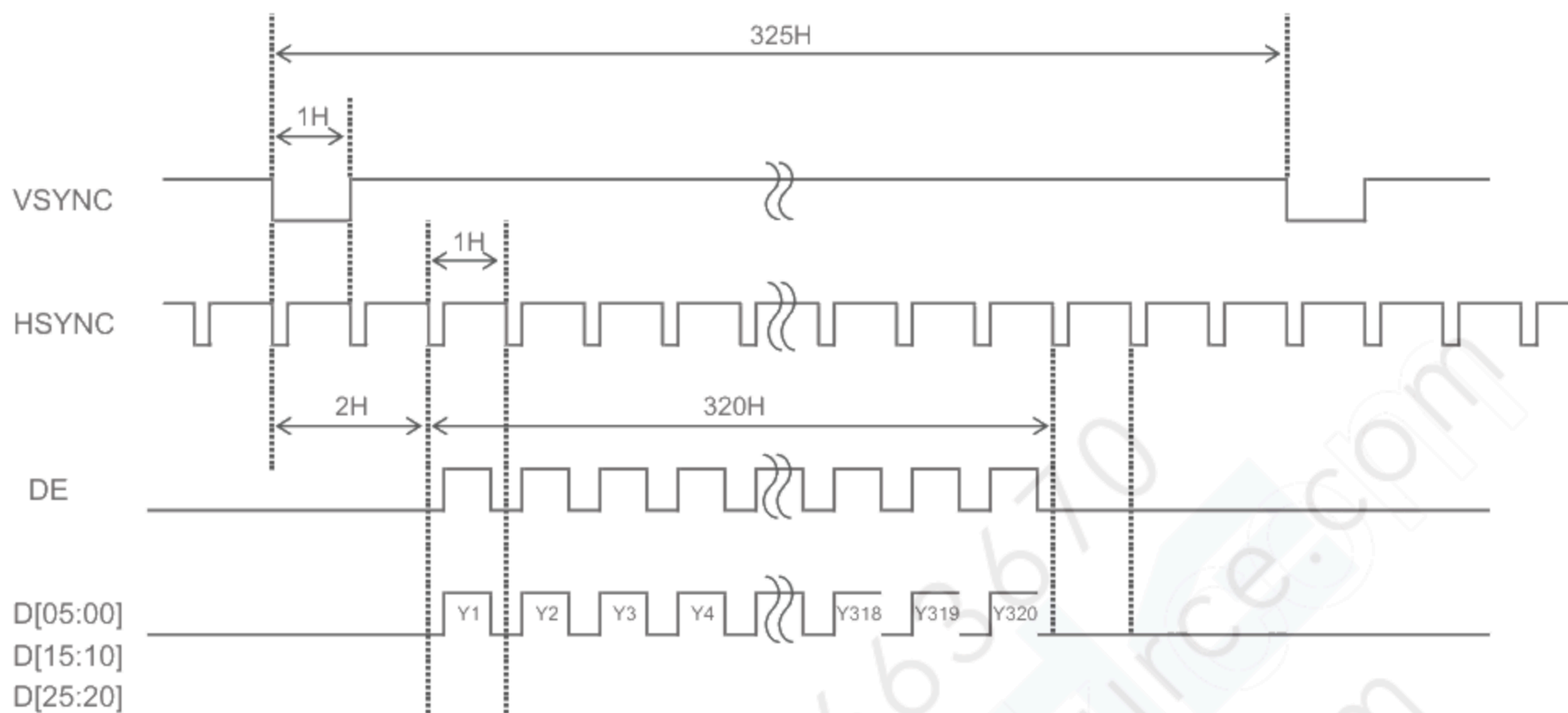
## II . Horizontal drive timing



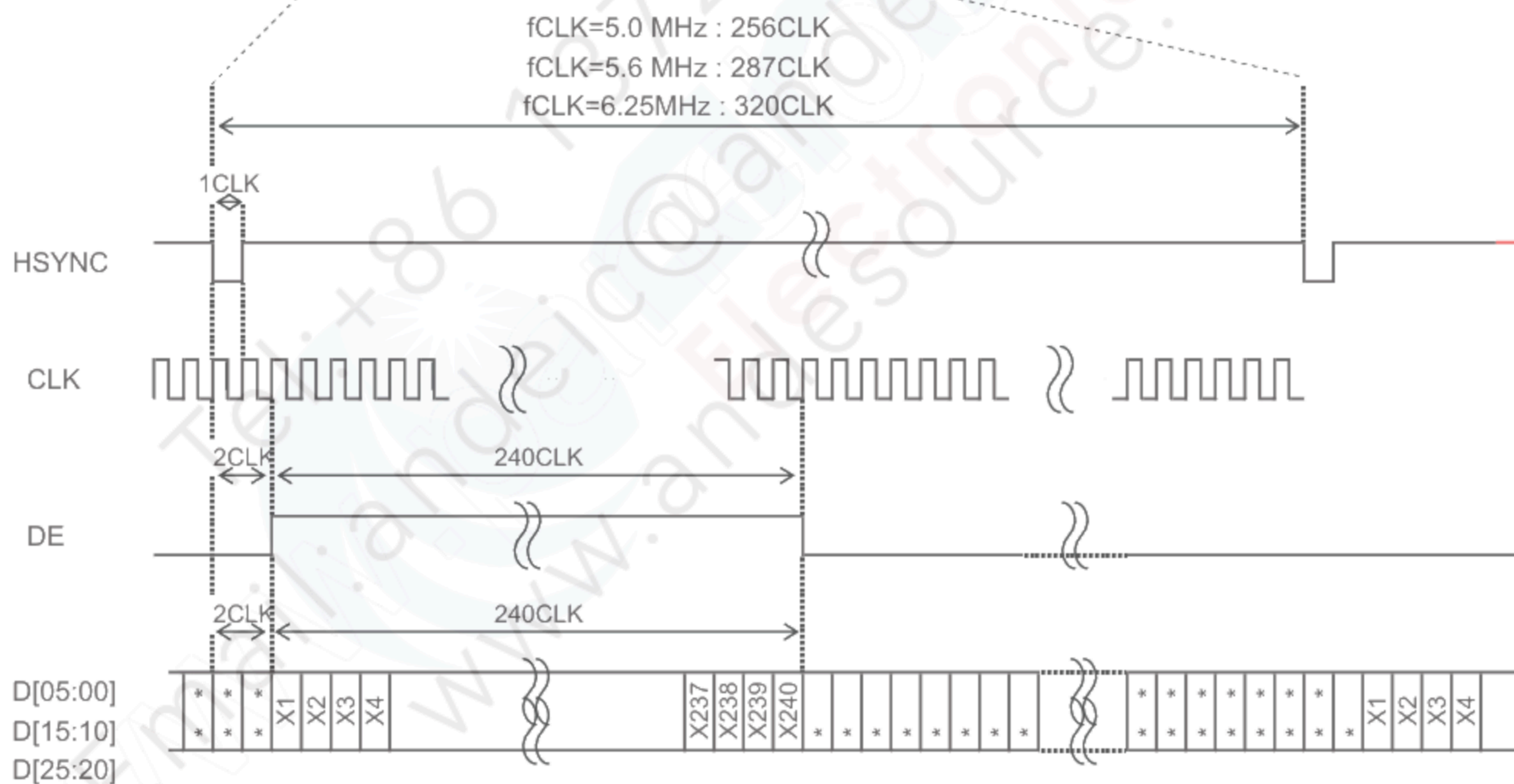


## 9.3 Input Timing example (fCLK = 5.0MHz、5.6MHz、6.25MHz)

## I . Vertical drive timing

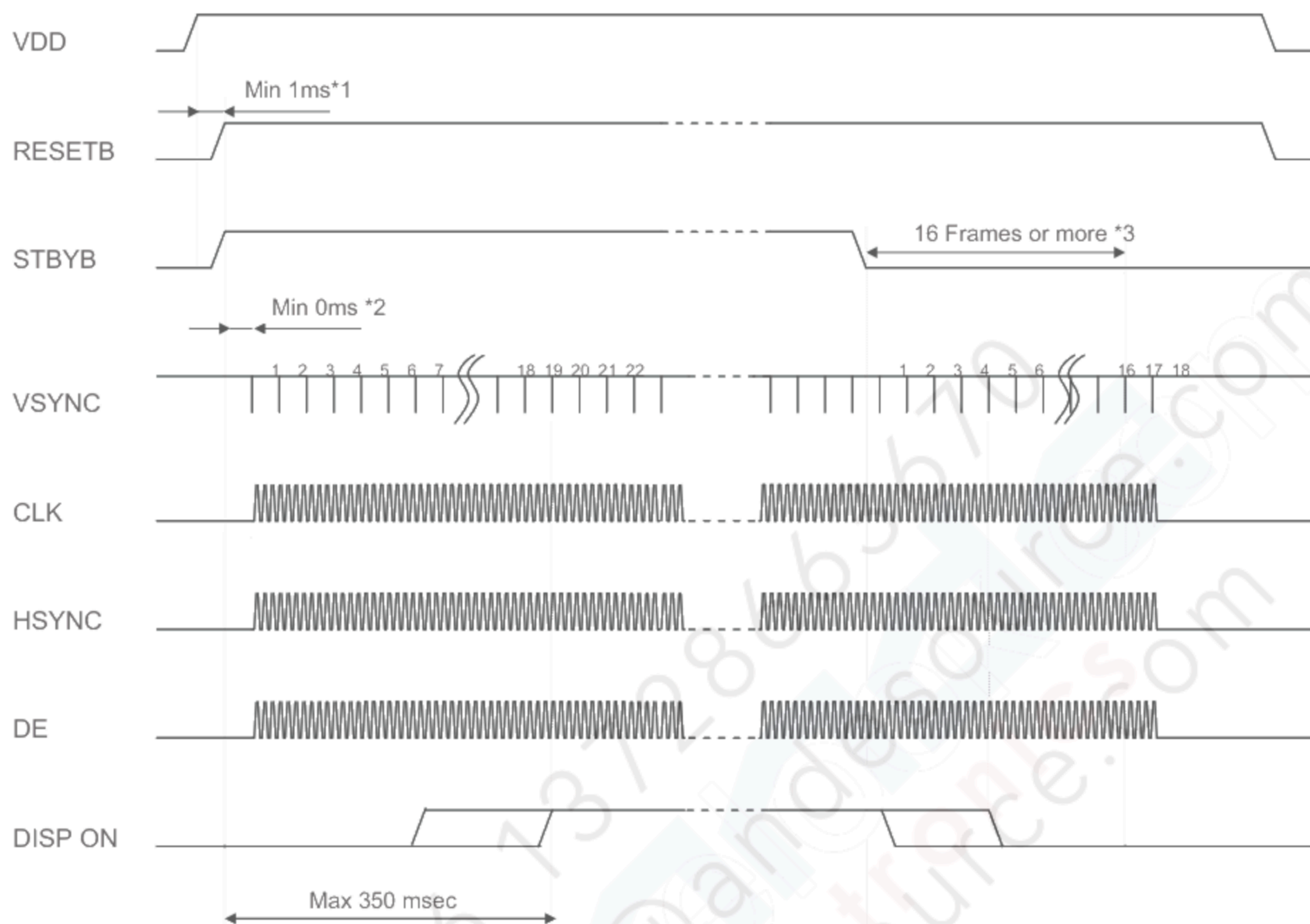


## II . Horizontal drive timing





## 10. Power ON/OFF sequence



\*1 After the power supply, Please execute RESETB. (12. Reset sequence Reference)

\*2 There is no regulations at time until each signal is supplied from RESETB "H".  
But meanwhile, It is necessary to fix each signal to "H" or "L".

