# Specifications for

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

Version 3.0 (Please be sure to check the specifications latest version.)

MODEL COM43H4N44ULC

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

# ORTUSTECH

TOPPAN PRINTING CO., LTD. **Electronics Division Ortus Subdivision** 

Approved by

Checked by

f. Kuyayama

Prepared by

Version History

| Ver.              | Date          | Page     |            | Description   |  |  |  |
|-------------------|---------------|----------|------------|---|--|--|--|
| 0.0               | Mar.1,2018    | -        | -          | Tentative issue   |  |  |  |
| 0.1               | Apr.24,2018   | 8        | correction | General tolerance $0.2 \rightarrow 0.5$                         |  |  |  |
| •                 |               | 12       | add        | Total LED current value IL1=IL2=(25) mA                         |  |  |  |
| A ×3              |               |          |            | Added LED VF value (reference value).                           |  |  |  |
|                   |               |          |            | Note 1, IL1 = IL2 recommended comment added                     |  |  |  |
|                   |               | 18       | correction | Number of LED lights changed. IL / IL 1 / IL 2 / VF 1 / VF 2.   |  |  |  |
|                   |               | 10       | CONECTION  | IL1 = IL2 Recommended comments added.                           |  |  |  |
| 0.2               | Aug 04 0010   | 00       |            |   |  |  |  |
| 0.2               | Aug.24,2018   | 23       | امام م     |   |  |  |  |
| ₿×1               |               |          | add        | Lightfastness   |  |  |  |
|                   | D = = 01 0010 |          |            |   |  |  |  |
| 1.0               | Dec.21,2018   |          |            | First issue   |  |  |  |
|                   |               | 3        | correction | Serial Label (S-LABEL) $\rightarrow$ Serial No. print (S-print) |  |  |  |
| $\wedge$          |               | 7        | add        | Weight  |  |  |  |
| <u>/</u> ×13      |               | 11       | add        | LED direction current of order                                  |  |  |  |
|                   |               | 12       | add        | Current consumption   |  |  |  |
|                   |               |          | correction | The backlight part  |  |  |  |
|                   |               | 19       | correction | Optical Characteristics   |  |  |  |
|                   |               | 20       | add        | White Chromaticity Range  |  |  |  |
|                   |               |          | correction | Temperature Characteristics                                     |  |  |  |
|                   |               | 21       | add        | Signal condition  |  |  |  |
|                   |               | 23       | add        | Reliability Test  |  |  |  |
|                   |               | 25       | add        | Packing Specifications  |  |  |  |
|                   |               | 29       | correction | Figure of Protective film                                       |  |  |  |
|                   |               | 30       |            |   |  |  |  |
| 0.0               | I.I.1 0010    |          | add        | The backlight current value                                     |  |  |  |
| 2.0               | Jul.1.2019    | All page | correction | It is a company name change from ORTUS TECHNOLOGY CO., LTD. to  |  |  |  |
|                   |               |          |            | TOPPAN PRINTING CO.,LTD.  |  |  |  |
| <u>∕</u> D_×3     |               | 4        | correction | RoHS(2.0) directive   |  |  |  |
|                   |               | 32       | add        | Measurement angle   |  |  |  |
| 3.0               | Mar. 31,2021  | 19       | change     | Measuring instruments   |  |  |  |
| A                 |               | 20       | change     | Measuring instruments   |  |  |  |
| ∠E\ <sub>×5</sub> |               | 23       | change     | Test condition (Vibration test)                                 |  |  |  |
|                   |               |          | correction | Temperature / humidity profile diagram                          |  |  |  |
|                   |               | 30       | change     | Measuring instruments   |  |  |  |
|                   |               | 32       | change     | Measuring instruments   |  |  |  |
|                   |               |          |            |   |  |  |  |
|                   |               |          |            |   |  |  |  |
|                   |               |          |            |   |  |  |  |
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|                   |               |          |            |   |  |  |  |
|                   |               |          |            |   |  |  |  |
|                   |               |          | TOPP       | AN PRINTING CO.,LTD.  |  |  |  |
| ,<br>,            |               |          |            |   |  |  |  |

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# 1. Application

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

- O 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/flexureor caused by stress to the LCD module shall be considered.
- O 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.
- TOPPAN PRINTING is not responsible for any nonconformities and defects that are not specified in this specifications.
- $\odot$  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.

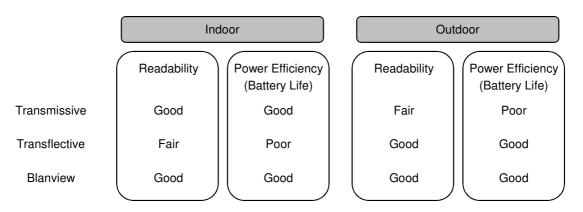
◎ This Product is compatible for RoHS(2.0) directive.

| 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                  |

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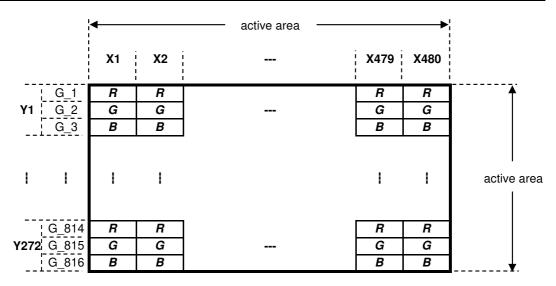
#### 2. Outline Specifications

- 2.1 Features of the Product
  - 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.

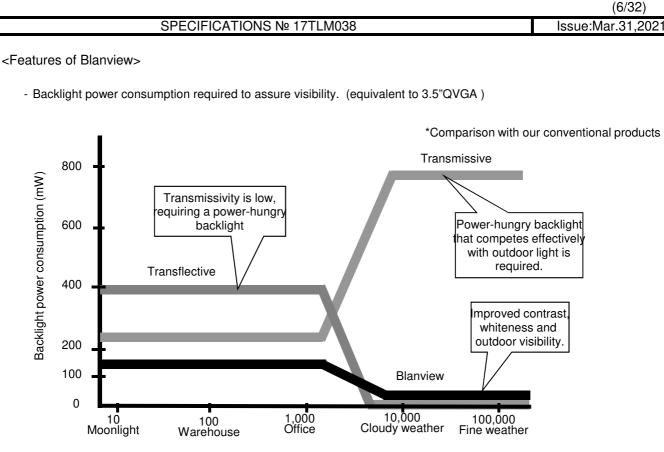


#### 2.2 Display Method

| Items               | Specifications                     | Remarks                     |
|---------------------|------------------------------------|-----------------------------|
| Display type        | VA type 16,777,216 colors.         |                             |
|                     | Blanview, Normally black.          |                             |
| Driving method      | a-Si TFT Active matrix.            |                             |
|                     | 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)

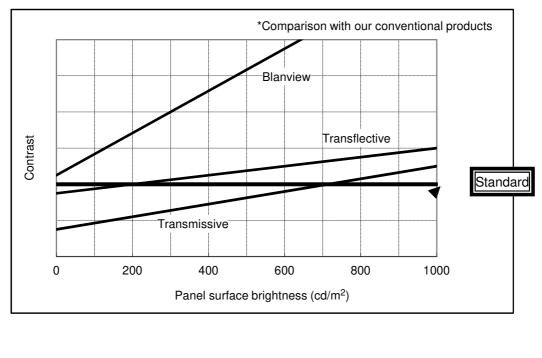


Surrounding illumination (lx)

