

# INDUSTRIAL STRENGTH... Start Your Application From YOURITECH





## Specifications for

### **Blanview TFT-LCD Monitor** ( 4.3" WQVGA 480 x RGB x 272 Landscape)



### **Sunlight readable TFT-LCD Monitor**

Version 5.0

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

**MODEL COM43H4N44ULC**

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

# ORTUSTECH



TOPPAN INC.  
Electronics Division  
Technological Development Department IV

Approved by

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Checked by

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Prepared by

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## TOPPAN INC.

## Version History

| Ver.                                                                                          | Date         | Page                                                                     | Description                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.0                                                                                           | Mar.1,2018   | -                                                                        | -                                                                                                                           | Tentative issue                                                                                                                                                                                                                                                                                                                                                                 |
| 0.1<br> ×3   | Apr.24,2018  | 8<br>12<br><br>18                                                        | correction<br>add<br><br>correction                                                                                         | General tolerance 0.2 → 0.5<br>Total LED current value IL1=IL2=(25) mA<br>Added LED VF value (reference value).<br>Note 1, IL1 = IL2 recommended comment added<br>Number of LED lights changed. IL / IL 1 / IL 2 / VF 1 / VF 2.<br>IL1 = IL2 Recommended comments added.                                                                                                        |
| 0.2<br> ×1   | Aug.24,2018  | 23                                                                       | add                                                                                                                         | Lightfastness                                                                                                                                                                                                                                                                                                                                                                   |
| 1.0<br> ×13  | Dec.21,2018  | <br>3<br>7<br>11<br>12<br><br>19<br>20<br><br>21<br>23<br>25<br>29<br>30 | <br>correction<br>add<br>add<br>add<br><br>correction<br>correction<br>add<br>correction<br>add<br>add<br>correction<br>add | First issue<br>Serial Label (S-LABEL) → Serial No. print (S-print)<br>Weight<br>LED direction current of order<br>Current consumption<br>The backlight part<br>Optical Characteristics<br>White Chromaticity Range<br>Temperature Characteristics<br>Signal condition<br>Reliability Test<br>Packing Specifications<br>Figure of Protective film<br>The backlight current value |
| 2.0<br> ×3 | Jul.1.2019   | All page<br><br>4<br>32                                                  | correction<br><br>correction<br>add                                                                                         | It is a company name change from ORTUS TECHNOLOGY CO.,LTD. to<br>TOPPAN PRINTING CO.,LTD.<br>RoHS(2.0) directive<br>Measurement angle                                                                                                                                                                                                                                           |
| 3.0<br> ×5 | Mar. 31,2021 | 19<br>20<br>23<br><br>30<br>32                                           | change<br>change<br>change<br>correction<br>change<br>change                                                                | Measuring instruments<br>Measuring instruments<br>Test condition (Vibration test)<br>Temperature / humidity profile diagram<br>Measuring instruments<br>Measuring instruments                                                                                                                                                                                                   |
| 4.0<br> ×9 | Jul.12,2023  | All<br><br>1<br>11<br><br>12<br>19<br>19-21,30                           | change<br><br>change<br>correction<br>add<br>correction<br>correction<br>correction                                         | It is a company name change from<br>TOPPAN PRINTING CO.,LTD. to TOPPAN INC.<br>Department name<br>LED direction current<br>Note<br>Estimated Life of LED<br>Center brightness<br>Notation of BI current                                                                                                                                                                         |
| 5.0<br> ×7 | Dec.26,2024  | All<br><br>P.1<br><br>P.4<br><br>P.6                                     | Change<br><br>Add<br>Change<br><br>Add<br>Change                                                                            | All<br>Company name font<br>Cover<br>Model specification<br>Department name<br>Contents<br>Item<br>2.1 Features of the Product<br>Note                                                                                                                                                                                                                                          |

| Ver.                                                                                 | Date        | Page | Description |                                         |
|--------------------------------------------------------------------------------------|-------------|------|-------------|-----------------------------------------|
| 5.0                                                                                  | Dec.26,2024 | P.7  | Change      | <Features of Blanview><br>Content       |
|  ×7 |             | P.20 |             | 10.2 About Sunlight readable<br>Content |
|                                                                                      |             |      | Add         |                                         |



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## 1. Application

This Specification is applicable to 109mm (4.3 inch) Blanview TFT-LCD monitor for non-military use.

- ◎ TOPPAN 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 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'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'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 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 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.
- ◎ TOPPAN is not responsible for any nonconformities and defects that are not specified in this specifications.
- ◎ If any issue arises as to information provided in this Specification or any other information, TOPPAN and Purchaser shall discuss them in good faith and seek solution.
- ◎ TOPPAN 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.

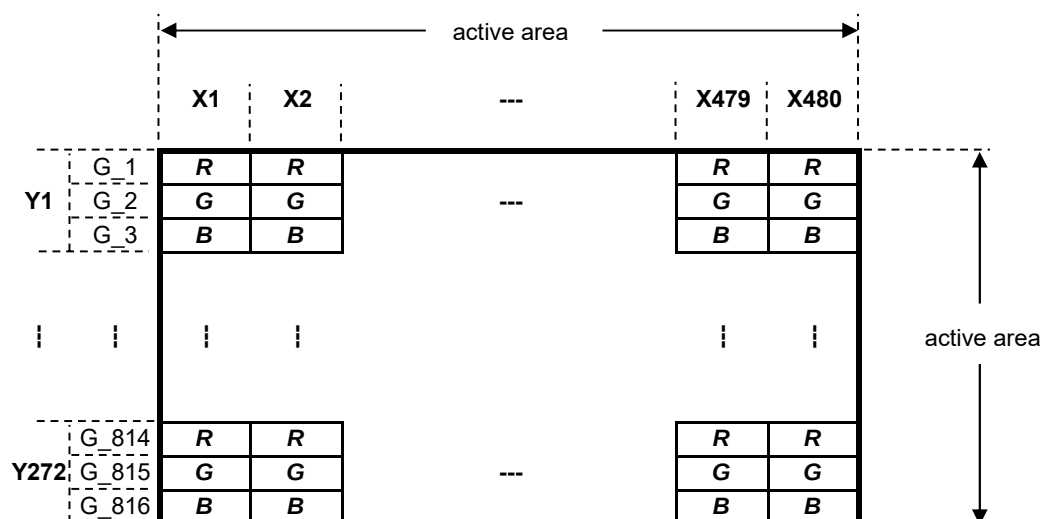
| Object substance                                   | Maximum content [ppm] |
|----------------------------------------------------|-----------------------|
| Cadmium and its compound                           | 100                   |
| Hexavalent Chromium Compound                       | 1000                  |
| 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                  |

AG

- 4.3 inch diagonal display, 480 [H] x 272RGB [V] dots.
- 8-bit 16,777,216 color display capability.
- Single power supply operation of 3.3V.
- Built in Timing generator (TG), Counter-electrode driving circuitry and power supply circuit.
- High bright white LED back-light.
- Blanview TFT-LCD, improved outdoor readability.

|               | Indoor      |                                    | Outdoor     |                                    |
|---------------|-------------|------------------------------------|-------------|------------------------------------|
|               | Readability | Power Efficiency<br>(Battery Life) | Readability | Power Efficiency<br>(Battery Life) |
| Transmissive  | Good        | Good                               | Average     | Poor                               |
| Transflective | Average     | Poor                               | Good        | Good                               |
| Blanview      | Good        | Good                               | Excellent   | Excellent                          |

| Items               | Specifications                                           | Remarks                     |
|---------------------|----------------------------------------------------------|-----------------------------|
| Display type        | VA type 16,777,216 colors.<br>Blanview, Normally black.  |                             |
| Driving method      | a-Si TFT Active matrix.<br>Line-scanning, Non-interlace. |                             |
| Dot arrangement     | RGB horizontal stripe arrangement.                       | Refer to "Dot arrangement". |
| Signal input method | 8-bit RGB, parallel input.                               |                             |
| Backlight type      | High bright white LED.                                   |                             |
| NTSC ratio          | 50%                                                      |                             |



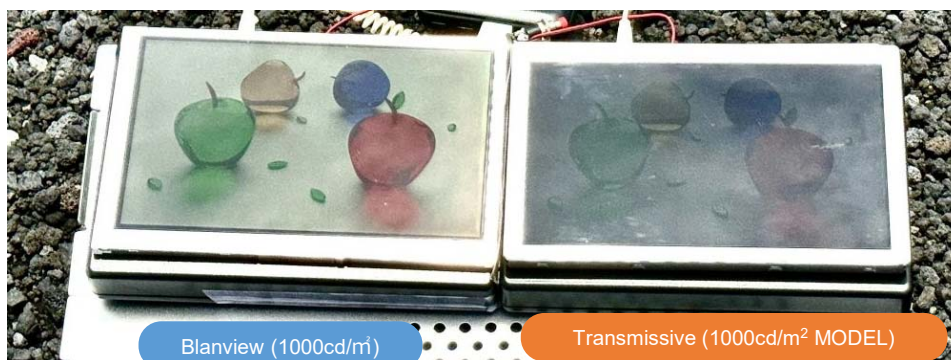
Dot arrangement (FPC cable placed downside)

## &lt;Features of Blanview&gt;

( A 7.0" WVGA display is shown as a typical sample)



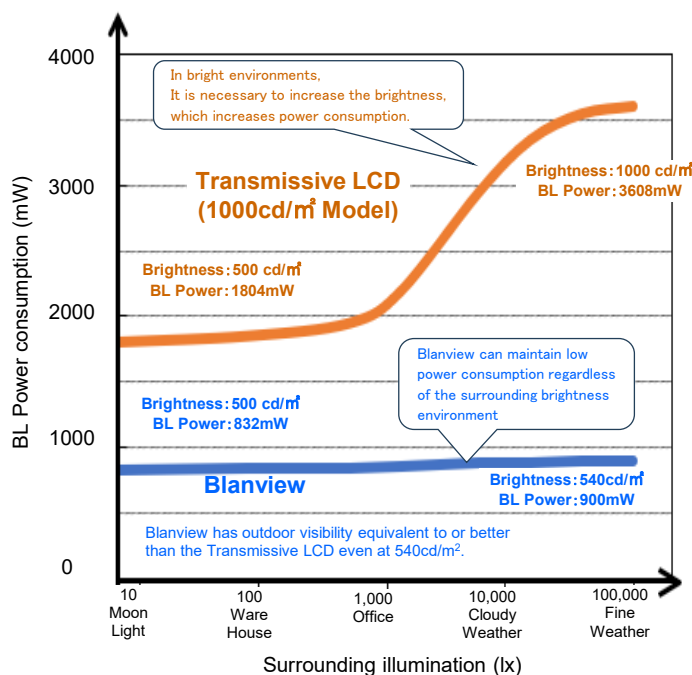
Blanview is a TFT-LCD monitor that achieves sunlight readability with low power consumption.