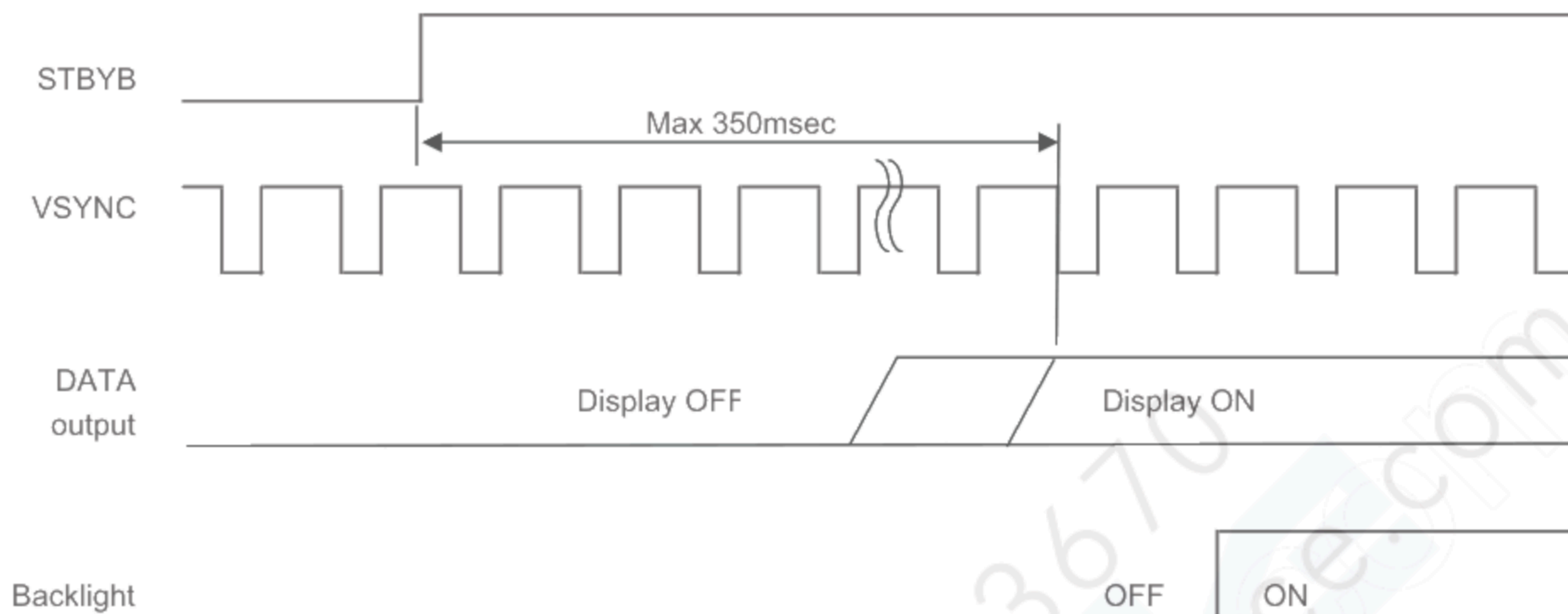
\*3 It is necessary to supply VSYNC and CLK (DOTCLK) for 16 frames or more from STBYB "L" to turning off the power supply without leaving the afterimage.



## 11. Display ON/OFF sequence

It explains the display sequence when display ON/OFF by the STBYB signal.

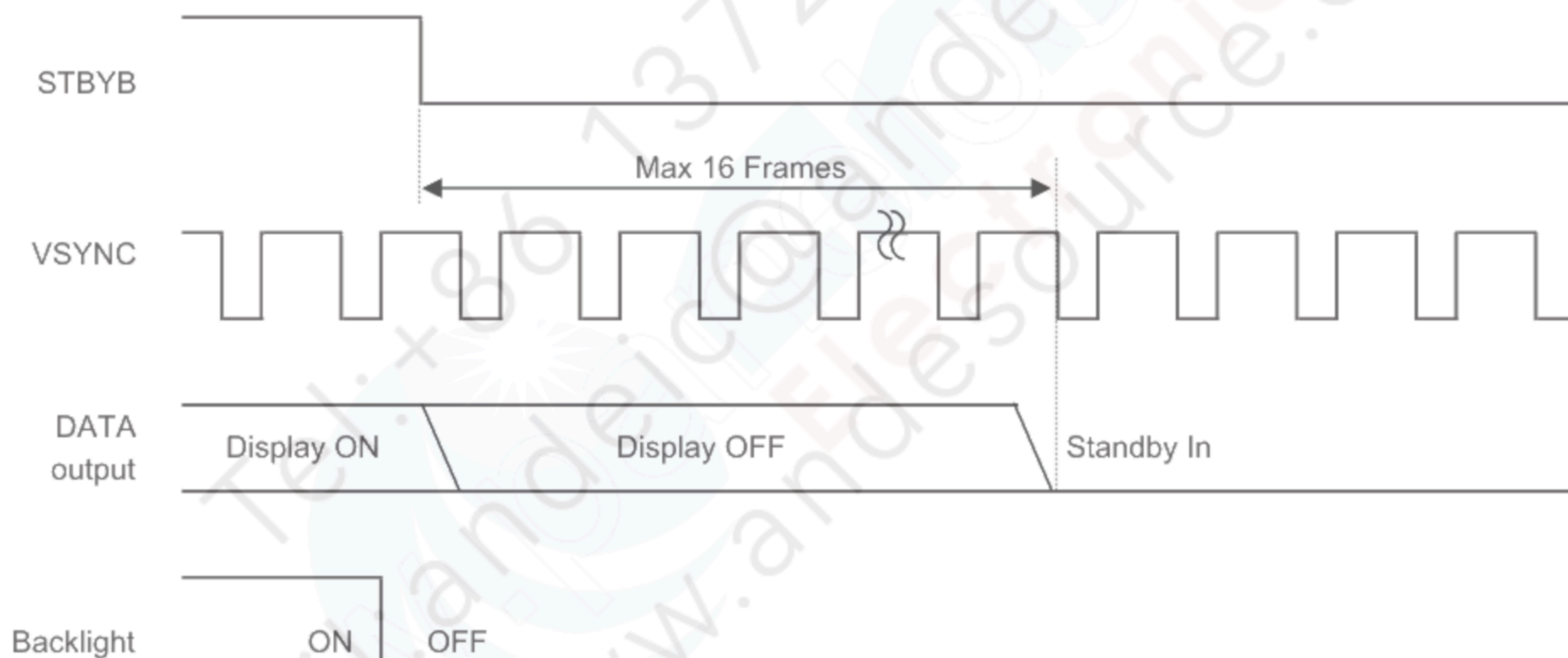
The following time will be needed by the time the displays begun from the standby release.



The following time will be needed by the time the standby sequence is ended from the standby setting.

Meanwhile, DOTCLK and the VSYNC signal should keep being supplied.

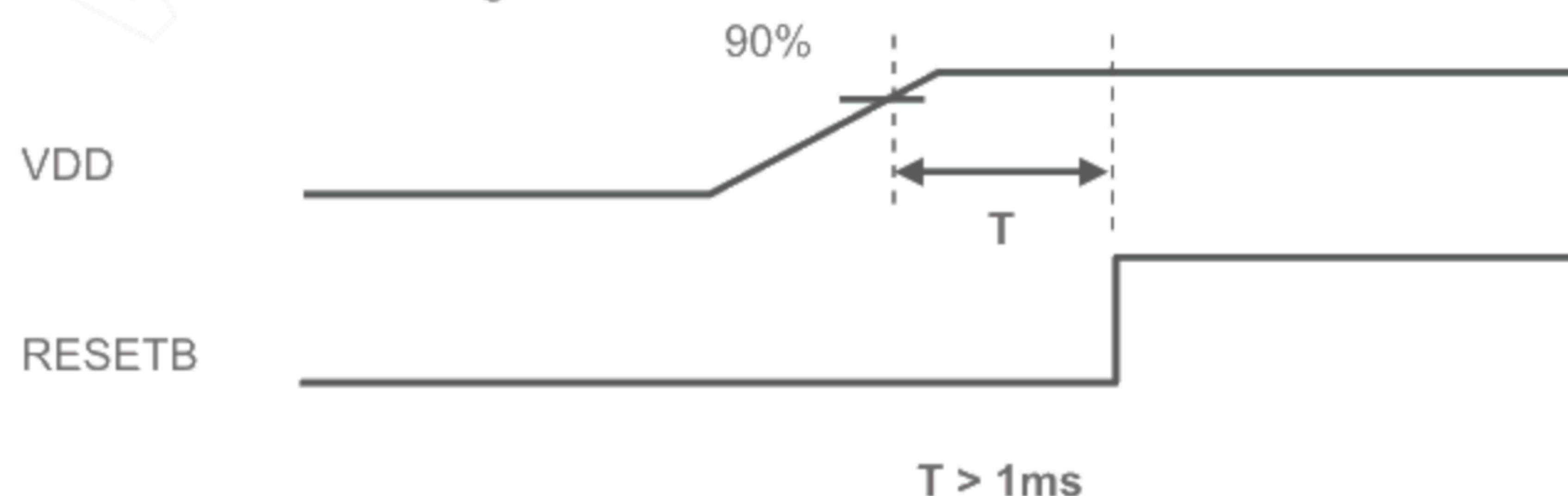
When DOTCLK and the VSYNC signal are stopped or the power supply is turned off to a regulated frame or less, the afterimage might remain.



