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# Datasheet

## Ortustech

**COM43H4N91UTC**

OR-20-038

**This product is under development and specifications are subject to change.**

# Specifications for

## **Blanview TFT-LCD Monitor (TENTATIVE)**

( 4.3" WVGA 480 x RGB x 800 Portrait)

Version 0.0

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

**MODEL COM43H4N91UTC**

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

# ORTUSTECH

TOPPAN PRINTING CO.,LTD.  
Electronics Division  
Ortus Subdivision

Approved by

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Checked by

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Prepared by

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Version History

| Ver. | Date        | Page | Description       |
|------|-------------|------|-------------------|
| 0.0  | Jul.31,2020 | -    | - Tentative issue |
|      |             |      |                   |

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## 1. Application

This Specification is applicable to 108.5mm (4.3 inch) Blanview TFT-LCD monitor with TP for non-military use.

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

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

## 2. Outline Specifications

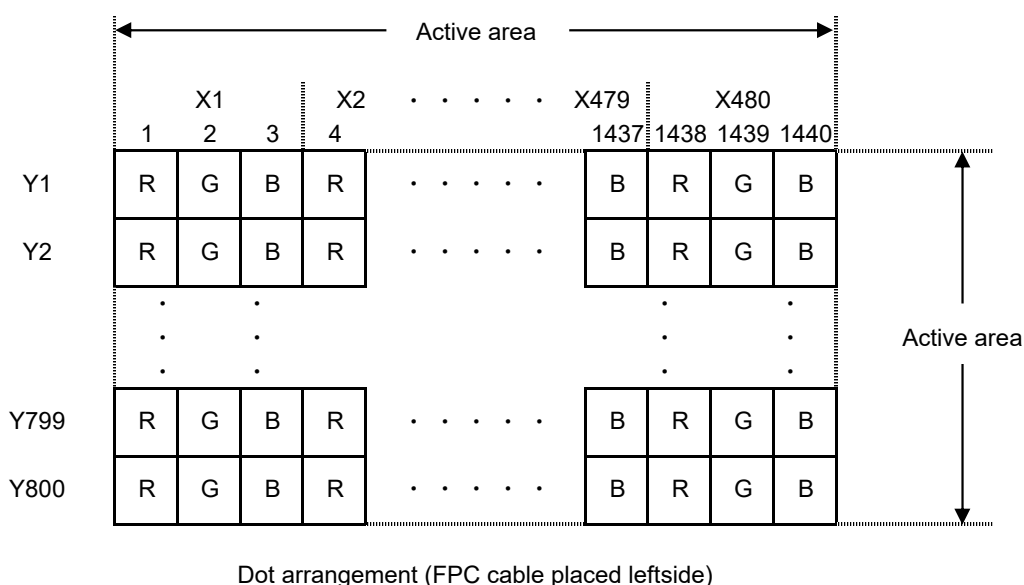
### 2.1 Features of the Product

- 4.3 inch diagonal display, 1440 [H] x 800 [V] dots.
- 6-bit / 262,144 colors.
- Timing generator [TG], Counter-electrode driving circuitry, Built-in power supply circuit.
- Power save (Standby) mode capable.
- Long life & High bright white LED back-light and Touch panel operation monitor.
- Blanview TFT-LCD, improved outdoor readability.

|               | Indoor      |                                 | Outdoor     |                                 |
|---------------|-------------|---------------------------------|-------------|---------------------------------|
|               | Readability | Power Efficiency (Battery Life) | Readability | Power Efficiency (Battery Life) |
| Transmissive  | Good        | Good                            | Fair        | Poor                            |
| Transflective | Fair        | Poor                            | Good        | Good                            |
| Blanview      | Good        | Good                            | Good        | Good                            |

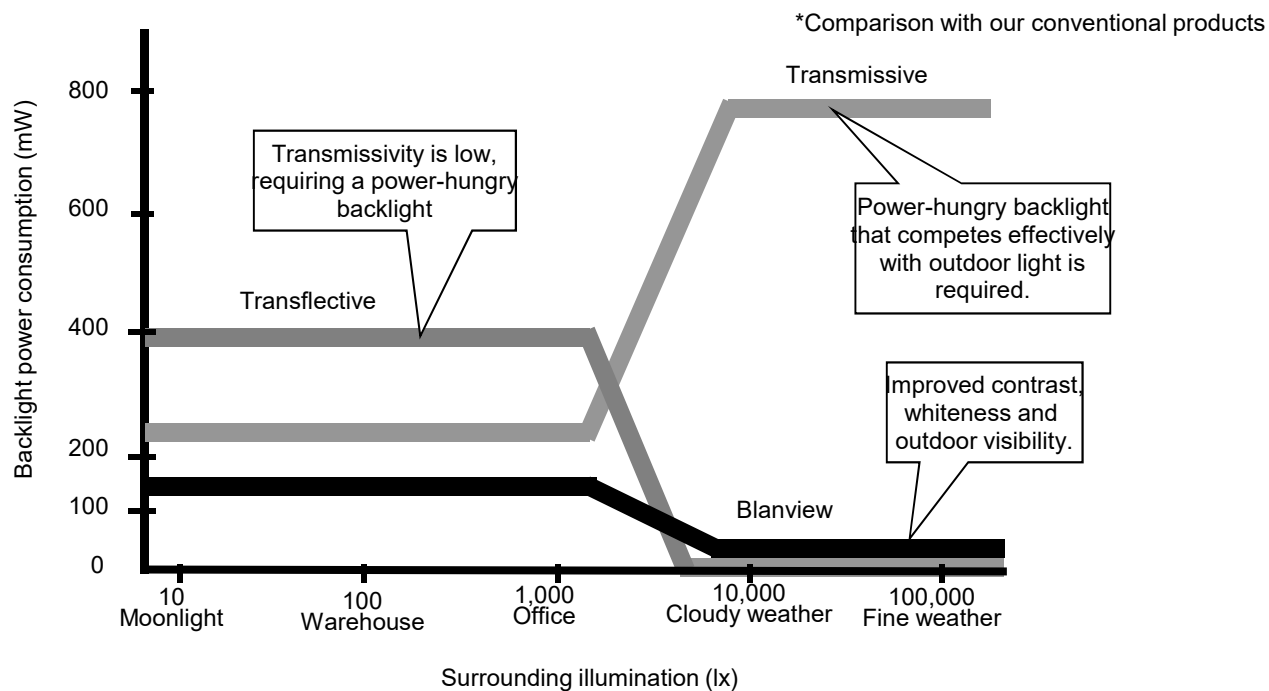
### 2.2 Display Method

| Items               | Specifications   | Remarks                    |
|---------------------|--|----------------------------|
| Display type        | 262,144 colors.<br>Blanview, Normally black.             |                            |
| Driving method      | a-Si TFT Active matrix.<br>Line-scanning, Non-interlace. |                            |
| Dot arrangement     | RGB stripe arrangement.                                  | Refer to "Dot arrangement" |
| Signal input method | 6-bit RGB, parallel input.                               |                            |
| Backlight type      | Long life & High bright white LED.                       |                            |
| Touch panel         | Resistance type, transmissive analog tablet              | Surface finishing: Clear   |
| NTSC ratio          | (35)%  |                            |



<Features of Blanview>

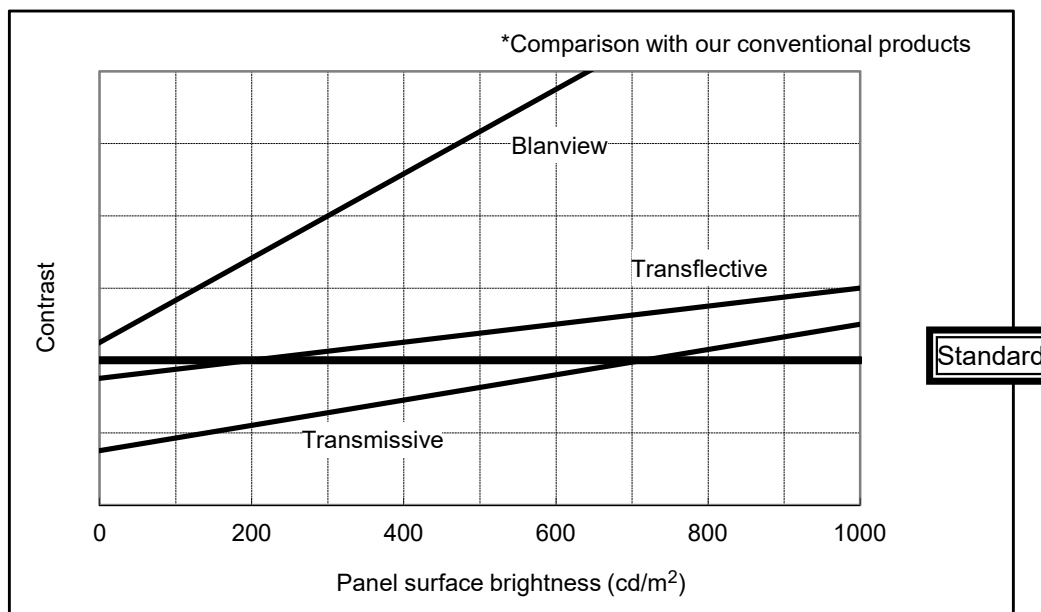
- Backlight power consumption required to assure visibility. (equivalent to 3.5"QVGA )



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

With better contrast (higher contrast ratio), Blanview TFT-LCD has the best outdoor 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