\*Display image comparison photo outdoors ( at 100,000lx )

\* When compared at the same power consumption, Blanview's contrast at 100,000lx is more than two times higher than that of a transmissive LCD (1000cd/m<sup>2</sup> model). Blanview's contrast is 17.5, while that of a transmissive LCD is 7.5. Sunlight readability is Good with a contrast of 8 or higher on the TOPPAN index. (Contrast at 100,000lx is reference data.)

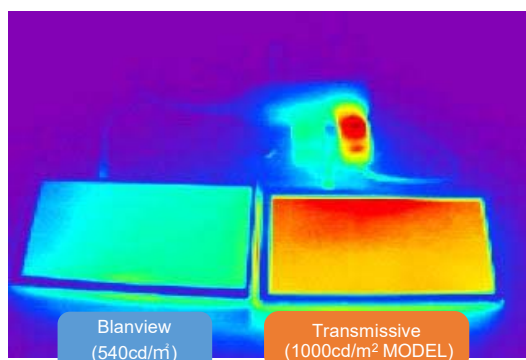
- Backlight power consumption required to assure visibility. (equivalent to 7.0" WVGA )



Sunlight Readable / BL Power comparison

|                                                | Sunlight Readable | BL Power  |
|------------------------------------------------|-------------------|-----------|
| Transmissive LCD (1000cd/m <sup>2</sup> Model) | Average           | Poor      |
| Blanview                                       | Excellent         | Excellent |

In bright environment, other companies' products require higher brightness, which increases power consumption, However TOPPAN' Blanview can maintain low power consumption without increasing brightness (visibility is not easily affected by the environment).



\*Observation image with thermograph

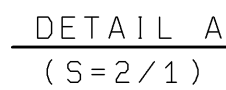
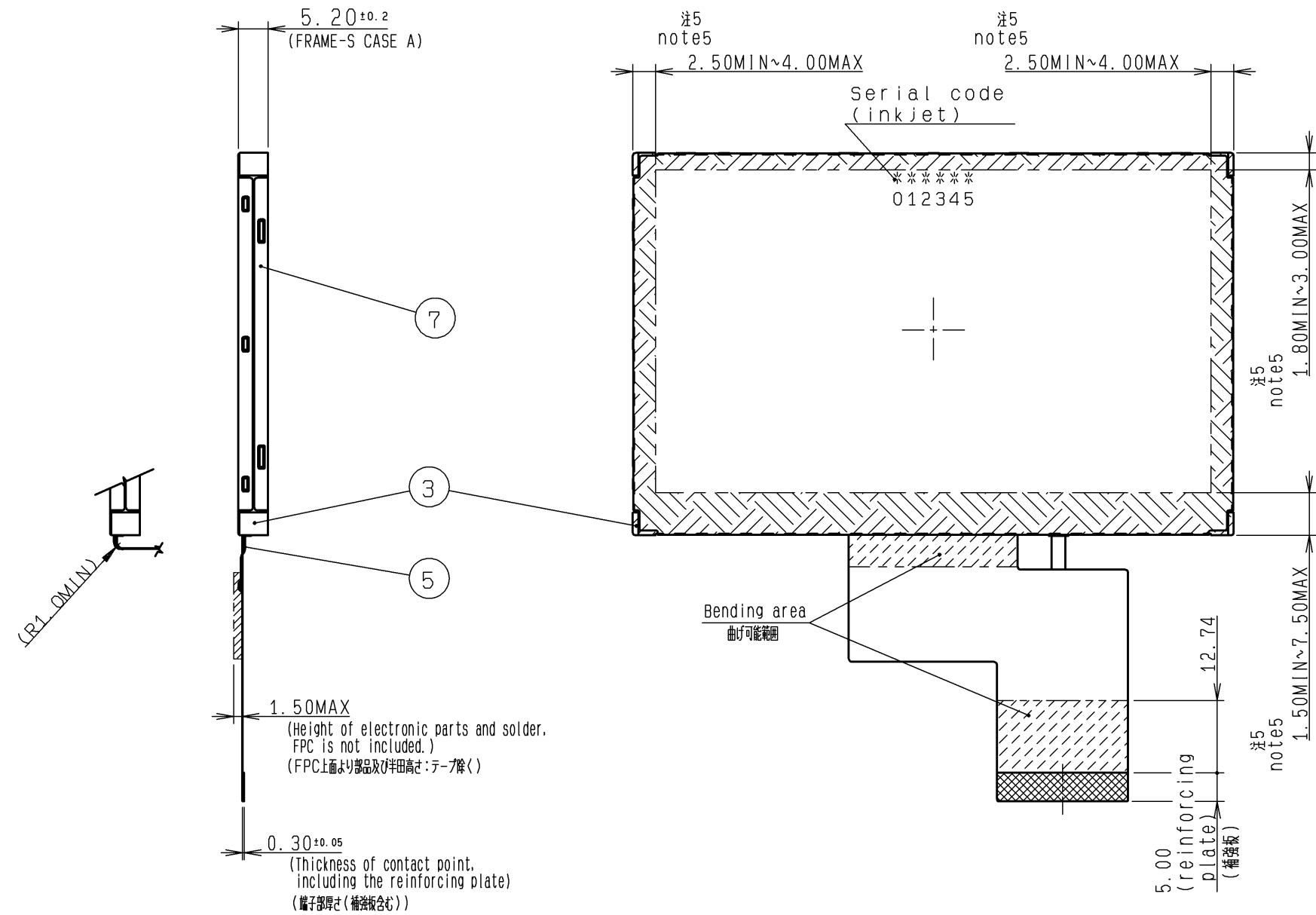
Transmissive LCD (1000cd/m<sup>2</sup> MODEL) consume a lot of power, which places a large load on the customer's power circuit, causing problems such as heat generation.

Blanview has low power consumption, so it places a low load on the customer's power supply circuit and does not cause any harmful effects such as heat generation.

## 3. Dimensions and Shape

## 3.1 Dimensions

| Items                             | Specifications                 | Unit | Remarks            |
|-----------------------------------|--------------------------------|------|--------------------|
| Outline dimensions                | 105.50[H] × 67.20[V] × 5.20[D] | mm   | Exclude FPC cable. |
| Active area                       | 95.04[H] × 53.86[V]            | mm   | 109mm diagonal.    |
| Number of dots                    | 480[H] × 816[V]                | dot  |                    |
| Dot pitch                         | 198.0[H] × 66.0[V]             | μm   |                    |
| Surface hardness of the polarizer | 2                              | H    | Load:2.94N         |
| Weight                            | 62                             | g    | Include FPC cable. |



|               |                        |                     |                                                                                       |                                                                                |      |       |      |
|---------------|------------------------|---------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------|-------|------|
| R TAPE        | 8                      |                     |                                                                                       |                                                                                |      |       |      |
| S CASE C      | 7                      |                     |                                                                                       |                                                                                |      |       |      |
| I TAPE        | 6                      |                     |                                                                                       |                                                                                |      |       |      |
| LED FPC       | 5                      |                     |                                                                                       |                                                                                |      |       |      |
| LCD FPC       | 4                      |                     |                                                                                       |                                                                                |      |       |      |
| FRAME         | 3                      |                     |                                                                                       |                                                                                |      |       |      |
| S CASE A      | 2                      |                     |                                                                                       |                                                                                |      |       |      |
| TFT-LCD PANEL | 1                      |                     |                                                                                       | Glass substrate thickness=0.5t                                                 |      |       |      |
| PART NAME     | ITEM                   | PART CODE           | MODEL NUMBER                                                                          | REMARK                                                                         |      |       |      |
| APPROVED 尾木   | GENERAL TOLERANCE ±0.5 | SCALE 1/1           | UNIT mm                                                                               | <b>TOPPAN</b><br>TOPPAN INC.<br>DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY |      |       |      |
| CHECKED 木下    | ISSUE (Y/M/D) 18:11:21 | MODEL COM43H4N44U** |                                                                                       |                                                                                |      |       |      |
| CHECKED       | NAME                   |                     |  | DRAWING No.                                                                    | REV. | SHEET | DIV. |
| DESIGN 前田創    | OUTLINE-D4N44          |                     |                                                                                       | RJD529744D201                                                                  |      |       |      |
| DRAW 栗津       |                        |                     |                                                                                       |                                                                                |      |       |      |

## 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                                      | 43EQC (Made in Japan)<br>43ERC (Made in Malaysia) |                                  |                                  |
| d | Serial number                                   |                                                   |                                  |                                  |

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

## •Made in Japan

8J43EQC000125

means "manufactured in October 2018, 4.3" EQ type, C specifications, serial number 000125"