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

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

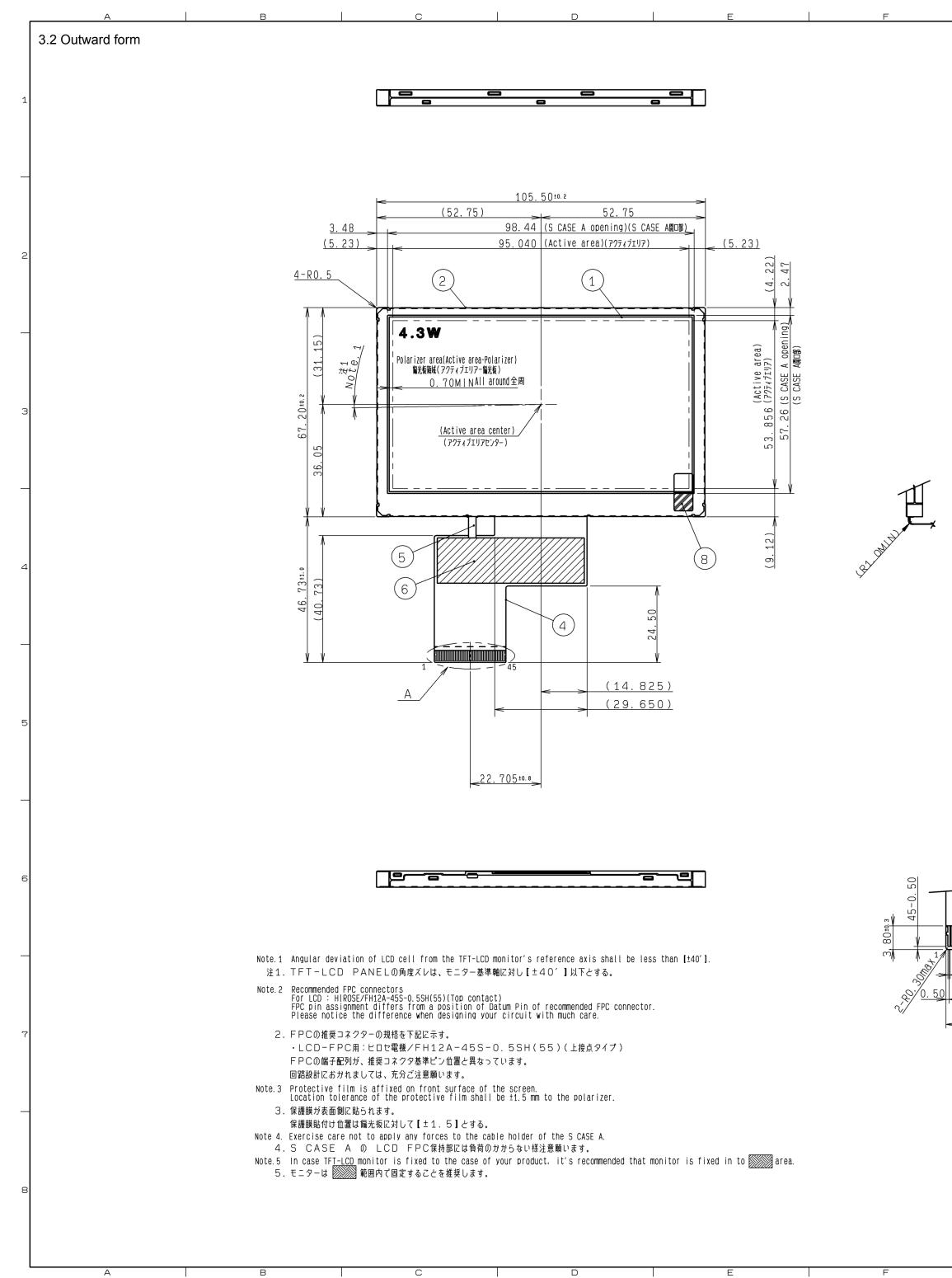
Below chart shows contrast value against panel surface brightness. (Horizontal: Panel surface brightness/ Vertical: Contrast value) LCD panel has enough outdoor readability above our Standard line. (TOPPAN PRINTING criteria)



# 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                              | Н    | Load:2.94N         |
| Weight                            | 62                             | g    | Include FPC cable. |



B1D4 4N44 RJD529744D210101EJ-T 03/29/19 20:03

| G   | н і і ј ј ј к. ј   |
|---|--|
|   | EC NO. REV.NO. REVISE (PATE) APPROVED CHECKED PREPARED   |
|   | (8/32)<br>17TLM038   |
|   | Issue:Mar.31,2021  |
|   |  |
|   |  |
|   |  |
| 5.20±0.2  | 25. 25. 25. 25. 25. 25. 25. 25. 25. 25.  |
| (FRAME-S CASE A)  | 注5<br>note5<br>  |
|   | Serial code<br>(inkjet)  |
|   |  |
|   | 012345 YVW00   |
|   |  |
|   |  |
|   | 1. B   |
|   |  |
|   |  |
|   |  |
| (5)   | Bending area   |
|   |  |
| $\rightarrow$ $< 1.50MAX$   |  |
| (Height of electronic parts and solder,<br>FPC is not included.)<br>(FPC上面より部品及び半田高さ:テープ除く) |  |
|   |  |
| O. 30 <sup>±0.05</sup><br>(Thickness of contact point,<br>including the reinforcing plate)  | 5.<br>(Treinf<br>上<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一<br>一 |
| (端子部厚さ(補強坂含む))  | 5  |
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|   |  |
|   |  |
| <u>&lt; 45−0. 35±0. 03</u>  |  |
| ₽0. 50±0.05X44=22.00±0.05   |  |
| < 23.00±0.07 >  | R TAPE 8<br>S CASE C 7   |
| DETAIL A  | I TAPE 6   |
| (S=2/1)   | LED FPC   5     LCD FPC   4  |
|   | FRAME   3     S CASE A   2   |
|   | TFT-LCD PANEL1Glass substrate thickness=0.5tPART NAMEITEMPART CODEMODEL NUMBERREMARK                         |
|   | APPROVED尾木 GENERAL TOLERANCE ± 0.5 SCALE 1/1 UNIT TOLERANCE ± 0.5 L/1 UNIT TOLERANCE ± 0.5 LIVE TOPPAN       |
|   | CHECKED NAME DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY  |
|   | DESIGN前田創 OUTUINE DANAA DRAWING NO. REV. SHEET DIV.  |
| G   | UUILINE-D4N44 RJD529744D201  |
| , G   | П   I   U   U   К  <br>2004. 2 DEVICE-TFT  |

# 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

<u>\* \* \*\*\*\*\*</u> <u>\*\*\*\*\*\*</u> a b c d

|   | Contents of display  |   |  |  |  |  |  |  |  |  |
|---|--|---|--|--|--|--|--|--|--|--|
| а | The least significant  | The least significant digit of manufacture year                               |  |  |  |  |  |  |  |  |
| b | Manufacture month  | Manufacture month Jan-A May-E Sep-I<br>Feb-B Jun-F Oct-J<br>Mar-C Jul-G Nov-K |  |  |  |  |  |  |  |  |
| С | Apr-D     Aug-H     Dec-L       Model code     43EQC (Made in Japan)<br>43ERC (Made in Malaysia)     43ERC |   |  |  |  |  |  |  |  |  |
| 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"

 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.