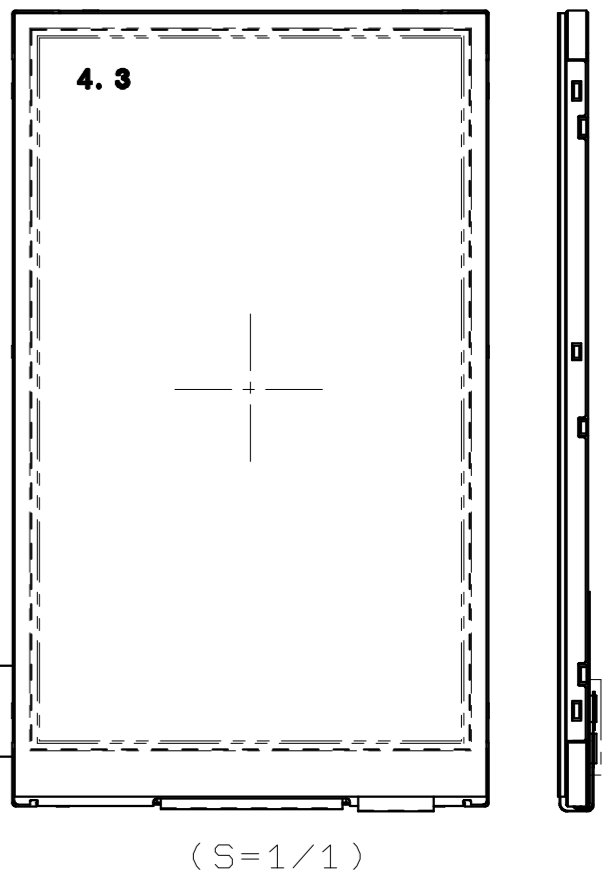
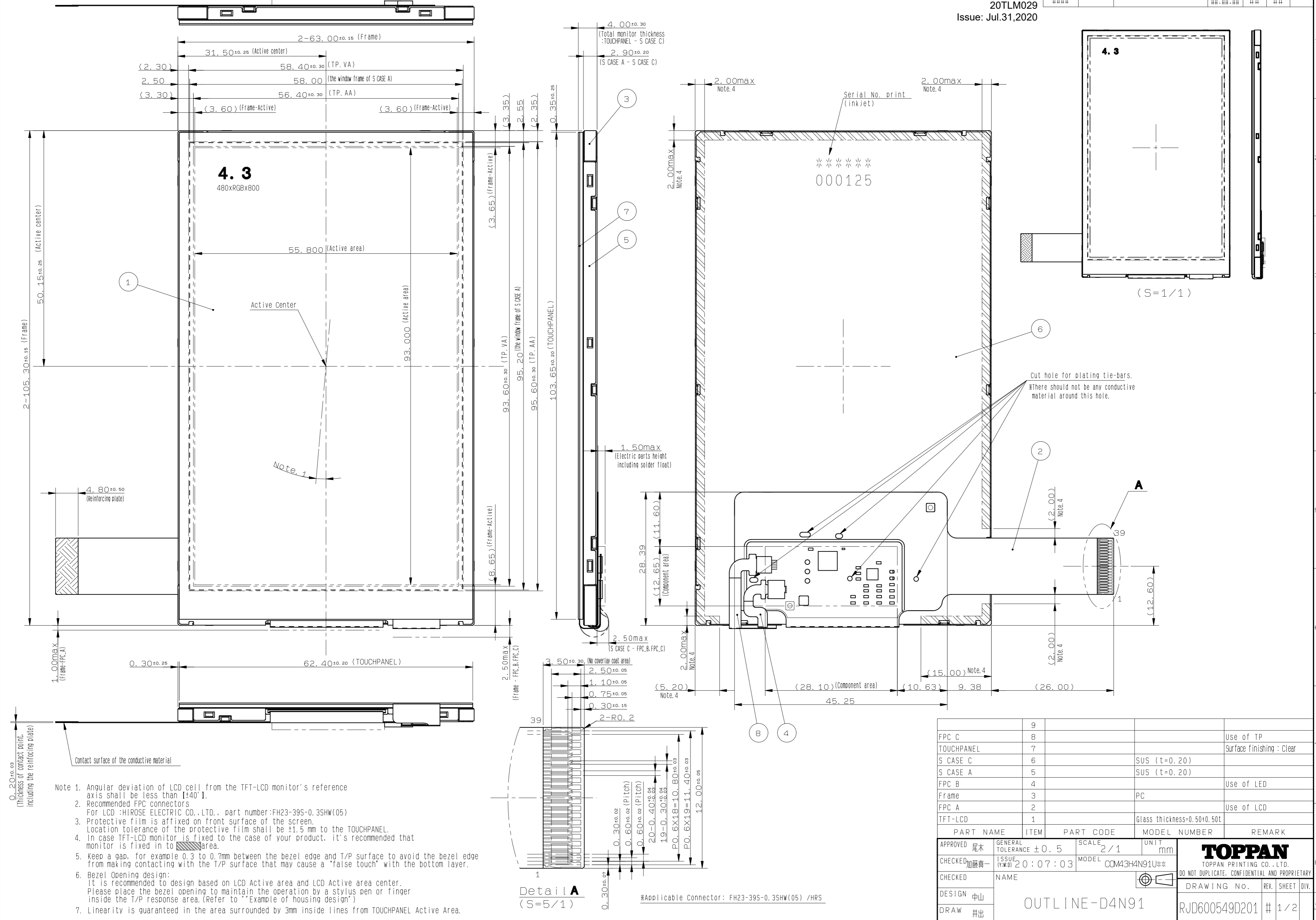
## 3.1 Dimensions

| Items                           | Specifications              | Unit | Remarks   |
|---------------------------------|-----------------------------|------|---|
| Outline dimensions              | 63.0[H] × 105.3[V] × 4.0[D] | mm   | Exclude FPC cable and parts on FPC.                             |
| Active area                     | 55.8[H] × 93.0[V]           | mm   | 108.5 mm diagonal   |
| Number of dots                  | 1440[H] × 800[V]            | dot  |   |
| Dot pitch                       | 38.75[H] × 116.25[V]        | μm   |   |
| Hardness of Touch Panel surface | 3                           | H    | Load:4.9N,Angle:45°<br>Reference judgment<br>standard:JIS-K5600 |
| Weight                          | 53.1                        | g    | Include FPC cable   |

3.2 Outward Form

(8/36)  
20TLM029  
Issue: Jul.31,2020

|        |          |        |              |          |         |          |
|--------|----------|--------|--------------|----------|---------|----------|
| EC No. | REV. No. | REVISE | DATE (Y:M:D) | APPROVED | CHECKED | PREPARED |
| ####   |          |        | ##:##:##     | ##       | ##      | ##       |



Cut hole for plating tie-bars.  
There should not be any conductive material around this hole.

Detail A  
(S=5/1)

Applicable Connector: FH23-39S-0.35HW(05) /HRS

- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±40'].
2. Recommended FPC connectors  
For LCD :HIROSE ELECTRIC CO.,LTD., part number:FH23-39S-0.35HW(05)
3. Protective film is affixed on front surface of the screen.  
Location tolerance of the protective film shall be ±1.5 mm to the TOUCHPANEL.
4. In case TFT-LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in to [hatched] area.
5. Keep a gap, for example 0.3 to 0.7mm between the bezel edge and T/P surface to avoid the bezel edge from making contacting with the T/P surface that may cause a "false touch" with the bottom layer.
6. Bezel Opening design:  
It is recommended to design based on LCD Active area and LCD Active area center.  
Please place the bezel opening to maintain the operation by a stylus pen or finger inside the T/P response area. (Refer to "Example of housing design")
7. Linearity is guaranteed in the area surrounded by 3mm inside lines from TOUCHPANEL Active Area.

|             |                        |                    |              |                            |
|-------------|------------------------|--------------------|--------------|----------------------------|
| FPC C       | 9                      |                    |              |                            |
| TOUCHPANEL  | 8                      |                    |              | Use of TP                  |
| S CASE C    | 7                      |                    |              | Surface finishing : Clear  |
| S CASE A    | 6                      |                    | SUS (t=0.20) |                            |
| FPC B       | 5                      |                    | SUS (t=0.20) |                            |
| Frame       | 4                      |                    |              | Use of LED                 |
| FPC A       | 3                      |                    | PC           |                            |
| TFT-LCD     | 2                      |                    |              | Use of LCD                 |
|             | 1                      |                    |              | Glass thickness=0.50±0.50t |
| PART NAME   | ITEM                   | PART CODE          | MODEL NUMBER | REMARK                     |
| APPROVED 尾木 | GENERAL TOLERANCE ±0.5 | SCALE 2/1          | UNIT mm      |                            |
| CHECKED 加藤  | ISSUE (Y:M:D) 20:07:03 | MODEL COM43H4N91** |              |                            |
| CHECKED     | NAME                   |                    |              |                            |
| DESIGN 中山   |                        |                    |              |                            |
| DRAW 井出     |                        |                    |              |                            |

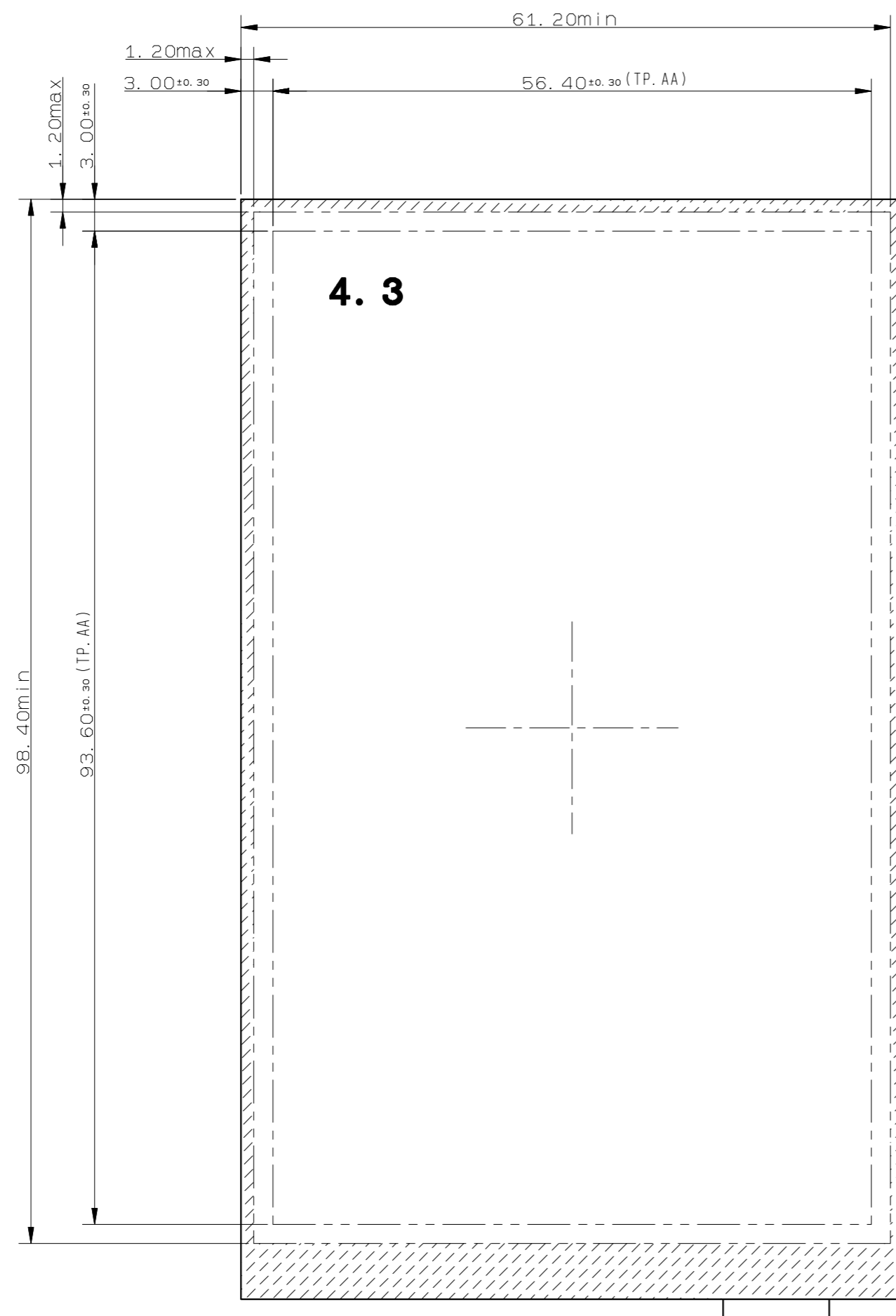
TOPPAN  
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DRAWING No. RJD600549D201 # 1/2