## 12. Reset sequence

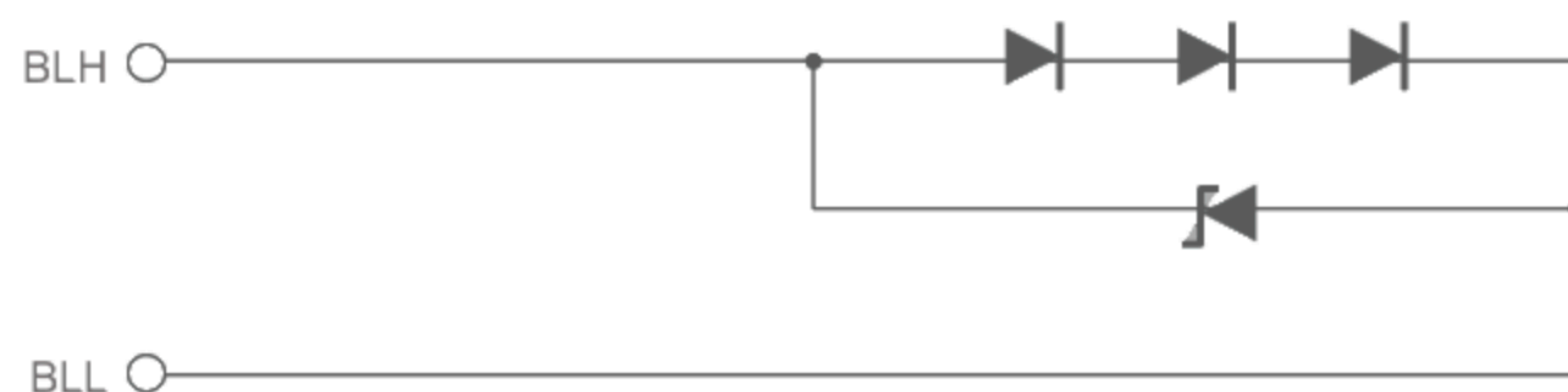
There is a limitation between the power supply turning on and the RESETB input.

Please defend the following conditions.





## 13. LED Circuit





## 14. Characteristics

## 14.1 Optical Characteristics

&lt; Measurement Condition &gt;

Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200(OTSUKA ELECTRONICS),  
EZcontrast160D (ELDIM)

Driving condition: VDD = 3.0V, VSS = 0V  
Optimized VCOMDC

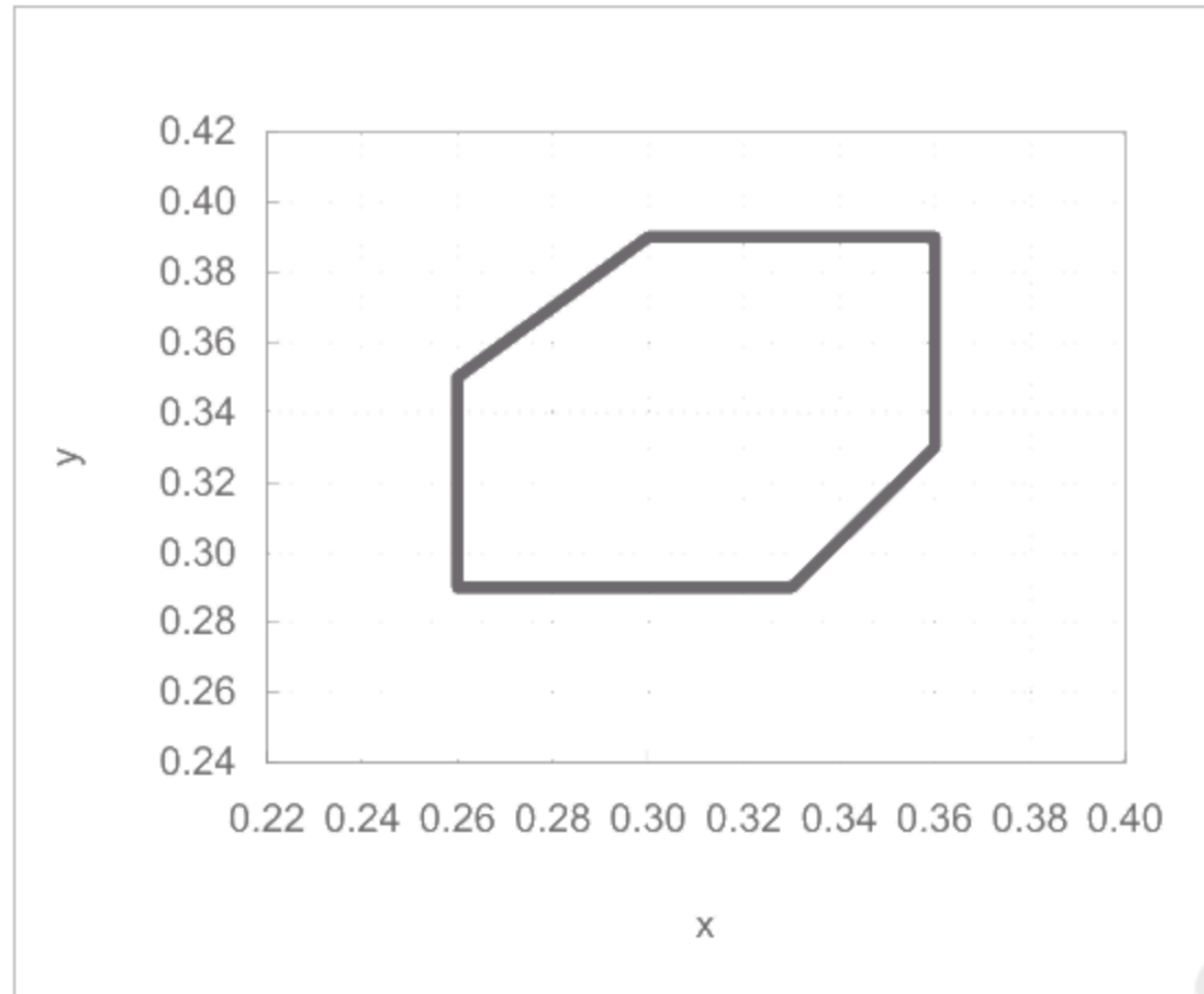
Backlight: IL=7.0mA

Measured temperature: Ta=25° C

| Item                    |               | Symbol | Condition                       | MIN                                                                                    | TYP | MAX | Unit              | Note No. | Remark |
|-------------------------|---------------|--------|---------------------------------|----------------------------------------------------------------------------------------|-----|-----|-------------------|----------|--------|
| Response time           | Rise time     | TON    | [Data]=<br>00h → 3Fh            | —                                                                                      | —   | 60  | ms                | 1        |        |
|                         | Fall time     | TOFF   | [Data]=<br>3Fh → 00h            | —                                                                                      | —   | 40  | ms                |          |        |
| Contrast ratio          | Backlight ON  | CR     | [Data]=<br>3Fh / 00h            | 400                                                                                    | 800 | —   |                   | 2        |        |
|                         | Backlight OFF |        |                                 | —                                                                                      | 2   | —   |                   |          |        |
| Viewing angle           | Left          | θL     | [Data]=<br>3Fh / 00h<br>CR ≥ 10 | 80                                                                                     | —   | —   | deg               | 3        |        |
|                         | Right         | θR     |                                 | 80                                                                                     | —   | —   | deg               |          |        |
|                         | Up            | φU     |                                 | 80                                                                                     | —   | —   | deg               |          |        |
|                         | Down          | φD     |                                 | 80                                                                                     | —   | —   | deg               |          |        |
| White Chromaticity      |               | x      | [Data]=3Fh                      | Refer to White chromaticity range                                                      |     |     | 4                 |          |        |
|                         |               | y      |                                 |                                                                                        |     |     |                   |          |        |
| Burn-in                 |               |        |                                 | No noticeable burn-in image shall be observed after 2 hours of window pattern display. |     |     | 5                 |          |        |
| Center brightness       |               |        | [Data]=3Fh                      | 240                                                                                    | 350 | —   | cd/m <sup>2</sup> | 6        |        |
| Brightness distribution |               |        | [Data]=3Fh                      | 70                                                                                     | —   | —   | %                 | 7        |        |

\* Note number 1 to 7: Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics and Performance".





White Chromaticity Range

【White Chromaticity Range】

| x    | y    |
|------|------|
| 0.30 | 0.39 |
| 0.26 | 0.35 |
| 0.26 | 0.29 |
| 0.33 | 0.29 |
| 0.36 | 0.33 |
| 0.36 | 0.39 |

## 14.2 Temperature Characteristics

&lt; Measurement Condition &gt;

Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200(OTSUKA ELECTRONICS)

Driving condition: VDD = 3.0V, VSS = 0V

Optimized VCOMDC

Backlight: IL=7.0mA

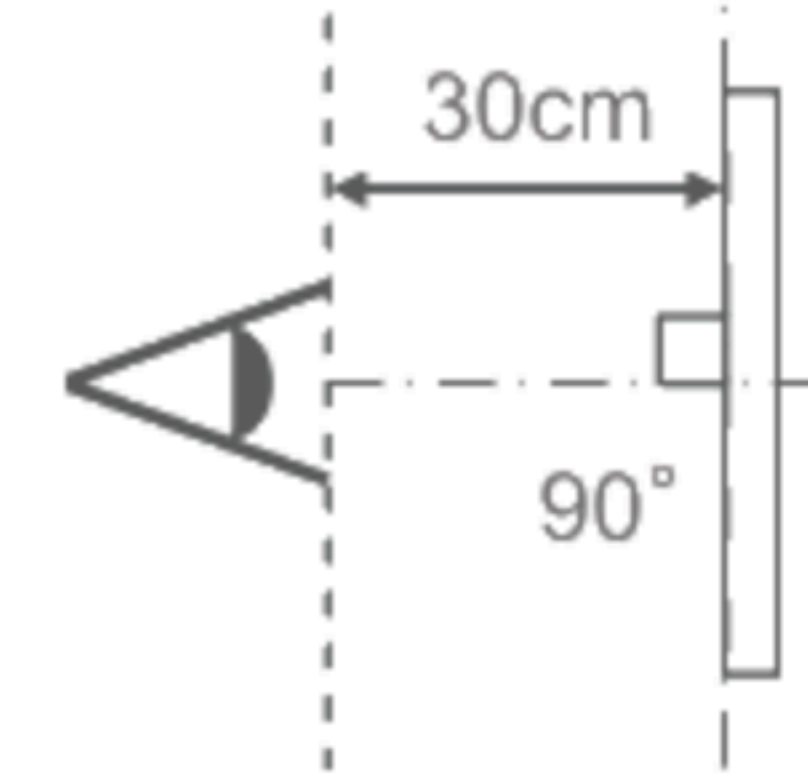
| Item            |           |      | Specification                                                    |                 | Remark       |
|-----------------|-----------|------|------------------------------------------------------------------|-----------------|--------------|
|                 |           |      | Ta=-20°C                                                         | Ta=70°C         |              |
| Contrast ratio  |           | CR   | 200 or more                                                      | 200 or more     | Backlight ON |
| Response time   | Rise time | TON  | 600 msec or less                                                 | 50 msec or less |              |
|                 | Fall time | TOFF | 400 msec or less                                                 | 30 msec or less |              |
| Display Quality |           |      | No noticeable display defect or ununiformity should be observed. |                 |              |