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#### 4. Pin Assignment

| No.      | Symbol     | Function   |
|----------|------------|--|
| 1        | VSS        | GND.   |
| 2        | VSS        | GND.   |
| 3        | VDD        | Power supply.  |
| 4        | VDD        | Power supply.  |
| 5        | D00        |  |
| 6        | D01        | Display data(R).   |
| 7        | D02        | 00h: Black   |
| 8        | D03        | D00:LSB D07:MSB  |
| 9        | D04        |  |
| 10       | D05        | Driver has internal gamma conversion.  |
| 11       | D06        | Connect unused pins to GND.  |
| 12       | D07        |  |
| 13       | D10        |  |
| 14       | D11        | Display data(G).   |
| 15       | D12        | 00h: Black   |
| 16       | D13        | D10:LSB D17:MSB  |
| 17       | D14        |  |
| 18       | D15        | Driver has internal gamma conversion.  |
| 19       | D16        | Connect unused pins to GND.  |
| 20       | D17        |  |
| 21       | D20        |  |
| 22       | D21        | Display data(B).   |
| 23       | D22        | 00h: Black   |
| 24       | D23        | D20:LSB D27:MSB  |
| 25       | D24        |  |
| 26       | D25        | Driver has internal gamma conversion.  |
| 27<br>28 | D26        | Connect unused pins to GND.  |
| 28<br>29 | D27<br>VSS | GND.   |
| 30       | CLK        | Clock signal.Latching data at the falling edge.                              |
| 30       | 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.

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### 5. Absolute Maximum Rating

|                             |                                     |                                    |      |         |      | VSS=0V                      |
|-----------------------------|-------------------------------------|------------------------------------|------|---------|------|-----------------------------|
| Item                        | Symbol                              | Condition                          | Ra   | ting    | 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          |
|                             |                                     |                                    |      |         |      | D[27:20],D[17:10],D[07:00], |
|                             |                                     |                                    |      |         |      | STBYB,LR,UD                 |
| LED direction current       | IL                                  |                                    |      | 70      | mA   | BLH - BLL1/BLL2             |
| of order                    |                                     |                                    |      |         |      |                             |
| Storage temperature range   | Tstg                                |                                    | -40  | 95      | °C   |                             |
| Storage humidity range Hstg |                                     | Non condensing in an environmental |      |         |      |                             |
|                             | moisture at or less than 40°C90%RH. |                                    |      |         |      |                             |

# 6. Recommended Operating Conditions

|                         |        |            |                                 |          |     |      | VSS=0V                |
|-------------------------|--------|------------|---------------------------------|----------|-----|------|-----------------------|
| 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 | 0                               |          | VDD | V    | CLK,VSYNC,HSYNC,      |
|                         |        | 3.6V       | ,                               |          |     |      | DE,D[27:20],D[17:10], |
|                         |        |            |                                 |          |     |      | D[07:00],STBYB,LR,UD  |
| Operating temperature   | Тор    | Note       | -30                             | 25       | 85  | °C   | Panel surface         |
| range                   |        |            |                                 |          |     |      | temperature           |
| Operating humidity      |        | Ta≦40° C   | 20                              |          | 85  | %    |                       |
| range Hop               |        | Ta>40° C   | Non conde                       | nsing 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".

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VSS=0V

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# 7. Characteristics

# 7.1 DC Characteristics

# 7.1.1 Display Module

|                            | l, Ta=25° | °C,VDD=3.3V,VSS=0V)            |         |        |         |      |   |
|----------------------------|-----------|--------------------------------|---------|--------|---------|------|---|
| Item                       | Symbol    | Condition                      |         | Rating |         | Unit | Applicable terminal                       |
|                            |           |                                | MIN     | TYP    | MAX     |      |   |
| Input voltage<br>for logic | VIH       | VDD=3.0 to 3.6V                | 0.7×VDD |        | VDD     | V    | CLK,VSYNC,HSYNC,<br>DE,D[27:20],D[17:10], |
|                            | VIL       |                                | 0       |        | 0.3×VDD | V    | D[07:00],STBYB,<br>LR,UD                  |
| Pull up<br>resister value  | Rpu       |                                |         | 100    |         | kΩ   | LR,UD                                     |
| Current<br>consumption     |           | fCLK=9MHz<br>Color bar display |         | 30     | 60      | mA   | VDD                                       |

# 7.1.2 Backlight

| Item             | Symbol | Condition          |     | Rating |      |     | 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  | VF1    | Ta=25° C           |     | 10.6   | 11.4 | V   | BLH - BLL1          |
| *Reference value | VF2    | IL1=IL2=20mA       |     | 10.6   | 11.4 | V   | BLH - BLL2          |
| Estimated Life   | LL     | Ta=25°C            |     | 50,000 |      | hrs |                     |
| of LED           |        | IL1=IL2=20mA,Note2 |     |        |      |     |                     |

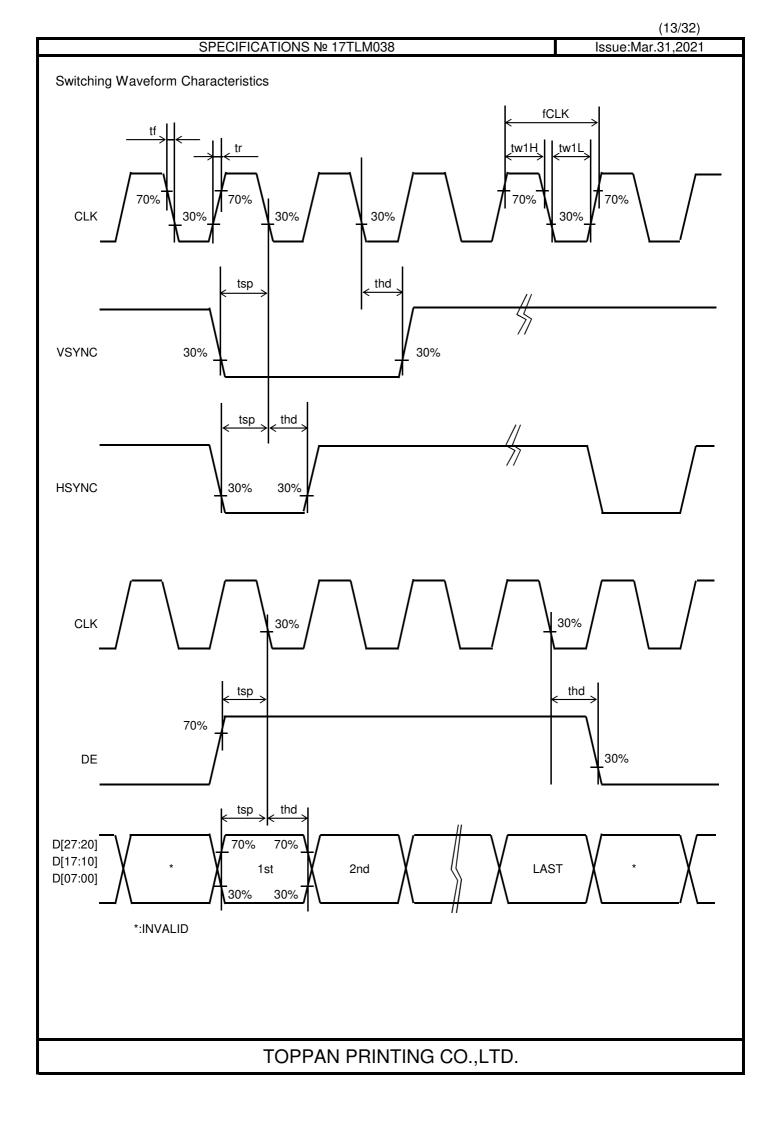
Note1: - Please control so that each current does not vary (IL1 = IL2).