## •Made in Malaysia

8J43ERC000125

means "manufactured in October 2018, 4.3" ER 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                                                                     |
|-----|--------|------------------------------------------------------------------------------|
| 1   | VSS    | GND.                                                                         |
| 2   | VSS    | GND.                                                                         |
| 3   | VDD    | Power supply.                                                                |
| 4   | VDD    | Power supply.                                                                |
| 5   | D00    | Display data(R).<br>00h: Black<br>D00:LSB D07:MSB                            |
| 6   | D01    |                                                                              |
| 7   | D02    |                                                                              |
| 8   | D03    |                                                                              |
| 9   | D04    |                                                                              |
| 10  | D05    |                                                                              |
| 11  | D06    |                                                                              |
| 12  | D07    | Driver has internal gamma conversion.<br>Connect unused pins to GND.         |
| 13  | D10    |                                                                              |
| 14  | D11    |                                                                              |
| 15  | D12    |                                                                              |
| 16  | D13    |                                                                              |
| 17  | D14    |                                                                              |
| 18  | D15    |                                                                              |
| 19  | D16    | Display data(G).<br>00h: Black<br>D10:LSB D17:MSB                            |
| 20  | D17    |                                                                              |
| 21  | D20    |                                                                              |
| 22  | D21    |                                                                              |
| 23  | D22    |                                                                              |
| 24  | D23    |                                                                              |
| 25  | D24    |                                                                              |
| 26  | D25    | Driver has internal gamma conversion.<br>Connect unused pins to GND.         |
| 27  | D26    |                                                                              |
| 28  | D27    |                                                                              |
| 29  | VSS    | GND.                                                                         |
| 30  | CLK    | Clock signal.Latching data at the falling edge.                              |
| 31  | STBYB  | Standby signal input. (Hi:Normal operation, Lo:Standby operation)            |
| 32  | HSYNC  | Horizontal sync signal input. (Low active)                                   |
| 33  | VSYNC  | Vertical sync signal input. (Low active)                                     |
| 34  | DE     | Input data effective signal. (It is effective for the period of "Hi")        |
| 35  | NC     | OPEN.                                                                        |
| 36  | VSS    | GND.                                                                         |
| 37  | NC     | OPEN.                                                                        |
| 38  | NC     | OPEN.                                                                        |
| 39  | NC     | OPEN.                                                                        |
| 40  | NC     | OPEN.                                                                        |
| 41  | BLL2   | Backlight drive (cathode side)                                               |
| 42  | BLL1   | Backlight drive (cathode side)                                               |
| 43  | BLH    | Backlight drive (anode side)                                                 |
| 44  | LR     | Left/Right Display reverse(Hi or OPEN:normal display, Low:inversion display) |
| 45  | UD     | Up/Down Display reverse(Hi or OPEN:normal display, Low:inversion display)    |

- Recommended connector: HIROSE ELECTRIC FH12 series [FH12A-45S-0.5SH(55)]
- Please make sure to check a consistency between pin assignment in "3.2 Outward Form" and your connector pin assignment when designing your circuit. Inconsistency in input signal assignment may cause a malfunction.
- Since FPC cable has gold plated terminals, gilt finish contact shoe connector is recommended.

## 5. Absolute Maximum Rating

VSS=0V

| Item                              | Symbol  | Condition                                                                  | Rating |         | Unit | Applicable terminal                                              |
|-----------------------------------|---------|----------------------------------------------------------------------------|--------|---------|------|------------------------------------------------------------------|
|                                   |         |                                                                            | MIN    | MAX     |      |                                                                  |
| Supply voltage                    | VDD     | Ta=25° C                                                                   | -0.3   | 5.0     | V    | VDD                                                              |
| Input voltage for logic           | VI      |                                                                            | -0.3   | VDD+0.3 | V    | CLK,VSYNC,HSYNC,DE<br>D[27:20],D[17:10],D[07:00],<br>STBYB,LR,UD |
| LED direction current<br>of order | IL1,IL2 | Ta=25° C                                                                   | --     | 70      | mA   | BLH - BLL1/BLL2                                                  |
|                                   |         | Ta=85° C                                                                   | --     | 21      |      |                                                                  |
| Storage temperature range         | Tstg    |                                                                            | -40    | 95      | ° C  |                                                                  |
| Storage humidity range            | Hstg    | Non condensing in an environmental<br>moisture at or less than 40° C90%RH. |        |         |      |                                                                  |

## 6. Recommended Operating Conditions

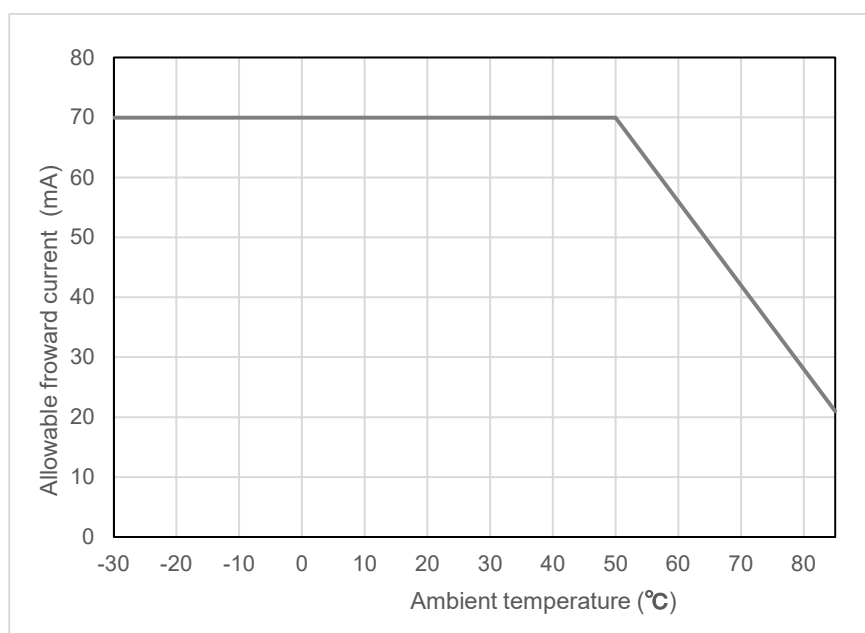
VSS=0V

VSS-0

| Item                        | Symbol | Condition       | Rating                                                                  |     |     | Unit | Applicable terminal                                         |
|-----------------------------|--------|-----------------|-------------------------------------------------------------------------|-----|-----|------|-------------------------------------------------------------|
|                             |        |                 | MIN                                                                     | TYP | MAX |      |                                                             |
| Supply voltage              | VDD    |                 | 3.0                                                                     | 3.3 | 3.6 | V    | VDD                                                         |
| Input voltage for logic     | VI     | VDD=3.0 to 3.6V | 0                                                                       | --  | VDD | V    | CLK,VSYNC,HSYNC, DE,D[27:20],D[17:10], D[07:00],STBYB,LR,UD |
| Operating temperature range | Top    | Note            | -30                                                                     | 25  | 85  | ° C  | Panel surface temperature                                   |
| Operating humidity range    | Hop    | Ta≤40° C        | 20                                                                      | --  | 85  | %    |                                                             |
|                             |        | Ta>40° C        | Non condensing in an environmental moisture at or less than 40° C85%RH. |     |     |      |                                                             |

Note : This monitor is operatable in this temperature range. With regard to optical characteristics,  
refer to Item "10. CHARACTERISTICS".

Note : The maximum value of LED forward current "IL1,IL2" , do not exceed the following allowable current value.



## 7. Characteristics

## 7.1 DC Characteristics

## 7.1.1 Display Module

(Unless otherwise noted, Ta=25°C, VDD=3.3V, VSS=0V)

| Item                    | Symbol | Condition                      | Rating  |     |         | Unit | Applicable terminal                        |
|-------------------------|--------|--------------------------------|---------|-----|---------|------|--------------------------------------------|
|                         |        |                                | MIN     | TYP | MAX     |      |                                            |
| Input voltage for logic | VIH    | VDD=3.0 to 3.6V                | 0.7×VDD | --  | VDD     | V    | CLK, VSYNC, HSYNC, DE, D[27:20], D[17:10], |
|                         | VIL    |                                | 0       | --  | 0.3×VDD | V    | D[07:00], STBYB, LR, UD                    |
| Pull up resistor value  | Rpu    |                                | --      | 100 | --      | kΩ   | LR, UD                                     |
| Current consumption     | IDD    | fCLK=9MHz<br>Color bar display | --      | 30  | 60      | mA   | VDD                                        |

## 7.1.2 Backlight

| Item                                | Symbol | Condition                      | Rating |        |      | Unit | Applicable terminal |
|-------------------------------------|--------|--------------------------------|--------|--------|------|------|---------------------|
|                                     |        |                                | MIN    | TYP    | MAX  |      |                     |
| Forward current                     | IL1    | Ta=25°C                        | --     | 20     | 50   | mA   | BLH - BLL1          |
|                                     | IL2    | Note1                          | --     | 20     | 50   | mA   | BLH - BLL2          |
| Forward voltage<br>*Reference value | VF1    | Ta=25°C                        | --     | 10.6   | 11.4 | V    | BLH - BLL1          |
|                                     | VF2    | IL1=IL2=20mA                   | --     | 10.6   | 11.4 | V    | BLH - BLL2          |
| Estimated Life of LED               | LL     | Ta=25°C<br>IL1=IL2=20mA, Note2 | --     | 70,000 | --   | hrs  |                     |

Note1: - Please control so that each current does not vary (IL1 = IL2).

Note2: - 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.