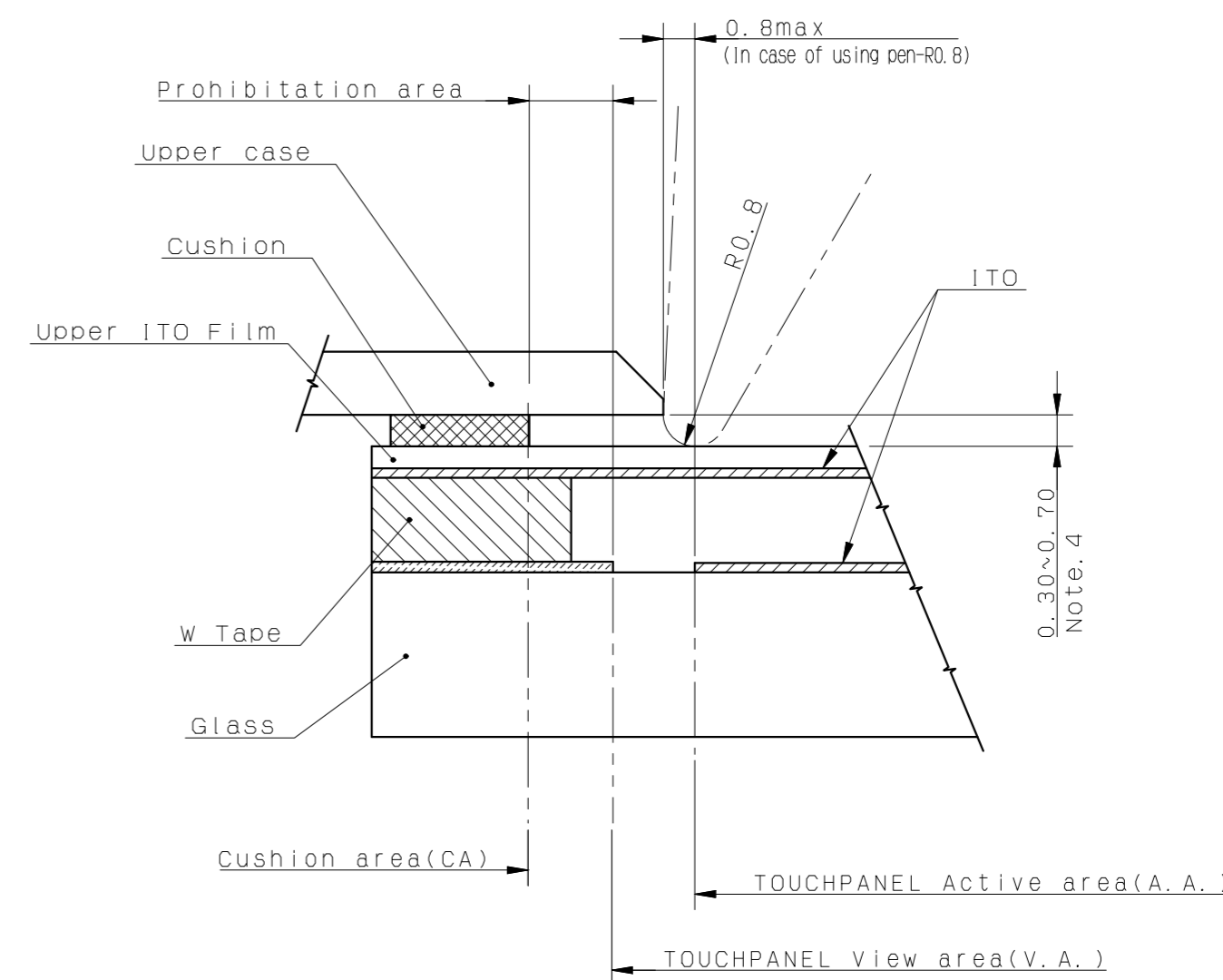
OUTLINE-D4N91

| EC No. | REV. No. | REVISE | DATE (Y:M:D) | APPROVED | CHECKED | PREPARED |
|--------|----------|--------|--------------|----------|---------|----------|
| ####   |          |        | ##:##:##     | ##       | ##      |          |

(9/36)  
20TLM029  
Issue: Jul.31,2020



Cushion area (TOUCHPANEL)



Example of Housing Design  
(S=Free)

Design guidance for the upper case & the cushion

Note 8. Upper case opening

- a. Please place the upper case opening to maintain the operation by a stylus pen inside the TP response area
- b. The any pressures in the area between TP response area and TP viewing area is prohibited.
- c. Please use the appropriate material (PMMA, PC, etc.) as the upper case.

9. Cushion design

- a. Please put the cushion on the upper case.
- b. Do not use an adhesive tape to stick on the TP surface.
- c. Please position the cushion over the cushion area to avoid a short.

|              |                        |                     |         |   |                 |       |
|--------------|------------------------|---------------------|---------|---|-----------------|-------|
| APPROVED 尾木  | GENERAL TOLERANCE ±0.5 | SCALE 2/1           | UNIT mm | <b>TOPPAN</b><br>TOPPAN PRINTING CO.,LTD.<br>DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY |                 |       |
| CHECKED 加藤貴一 | ISSUE (Y:M:D) 20:07:03 | MODEL COM43H4N91U** |         |   |                 |       |
| CHECKED      | NAME                   | OUTLINE-D4N91       |         | DRAWING No.   | REV. SHEET DIV. |       |
| DESIGN 中山    |                        |                     |         | RJD600549D201   | # 2/2           | ASS'Y |
| DRAW 井出      |                        |                     |         |   |                 |       |

## 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                                      | 43FPC (Made in Japan)<br>43FQC (Made in Malaysia) |                                  |                                  |
| d                   | Serial number                                   |   |                                  |                                  |

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

•Made in Japan

0L43FPC000125

means "manufactured in December 2020, 4.3" FP type, C specifications, serial number 000125"

•Made in Malaysia

0L43FQC000125

means "manufactured in December 2020, 4.3" FQ type, C specifications, serial number 000125"

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

Refer to 3.2 "Outward Form".

## 3)Others

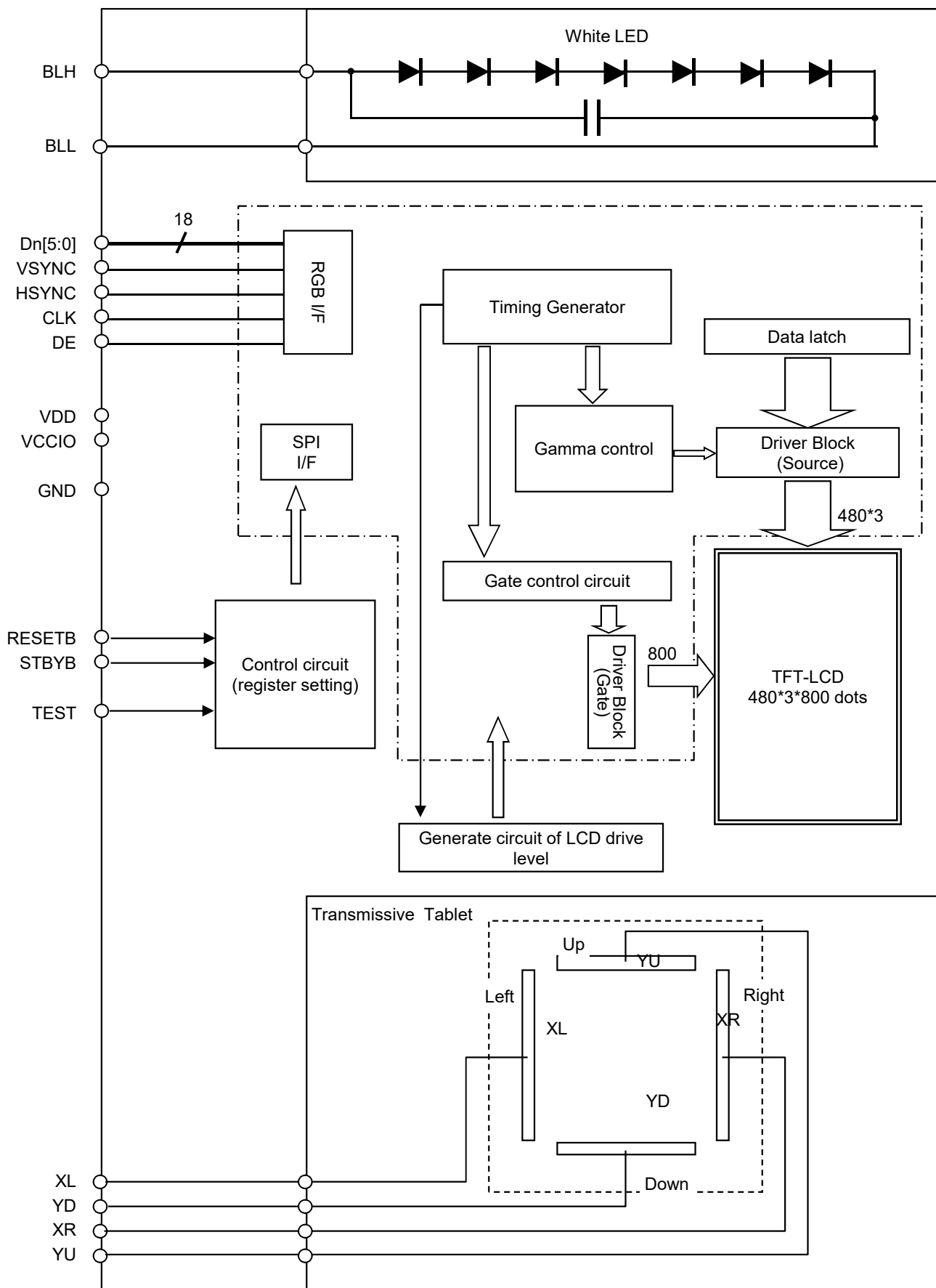
Please note that it is likely to disappear with an organic solvent about the Serial print.

## 4. Pin Assignment

| No. | Symbol | Function  |
|-----|--------|---|
| 1   | VSS    | Ground  |
| 2   | VSS    | Ground  |
| 3   | VDD    | Power supply input.   |
| 4   | VCCIO  | Logic Interface Power supply input.   |
| 5   | VSS    | Ground  |
| 6   | RESETB | System reset signal input.(Lo: active)  |
| 7   | HSYNC  | Horizontal sync signal input. (Negative polarity)   |
| 8   | VSYNC  | Vertical sync signal input.(Negative polarity)  |
| 9   | CLK    | Clock input for display. (Data Input on the falling edge)   |
| 10  | VSS    | Ground  |
| 11  | D00    | Display data input for (B).<br>00h for black display<br>D00:LSB D05:MSB<br><br>Driver IC carries out gamma conversion internally. |
| 12  | D01    |   |
| 13  | D02    |   |
| 14  | D03    |   |
| 15  | D04    |   |
| 16  | D05    |   |
| 17  | D10    | Display data input for (G).<br>00h for black display<br>D10:LSB D15:MSB<br><br>Driver IC carries out gamma conversion internally. |
| 18  | D11    |   |
| 19  | D12    |   |
| 20  | D13    |   |
| 21  | D14    |   |
| 22  | D15    |   |
| 23  | D20    | Display data input for (R).<br>00h for black display<br>D20:LSB D25:MSB<br><br>Driver IC carries out gamma conversion internally. |
| 24  | D21    |   |
| 25  | D22    |   |
| 26  | D23    |   |
| 27  | D24    |   |
| 28  | D25    |   |
| 29  | VSS    | Ground  |
| 30  | DE     | Input data effective signal. (It is effective for the period of "H")  |
| 31  | STBYB  | Standby signal (Lo:Standby operation,Hi:Normal operation)   |
| 32  | TEST1  | Connect to Ground.  |
| 33  | XL     | X-axis left terminal  |
| 34  | YD     | Y-axis downside terminal  |
| 35  | XR     | X-axis right terminal   |
| 36  | YU     | Y-axis upside terminal  |
| 37  | TEST2  | Connect to Ground.  |
| 38  | BLH    | LED drive power source. (Anode side)  |
| 39  | BLL    | LED drive power source. (Cathode side)  |

- Recommended connector: HIROSE ELECTRIC FH23 series [FH23-39S-0.3SHW(05)]
- 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. Block Diagram