## 15. Criteria of Judgment

## 15.1 Defective Display and Screen Quality

|                      |                                                                                    |
|----------------------|------------------------------------------------------------------------------------|
| Test Condition:      | Observed TFT-LCD monitor from front during operation with the following conditions |
| Driving Signal       | Raster Pattern (RGB, white, black)                                                 |
| Signal condition     | [Data]: 00h, 28h, 3Fh (3steps)                                                     |
| Observation distance | 30 cm                                                                              |
| Illuminance          | 200 to 350 lx                                                                      |
| Backlight            | IL=7.0mA                                                                           |



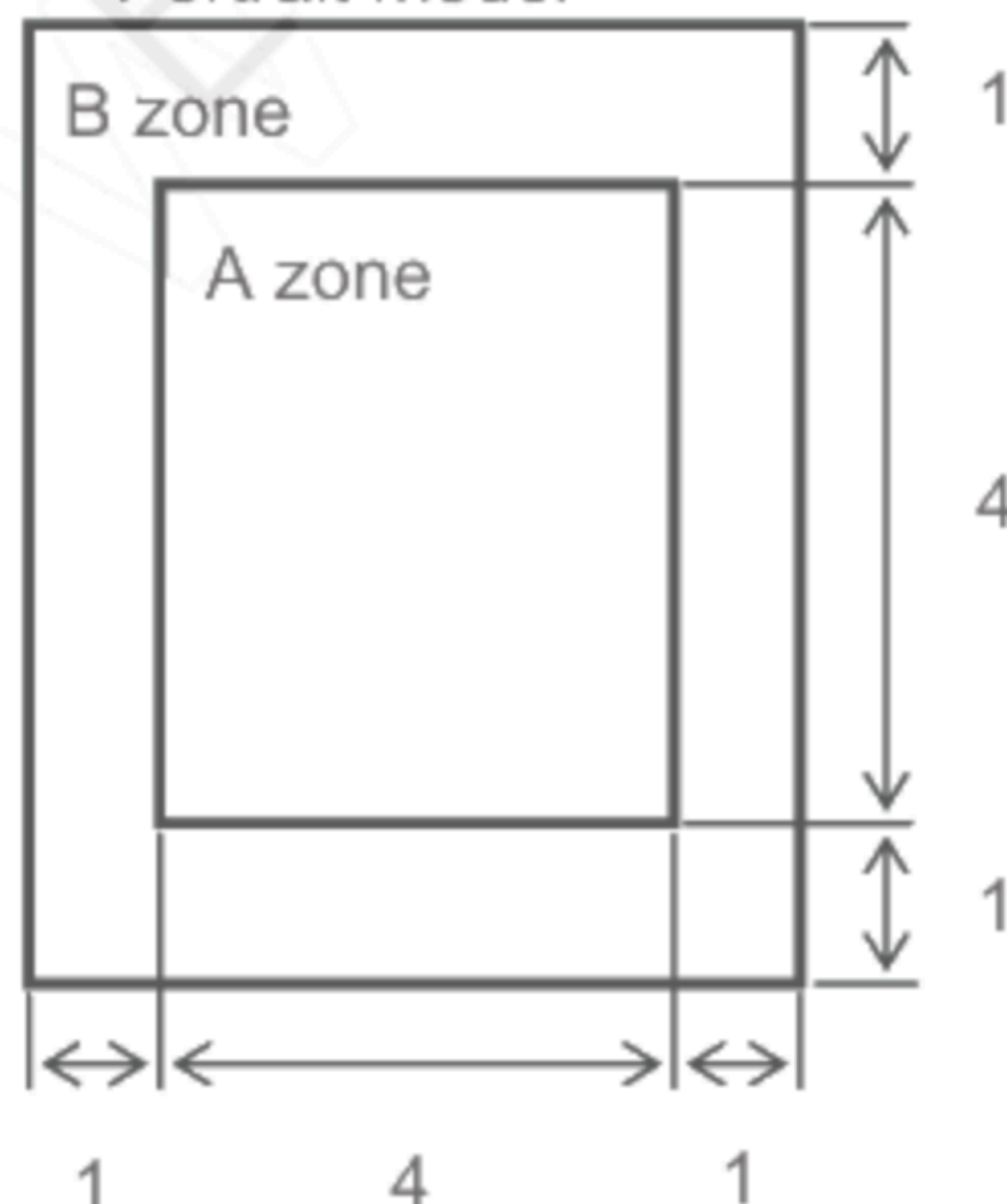
| Defect item     | Defect content   |                                                                                                                                                                                                                                                                                                                                                                        | Criteria                                                                                           |
|-----------------|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Display Quality | Line defect      | Black, white or color line, 3 or more neighboring defective dots                                                                                                                                                                                                                                                                                                       | Not exists                                                                                         |
|                 | Dot defect       | Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot)<br>High bright dot: Visible through 2% ND filter at [Data]=00h<br>Low bright dot: Visible through 5% ND filter at [Data]=00h<br>Dark dot: Appear dark through white display at [Data]=28h<br>Invisible through 5% ND filter at [Data]=00h | Refer to table 1                                                                                   |
|                 |                  |                                                                                                                                                                                                                                                                                                                                                                        | Acceptable                                                                                         |
|                 |                  |                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                    |
| Screen Quality  | Dirt             | Uneven brightness (white stain, black stain etc)                                                                                                                                                                                                                                                                                                                       | Invisible through 5% ND filter at Black screen.<br>Invisible through 1% ND filter at other screen. |
|                 | Foreign particle | Point-like                                                                                                                                                                                                                                                                                                                                                             | 0.25mm < $\phi$                                                                                    |
|                 |                  |                                                                                                                                                                                                                                                                                                                                                                        | 0.20mm < $\phi$ ≤ 0.25mm                                                                           |
|                 |                  |                                                                                                                                                                                                                                                                                                                                                                        | $\phi$ ≤ 0.20mm                                                                                    |
|                 |                  | Liner                                                                                                                                                                                                                                                                                                                                                                  | 3.0mm < length and 0.08mm < width                                                                  |
|                 |                  |                                                                                                                                                                                                                                                                                                                                                                        | length ≤ 3.0mm or width ≤ 0.08mm                                                                   |
|                 | Others           |                                                                                                                                                                                                                                                                                                                                                                        | Use boundary sample for judgment when necessary                                                    |

$\phi$ (mm): Average diameter = (major axis + minor axis)/2  
Permissible number: N

Table 1

| Area  | High bright dot | Low bright dot | Dark dot | Total | Criteria                                                                                           |
|-------|-----------------|----------------|----------|-------|----------------------------------------------------------------------------------------------------|
| A     | 0               | 2              | 2        | 3     | Permissible distance between same color bright dots (includes neighboring dots): 3 mm or more      |
| B     | 2               | 4              | 4        | 5     | Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more |
| Total | 2               | 4              | 4        | 5     |                                                                                                    |

&lt;Portrait model&gt;



Division of A and B areas

B area: Active area

Dimensional ratio between A and B areas: 1: 4: 1 (Refer to the left figure)



## 15.2 Screen and Other Appearance

## Testing conditions

Observation distance

30cm

Illuminance

1200~2000 lx

| Item      |        | Criteria                                          | Remark                                                                               |
|-----------|--------|---------------------------------------------------|--------------------------------------------------------------------------------------|
| Polarizer | Flaw   | Ignore invisible defect when the backlight is on. | Applicable area:<br>Active area only<br>(Refer to the section<br>3.2 "Outward form") |
|           | Stain  |                                                   |                                                                                      |
|           | Bubble |                                                   |                                                                                      |
|           | Dust   |                                                   |                                                                                      |
|           | Dent   |                                                   |                                                                                      |
| S-case    |        | No functional defect occurs                       |                                                                                      |
| FPC cable |        | No functional defect occurs                       |                                                                                      |



## 16. Reliability Test

| Test item                     |                                                 | Test condition                                                                                                                                                                                                                                 | number of failures<br>/number of examinations |
|-------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Durability test               | High temperature storage                        | Ta=80° C 240hrs                                                                                                                                                                                                                                | 0 / 3                                         |
|                               | Low temperature storage                         | Ta=-30° C 240hrs                                                                                                                                                                                                                               | 0 / 3                                         |
|                               | High temperature & high humidity storage        | Ta=60° C, RH=90%<br>non condensing ※                                                                                                                                                                                                           | 0 / 3                                         |
|                               | High temperature operation                      | Tp=70° C 240hrs                                                                                                                                                                                                                                | 0 / 3                                         |
|                               | Low temperature operation                       | Tp=-20° C 240hrs                                                                                                                                                                                                                               | 0 / 3                                         |
|                               | High temp & humid operation                     | Tp=40° C, RH=90%<br>non condensing ※                                                                                                                                                                                                           | 0 / 3                                         |
|                               | Thermal shock storage                           | -30←→80° C(30min/30min) 100 cycles                                                                                                                                                                                                             | 0 / 3                                         |
|                               | Lightfastness                                   | Xenon Blackpanel 63±3°C non-shower<br>450W/m <sup>2</sup> (300~700nm) non-operating<br>Integral dose 800MJ/m <sup>2</sup>                                                                                                                      | 0 / 3                                         |
| Mechanical environmental test | Electrostatic discharge test<br>(Non operation) | Confirms to EIAJ ED-4701/300<br>C=200pF,R=0Ω,V=±200V<br>Each 3 times of discharge on and power supply<br>and other terminals.                                                                                                                  | 0 / 3                                         |
|                               | Surface discharge test<br>(Non operation)       | C=250pF, R=100Ω, V=±12kV<br>Each 5 times of discharge in both polarities<br>on the center of screen with the case grounded.                                                                                                                    | 0 / 3                                         |
|                               | Vibration test                                  | Total amplitude 1.5mm, f=10~55Hz, X,Y,Z<br>directions for each 2 hours                                                                                                                                                                         | 0 / 3                                         |
|                               | Impact test                                     | Use TOPPAN PRINTING original jig<br>(see next page)and make an impact with<br>peak acceleration of 1000m/s <sup>2</sup> for 6 msec with<br>half sine-curve at 3 times to each X, Y, Z directions<br>in conformance with JIS C 60068-2-27-2011. | 0 / 3                                         |
| Packing test                  | Packing vibration-proof test                    | Acceleration of 19.6m/s <sup>2</sup> with frequency of<br>10→55→10Hz, X,Y, Zdirection for each<br>30 minutes                                                                                                                                   | 0 / 1 packing                                 |
|                               | Packing drop test                               | Drop from 75cm high.<br>1 time to each 6 surfaces, 3 edges, 1 corner                                                                                                                                                                           | 0 / 1 packing                                 |

Note:Ta=ambient temperature Tp=Panel temperature

※ The profile of high temperature/humidity storage and High Temperature/humidity operation  
(Pure water of over 10MΩ·cm shall be used.)