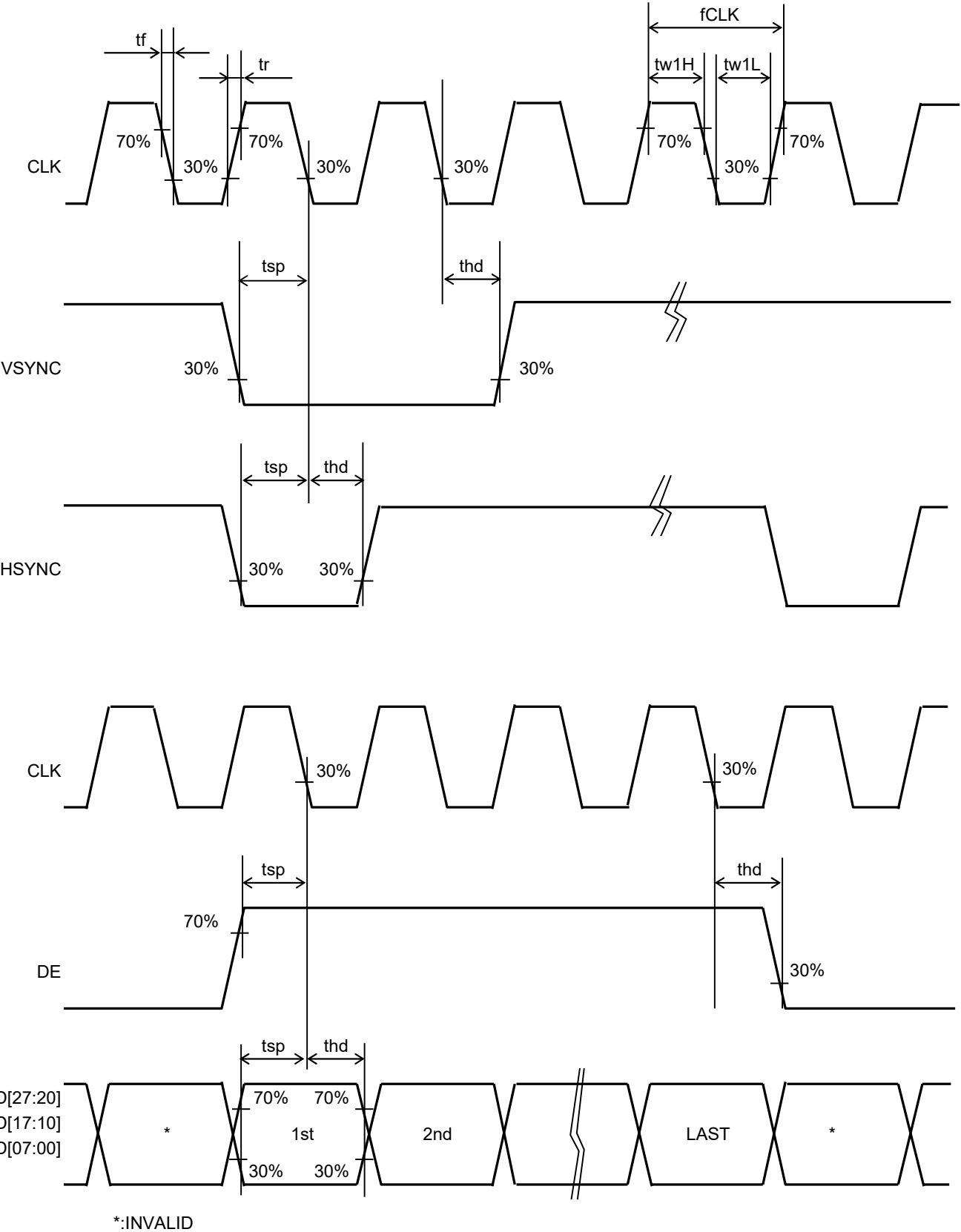
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

## 7.2 AC Characteristics

(Unless otherwise noted, Ta=25°C, VDD=3.3V, VSS=0V)

| Item             | Symbol | Condition        | Rating |     |      | Unit | Applicable terminal                                 |
|------------------|--------|------------------|--------|-----|------|------|-----------------------------------------------------|
|                  |        |                  | MIN    | TYP | MAX  |      |                                                     |
| CLK frequency    | fCLK   |                  | 7.2    | 9.0 | 12.0 | MHz  | CLK                                                 |
| CLK rising time  | tr     |                  | --     | --  | 10   | ns   |                                                     |
| CLK falling time | tf     |                  | --     | --  | 10   | ns   |                                                     |
| CLK Low period   | tw1L   | 0.3×VDD or less. | 26.4   | --  | --   | ns   |                                                     |
| CLK High period  | tw1H   | 0.7×VDD or more. | 26.4   | --  | --   | ns   |                                                     |
| Setup time       | tsp    |                  | 10.0   | --  | --   | ns   | CLK, VSYNC, HSYNC, DE, D[27:20], D[17:10], D[07:00] |
| Hold time        | thd    |                  | 16.0   | --  | --   | ns   |                                                     |

Switching Waveform Characteristics



## 7.3 Input Timing Characteristics

(Unless otherwise noted, Ta=25°C,VDD=3.3V,VSS=0V)

| Item                      | Symbol | Rating   |       |       | Unit | Applicable terminal                           |
|---------------------------|--------|----------|-------|-------|------|-----------------------------------------------|
|                           |        | MIN      | TYP   | MAX   |      |                                               |
| CLK frequency             | fCLK   | 7.2      | 9.0   | 12.0  | MHz  | CLK                                           |
| VSYNC frequency      Note | fVSYNC | 54       | 60    | 66    | Hz   | VSYNC                                         |
| VSYNC signal cycle time   | tv     | 277      | 288   | 396   | H    | VSYNC,HSYNC                                   |
| VSYNC pulse width         | tw2H   | 1        | --    | --    | H    |                                               |
| Vertical back porch       | tvb    | tw2H + 2 | 8     | 31    | H    |                                               |
| Vertical front porch      | tvf    | 2        | 8     | 93    | H    |                                               |
| Vertical display period   | tvd    | --       | 272   | --    | H    | VSYNC,HSYNC,DE,D[27:20],<br>D[17:10],D[07:00] |
| HSYNC frequency           | fHSYNC | 15.38    | 16.67 | 18.18 | kHz  | HSYNC                                         |
| HSYNC signal cycle time   | th     | 521      | 525   | 734   | CLK  | HSYNC,CLK                                     |
| HSYNC pulse width         | tw3H   | 1        | --    | --    | CLK  |                                               |
| Horizontal back porch     | thb    | tw3H + 1 | 40    | 127   | CLK  | HSYNC,DE,CLK                                  |
| Horizontal front porch    | thf    | 1        | 5     | 127   | CLK  |                                               |
| Horizontal display period | thdp   | --       | 480   | --    | CLK  | DE,D[27:20],D[17:10],D[07:00],<br>CLK         |
| DE pulse width            | tw4H   | --       | 480   | --    | CLK  | DE,CLK                                        |

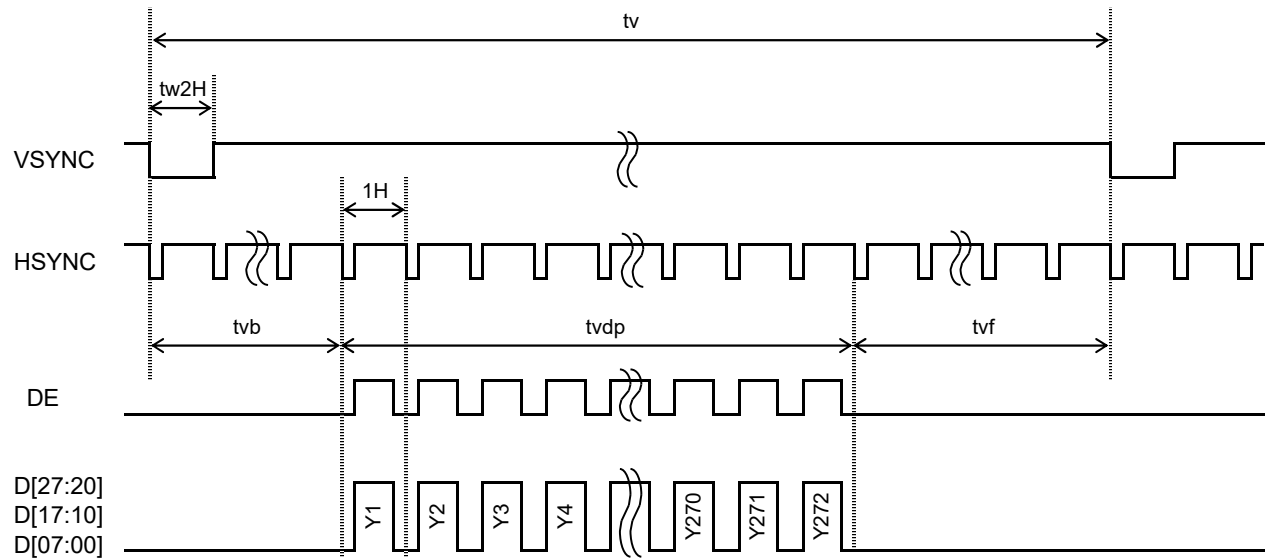
Note: The characteristic of this item is recommended standard.

Please use it after it confirms it enough like the display fineness etc.

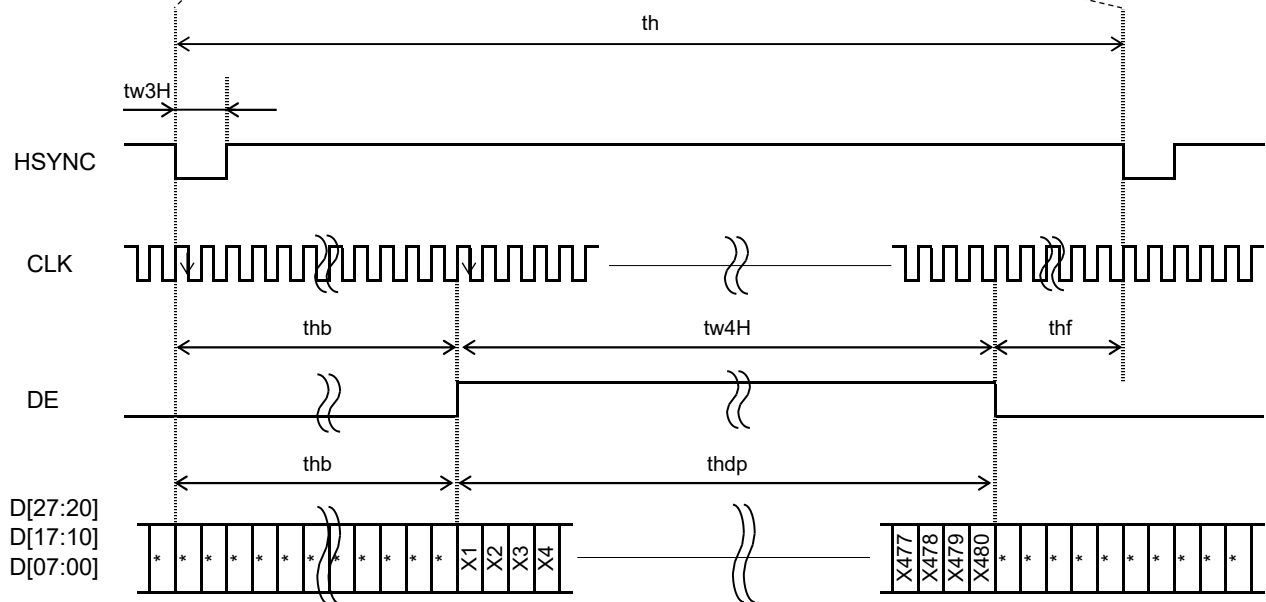
When it comes off from this characteristic and it is used.