- 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)

|                  |        |                  |      | <b>\</b> |      | ,   | , , , ,               |
|------------------|--------|------------------|------|----------|------|-----|-----------------------|
| Item             | Symbol | Condition        |      | Rating   |      |     | 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,      |
| Hold time        | thd    |                  | 16.0 |          |      | ns  | DE,D[27:20],D[17:10], |
|                  |        |                  |      |          |      |     | D[07:00]              |



# 7.3 Input Timing Characteristics

| (Unless othe | erwise note | ed, Ta=25 | °C,VDD= | 3.3V,VSS | =0V) |
|--------------|-------------|-----------|---------|----------|------|
|              |             |           |         |          |      |

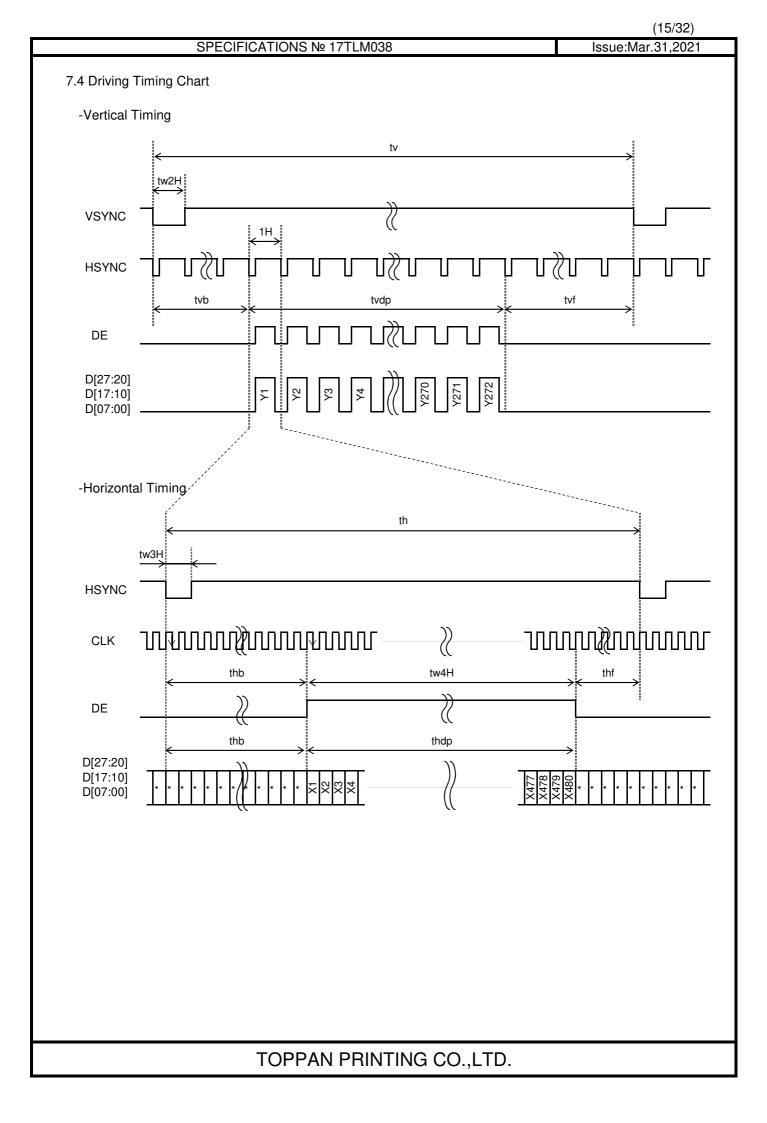
| Item                      | Symbol | -        | Rating | <b>`</b> | Unit | Applicable terminal                           |
|---------------------------|--------|----------|--------|----------|------|---|
|                           |        | MIN      | TYP    | MAX      |      |   |
| CLK frequency             | 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      | Н    | VSYNC,HSYNC                                   |
| VSYNC pulse width         | tw2H   | 1        |        |          | Н    |   |
| Vertical back porch       | tvb    | tw2H + 2 | 8      | 31       | Н    |   |
| Vertical front porch      | tvf    | 2        | 8      | 93       | Н    | -   |
| Vertical display period   | tvdp   |          | 272    |          | Н    | 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  |

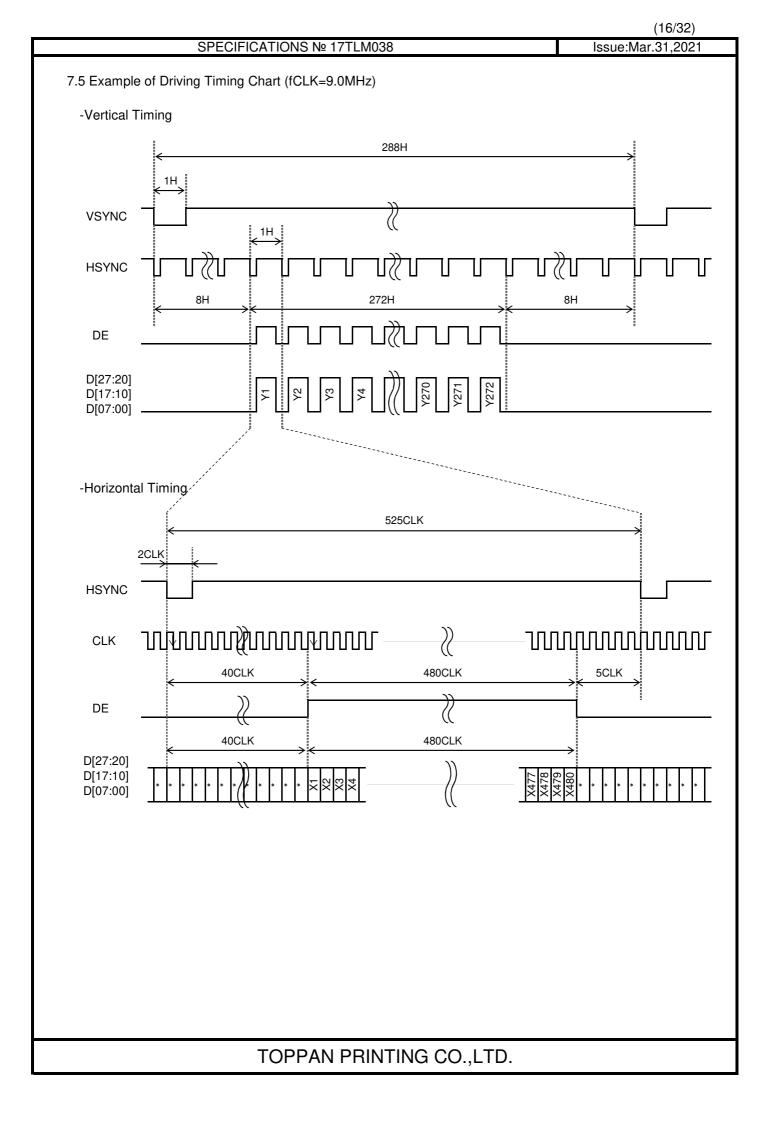
Note: The characteristic of this item is recommended standard.

Please use it after it confirms it enough like the display fineness etc. When it comes off from this characteristic and it is used.