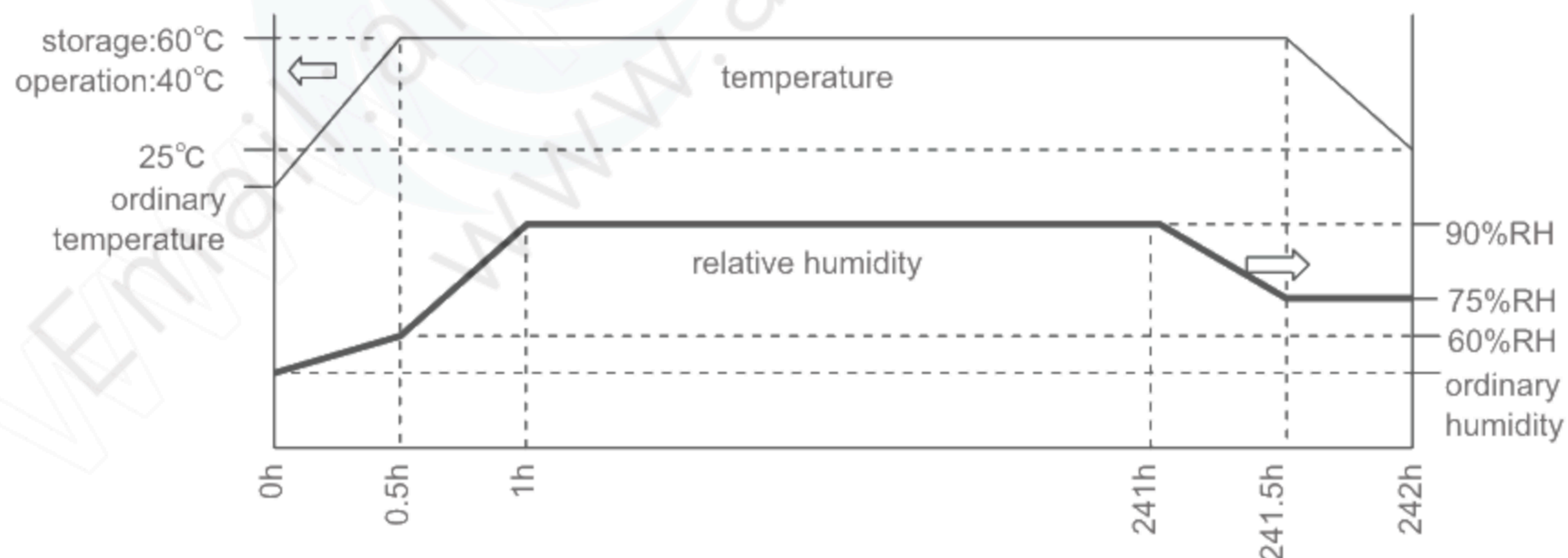


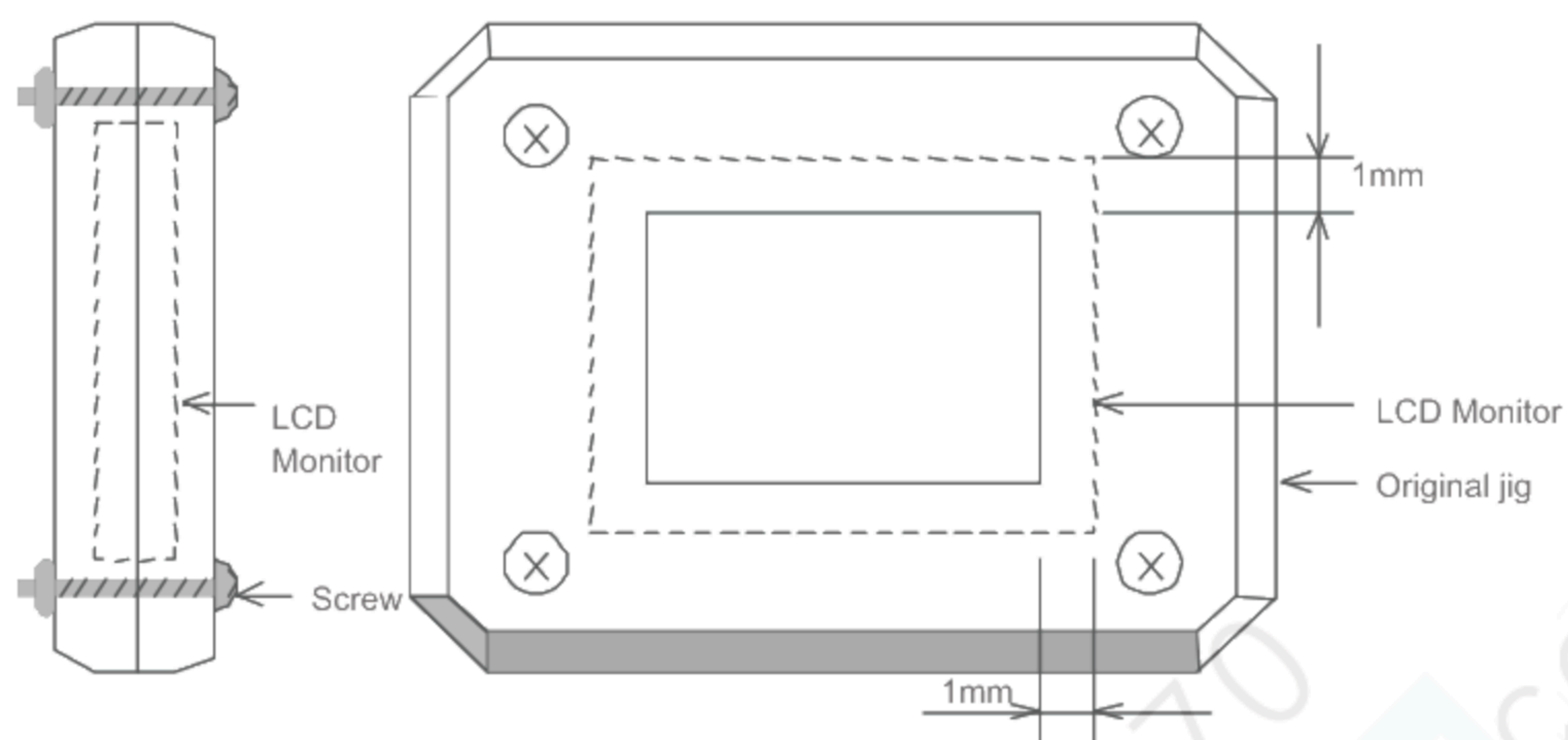
Table2.Reliability Criteria

The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

| item            | Standard                                                                               | Remarks      |
|-----------------|----------------------------------------------------------------------------------------|--------------|
| Display quality | No visible abnormality shall be seen.<br>(Except for unevenness by Pol deterioration.) |              |
| Contrast ratio  | 200 or more                                                                            | Backlight ON |

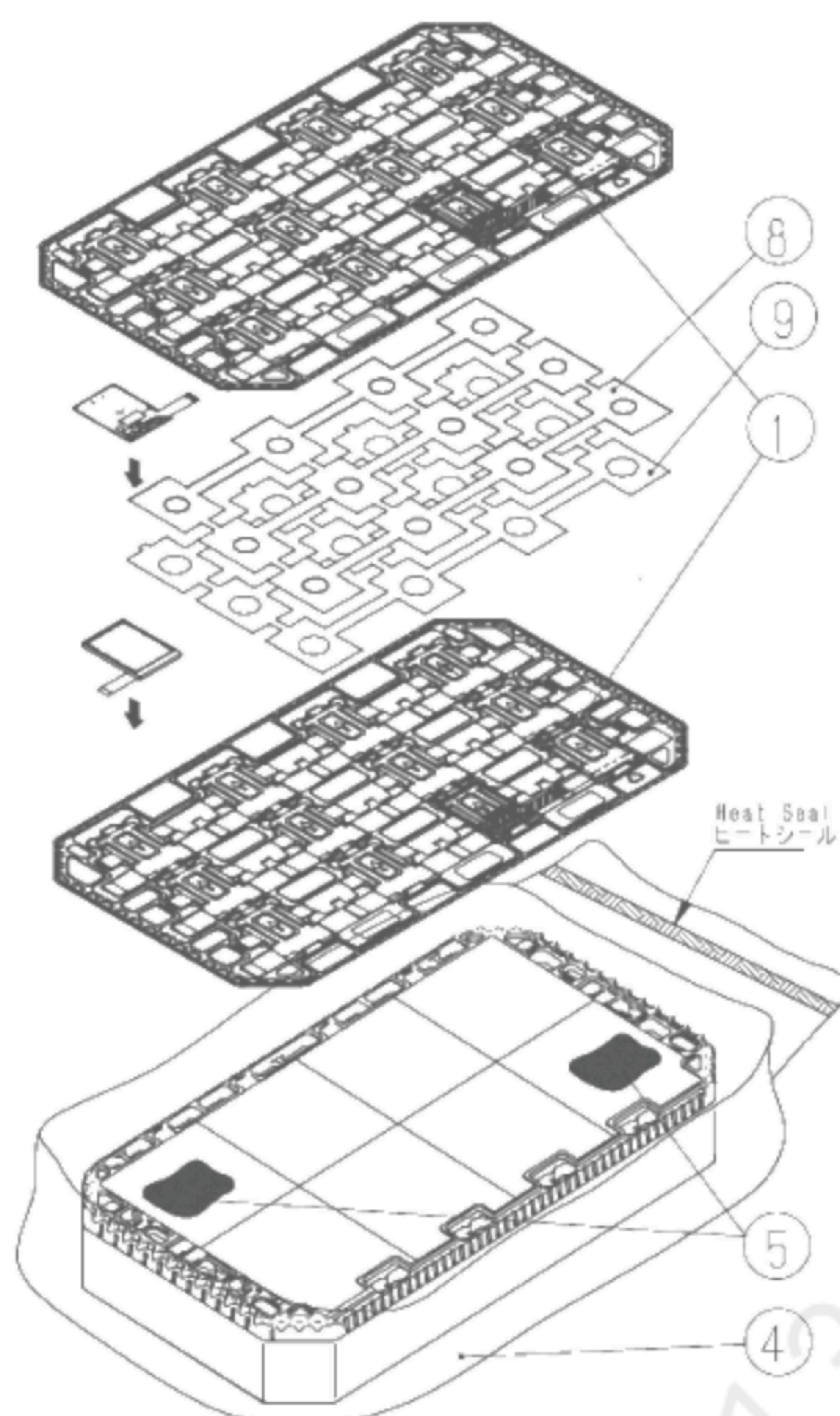


## TOPPAN PRINTING Original Jig





## 17. Packing Specifications



Step 1. Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.  
Foam sheet A/B are to be placed on the products in the tray.  
Each product is to be placed in one of the cut-outs of the tray with the display surface facing downward.(24products per tray)