7.4 Driving Timing Chart

-Vertical Timing

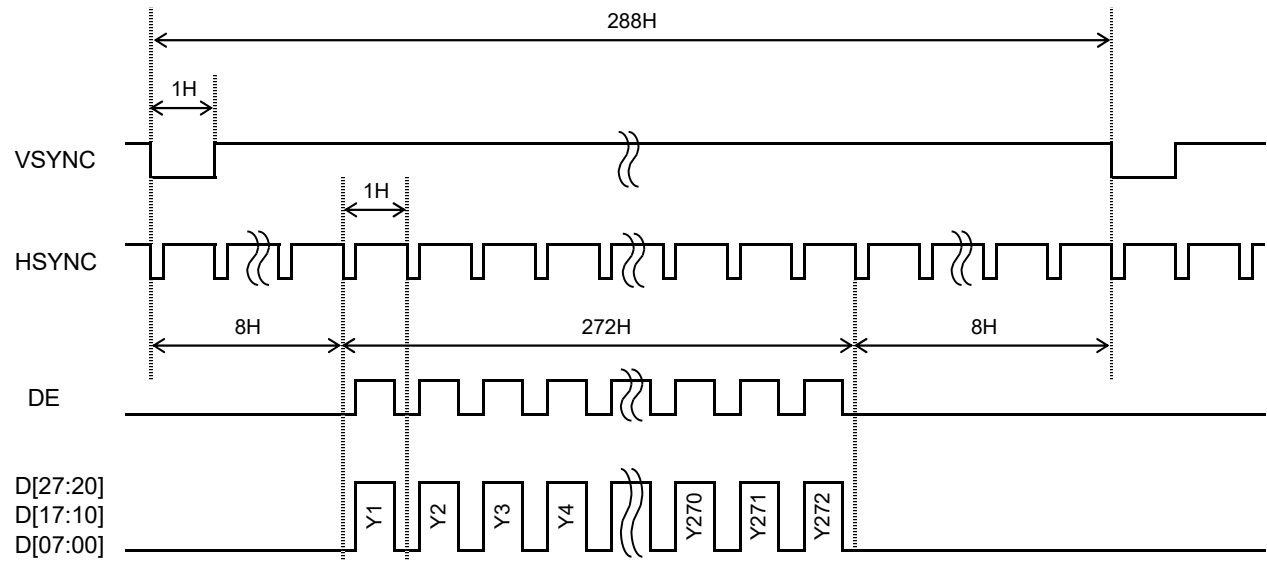


-Horizontal Timing

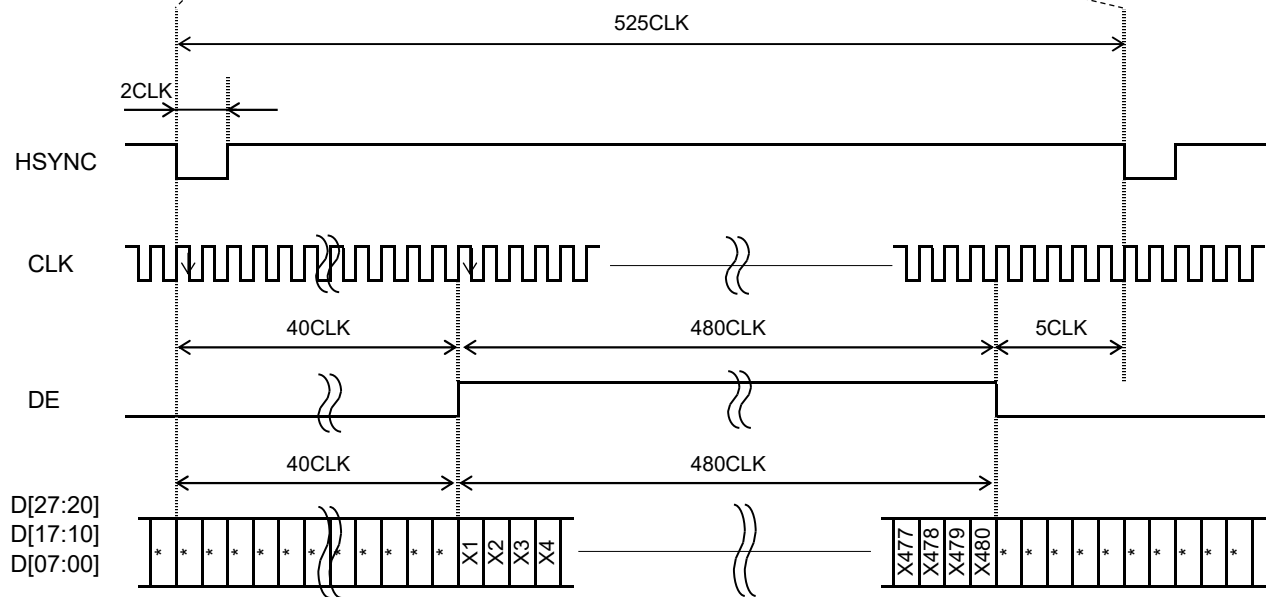


7.5 Example of Driving Timing Chart (fCLK=9.0MHz)

-Vertical Timing

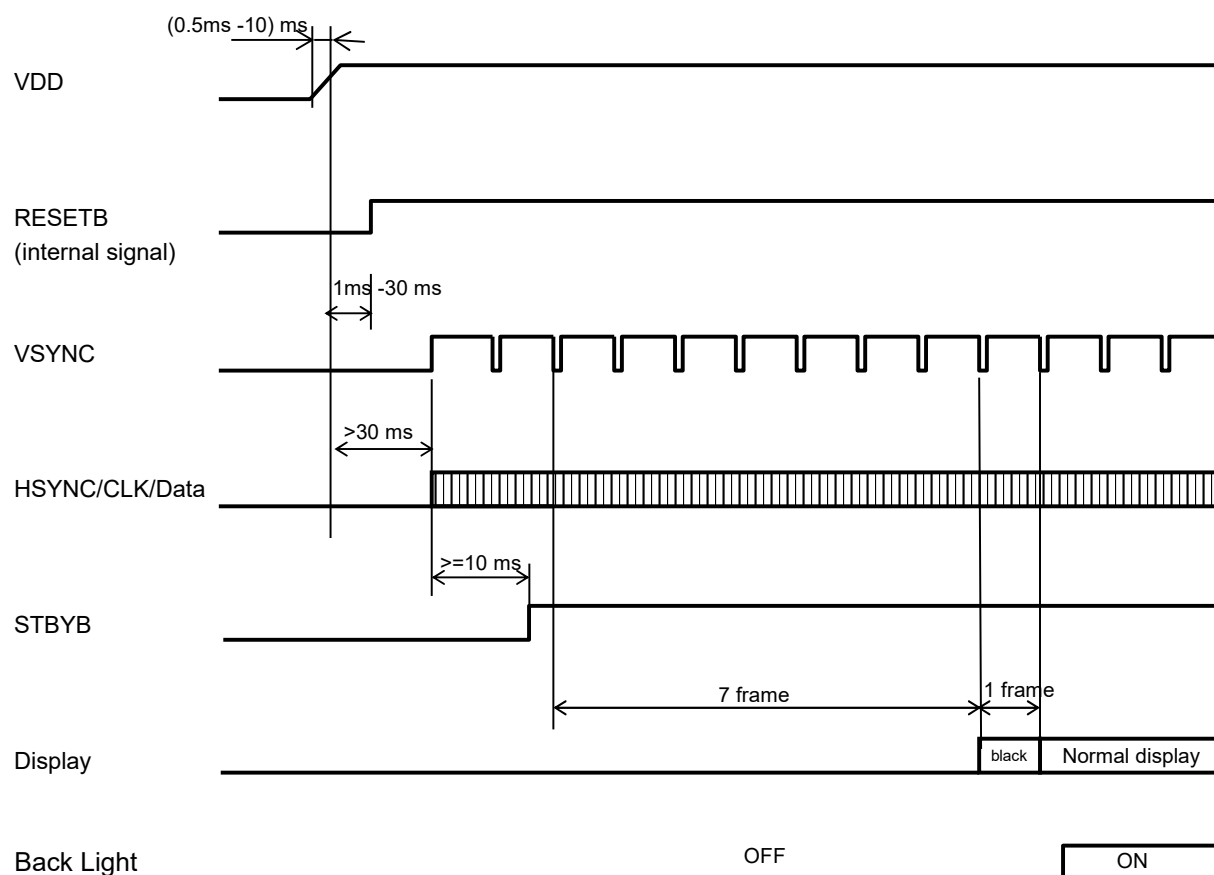


-Horizontal Timing

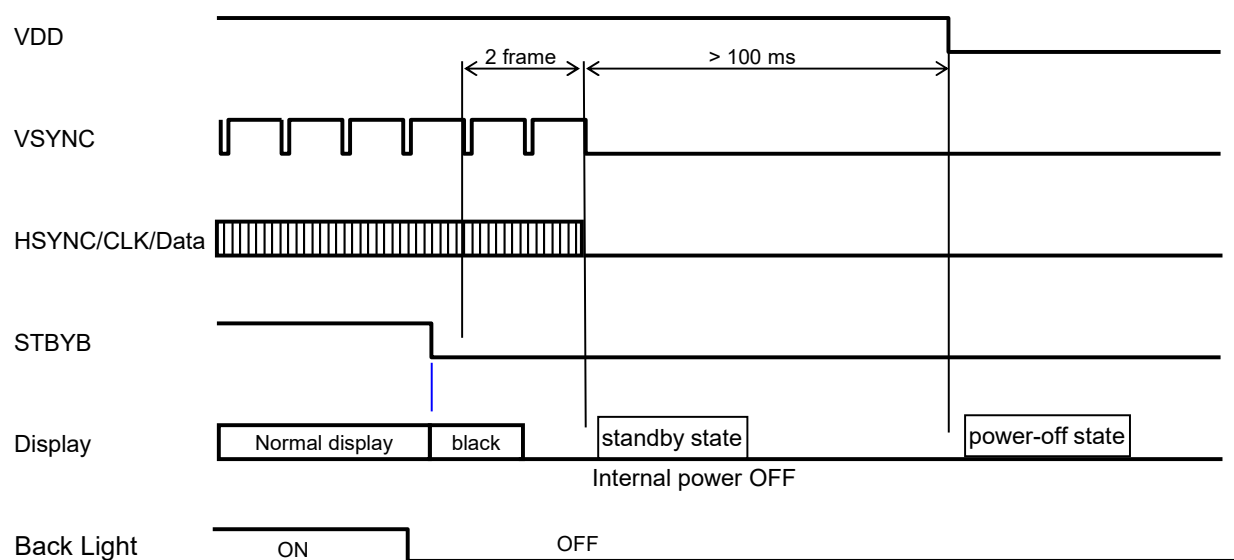


## 8. Power ON/OFF Sequence

## 8.1 Power ON Sequence

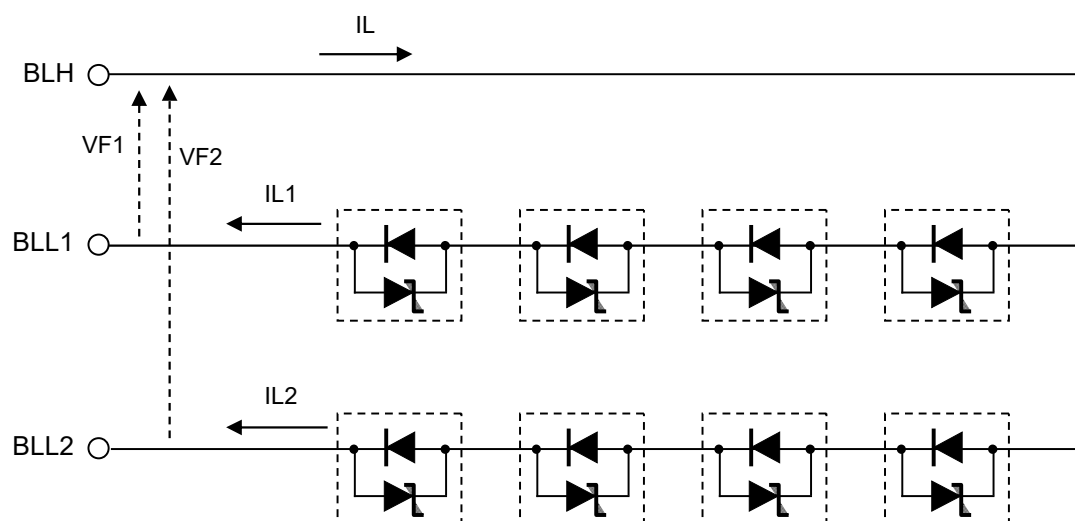


## 8.2 Standby / Power OFF Sequence



If CLK and VSYNC signals are stopped or the power supply is turned off to a regulated frame or less, the afterimage might remain.

## 9. LED Circuit



\* It is recommended to control currents of BLL1 / BLL2 to equal current values ( $IL1 = IL2$ ).

## 10. Characteristics

## 10.1 Optical Characteristics

&lt; Measurement Condition &gt;

Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)

Driving condition: VDD = 3.3V, VSS = 0V

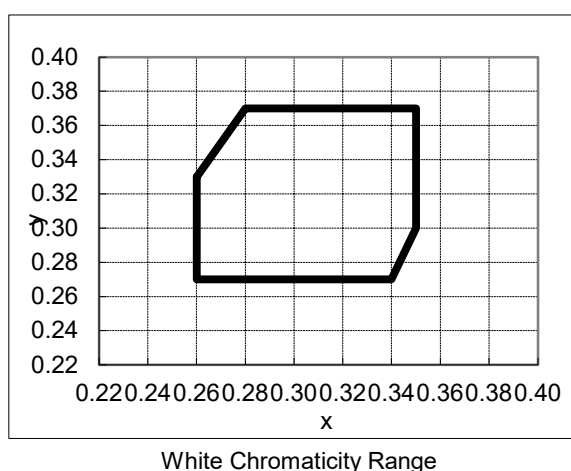
Optimized VCOMDC

Backlight: IL1=IL2=20mA

Measured temperature: Ta=25° C

| Item                    | Symbol                | Condition                    | MIN                                                                                    | TYP  | MAX | Unit              | Note No. | Remark                     |
|-------------------------|-----------------------|------------------------------|----------------------------------------------------------------------------------------|------|-----|-------------------|----------|----------------------------|
| Response time           | Rise time + Fall time | TON [Data]=00h→FFh           | —                                                                                      | 50   | 100 | ms                | 1        |                            |
|                         |                       | TOFF [Data]=FFh→00h          |                                                                                        |      |     |                   |          |                            |
| Contrast ratio          | Backlight ON          | CR [Data]=FFh/00h            | 400                                                                                    | 800  | —   |                   | 2        |                            |
|                         | Backlight OFF         |                              | —                                                                                      | 2    | —   |                   |          |                            |
| Viewing angle           | Left                  | θL [Data]=FFh/00h<br>CR ≥ 10 | 80                                                                                     | —    | —   | deg               | 3        |                            |
|                         | Right                 |                              | 80                                                                                     | —    | —   | deg               |          |                            |
|                         | Up                    |                              | 80                                                                                     | —    | —   | deg               |          |                            |
|                         | Down                  |                              | 80                                                                                     | —    | —   | deg               |          |                            |
| White Chromaticity      | x                     |                              | 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]=FFh                   | —                                                                                      | 1200 | —   | cd/m <sup>2</sup> | 6        | IL1=IL2=38mA               |
|                         |                       |                              | 390                                                                                    | 600  | —   |                   |          | *Reference<br>IL1=IL2=20mA |
| Brightness distribution |                       | [Data]=FFh                   | 70                                                                                     | —    | —   | %                 | 7        |                            |

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



【White Chromaticity Range】

| x    | y    |
|------|------|
| 0.26 | 0.33 |
| 0.26 | 0.27 |
| 0.34 | 0.27 |
| 0.35 | 0.30 |
| 0.35 | 0.37 |
| 0.28 | 0.37 |

## 10.2 About Sunlight readable



| Item              | Illuminance | Display visibility | Remarks                         |
|-------------------|-------------|--------------------|---------------------------------|
| Sunlight readable | 100,000 lx  | Possible           | Refer to <Features of Blanview> |

## 10.3 Temperature Characteristics

&lt; Measurement Condition &gt;

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

Driving condition: VDD = 3.3V, VSS = 0V

Optimized VCOMDC

Backlight: IL1=IL2=20mA

| Item            |                             | Symbol           | Specification                                                    |        |         | Remark                  |
|-----------------|-----------------------------|------------------|------------------------------------------------------------------|--------|---------|-------------------------|