## 6. Absolute Maximum Rating

VSS=0V

| Item                      | Symbol | Condition   | Rating |           | Unit | Applicable terminal  |
|---------------------------|--------|---|--------|-----------|------|--|
|                           |        |   | MIN    | MAX       |      |  |
| Supply voltage            | VDD    | Ta=25° C  | -0.3   | 4.6       | V    | VDD  |
| Logic interface voltage   | VCCIO  |   | -0.3   | VDD       | V    | VCCIO  |
| Input voltage for logic   | VI     |   | -0.3   | VCCIO+0.3 | V    | CLK,VSYNC,HSYNC,DE<br>D[05:00],D[15:10]<br>D[25:20],STBYB,RESETB |
| Forward current           | IL     | Ta = 25° C  | --     | 35        | mA   | BLH-BLL  |
|                           |        | Ta = 70° C  | --     | 15        |      |  |
| Touch Panel input voltage | VIT    |   | --     | 7.0       | V    | XR,XL,YU,YD  |
| Storage temperature range | Tstg   |   | -30    | 80        | °C   |  |
| Storage humidity range    | Hstg   | Non condensing in an environmental moisture at or less than 40° C90%RH. |        |           |      |  |

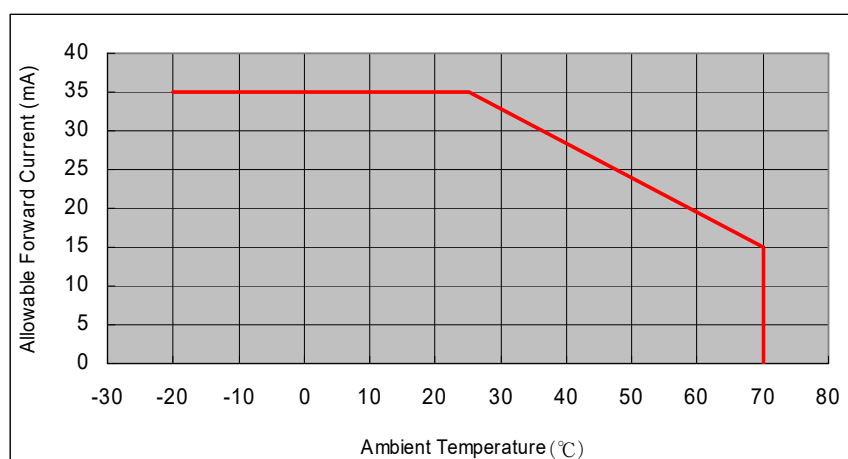
## 7. Recommended Operating Conditions

VSS=0V

| Item                          | Symbol | Condition | Rating   |     |       | Unit | Applicable terminal  |
|-------------------------------|--------|-----------|--|-----|-------|------|--|
|                               |        |           | MIN  | TYP | MAX   |      |  |
| Supply voltage                | VDD    |           | 2.7  | 3.0 | 3.6   | V    | VDD  |
| Logic interface voltage       | VCCIO  |           | 1.7  | 1.8 | VDD   | V    | VCCIO  |
| Input voltage for logic       | VI     |           | 0  | --  | VCCIO | V    | CLK,VSYNC,HSYNC,DE<br>D[05:00],D[15:10]<br>D[25:20],STBYB,RESETB |
| Operational temperature range | Top    | Note1,2   | -20  | +25 | +70   | °C   | Touch 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 °C 85%RH. |     |       |      |  |

Note1: This monitor is operatable in this temperature range. With regard to optical characteristics, refer to Item 10."CHARACTERISTICS".

Note 2: Acceptable Forward Current to LED is up to 15mA, when Ta=+70° C.  
Do not exceed Allowable Forward Current shown on the chart below.



## 8. Electrical Characteristics

## 8.1 DC Characteristics

## 8.1.1 Display Module

(Unless otherwise noted, Ta=25°C, VDD=3.0V, VCCIO=1.8V, VSS=0V)

| Item                 | Symbol | Condition         | Rating    |       |           | Unit | Applicable terminal  |
|----------------------|--------|-------------------|-----------|-------|-----------|------|--|
|                      |        |                   | MIN       | TYP   | MAX       |      |  |
| Input Signal Voltage | VIH    | VCCIO=1.7-3.6     | 0.7×VCCIO | --    | VCCIO     | V    | CLK, VSYNC, HSYNC, DE, D[05:00], D[15:10], D[25:20], STBYB, RESETB |
|                      | VIL    |                   | 0         | --    | 0.3×VCCIO | V    |  |
| Operating Current    | IDD    | fCLK=25MHz        | --        | (8.5) | (17.0)    | mA   | VDD  |
|                      | ICCIO  | Color bar display | --        | (0.6) | (1.2)     | mA   | VCCIO  |
| Stand-by Current     | IDDS   | Other input with  | --        | (5.0) | (15.0)    | μA   | VDD  |
|                      | ICCIOS | constant voltage  | --        | --    | (1.0)     | μA   | VCCIO  |

## 8.1.2 Backlight

| Item                              | Symbol | Condition                     | Rating |          |      | Unit | Applicable terminal |
|-----------------------------------|--------|-------------------------------|--------|----------|------|------|---------------------|
|                                   |        |                               | MIN    | TYP      | MAX  |      |                     |
| Forward current                   | IL25   | Ta=25 °C                      | —      | 10.0     | 35.0 | mA   | BLH – BLL           |
|                                   | IL70   | Ta=70 °C                      | —      | —        | 15.0 | mA   |                     |
| Forward voltage (Reference Value) | VL     | Ta=25 °C<br>IL=10.0mA         | —      | 19.6     | 20.3 | V    |                     |
| Estimated Life of LED             | LL     | Ta=25 °C<br>IL=10.0mA<br>Note | —      | (50,000) | —    | hrs  |                     |

Note: - The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.

- This figure is given as a reference purpose only, and not as a guarantee.
- This figure is estimated for an LED operating alone.

As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.

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



## 8.1.3 Touch Panel

Ta=25° C

| Item                  | Symbol | Condition                 | Rating |     |      | Unit | Applicable terminals |
|-----------------------|--------|---------------------------|--------|-----|------|------|----------------------|
|                       |        |                           | MIN    | TYP | MAX  |      |                      |
| Linearity             | LE     | Note                      | -1.5   | —   | +1.5 | %    |                      |
| Insulation resistance | RI     | DC 25V                    | 20     | —   | —    | MΩ   | XL,XR — YD,YU        |
| Terminal resistance   |        | X                         | 100    | —   | 800  | Ω    | XL,XR                |
|                       |        | Y                         | 200    | —   | 900  |      | YD,YU                |
| Rated voltage         |        | DC                        | —      | 5   | 7    | V    | XL,YD,XR,YU          |
| on/off chattering     |        | R 0.8mm<br>Polyacetal pen | —      | —   | 10   | ms   | XL,YD,XR,YU          |

Note: -Please refer to "3.2 Outward Form" for the range of the guarantee.

-Linearity Measurement:Refer to the APPENDIX of "Reference Method for Measuring Optical Characteristics".

## Mechanical Reliability

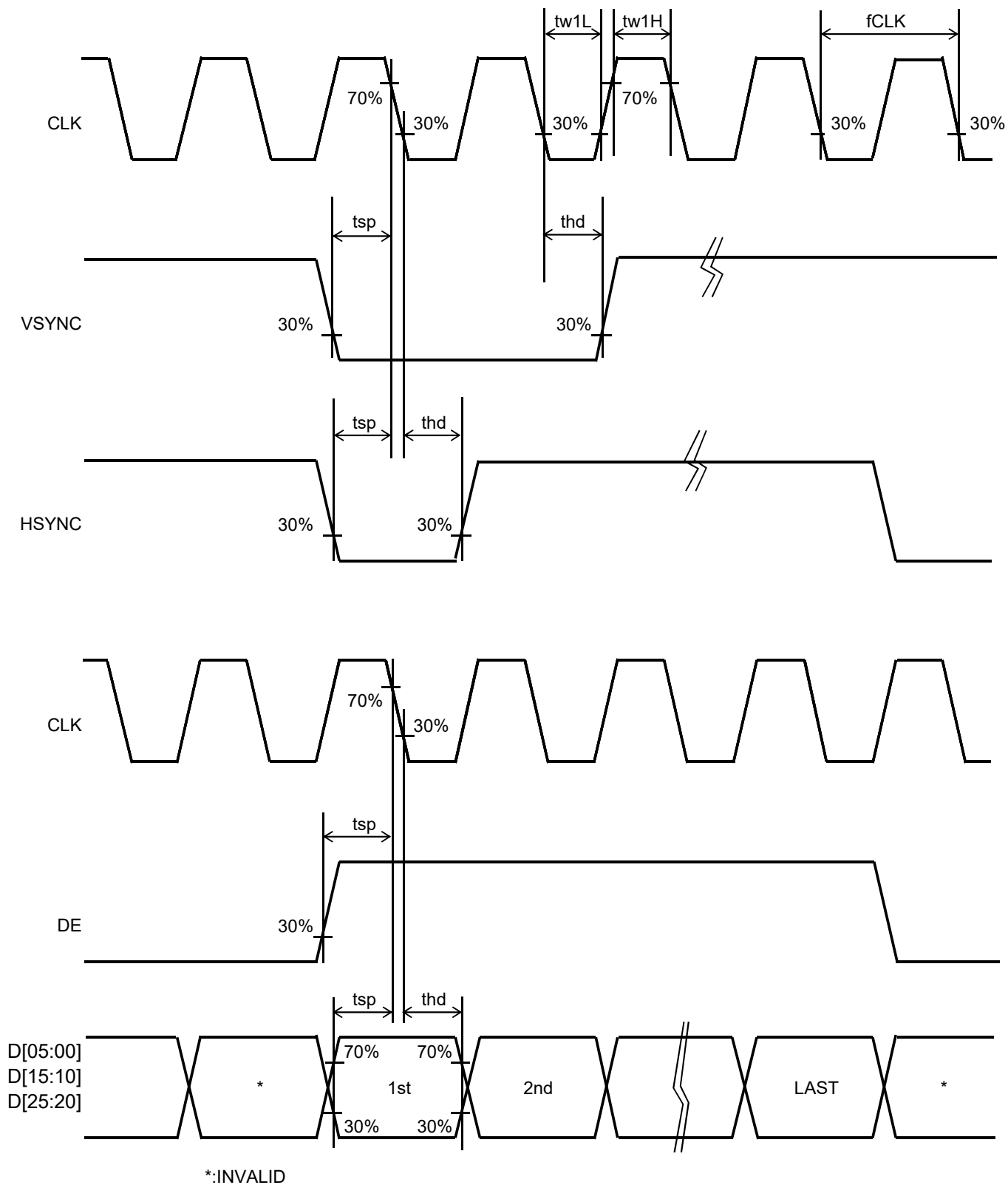
| Item                        | Rating    |     |      | Unit  | Remark  |
|-----------------------------|-----------|-----|------|-------|---|
|                             | MIN       | TYP | MAX  |       |   |
| Detectable activation force | 0.05      | —   | 1.20 | N     | R0.8mm Polyacetal pen or finger<br>Resistance between X and Y axis must be equal or lower than 2KΩ.                                       |
| Keystroke durability        | 1,000,000 | —   | —    | times | key the same part by silicon rubber<br>(Touch Panel Active area only)<br>•Rubber tip part: R8mm<br>•Load: 2.45N<br>•speed: 2 times/second |