Step 2. Each tray is to be piled up in same orientation and the trays be in a stack of 6.  
One empty tray is to be put on the top of stack of 6 trays.

Step 3. 2 packs of moisture absorbers are to be placed on the top tray as shown in the drawing.  
Put piled trays into a sealing bag.

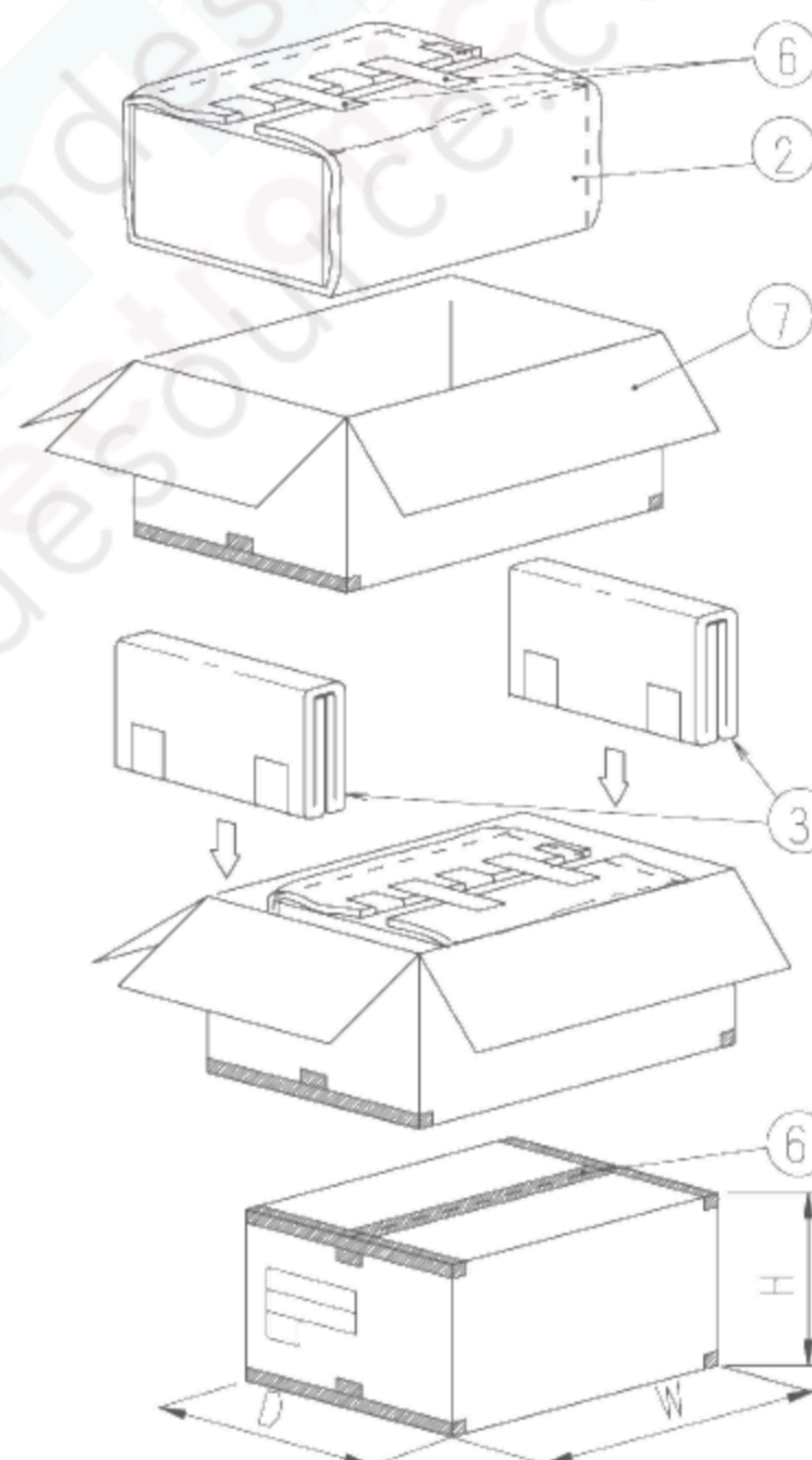
Step 4. Vacuum and seal the sealing bag with the vacuum sealing machine.

Step 5. The stack of trays in the plastic back is to be wrapped with B SHEET A.

Step 6. The wrapped trays are placed in the carton.

Step 7. B SHEET B are to be inserted into a outer carton with same orientation.  
The outer carton is to be sealed in H-shape with packing tape as shown in the drawing.

Step 8. The model number, quantity of products, and shipping date are to be printed on the outer carton.  
If necessary, shipping labels or impression markings are to be put on the outer carton.



Remark: The return of packing materials is not required.

| Packing item name | Specs., Material             |
|-------------------|------------------------------|
| ① Tray            | A-PET                        |
| ② B SHEET A       | Anti-static air babble sheet |
| ③ B SHEET B       | Anti-static air babble sheet |
| ④ Sealing bag     |                              |
| ⑤ Drier           | Moisture absorber            |
| ⑥ Packing tape    |                              |
| ⑦ Outer carton    | Corrugated cardboard         |
| ⑧ FOAM SHEET A    | Anti-static polyethylene     |
| ⑨ FOAM SHEET B    | Anti-static polyethylene     |

| Dimension of outer carton                  |           |
|--------------------------------------------|-----------|
| D : Approx.                                | ( 337mm ) |
| W : Approx.                                | ( 618mm ) |
| H : Approx.                                | ( 179mm ) |
| Quantity of products packed in one carton: | 144       |
| Gross weight : Approx.                     | 5.2 Kg    |



## 18. Handling Instruction

## 18.1 Cautions for Handling LCD panels

**Caution**

- (1) Do not make an impact on the LCD panel glass because it may break and you may get injured from it.
- (2) If the glass breaks, do not touch it with bare hands.  
(Fragment of broken glass may stick you or you cut yourself on it.)
- (3) If you get injured, receive adequate first aid and consult a medical doctor.
- (4) Do not let liquid crystal get into your mouth.  
(If the LCD panel glass breaks, try not let liquid crystal get into your mouth even toxic property of liquid crystal has not been confirmed.)
- (5) If liquid crystal adheres, rinse it out thoroughly.  
(If liquid crystal adheres to your cloth or skin, wipe it off with rubbing alcohol or wash it thoroughly with soap. If liquid crystal gets into eyes, rinse it with clean water for at least 15 minutes and consult an eye doctor.)
- (6) If you scrap this products, follow a disposal standard of industrial waste that is legally valid in the community, country or territory where you reside.
- (7) Do not connect or disconnect this product while its application products is powered on.
- (8) Do not attempt to disassemble or modify this product as it is precision component.
- (9) If a part of soldering part has been exposed, and avoid contact (short-circuit) with a metallic part of the case etc. about FPC of this model, please.  
Please insulate it with the insulating tape etc. if necessary.  
The defective operation is caused, and there is a possibility to generation of heat and the ignition.
- (10) Since excess current protection circuit is not built in this TFT module, there is the possibility that LCD module or peripheral circuit become feverish and burned in case abnormal operation is generated.  
We recommend you to add excess current protection circuit to power supply.
- (11) The devices on the FPC are damageable to electrostatic discharge, because the terminals of the devices are exposed.  
Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors.  
Designate an appropriate operating area, and set equipment, tools, and machines properly when handling this product.

**Caution**

This mark is used to indicate a precaution or an instruction which, if not correctly observed, may result in bodily injury, or material damages alone.



## 18.2 Precautions for Handling

- 1) Wear finger tips at incoming inspection and for handling the TFT monitors to keep display quality and keep the working area clean.  
Do not touch the surface of the monitor as it is easily scratched.
- 2) Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors as the LED in this TFT monitors is damageable to electrostatic discharge. Designate an appropriate operating area, and set equipment, tools, and machines properly when handling this product.
- 3) Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors for protecting their glass parts. Do not use the TFT monitors that have been experienced dropping or strong mechanical shock.
- 4) Do not use or storage the TFT monitors at high temperature and high humidity environment. Particularly, never use or storage the TFT monitors at a location where condensation builds up.
- 5) Avoid using and storing TFT monitors at a location where they are exposed to direct sunlight or ultraviolet rays to prevent the LCD panels from deterioration by ultraviolet rays.
- 6) Do not stain or damage the contacts of the FPC cable .  
FPC cable needs to be inserted until it can reach to the end of connector slot.  
During insertion, make sure to keep the cable in a horizontal position to avoid an oblique insertion.  
Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable.
- 7) Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.
- 8) Peel off the protective film on the TFT monitors during mounting process.  
Refer to the section 18.5 on how to peel off the protective film.  
We are not responsible for electrostatic discharge failures or other defects occur when peeling off the protective film.