|                 |                             |                  | MIN                                                              | TYP    | MAX     |                         |
| Contrast ratio  |                             | CR               | 200                                                              | —      | —       | Ta=-30℃<br>Backlight ON |
|                 |                             |                  | 200                                                              | —      | —       | Ta=85℃<br>Backlight ON  |
| Response time   | Rise time<br>+<br>Fall time | TON<br>+<br>TOFF | —                                                                | 980 ms | 1500 ms | Ta=-30℃                 |
|                 |                             |                  | —                                                                | 40 ms  | 80 ms   | Ta=85℃                  |
| Display Quality |                             |                  | No noticeable display defect or ununiformity should be observed. |        |         |                         |

## 11. Criteria of Judgment

## 11.1 Defective Display and Screen Quality

Test Condition: Observed TFT-LCD monitor from front during operation  
with the following conditions

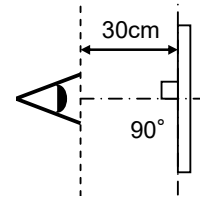
Driving Signal Raster Patter (RGB, white, black)

Signal condition [Data]: 00h, 94h, FFh (3steps)

Observation distance 30 cm

Illuminance 200 to 350 lx

Backlight IL1=IL2=20mA



| 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]=94h |                                                  | Refer to table 1                                |
|                 |                  | Invisible through 5% ND filter at [Data]=00h                                                                                                                                                                                                                                                                           |                                                  | Acceptable                                      |
|                 |                  | Dirt                                                                                                                                                                                                                                                                                                                   | Uneven brightness (white stain, black stain etc) |                                                 |
| Screen Quality  | Foreign particle | Point-like                                                                                                                                                                                                                                                                                                             | 0.25mm< φ                                        | N=0                                             |
|                 |                  |                                                                                                                                                                                                                                                                                                                        | 0.20mm< φ ≤0.25mm                                | N≤2                                             |
|                 |                  |                                                                                                                                                                                                                                                                                                                        | φ ≤0.20mm                                        | Acceptable                                      |
|                 | Liner            | 3.0mm<length and 0.08mm<width                                                                                                                                                                                                                                                                                          | N=0                                              |                                                 |
|                 |                  | length≤3.0mm or width≤0.08mm                                                                                                                                                                                                                                                                                           | Acceptable                                       |                                                 |
|                 | Others           |                                                                                                                                                                                                                                                                                                                        |                                                  | Use boundary sample for judgment when necessary |