## 8.2 AC Characteristics

(Unless otherwise noted, Ta=25° C, VDD=3.0V, VCCIO=1.8V, VSS=0V)

| Item            | Symbol | Condition         | Rating |     |     | Unit | Applicable terminal            |
|-----------------|--------|-------------------|--------|-----|-----|------|--------------------------------|
|                 |        |                   | MIN    | TYP | MAX |      |                                |
| CLK frequency   | fCLK   |                   | 22     | 25  | 28  | MHz  | CLK                            |
| CLK Low period  | tw1L   | 0.3×VCCIO or less | 10     | --  | --  | ns   |                                |
| CLK High period | tw1H   | 0.7×VCCIO or more | 10     | --  | --  | ns   |                                |
| Setup time      | tsp    |                   | 10     | --  | --  | ns   | CLK, VSYNC,<br>HSYNC, DE,      |
| Hold time       | thd    |                   | 10     | --  | --  | ns   | D[05:00], D[15:10]<br>D[25:20] |

Switching Waveform Characteristics



## 8.3 Input Timing Characteristics

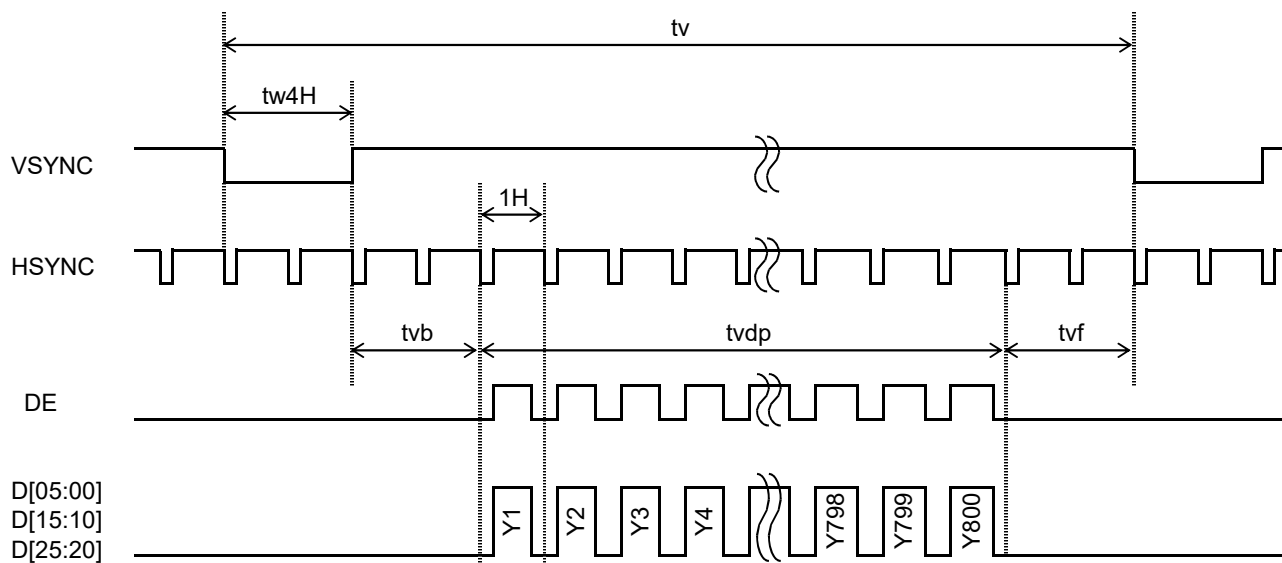
| Item                        | Symbol          | Rating |      |     | Unit | Applicable terminal                   |
|-----------------------------|-----------------|--------|------|-----|------|---------------------------------------|
|                             |                 | MIN    | TYP  | MAX |      |                                       |
| CLK Frequency               | fCLK            | 22     | 25   | 28  | MHz  | CLK                                   |
| VSYNC Frequency             | Note1<br>fVSYNC | 54     | 60   | 66  | Hz   | VSYNC                                 |
| VSYNC Cycle                 | tv              | 806    | 809  | 810 | H    | VSYNC,HSYNC                           |
| VSYNC Pulse Width           | tw4H            | 2      | 3    | 4   | H    |                                       |
| Vertical Back Porch         | tvb             | 2      | 3    | 4   | H    | VSYNC,HSYNC,DE,                       |
| Vertical Front Porch        | tvf             | 2      | 3    | 4   | H    | D[05:00],D[15:10],D[25:20]            |
| Vertical Display Period     | tvdp            | --     | 800  | --  | H    |                                       |
| HSYNC frequency             | Note2<br>fHSYNC | 43.6   | 48.5 | 50  | kHz  | HSYNC                                 |
| HSYNC Cycle                 | th              | 504    | 515  | 568 | CLK  | CLK,HSYNC                             |
| HSYNC Pulse Width           | tw5H            | 5      | 10   | 78  | CLK  |                                       |
| Horizontal Back Porch       | thb             | 5      | 15   | 78  | CLK  | CLK,HSYNC,DE,                         |
| Horizontal Front Porch      | thf             | 5      | 10   | 78  | CLK  | D[05:00],D[15:10],D[25:20]            |
| Horizontal data start Point | tw5H+thb        | 19     | --   | 83  | CLK  |                                       |
| Horizontal Blanking Period  | tw5H+thb+thf    | 24     | --   | 88  | CLK  |                                       |
| DE Pulse Width              | tw6H            | --     | 480  | --  | CLK  | CLK,DE                                |
| Horizontal Display Period   | thdp            | --     | 480  | --  | CLK  | CLK,DE,<br>D[05:00],D[15:10],D[25:20] |

Note1: This is recommended spec to get high quality picture on display. It is customer's risk to use out of this frequency.

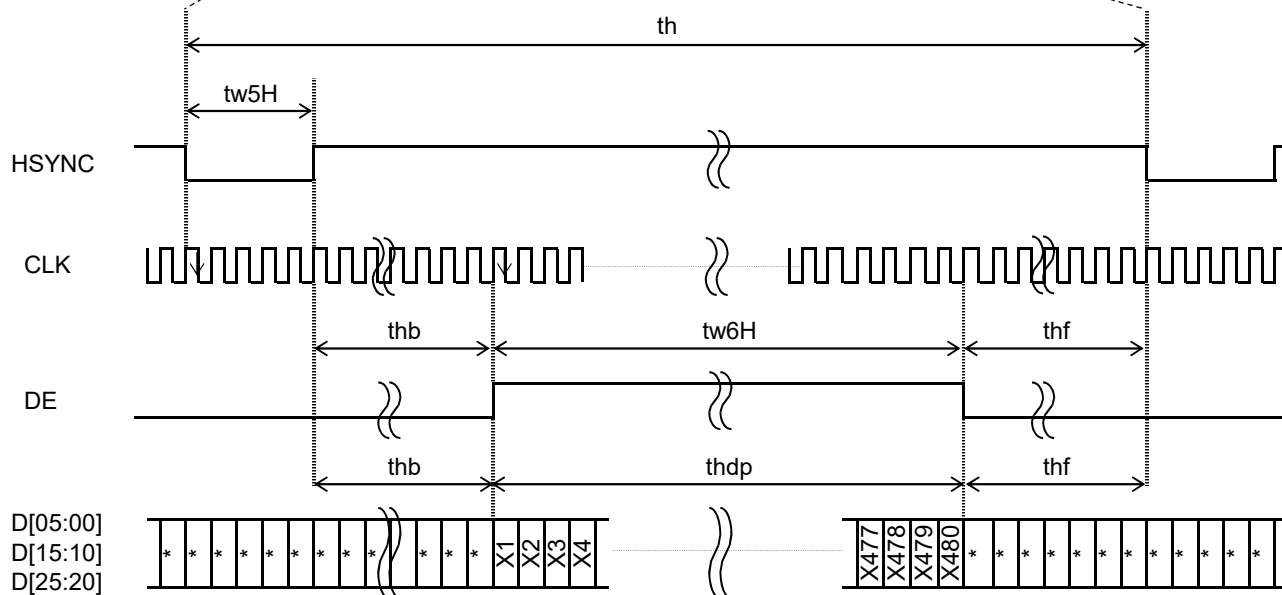
Note2: Please set "Hsync frequency" within given design limits.