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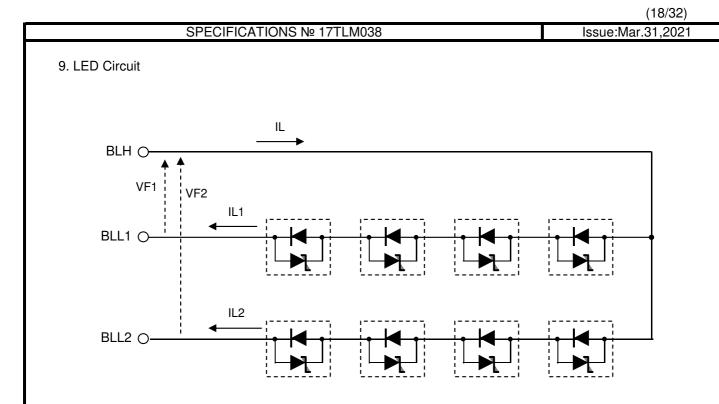
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| (17/ | 32) |
|------|-----|
|------|-----|

|                             | (17/32)<br>Issue:Mar.31,2021  |                      |  |  |  |  |  |
|-----------------------------|---|----------------------|--|--|--|--|--|
| 8. Power ON/OFF S           | 13500.1011.01,2021  |                      |  |  |  |  |  |
| 8.1 Power ON Seq            |   |                      |  |  |  |  |  |
|                             |   |                      |  |  |  |  |  |
| (U.Sm                       | ns -10) ms  |                      |  |  |  |  |  |
| RESETB<br>(internal signal) | 1ms -30 ms  |                      |  |  |  |  |  |
| VSYNC                       |   |                      |  |  |  |  |  |
| HSYNC/CLK/Data              | →=10 ms   |                      |  |  |  |  |  |
| STBYB                       | 7 frame   | 1 frame              |  |  |  |  |  |
| Display                     | ·   | black Normal display |  |  |  |  |  |
| Back Light                  | OFF   | ON                   |  |  |  |  |  |
| 8.2 Standby / Powe          | er OFF Sequence   |                      |  |  |  |  |  |
| VDD                         | <del>&lt; <sup>2</sup> frame</del> →  < > 100 ms →  |                      |  |  |  |  |  |
| VSYNC                       |   |                      |  |  |  |  |  |
| HSYNC/CLK/Data              |   |                      |  |  |  |  |  |
| STBYB                       |   |                      |  |  |  |  |  |
| Display                     | Normal display         black         standby state           Internal power OFF           | power-off state      |  |  |  |  |  |
| Back Light                  | ON OFF  |                      |  |  |  |  |  |
|                             | SYNC signals are stopped or the power supply is turned off to a regulate ge might remain. | d frame or less,     |  |  |  |  |  |
|                             | TOPPAN PRINTING CO.,LTD.  |                      |  |  |  |  |  |



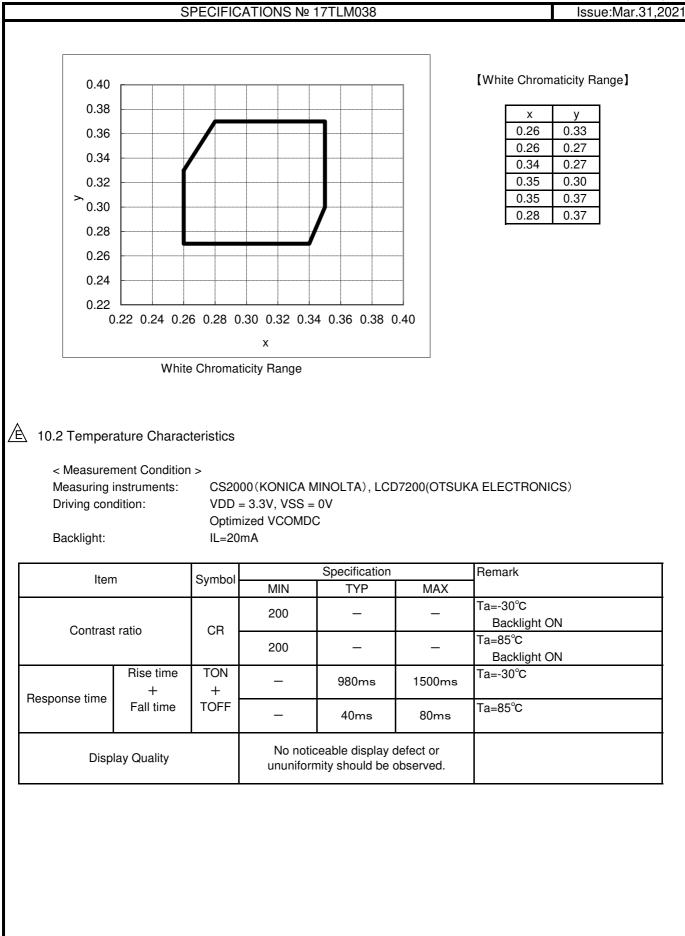
\* It is recommended to control currents of BLL1 / BLL2 to equal current values (IL1 = IL2).

|                   | SPECIFICATIONS № 17TLM038                        |           |                    |          |                        |          |                          |          |                           | - <i>)</i><br>202 |
|-------------------|--|-----------|--------------------|----------|------------------------|----------|--------------------------|----------|---------------------------|-------------------|
| ) Cha             | . Characteristics                                |           |                    |          |                        |          |                          |          |                           |                   |
| . 0114            |  |           |                    |          |                        |          |                          |          |                           |                   |
| < Mea             | Optical Chara<br>asurement Cor<br>uring instrume | ndition > |                    | /INOLTA  | ), LCD72               | 00 (OTS  | UKA ELI                  | ECTRON   | ICS), EZcontrastXL88 (ELI | DIN               |
| Drivin            | g condition:                                     |           | DD = 3.3V, VSS =   |          |                        |          |                          |          |                           |                   |
|                   |  | •         | otimized VCOMDC    | 2        |                        |          |                          |          |                           |                   |
| Backl             | -  |           | =20mA              |          |                        |          |                          |          |                           |                   |
| Meas              | ured temperati                                   | ure: la   | a=25° C            |          |                        |          |                          |          |                           |                   |
|                   |  |           |                    |          |                        |          |                          |          |                           |                   |
|                   | Item   | Symbol    | Condition          | MIN      | TYP                    | MAX      | Unit                     | Note No. | Remark                    | ]                 |
|                   | D:   | TON       |                    |          |                        |          |                          | -        |                           |                   |
| Ise               | Rise time<br>+                                   | TON       | [Data]=            |          |                        |          | ms                       | 1        |                           |                   |
| Response<br>time  | +<br>Fall time                                   | TOFF      | 00h→FFh<br>[Data]= | -        | 50                     | 100      |                          |          |                           |                   |
| Ë                 |  | 1011      | FFh→00h            |          |                        |          |                          |          |                           |                   |
| ÷                 |  | CR        | [Data]=            | 400      | 800                    | _        |                          | 2        |                           |                   |
| ontras<br>ratio   | Backlight ON                                     |           | FFh/00h            |          |                        |          |                          |          |                           |                   |
| Contrast<br>ratio | Backlight OFF                                    |           |                    |          | 2                      | -        |                          |          |                           |                   |
|                   | Left   | θL        | [Data]=            | 80       | _                      | _        | deg                      | 3        |                           |                   |
| Viewing<br>angle  |  | θR        | FFh/00h            | 80       | —                      | _        | deg                      | -        |                           |                   |
| /iew<br>anç       | Right<br>Up                                      | φU        | CR≧10              | 80       | —                      | _        | deg                      |          |                           |                   |
| ^                 | Down   | φD        |                    | 80       |                        | _        | deg                      |          |                           |                   |
| White             | Chromaticity                                     | х         |                    | White ch | romatici               | ty range |                          | 4        |                           |                   |
|                   | omoniationy                                      | у         |                    |          |                        |          |                          |          |                           |                   |
|                   | <b>.</b> .                                       |           |                    |          | eable bu               |          |                          | 5        |                           |                   |
|                   | Burn-in  |           |                    |          | oserved a<br>ndow pati |          |                          |          |                           |                   |
| Cente             | er brightness                                    |           | [Data]=FFh         |          | 1100 pail              |          | ay.<br>cd/m <sup>2</sup> | 6        | ILED=35mA                 |                   |
| Oenic             | er brightness                                    |           |                    |          | 1100                   |          | cu/m                     | Ŭ        |                           |                   |
|                   |  |           |                    | 390      | 600                    | _        |                          |          | ILED=20mA                 | 1                 |
| Bright            | tness distributi                                 | on        | [Data]=FFh         | 70       | _                      | _        | %                        | 7        |                           | -                 |
|                   |  |           |                    |          |                        |          |                          |          |                           |                   |