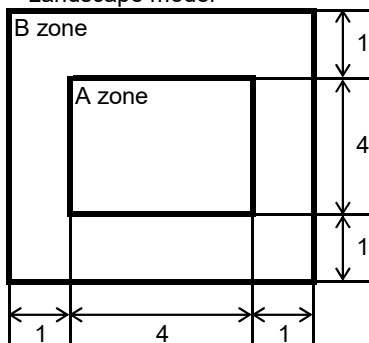
$\phi(\text{mm})$ : Average diameter = (major axis + minor axis)/2

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        | 6     | Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more |
| Total | 2               | 4              | 4        | 7     |                                                                                                    |

<Landscape model>



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)

11.2 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                       |                                                                                      |

## 12. Reliability Test

| Test item                     |                                              | Test condition                                                                                                                                                                                                                      |           | number of failures /<br>number of examinations |
|-------------------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------|
| Durability test               | High temperature storage                     | Ta = 95°C                                                                                                                                                                                                                           | 500hrs    | 0 / 3                                          |
|                               | Low temperature storage                      | Ta = -40°C                                                                                                                                                                                                                          | 500hrs    | 0 / 3                                          |
|                               | High temperature & high humidity storage     | Ta = 60°C, RH = 90%,<br>non condensing                                                                                                                                                                                              | 500hrs    | 0 / 3                                          |
|                               | High temperature operation                   | Tp = 85°C                                                                                                                                                                                                                           | 500hrs    | 0 / 3                                          |
|                               | Low temperature operation                    | Tp = -30°C                                                                                                                                                                                                                          | 500hrs    | 0 / 3                                          |
|                               | High temperature & high humidity operation   | Tp = 40°C, RH = 90%,<br>non condensing                                                                                                                                                                                              | 500hrs    | 0 / 3                                          |
|                               | Thermal shock storage                        | -40°C ↔ 85°C (30min / 30min)                                                                                                                                                                                                        | 100cycles | 0 / 3                                          |
|                               | Lightfastness                                | Xenon Blackpanel 63±3°C non-shower<br>450W/m <sup>2</sup> (300~700nm) non-operating Integral dose 800MJ/m <sup>2</sup>                                                                                                              |           | 0 / 3                                          |
| Mechanical environmental test | Electrostatic discharge test (Non operation) | Confirms to EIAJ ED-4701/300, C=200pF,R=0Ω,V=±200V<br>Each 3 times of discharge on and power supply and other terminals.                                                                                                            |           | 0 / 3                                          |
|                               | Surface discharge test (Non operation)       | C=250pF, R=100Ω, V=±12kV<br>Each 5 times of discharge in both polarities on the center of screen with the case grounded.                                                                                                            |           | 0 / 3                                          |
|                               | FPC tension test                             | Pull the FPC with the force of 3N for 10 sec.<br>in the direction - 90-degree to its original direction.                                                                                                                            |           | 0 / 3                                          |
|                               | FPC bend test                                | Pull the FPC with the force of 3N for 10 sec.<br>in the direction -180-degree to its original direction.<br>Reciprocate it 3 times.                                                                                                 |           | 0 / 3                                          |
|                               | Vibration test (Non operation)               | Use TOPPAN original jig (see next page)<br>Vibration Acceleration : 66.64 m/s <sup>2</sup> (6.8 G)<br>Frequency : 20 ~ 500 Hz , Cycle : 10 min/sweep<br>Orientation : X,Y,Z-directions 10 hours per direction<br>(Total 30 hrs)     |           | 0 / 3                                          |
|                               | Impact test (Non operation)                  | Use TOPPAN original jig (see next page) and<br>make an impact with peak acceleration of 1000m/s <sup>2</sup> for 6 msec<br>with 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 10→55→10Hz,<br>X,Y, Zdirection for each 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.)

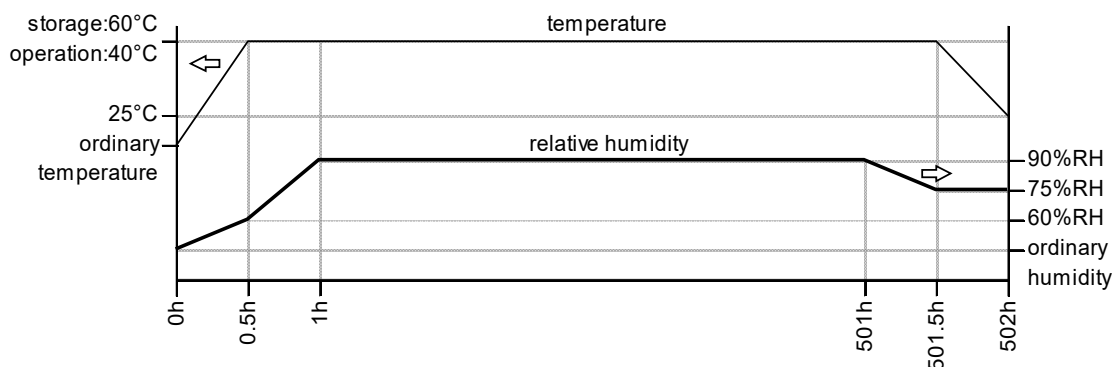
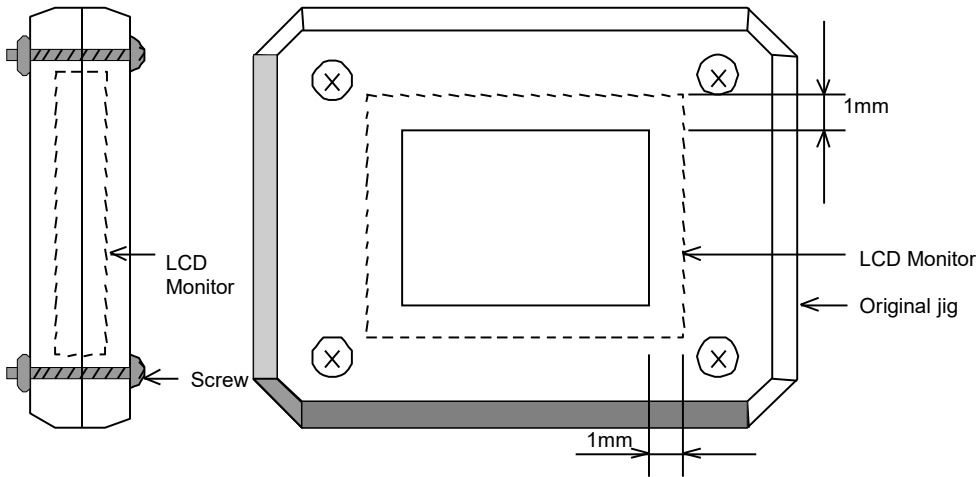


Table2.Reliability Criteria

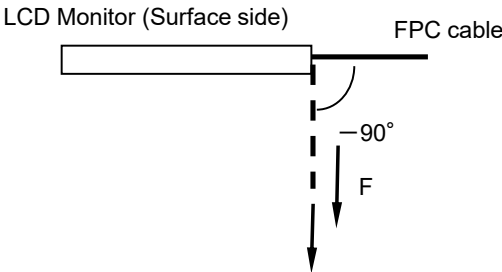
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

| 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 |

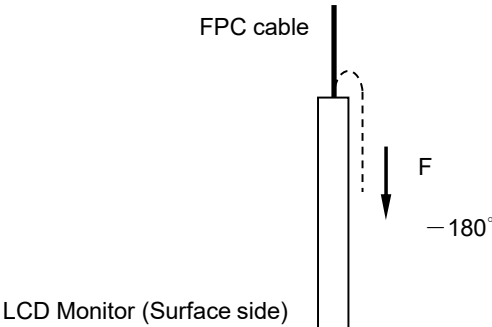
TOPPAN Original Jig



Tension Test Method for FPC cable



Bend Test Method for FPC cable



## 13. 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. (8products per tray)

Step 2. Each tray is to be piled up in same orientation and the trays be in a stack of 9.  
One empty tray is to be put on the top of stack of 9 trays.

Step3. 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.

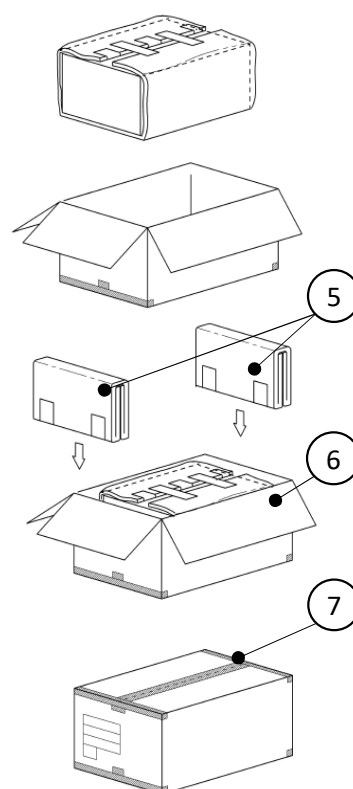
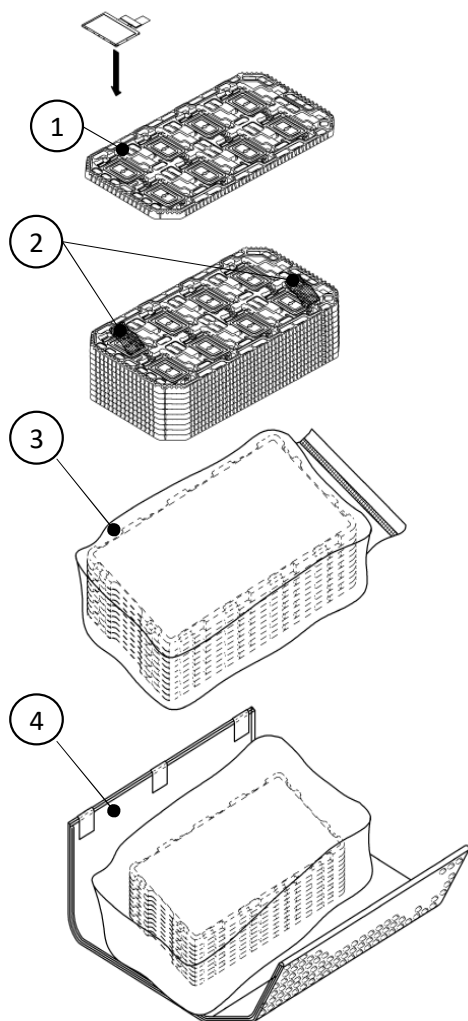
Step4. Vacuum and seal the sealing bag with the vacuum sealing machine.