## 18.3 Precautions for Operation

- 1) Since this TFT monitors are not equipped with light shielding for the driver IC, do not expose the driver IC to strong lights during operation as it may cause functional failures.
- 2) In case of powering up or powering off this LCD module, be sure to comply the sequence as instructed in this specification.
- 3) Do not plug in or out the FPC cable while power supply is switch on.  
Plug the FPC cable in and out while power supply is switched off.
- 4) Do not operate the TFT monitors in the strong magnetic field. It may break the TFT monitors.
- 5) Do not display a fixed image on the screen for a long time.  
Use a screen-saver or other measures to avoid a fixed image displayed on the screen for a long time.  
Otherwise, it may cause burn-in image on the screen due the characteristics of liquid crystal.



## 18.4 Storage Condition for Shipping Cartons

## Storage environment

- Temperature 0 to 40° C
- Humidity 60%RH or less  
No-condensing occurs under low temperature with high humidity condition.
- Atmosphere No poisonous gas that can erode electronic components and/or wiring materials should be detected.
- Time period 1 year
- Unpacking To prevent damages caused by static electricity, anti-static precautionary measures (e.g. earthing, anti-static mat) should be implemented.  
After unpack, keep product in the appropriate condition, otherwise bubble seal of Protective film may be printed on Polarizer.
- Maximum piling up 7 cartons

## \*Conditions to storage after unpacking

## Storage environment

- Temperature 0 to 40° C
- Humidity 60%RH or less  
No-condensing occurs under low temperature with high humidity condition.
- Atmosphere No poisonous gas that can erode electronic components and/or wiring materials should be detected.
- Time period 1 year (Shelf life)
- Others Keep/ store away from direct sunlight  
Storage goods on original tray made by TOPPAN PRINTING.



## 18.5 Precautions for Peeling off the Protective film

The followings work environment and work method are recommended to prevent the TFT monitors from static damage or adhesion of dust when peeling off the protective films.

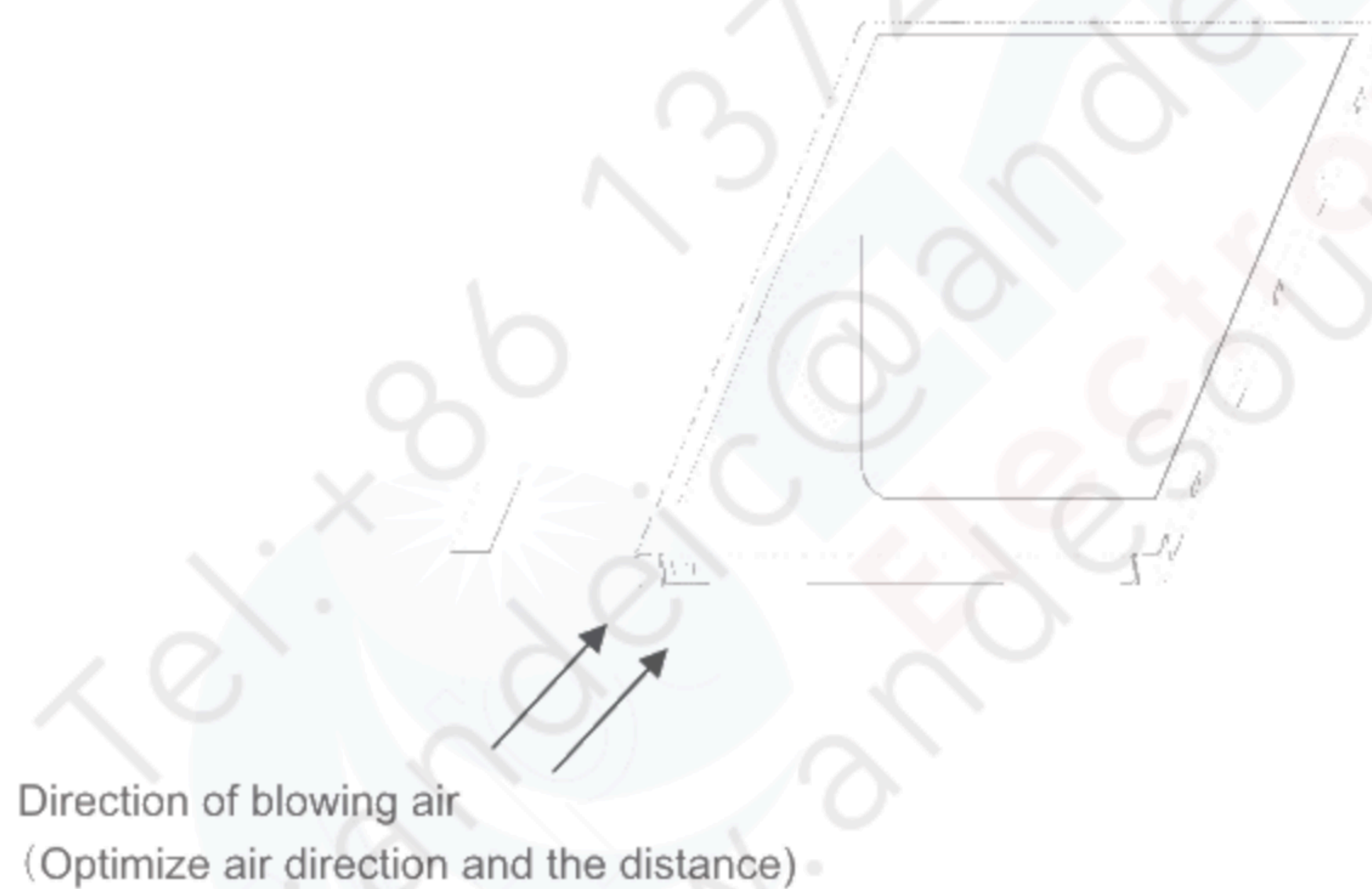
### A) Work Environment

- a) Humidity: 50 to 70 %RH, Temperature 15 to 27 °C
- b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps.  
Use an electrostatic neutralization blower.  
Anti-static treatment should be implemented to work area's floor.
- c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

### B) Work Method

The following procedures should be taken to prevent the driver ICs from charging and discharging.

- a) Use an electrostatic neutralization blower to blow air on the TFT monitors to its lower left when FPC is placed at the left.  
Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Put an adhesive tape (Scotch tape, etc) at the lower left corner area of the protective film to prevent scratch on surface of TFT monitors.
- c) Peel off the adhesive tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



## 18.6 Warranty

TOPPAN PRINTING is only liable to defective goods which is stored and used under the condition complying with this specifications and returned within 1 (one) year.

Warranty caused by manufacturing defect shall be conducted by replacement of goods or refundment at unit price.



**APPENDIX**

## Reference Method for Measuring Optical Characteristics and Performance

## 1. Measurement Condition (Backlight ON)

Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrast160D (ELDIM)

Driving condition: Refer to the section "Optical Characteristics"

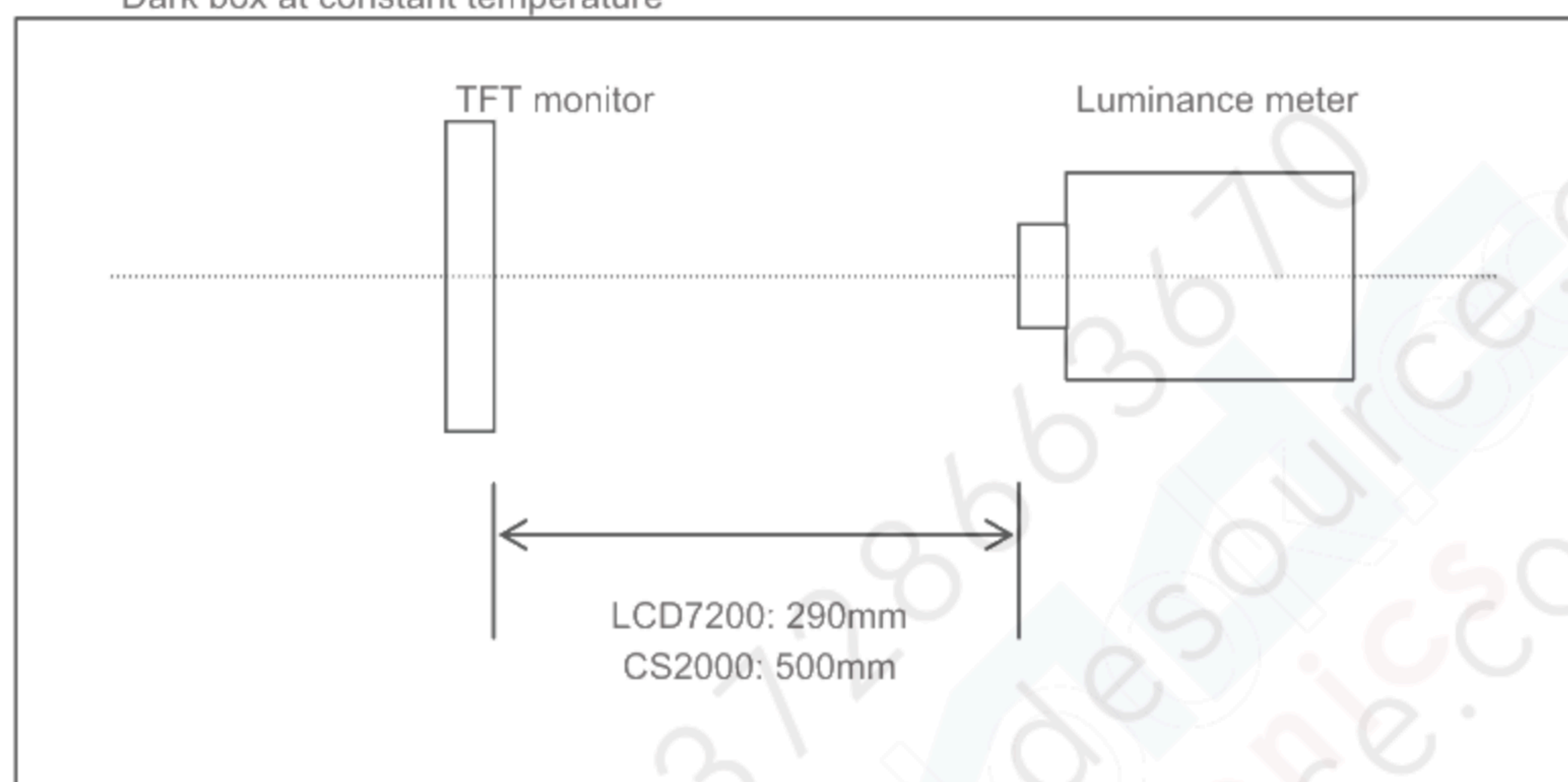
Measured temperature: 25° C unless specified

Measurement system: See the chart below.

The luminance meter is placed on the normal line of measurement system.