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

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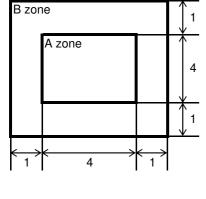
(20/32)

|   |  |   | SPECIFICATIONS № 17TLM038  | Issue:Mar.31,2021  |
|---|--|---|--|--|
| 11  | . Criteria c   | of Judgment   |  |  |
|   | 11.1 Defe  | ctive Display a   | nd Screen Quality  |  |
| Test Condition:<br>Driving Signal<br>Signal condition<br>Observation distance<br>Illuminance<br>Backlight |  |   | Observed TFT-LCD monitor from front during ope<br>with the following conditions<br>Raster Patter (RGB, white, black)<br>[Data]: 00h, 94h, FFh (3steps)<br>30 cm<br>200 to 350 lx<br>IL=20mA  | eration  |
| D   | efect item   |   | Defect content   | Criteria   |
|   | Line<br>defect   | Black, white or   | color line, 3 or more neighboring defective dots   | Not exists   |
| Display Quality   | Dot<br>defect  | TFT or CF, or c<br>(brighter dot, da<br>High bright dot:<br>Low bright dot:<br>Dark dot: Appe | ness on dot-by-dot base due to defective<br>dust is counted as dot defect<br>arker dot)<br>: Visible through 2% ND filter at [Data]=00h<br>Visible through 5% ND filter at [Data]=00h<br>ear dark through white display at [Data]=94h<br>gh 5% ND filter at [Data]=00h | Refer to table 1 Acceptable  |
|   | Dirt   | -   | ness (white stain, black stain etc)  | Invisible through 5% ND filter at Black screen.<br>Invisible through 1% ND filter at other screen. |
| Screen Quality  | Point-like $0.25 \text{mm} < \varphi$<br>Foreign $\varphi \leq 0.25 \text{mm}$ |   |  | N=0<br>N≦2<br>Acceptable   |
| Screer  | particle   | Liner   | 3.0mm <length 0.08mm<width<br="" and="">length≦3.0mm or width≦0.08mm</length>  | N=0<br>Acceptable  |
|   | Others   |   | Use boundary sample<br>for judgment when necessary   |  |
|   |  |   |  | erage diameter = (major axis + minor axis)/2<br>e number: N  |

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| Table I |                       |                      |             |       |   |
|---------|-----------------------|----------------------|-------------|-------|---|
| Area    | High<br>bright<br>dot | Low<br>bright<br>dot | Dark<br>dot | Total | Criteria  |
| А       | 0                     | 2                    | 2           | 3     | Permissible distance between same color bright dots (includes neighboring dots): 3 mm or more         |
| В       | 2                     | 4                    | 4           | 6     | Permissible distance between same color high bright dots<br>(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

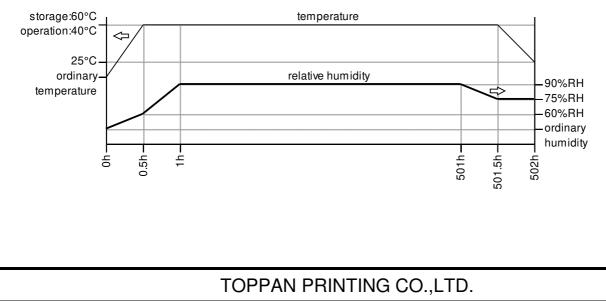
Observation distance Illuminance 30cm 1200∼2000 lx

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

|                               | 2. Reliability Test<br>Test item | Test condition  | number of failures /   |
|-------------------------------|----------------------------------|---|------------------------|
|                               |                                  |   | number of examinations |
|                               | High temperature storage         | Ta = 95°C 500hrs  | 0/3                    |
|                               | Low temperature storage          | Ta = -40°C 500hrs   | 0/3                    |
|                               | High temperature &               | Ta = 60°C, RH = 90%, 500hrs   | 0 / 3                  |
| st                            | high humidity storage            | non condensing X  |                        |
| Durability test               | High temperature operation       | Tp = 85°C 500hrs  | 0/3                    |
| bilit                         | Low temperature operation        | Tp = -30°C 500hrs   | 0 / 3                  |
| Jra                           | High temperature &               | $Tp = 40^{\circ}C, RH = 90\%,$ 500hrs   | 0 / 3                  |
| ā                             | high humidity operation          | non condensing X  |                        |
|                               | Thermal shock storage            | -40°C ↔ 85°C (30min / 30min) 100cycles  | 0 / 3                  |
|                               | Lightfastness                    | Xenon Blackpanel 63±3°C non-shower  | 0 / 3                  |
|                               |                                  | 450W/m(300~700nm) non-operating Integral dose 800MJ/m   |                        |
|                               | Electrostatic discharge test     | Confirms to EIAJ ED-4701/300, C=200pF,R=0Ω,V=±200V  | 0 / 3                  |
|                               | (Non operation)                  | Each 3 times of discharge on and power supply   |                        |
|                               |                                  | and other terminals.  |                        |
|                               | Surface discharge test           | C=250pF, R=100Ω, V=±12kV  | 0 / 3                  |
|                               | (Non operation)                  | Each 5 times of discharge in both polarities  |                        |
| est                           |                                  | on the center of screen with the case grounded.   |                        |
| al té                         | FPC tension test                 | Pull the FPC with the force of 3N for 10 sec.   | 0 / 3                  |
| Mechanical environmental test |                                  | in the direction - 90-degree to its original direction.                                       |                        |
| Ĕ                             | FPC bend test                    | Pull the FPC with the force of 3N for 10 sec.   | 0/3                    |
| 'iroi                         |                                  | in the direction -180-degree to its original direction.                                       |                        |
| env                           |                                  | Reciprocate it 3 times.   |                        |
| cal                           | Vibration test                   | Use TOPPAN PRINTING original jig (see next page)  | 0 / 3                  |
| ani                           | (Non operation)                  | Vibration Acceleration : 66.64 m/s <sup>2</sup> (6.8 G)                                       |                        |
| sch                           |                                  | Frequency : 20 ~ 500 Hz , Cycle : 10 min/sweep  |                        |
| ¥                             |                                  | Orientation : X,Y,Z-directions 10 hours per direction   |                        |
|                               |                                  | (Total 30 hrs)  |                        |
|                               | Impact test                      | Use TOPPAN PRINTING original jig (see next page) and  | 0 / 3                  |
|                               | (Non operation)                  | make an impact with peak acceleration of 1000m/s <sup>2</sup> for 6 msec                      |                        |
|                               |                                  | with half sine-curve at 3 times to each X, Y, Z directions                                    |                        |
|                               |                                  | in conformance with JIS C 60068-2-27-2011.  |                        |
| Packing<br>test               | Packing vibration-proof test     | Acceleration of 19.6m/s <sup>2</sup> with frequency of $10 \rightarrow 55 \rightarrow 10$ Hz, | 0 / 1 packing          |
|                               |                                  | X,Y, Zdirection for each 30 minutes.  |                        |
| bac<br>te                     | Packing drop test                | Drop from 75cm high.  | 0 / 1 packing          |
| LTTT -                        |                                  | 1 time to each 6 surfaces, 3 edges, 1 corner  |                        |