Step5. The stack of trays in the sealing bag is to be wrapped with a bubble cushioning sheet.

Step6. The wrapped trays are placed in the outer carton.

Step7. Bubble cushioning sheets are to be inserted into the outer carton with same orientation. The outer carton is to be sealed in H-shape with packing tape as shown in the drawing.

Step8. 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 | Drier             | Moisture absorber           |
| ③ | Sealing bag       |                             |
| ④ | B SHEET C         | Antistatic air bubble sheet |
| ⑤ | B SHEET D         | Antistatic air bubble sheet |
| ⑥ | Outer carton      | Corrugated cardboard        |
| ⑦ | Packing tape      |                             |

| Dimension of outer carton                  |         |
|--------------------------------------------|---------|
| D : Approx.                                | (356mm) |
| W : Approx.                                | (664mm) |
| H : Approx.                                | (182mm) |
| Quantity of products packed in one carton: | 72      |
| Gross weight : Approx.                     | 7.2kg   |

## 14. Handling Instruction

## 14.1 Cautions for Handling LCD panels

**Caution**

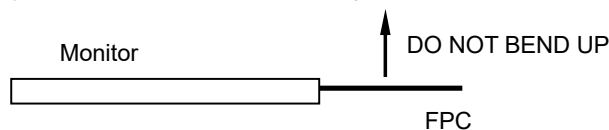
- (1) Do not make an impact on the LCD panel glass because it may break and you may get injured from it.
- (2) If the glass breaks, do not touch it with bare hands.  
(Fragment of broken glass may stick you or you cut yourself on it.)
- (3) If you get injured, receive adequate first aid and consult a 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.**

## 14.2 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.  
Especially, it will cause mechanical damage or critical defect if FPC is pull up or bent up to short of display.



- 8) Peel off the protective film on the TFT monitors during mounting process.  
Refer to the section 14.5 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.

## 14.3 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.

#### 14.4 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.

#### 14.5 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.

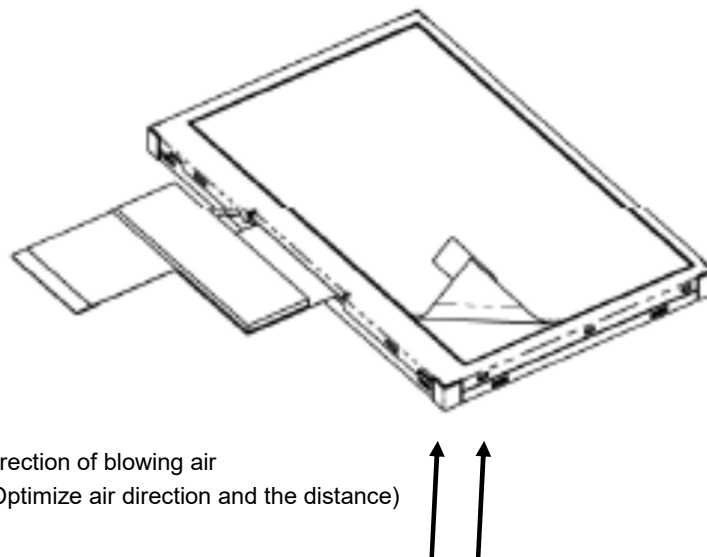
##### A) Work Environment

- 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 right when FPC is placed at the bottom.  
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.



#### 14.6 Warranty

TOPPAN 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)

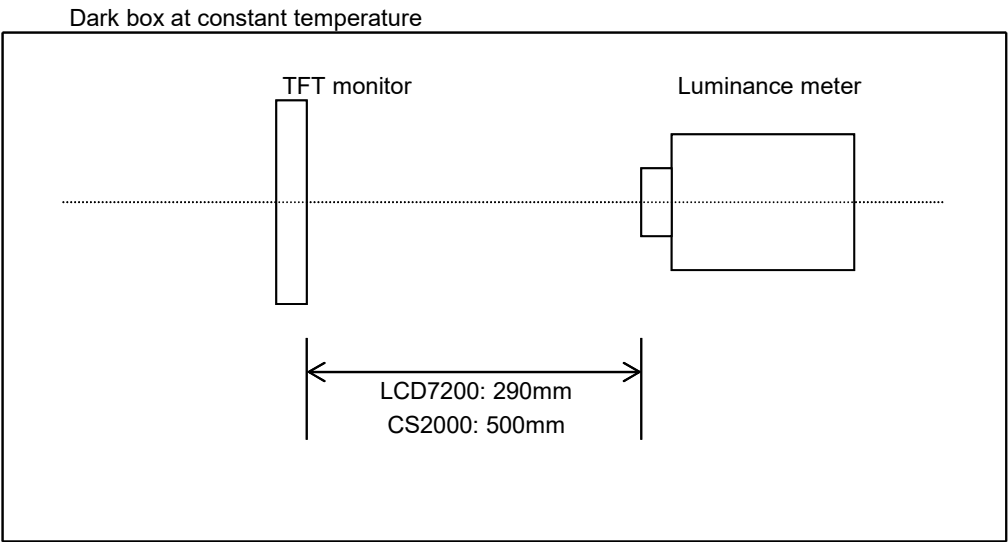
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)

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.

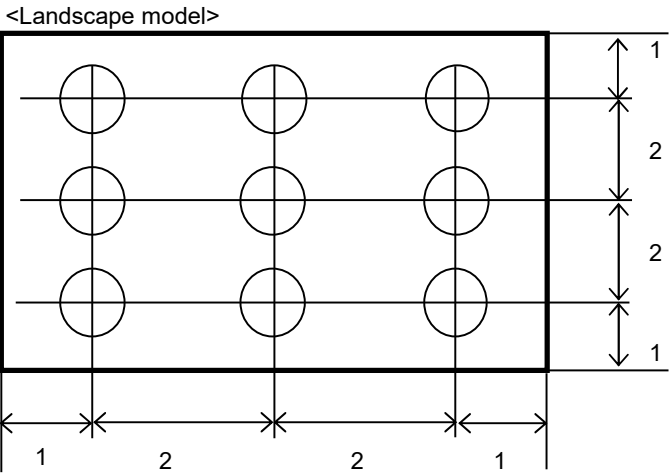
Measurement point: At the center of the screen unless otherwise specified



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.



Dimensional ratio of active area

Backlight IL1=IL2=20mA

Measurement Condition (Contrast ratio Backlight OFF only)

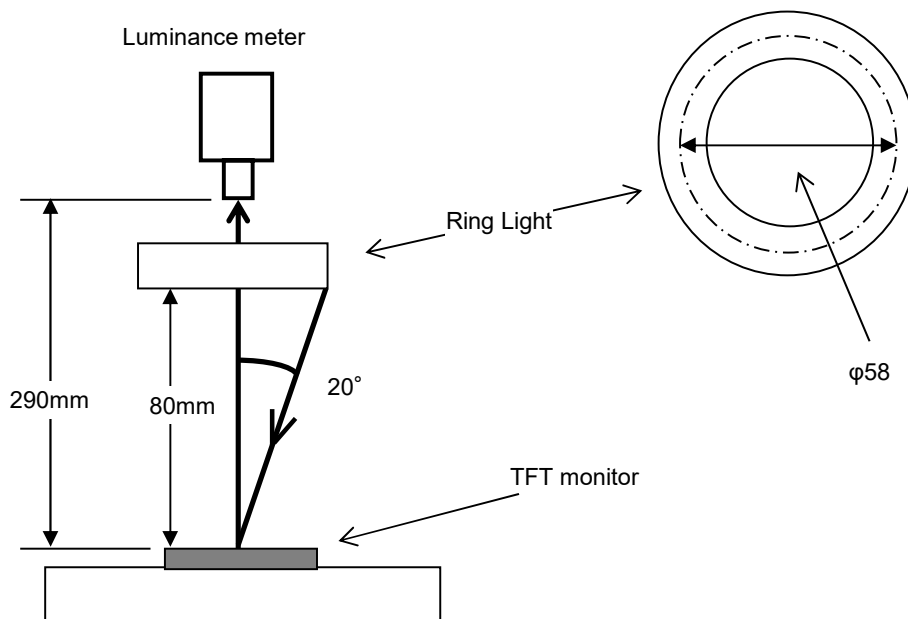
Measuring instruments: LCD7200(OTSUKA ELECTRONICS),Ring Light(40,000 lx,φ58)

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 white to black and from black to white</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                      TON                      TOFF</p> | LCD7200              | <p>Black display [Data]=00h</p> <p>White display [Data]=FFh</p> <p>TON</p> <p>Rise time</p> <p>TOFF</p> <p>Fall time</p> |
| 2      | Contrast ratio                            | <p>Measure maximum luminance Y1([Data]=FFh) 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.                                                                                                                                                                                                                                                           | EZcontrastXL88       |                                                                                                                          |
| 4      | White chromaticity                        | <p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = FFh</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/FFh).                                                                                                                                                                                                                                                                             |                      | At optimized 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               |                                                                                                                          |

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