### 8.4 Driving Timing Chart

#### -Vertical Timing

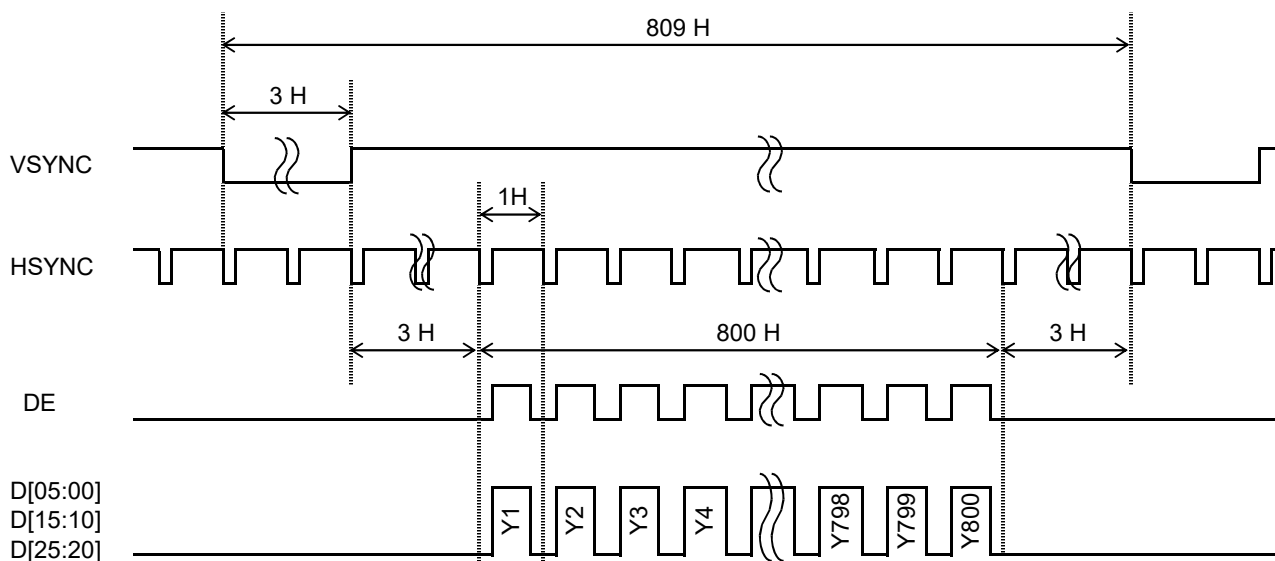


#### -Horizontal Timing

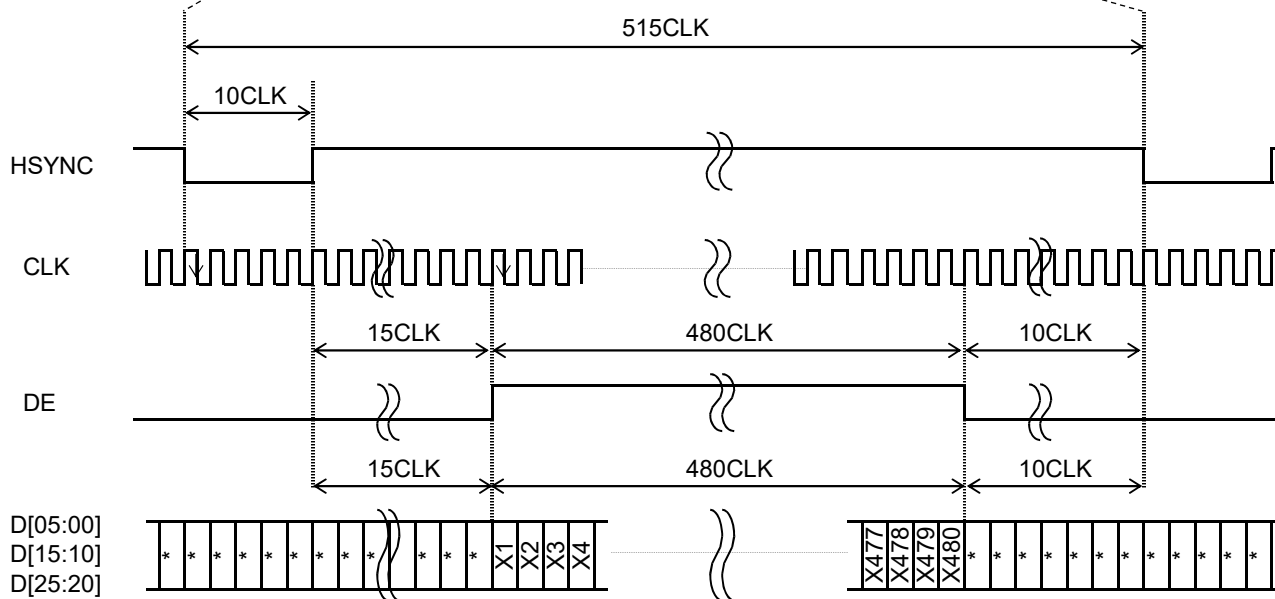


8.5 Example of Driving Timing Chart (fCLK=19.8MHz)

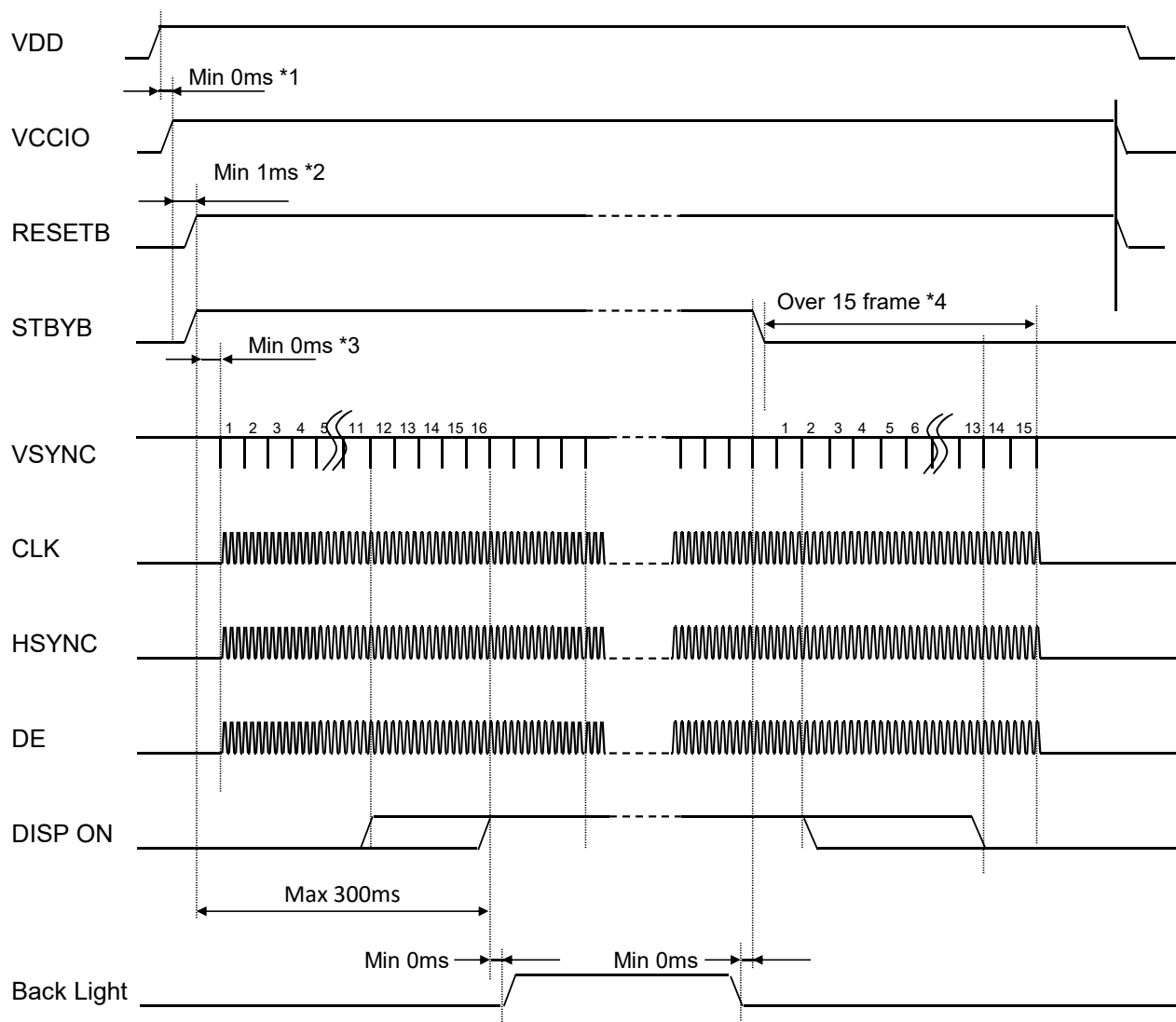
-Vertical Timing



-Horizontal Timing



## 9 Power ON/OFF sequence



\*1 Please start up VDD and VCCIO at the same time or in order of VDD --> VCCIO.

\*2 After the power supply, Please execute RESETB.

\*3 There is no regulations at time until each signal is supplied from RESETB "H"  
But meanwhile, It is necessary to fix each signal to "H" or "L".

\*4 It is necessary to supply VSYNC and CLK for 15 frames or more from STBYB "L" to  
turning off the power supply without leaving the afterimage.

## 10. Characteristics

## 10.1 Optical Characteristics

&lt; Measurement Condition &gt;

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

Driving condition: VDD=3.0V,VCCIO=1.8V

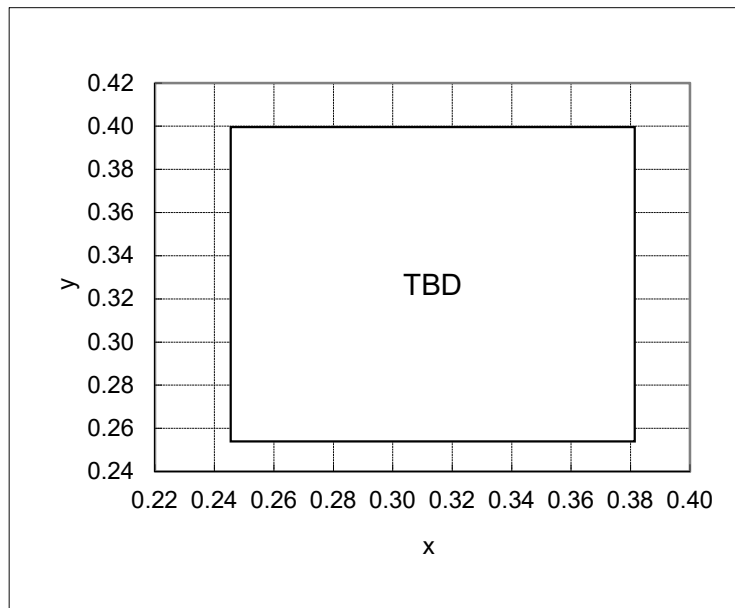
Optimized VCOMDC

Backlight: IL=(10.0)mA

Measured temperature: Ta=25° C

| Item                    |               | Symbol | Condition                             | MIN  | TYP   | MAX  | Unit              | Note No. | Remark |
|-------------------------|---------------|--------|---------------------------------------|--|-------|------|-------------------|----------|--------|
| Response time           | Rise time     | TON    | [Data]=<br>(00)h→(3F)h                | —  | —     | (40) | ms                | 1        | ※      |
|                         | Fall time     | TOFF   | [Data]=<br>(3F)h→(00)h                | —  | —     | (60) | ms                |          |        |
| Contrast ratio          | Backlight ON  | CR     | [Data]=<br>(3F)h / (00)h              | (TBD)  | (600) | —    |                   | 2        |        |
|                         | Backlight OFF |        |                                       | —  | (TBD) | —    |                   |          |        |
| Viewing angle           | Left          | θL     | [Data]=<br>(3F)h / (00)h<br>CR ≥ (10) | —  | (80)  | —    | deg               | 3        | ※      |
|                         | Right         | θR     |                                       | —  | (80)  | —    | deg               |          |        |
|                         | Up            | φU     |                                       | —  | (80)  | —    | deg               |          |        |
|                         | Down          | φD     |                                       | —  | (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]=(3F)h                          | (220)  | (320) | —    | cd/m <sup>2</sup> | 6        |        |
| Brightness distribution |               |        | [Data]=(3F)h                          | (70)   | —     | —    | %                 | 7        |        |

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



White Chromaticity Range

【White Chromaticity Range】

| x   | y   |
|-----|-----|
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |
| TBD | TBD |

## 10.2 Temperature Characteristics

< Measurement Condition >

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

Driving condition: VDD=3.0V, VCCIO=1.8V

Optimized VCOMDC

Backlight: IL=(10.0)mA

| Item            |           |      | Specification  |                   | Remark       |
|-----------------|-----------|------|--|-------------------|--------------|
|                 |           |      | Ta=(-10)°C   | Ta=70 °C          |              |
| Contrast ratio  |           | CR   | (200) or more  | (200) or more     | Backlight ON |
| Response time   | Rise time | TON  | (200) msec or less   | (30) msec or less |              |
|                 | Fall time | TOFF | (300) msec or less   | (50) msec or less |              |
| 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

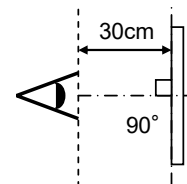
Driving Signal Raster Pattern (RGB, white, black)

Signal condition [Data]: (00)h, (25)h, (3F)h (3steps)

Observation distance 30 cm

Illuminance 200 to 350 lx

Backlight IL=(10.0) mA



| 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]=(00)h<br>Low bright dot: Visible through 5% ND filter at [Data]=(00)h<br>Dark dot: Appear dark through white display at [Data]=(25)h<br>Invisible through 5% ND filter at [Data]=(00)h | Refer to table 1<br><br><br><br>Acceptable  |   |
|                 |                  | Stain  | Uneven brightness (white stain, black stain etc)  | Invisible through 5% ND filter at Black screen.<br>Invisible through 1% ND filter at other screen.                            |
| Screen Quality  | Foreign particle | Point-like   | $0.25\text{mm} < \varphi$<br>$0.20\text{mm} < \varphi \leq 0.25\text{mm}$<br>$\varphi \leq 0.20\text{mm}$                         | N=0<br>N≤2<br>Acceptable  |
|                 |                  | Liner  | $3.0\text{mm} < \text{length and } 0.08\text{mm} < \text{width}$<br>$\text{length} \leq 3.0\text{mm or width} \leq 0.08\text{mm}$ | N=0<br>Acceptable   |
|                 |                  | Flaw   | Flaw on the surface of the Touch panel  | $0.05\text{mm} < W$<br>$0.03 < W \leq 0.05\text{mm}$ $2 < L \leq 5\text{mm}$<br>$L \leq 2\text{mm}$<br>$W \leq 0.03\text{mm}$ |
|                 | Others           |  |   | Use boundary sample for judgment when necessary   |