Note:Ta=ambient temperature Tp=Panel temperature

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





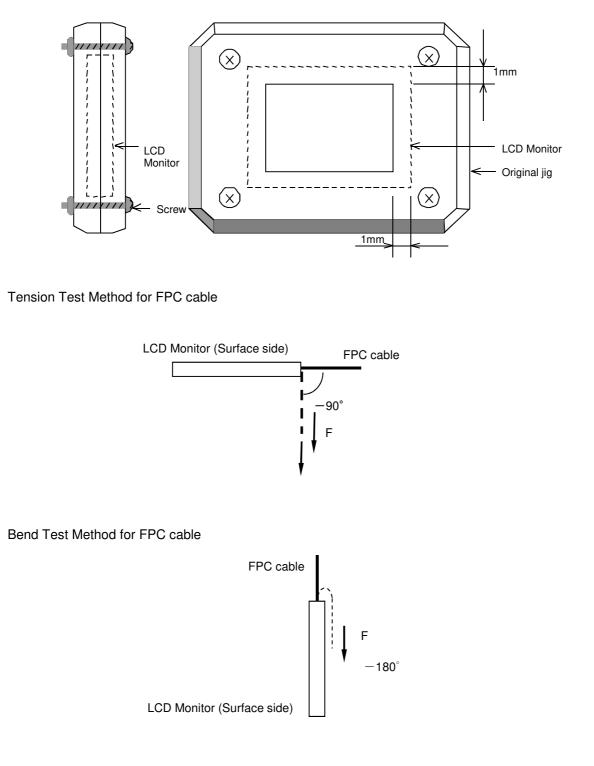
lssue:Mar.31,2021

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.         |              |
|                 | (Except for unevenness by Pol deterioration.) |              |
| Contrast ratio  | 200 or more                                   | Backlight ON |

# **TOPPAN PRINTING Original Jig**

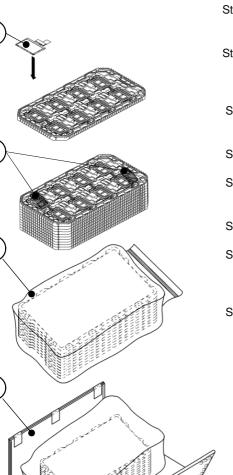


1

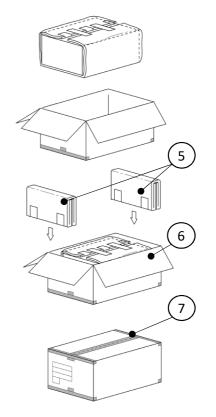
2

3

4



- 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.



| Dimension o               | fouter carton     |       |
|---------------------------|-------------------|-------|
| D : Approx.               | (356mm)           |       |
| W : Approx.               | (664mm)           |       |
| H : Approx.               | (182mm)           |       |
| Quantity of products pack | ed in one carton: | 72    |
| Gross weight : Appr       | ΌΧ.               | 7.2Kg |

Remark: The return of packing materials is not required.

|   | Packing item name |              | Specs., Material            |  |
|---|-------------------|--------------|-----------------------------|--|
| ſ | 1                 | Tray         | A-PET                       |  |
| ſ | 2                 | Drier        | Moisture absorber           |  |
| ſ |                   | Sealing bag  |                             |  |
| ſ | 4                 | B SHEET C    | Antistatic air bubble sheet |  |
| ſ | 5                 | B SHEET D    | Antistatic air bubble sheet |  |
| ſ | 6                 | Outer carton | Corrugated cardboard        |  |
|   | $\bigcirc$        | Packing tape |                             |  |

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# 14. Handling Instruction

14.1 Cautions for Handling LCD panels

| (2) | Do not make an impact on the LCD panel glass because it may break and you may get injured from it.<br>If the glass breaks, do not touch it with bare hands.  |
|-----|--|
|     | -  |
| (3) | (Fragment of broken glass may stick you or you cut yourself on it.)  |
|     | If you get injured, receive adequate first aid and consult a medial doctor.  |
|     | Do not let liquid crystal get into your mouth.<br>(If the LCD panel glass breaks, try not let liquid crystal get into your mouth even toxic property<br>of liquid crystal has not been confirmed.  |
|     | If liquid crystal adheres, rinse it out thoroughly.<br>(If liquid crystal adheres to your cloth or skin, wipe it off with rubbing alcohol or wash<br>it thoroughly with soap. If liquid crystal gets into eyes, rinse it with clean water<br>for at least 15 minutes and consult an eye doctor.  |
|     | 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.   |
|     | If a part of soldering part has been exposed, and avoid contact (short-circuit)<br>with a metallic part of the case etc. about FPC of this model, please.<br>Please insulate it with the insulating tape etc. if necessary.<br>The defective operation is caused, and there is a possibility to generation<br>of heat and the ignition.  |
|     | 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.   |
|     | The devices on the FPC are damageable to electrostatic discharge,<br>because the terminals of the devices are exposed.<br>Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static<br>charge and discharge when handling the TFT monitors.<br>Designate an appropriate operating area, and set equipment, tools, and machines properly<br>when handling this product. |
| L   | 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.   |

|        |   | (27/32)           |
|--------|---|-------------------|
|        | SPECIFICATIONS № 17TLM038   | lssue:Mar.31,2021 |
| 14.2 P | recautions 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.<br>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 ch<br>when handling the TFT monitors as the LED in this TFT monitors is damageable to electros<br>Designate an appropriate operating area, and set equipment, tools, and machines properly<br>when handling this product.             | static discharge. |
| 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<br>Particularly, never use or storage the TFT monitors at a location where condensation builds   |                   |
| 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 .<br>FPC cable needs to be inserted until it can reach to the end of connector slot.<br>During insertion, make sure to keep the cable in a horizontal position to avoid an oblique in<br>Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable. | sertion.          |
| 7)     | Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.<br>Especially, it will cause mechanical damage or critical defect if FPC is pull up or bent up to  | short of display. |
|        | Monitor DO NOT BEND UP  |                   |
|        | FPC   |                   |
| 8)     | Peel off the protective film on the TFT monitors during mounting process.<br>Refer to the section 14.5 on how to peel off the protective film.<br>We are not responsible for electrostatic discharge failures or other defects<br>occur when peeling off the protective film.   |                   |
| 14.3 P | recautions 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 failu   | res.              |
| 2)     | In case of powering up or powering off this LCD module,<br>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.<br>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 monitor  | rs.               |
| 5)     | Do not display a fixed image on the screen for a long time.<br>Use a screen-saver or other measures to avoid a fixed image displayed on the screen for a<br>Otherwise, it may cause burn-in image on the screen due the characteristics of liquid crysta  | -                 |
|        |   |                   |

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### SPECIFICATIONS № 17TLM038

# 14.4 Storage Condition for Shipping Cartons

Storage environment

| <ul> <li>Temperature</li> </ul> | 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.  |
| <ul> <li>Time period</li> </ul> | 1 year  |
| <ul> <li>Unpacking</li> </ul>   | 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

| 0           |  |
|-------------|--|
| 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.