Measurement point: At the center of the screen unless otherwise specified

Dark box at constant temperature

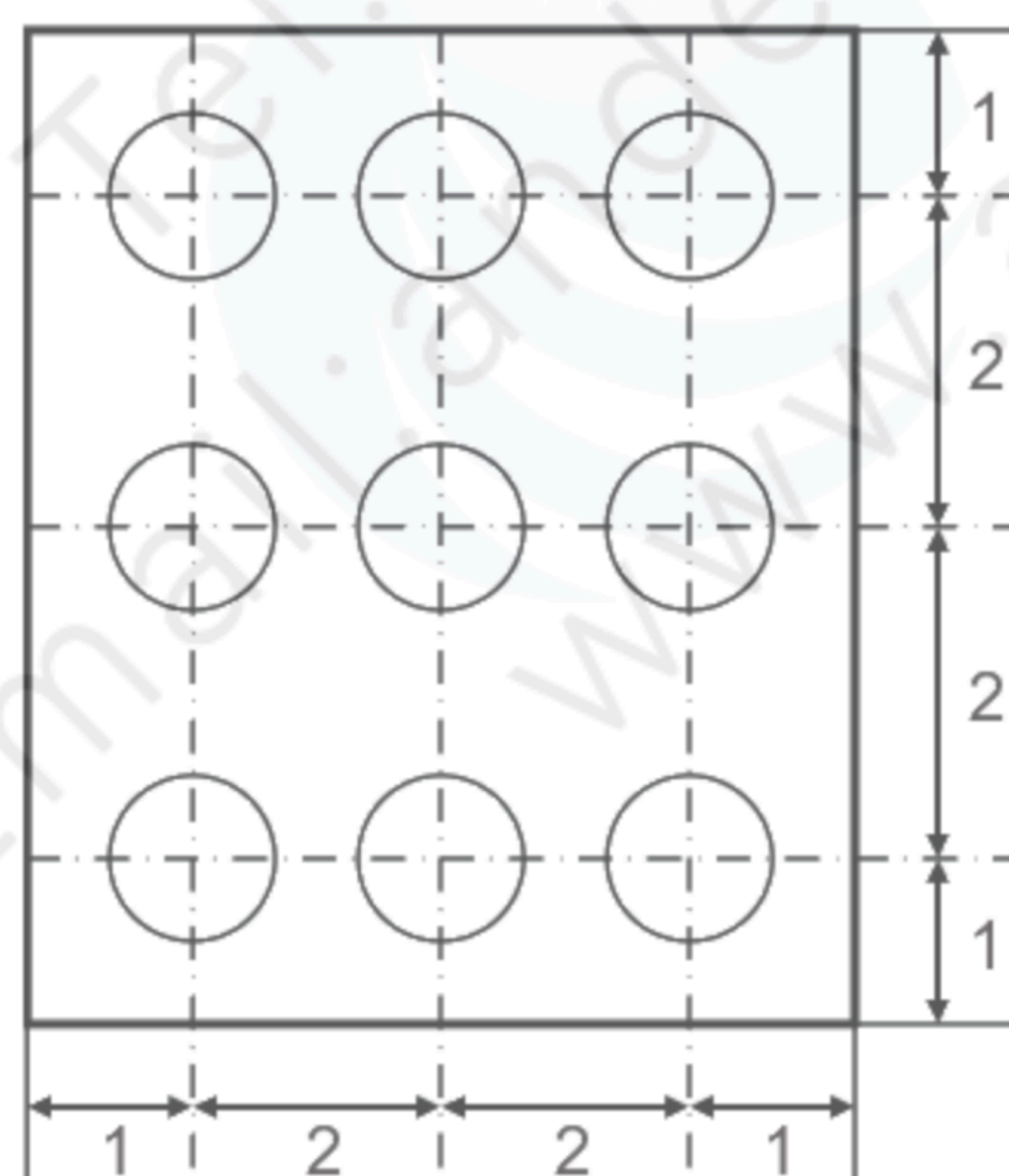


Measurement is made after 30 minutes of lighting of the backlight.

Measurement point: At the center point of the screen

Brightness distribution: 9 points shown in the following drawing.

<Portrait model>



Dimensional ratio of active area

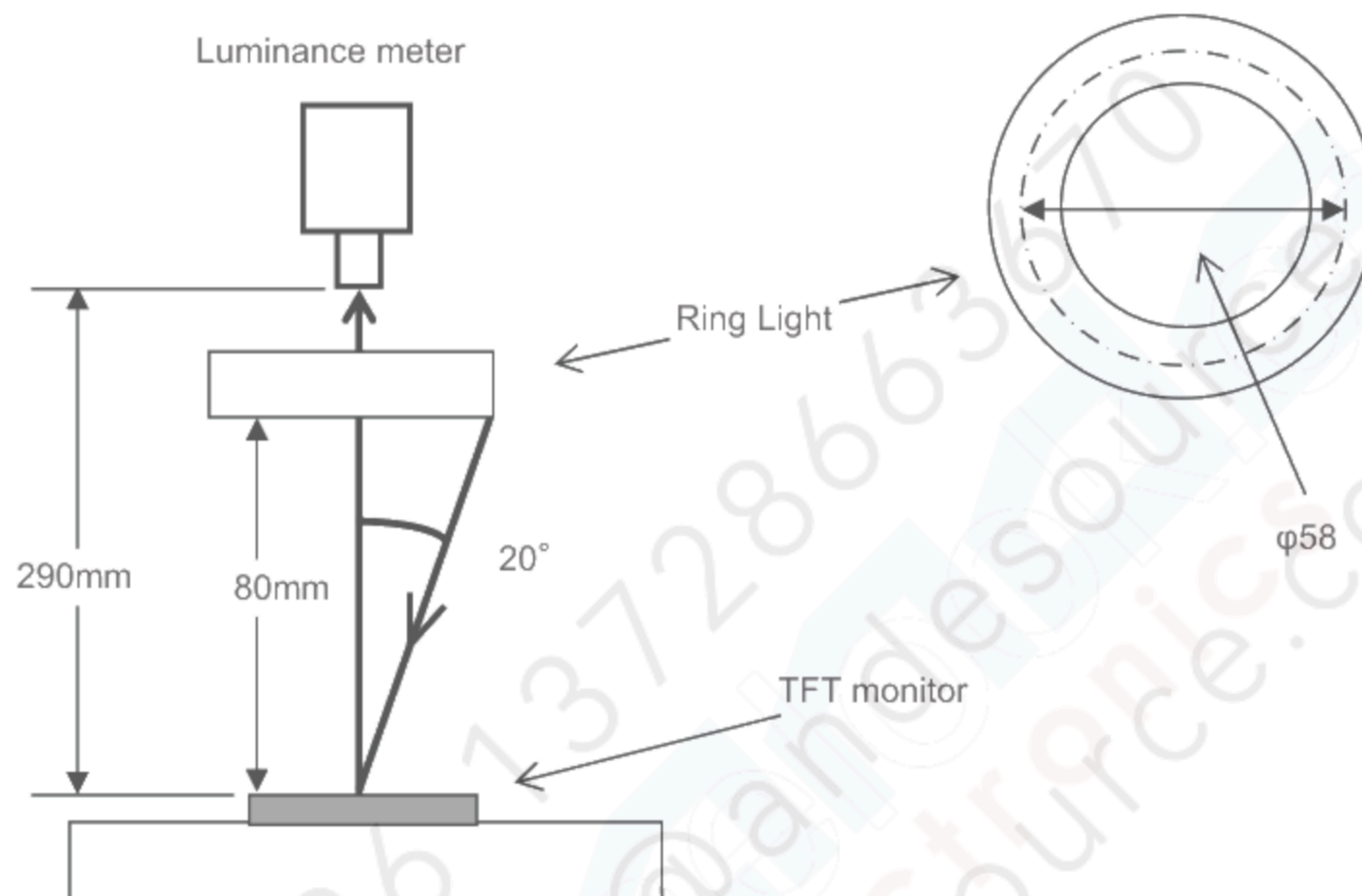
Backlight

IL=7.0mA



## Measurement Condition (Contrast ratio Backlight OFF only)

Measuring instruments: LCD7200(OTSUKA ELECTRONICS),Ring Light(40,000 lx, $\phi 58$ )  
Driving condition: Refer to the section "Optical Characteristics"  
Measured temperature: 25° C unless specified  
Measurement system: See the chart below.  
Measurement point: At the center of the screen.





## 2. Test Method

| Notice | Item                                      | Test method                                                                                                                                                                                                                                                                                                                                    | Measuring instrument   | Remark                                                                                                                   |
|--------|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1      | Response time                             | <p>Measure output signal waves with a brightness meter when the raster or window pattern is changed over from Black to White and from White to Black</p> <p>Black White Black</p> <p>White brightness</p> <p>100%</p> <p>90%</p> <p>10%</p> <p>0%</p> <p>Black brightness</p> <p>TON</p> <p>TOFF</p>                                           | LCD7200                | <p>Black display [Data]=00h</p> <p>White display [Data]=3Fh</p> <p>TON</p> <p>Rise time</p> <p>TOFF</p> <p>Fall time</p> |
| 2      | Contrast ratio                            | <p>Measure maximum luminance Y1([Data]=3Fh) and minimum luminance Y2([Data]=00h) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values.</p> <p>Contrast ratio = Y1/Y2</p> <p>Diameter of measuring point: 7.8mmφ(CS2000)</p> <p>Diameter of measuring point: 3mmφ(LCD7200)</p> | CS2000<br>LCD7200      | Backlight ON<br>Backlight OFF                                                                                            |
| 3      | Viewing angle<br>Horizontalθ<br>Verticalφ | Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is 10.                                                                                                                                                                                                                               | EZcontrast160D         |                                                                                                                          |
| 4      | White chromaticity                        | <p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = 3Fh</p> <p>Color matching function: 2°view</p> <p>Measurement angle: 1°</p>                                                                                                                                                                             | CS2000                 |                                                                                                                          |
| 5      | Burn-in                                   | Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=00h/3Fh).                                                                                                                                                                                                                                                 | At optimized<br>VCOMDC |                                                                                                                          |
| 6      | Center brightness                         | Measure the brightness at the center of the screen.                                                                                                                                                                                                                                                                                            | CS2000                 |                                                                                                                          |
| 7      | Brightness distribution                   | <p>(Brightness distribution) = 100 x B/A %</p> <p>A : max. brightness of the 9 points</p> <p>B : min. brightness of the 9 points</p>                                                                                                                                                                                                           | CS2000                 |                                                                                                                          |