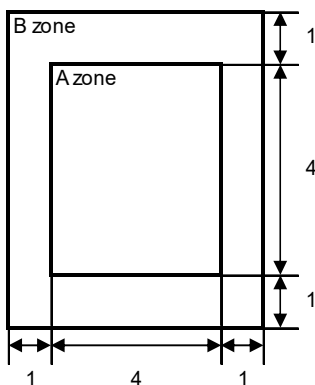
$\varphi$ (mm): Average diameter = (major axis + minor axis)/2

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

<Portrait 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

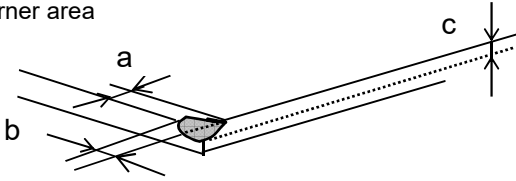
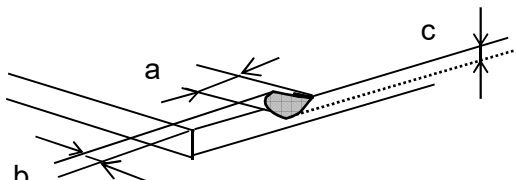
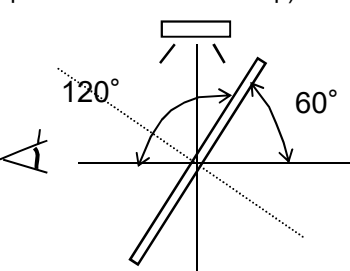
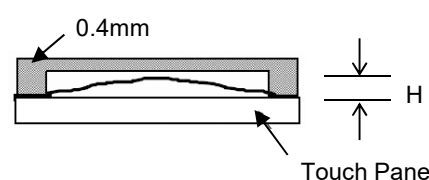
Observation distance

30cm

Illuminance

1200~2000 lx

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

| Item   | Appearance  | Criteria   |
|--|---|--|
| Touch Panel  | Corner area<br>  | Unit:mm<br>$a \leq 3$<br>$b \leq 3$<br>$c \leq t$ (t: glass thickness)<br>$a, b \leq 0.5$ is acceptable<br>$n \leq 2$  |
|  | Others<br>  | Unit:mm<br>$a \leq 5$<br>$b \leq 1$<br>$c \leq t$ (t:glass thickness)<br>$a, b \leq 0.5$ is acceptable<br>Maximum permissible number of chipping off on a side is 5. |
|  | Progressive crack   | None   |
|  | Interference fringe<br>(Test method)<br>Observe the Panel surface from 60 degrees angle to the surface under white fluorescent lamp (Triple band fluorescent lamp)<br> | Size: 1/3 or less of Active area.<br>Darkness: comply with the boundary sample   |
| Puffiness<br> | $H \leq 0.4\text{mm}$ is acceptable.  |  |

## 12. Reliability Test

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

Note:Ta=ambient temperature Tp=Panel temperature

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

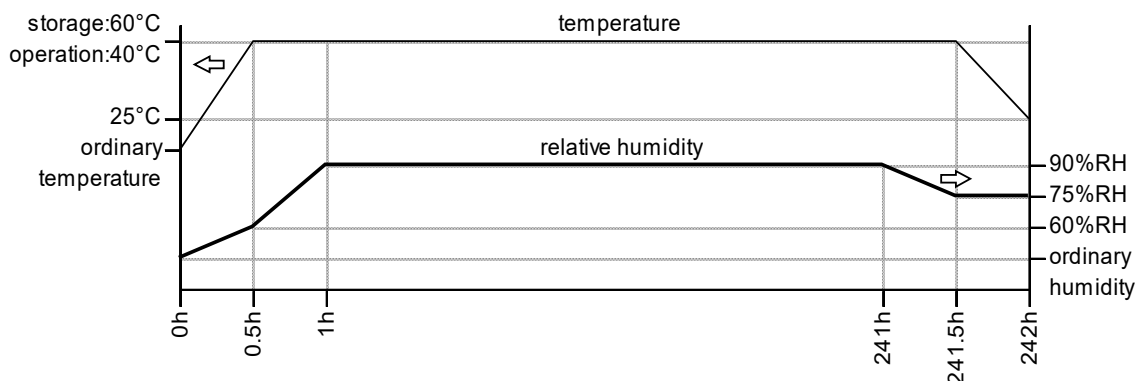
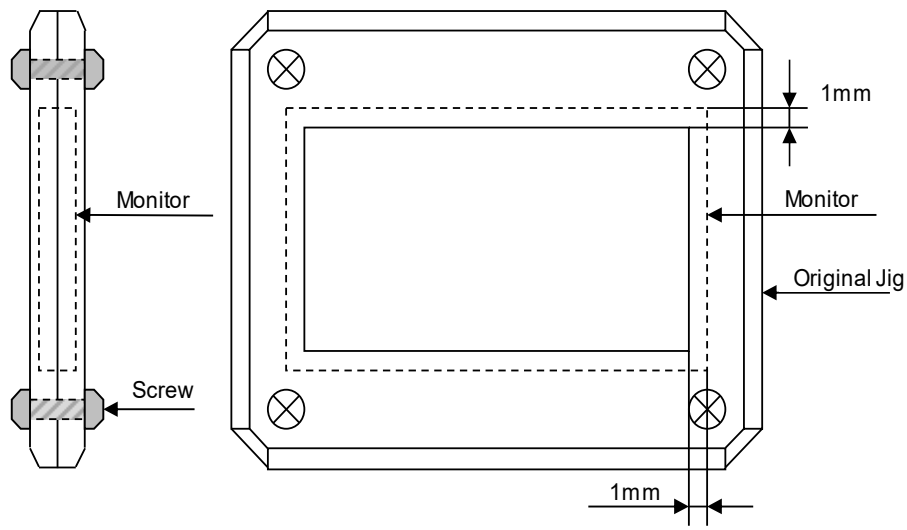


Table2.Reliability Criteria

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

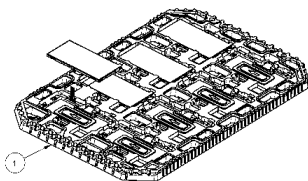
| item            | Standard   | Remarks      |
|-----------------|--|--------------|
| Display quality | No visible abnormality shall be seen.<br>(Except for unevenness by Pol deterioration.) |              |
| Contrast ratio  | 200 or more  | Backlight ON |

TOPPAN PRINTING Original Jig

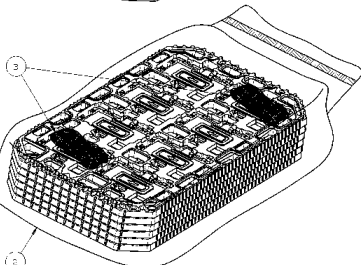


## 13. Packing Specifications

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)

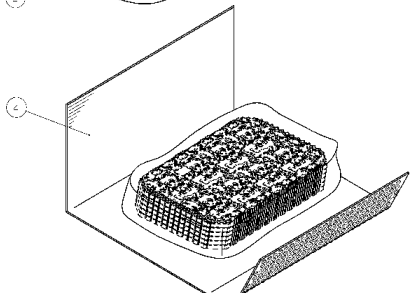


Step 2. Each tray filled with the products is to be piled up in the stack of 5 trays.  
One empty tray is to be put on the top of the stack of 5 trays.  
Each tray including top empty tray needs to be piled up same direction with respect to the tray below and above it.



Step 3. Two packs of moisture absorbers are to be placed on the top tray as shown in the drawing.  
Put piled trays into a sealing bag.  
Vacuum and seal the sealing bag with the vacuum sealing machine.

Step 4. The piled trays are to be wrapped with a B SHEET A, and to be fixed with adhesive tape.  
The side is to be folded as shown in figure.

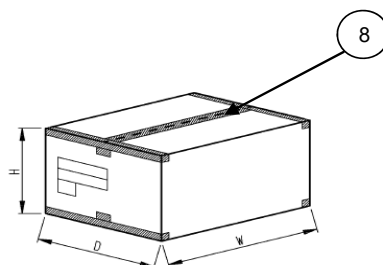
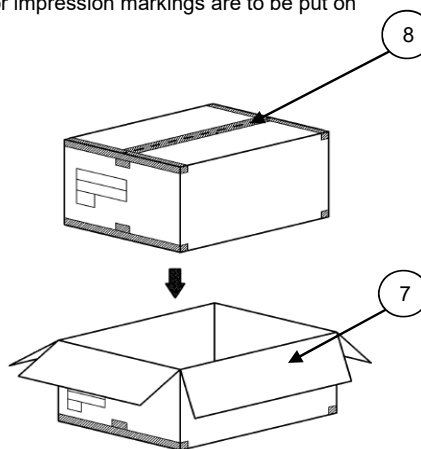
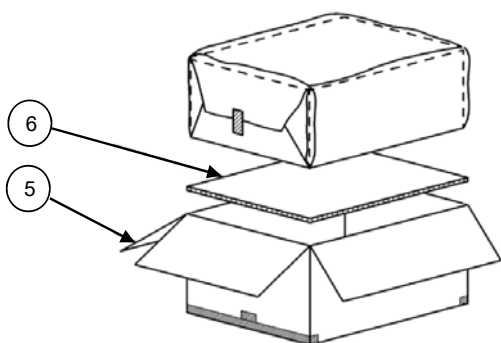


Step 5. A corrugated board is to be placed in the bottom of the inner carton.  
The wrapped trays are to be put on the corrugated board in the outer carton.

Step 6. The wrapped trays are to be put on the corrugated board in the outer carton.  
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.

Step 7. The outer carton is to be inserted into a extra outer carton with same direction.

Step 8. The extra outer carton needs to sealed with packing tape as shown in the drawing.  
The model number, quantity of products, and shipping date are to be printed on two opposites of the extra outer carton with black ink.  
If necessary, shipping labels or impression markings are to be put on the extra outer carton.



Remark: The return of packing materials is not required.

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

| Dimension of extra outer carton                |         |
|--|---------|
| D : Approx                                     | (337mm) |
| W : Approx.                                    | (618mm) |
| H : Approx.                                    | (179mm) |
| Quantity of products packed in one carton : 40 |         |
| Gross weight : Approx. 4.9kg                   |         |

## 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 medial 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 end part of glass and film of touch panel has conductivity, and avoid contact (short-circuit) with electroconductive case etc.. There is a possibility of setting up a defective touch panel, and insulate it for the case suppression (cushion etc.) if necessary, please.
- (12) 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) The FPC cable is a design very weak to the bend and the pull as it is fixed with the tape.  
Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.
- 8) Peel off the protective film on the TFT monitors during mounting process.  
Refer to the section 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 PRINTING.