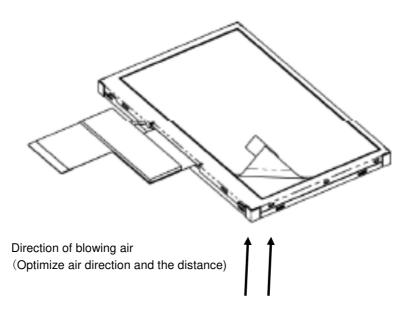
- A) Work Environment
  - a) Humidity: 50 to 70 %RH, Temperature15 to 27°C
  - b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. Use an electrostatic neutralization blower.

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 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 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

Æ

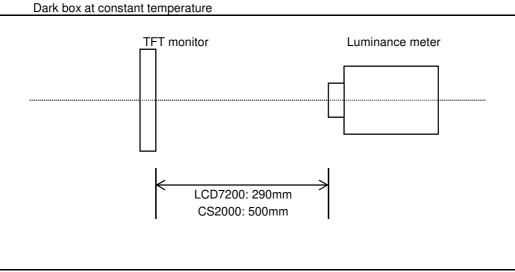
Reference Method for Measuring Optical Characteristics and Performance

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

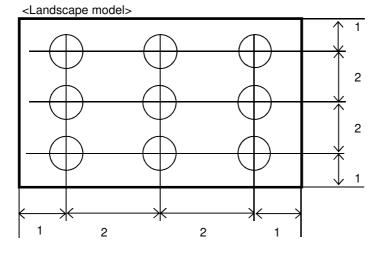
Measurement system: See the chart below. The luminance meter is placed on the normal line of measurement system. Measurement point: At the center of the screen unless otherwise specified



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

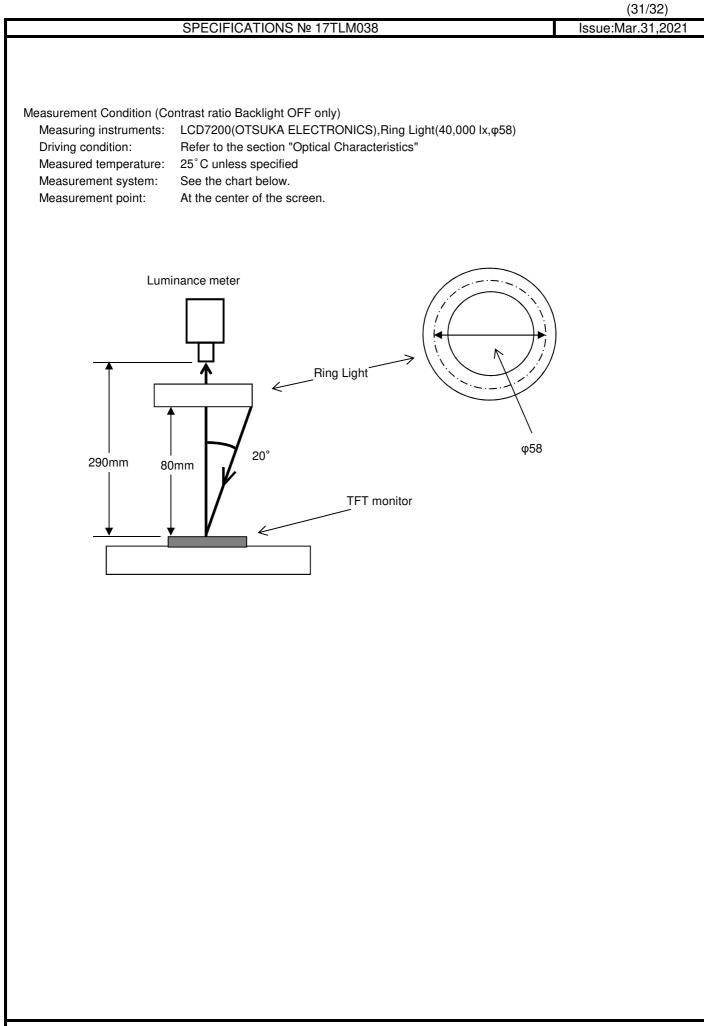
Measurement point:

At the center point of the screen Brightness distribution: 9 points shown in the following drawing.



Dimensional ratio of active area

Backlight IL=20mA



|                  |                | SPECIFICATIONS № 17TLM038                              |                | Issue:Mar.    |
|------------------|----------------|--|----------------|---------------|
| - oot 1 /        | thad           |  |                |               |
| est Me<br>Notice | thod Item      | Test method  | Measuring      | Remark        |
| Notice           | item           | rest method  | instrument     | nemark        |
| 1                | Response       | Measure output signal waves with a brightness meter    | LCD7200        | Black display |
| 1                | time           | when the raster or window pattern is changed over from | LOD7200        |               |
|                  | ume            |  |                | [Data]=00h    |
|                  |                | white to black and from black to white                 |                | White displat |
|                  |                |  |                | [Data]=FFh    |
|                  |                |  |                | TON           |
|                  |                | Black White Black                                      |                | Rise time     |
|                  |                |  |                | TOFF          |
|                  |                | White brightness                                       |                | Fall time     |
|                  |                | 100%   |                |               |
|                  |                |  |                |               |
|                  |                | 90%  |                |               |
|                  |                | 90 %   |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                |  |                |               |
|                  |                | 10%  |                |               |
|                  |                |  |                |               |
|                  |                | $0\% \longleftrightarrow $                             |                |               |
|                  |                |  |                |               |
|                  |                | Black  |                |               |
|                  |                | brightness TON TOFF                                    |                |               |
|                  |                |  |                |               |
| 2                | Contrast ratio | Measure maximum luminance Y1([Data]=FFh) and           | CS2000         | Backlight ON  |
|                  |                | minimum luminance Y2([Data]=00h) at the center of      | LCD7200        | Backlight OF  |
|                  |                | the screen by displaying raster or window pattern.     |                |               |
|                  |                | Then calculate the ratio between these two values.     |                |               |
|                  |                | Contrast ratio = $Y1/Y2$                               |                |               |
|                  |                | Diameter of measuring point: 7.8mmφ(CS2000)            |                |               |
|                  |                | Diameter of measuring point: 3mmq(LCD7200)             |                |               |
| 3                | Viewing        | Move the luminance meter from right to left and up     | EZcontrastXL88 |               |
|                  | angle          | and down and determine the angles where                |                |               |
|                  | Horizontal0    | contrast ratio is 10.                                  |                |               |
|                  | Verticalφ      |  |                |               |
| 4                | White          | Measure chromaticity coordinates x and y of CIE1931    | CS2000         |               |
|                  | chromaticity   | colorimetric system at [Data] = FFh                    |                |               |
|                  |                | Color matching function: 2°view                        |                |               |
|                  |                | Measurement angle: 1°                                  |                |               |
| 5                | Burn-in        | Visually check burn-in image on the screen             |                |               |
| •                |                | after 2 hours of "window display" ([Data]=00h/FFh).    |                |               |
| 6                | Center         | Measure the brightness at the center of the screen.    | CS2000         |               |
| U                |                |  | 002000         |               |
| 7                | brightness     | (Drightnoop distribution) 100 x D/A 0/                 | 00000          |               |
| 1                | Brightness     | (Brightness distribution) = 100 x B/A %                | CS2000         |               |
|                  | distribution   | A : max. brightness of the 9 points                    |                |               |
|                  | 1              | B : min. brightness of the 9 points                    |                |               |

(32/32)