#### 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.

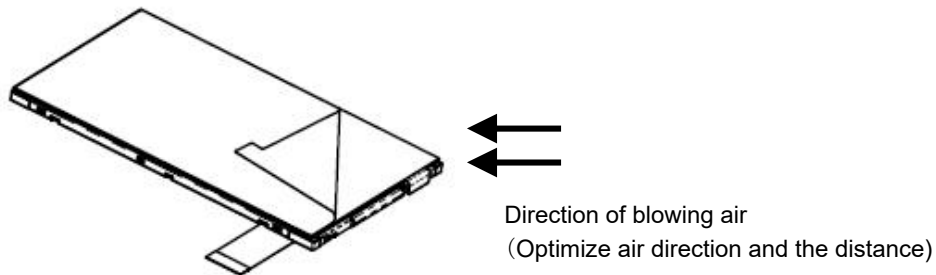
##### A) Work Environment

- 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 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 the FPC cable facing to the left side.  
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 right 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**

Reference Method for Measuring Optical Characteristics and Performance

1. Measurement Condition (Backlight ON)

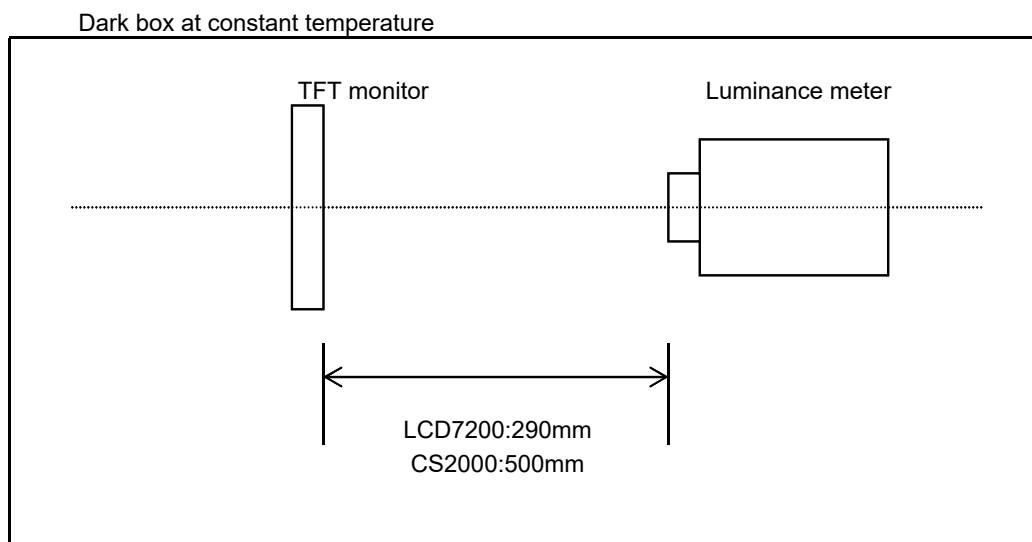
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200(OTSUKA ELECTRONICS),EZcontrastXL88 (ELDIM)

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

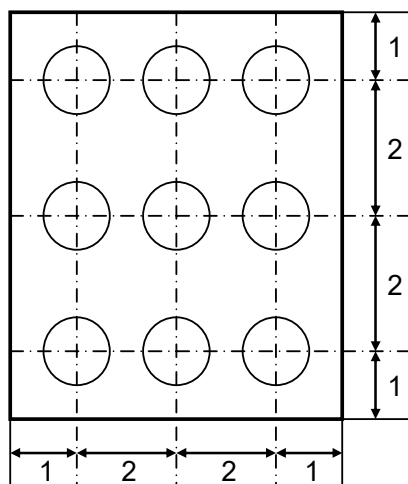


Measurement is made after 30 minutes of lighting of the backlight.

Measurement point: At the center point of the screen

Brightness distribution: 9 points shown in the following drawing.

<Portrait model>



Dimensional ratio of active area

Backlight IL=(10.0)mA

Measurement Condition (Contrast ratio Backlight OFF only)

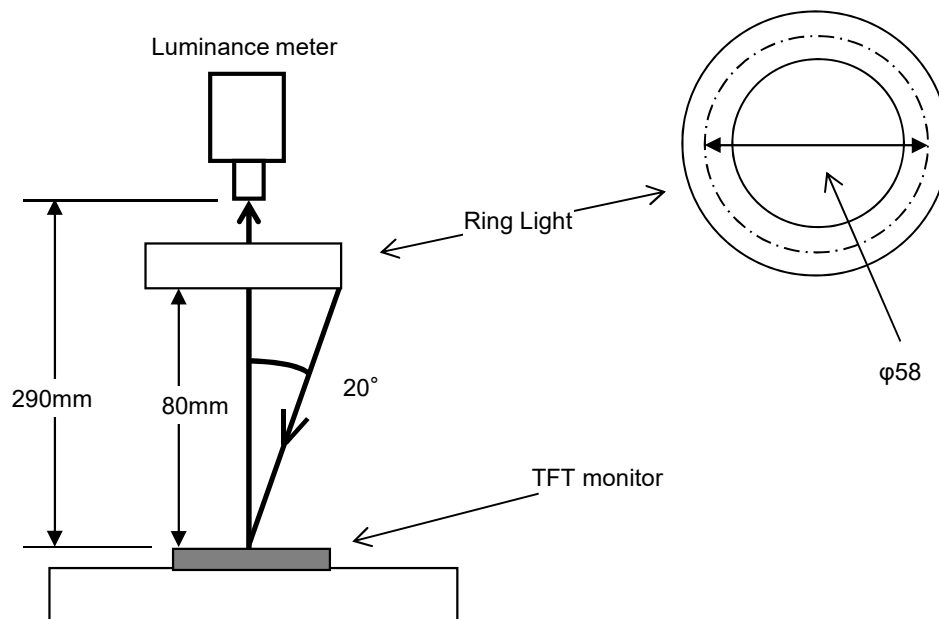
Measuring instruments: LCD7200(OTSUKA ELECTRONICS),Ring Light(40,000 lx, $\phi$ 58)

Driving condition: Refer to the section "Optical Characteristics"

Measured temperature: 25°C unless specified

Measurement system: See the chart below.

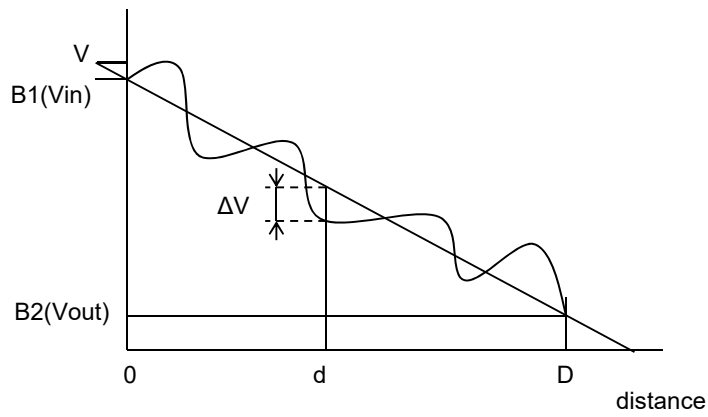
Measurement point: At the center of the screen.



## 2. Test Method

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

\* Linearity Measurement of Touch Panel



$$LE(\%) = \frac{\Delta V}{(V_{in} - V_{out})} \times 100$$

$$LE_{max}(\%) = \frac{\Delta V_{max}}{(V_{in} - V_{out})} \times 100$$

■ Cautionary instruction to handle a Touch-panel

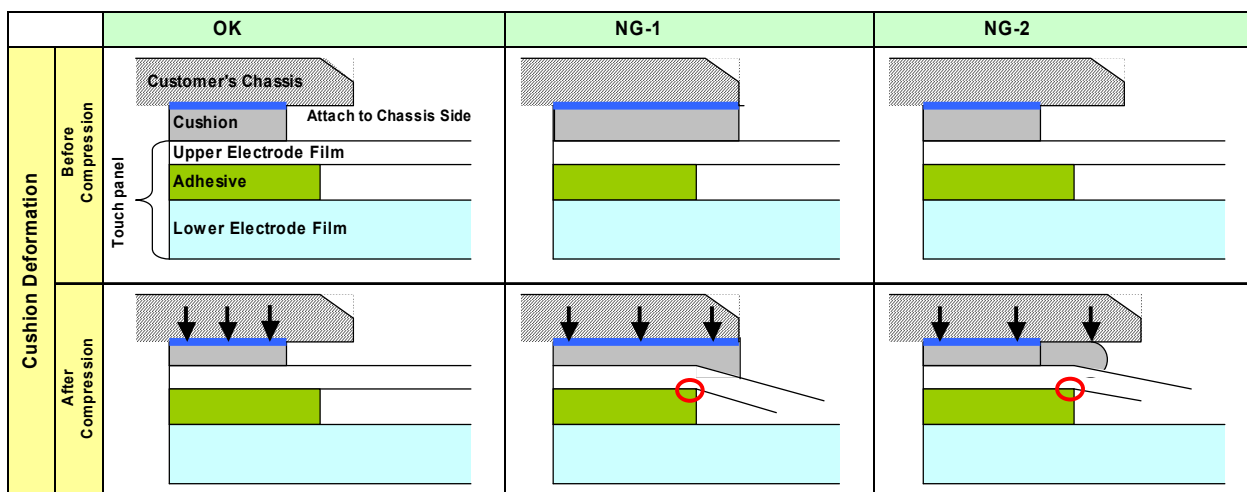
● Cushion (between Touch Panel Chassis) Design

1) A cushion is required to be placed between Touch Panel and customer's chassis and there is a designated area to attach it. Attachment at area inside Input Prohibition Area must be forbidden.

If cushion was located inside Input Prohibition Area, Upper Electrode may be push constantly and which may cause the electrode breakage at the position falling on the edge of adhesive; it eventually results in Touch Panel malfunction in the future. (Please see "NG-1")

2) Be attention to the cushion material you use. In the case that too soft cushion was used, the cushion may protrude into Prohibition Area by being push strongly; which may result in the electrode breakage. Eventually there is a chance that the electrode breakage leads to the malfunction of Touch Panel in the future. (Please see "NG-2")

3) Cushion is required to be attached at the side of Customer's chassis. Attaching a cushion at the side of Upper Electrode Film has a chance to deform the film and lead to the malfunction of Touch Panel in the future.



● Design Guidance of Chassis (Front Part)

4) Be attention to stay Input Prohibition Area away from touching and/or drawing by a stylus pens in order to avoid the electrode breakage and potential malfunction of Touch Panel. (Please see "NG-3")

We recommend customers to design chassis (front case) being able to protect Input Prohibition Area.

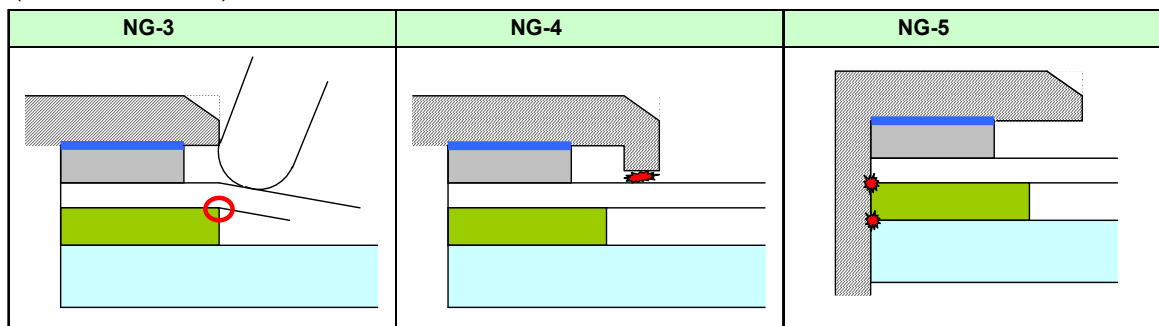
5) Clearance between customer's chassis and Touch Panel surface is certainly required in order to avoid erroneous input caused by a collision of the edge of chassis. (Please see "NG-4")

A clearance of 0.3 to 0.7mm is recommended.

● Design Guidance of Chassis (Side Part)

6) Upper Electrode and Lower Electrode fall on the edge of Touch Panel outline.

Redundant design having enough clearance to avoid electric short with chassis is highly recommended. (Please see "NG-5")



● Example of Recommended Chassis Design

Refer to "3.2 Outward Form".

● As a terminal resistance has individual specificity, calibration to align the displaying and the sensing position one each is mandatory before use.

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