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DISPLAY TECHNOLOGY

# Datasheet

# Ortustech

## COM35H3P58ULC

OR-20-044

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# Specifications for

# Blanview TFT-LCD Monitor

## ( 3.5" QVGA 240 x RGB x 320 Landscape)

Version 1.0

**MODEL COM35H3P58ULC**

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

Customer's Approval

Signature:

Name:

Section:

Title:

Date:

**ORTUSTECH**

TOPPAN PRINTING CO.,LTD.
Electronics Division
Ortus Subdivision

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| 0.0 | Jul.10,2020 | - | - | Tentative issue |
| 1.0 | Apr.9.2021 | - | - | First issue |
| | | P.7 | | 3.1 Dimensions |
| △A ×12 | | | Add | Weight |
| | | P.11 | | 5. Absolute Maximum Rating |
| | | | Add | Rating |
| | | P.12 | | 7.1.1 Display Module |
| | | | Add | Rating |
| | | | | 7.1.2 Backlight |
| | | | Add | Rating |
| | | | | 7.2 AC Characteristics |
| | | | Add | Rating |
| | | P.14 | | 7.3 Input Timing Characteristics |
| | | | Add | Rating |
| | | | | 10.1 Optical Characteristics |
| | | P.19 | Add | Rating |
| | | P.20 | Add | White Chromaticity Range |
| | | P.20 | | 10.2 Temperature Characteristics |
| | | | Add | Rating |
| | | P.23 | | 12. Reliability Test |
| | | | Add | number of failures / number of examinations |
| | | | Correct | Temperature / humidity profile diagram |
| | | P.25 | | 13. Packing Specifications |
| | | | Add | Packing Specifications |
| | | P.29 | | 14.5 Precautions for Peeling off the Protective film |
| | | | Add | Work Method |

## Contents

1. Application ·········· 4

2. Outline Specifications
   - 2.1 Features of the Product ·········· 5
   - 2.2 Display Method ·········· 5

3. Dimensions and Shape
   - 3.1 Dimensions ·········· 7
   - 3.2 Outward Form ·········· 8
   - 3.3 Serial №. print (S-print) ·········· 9

4. Pin Assignment ·········· 10

5. Absolute Maximum Rating ·········· 11

6. Recommended Operating Conditions ·········· 11

7. Characteristics
   - 7.1 DC Characteristics
     - 7.1.1 Display Module ·········· 12
     - 7.1.2 Backlight ·········· 12
   - 7.2 AC Characteristics ·········· 12
   - 7.3 Input Timing Characteristics ·········· 14
   - 7.4 Driving Timing Chart ·········· 15
   - 7.5 Example of Driving Timing Chart (fCLK=5.6MHz) ·········· 16

8. Power ON/OFF Sequence
   - 8.1 Power ON Sequence ·········· 17
   - 8.2 Standby / Power OFF Sequence ·········· 17

9. LED Circuit ·········· 18

10. Characteristics
    - 10.1 Optical Characteristics ·········· 19
    - 10.2 Temperature Characteristics ·········· 20

11. Criteria of Judgment
    - 11.1 Defective Display and Screen Quality ·········· 21
    - 11.2 Screen and Other Appearance ·········· 22

12. Reliability Test ·········· 23

13. Packing Specifications ·········· 25

14. Handling Instruction
    - 14.1 Cautions for Handling LCD panels ·········· 26
    - 14.2 Precautions for Handling ·········· 27
    - 14.3 Precautions for Operation ·········· 27
    - 14.4 Storage Condition for Shipping Cartons ·········· 28
    - 14.5 Precautions for Peeling off the Protective film ·········· 29
    - 14.6 Warranty ·········· 29

APPENDIX ·········· 30

## 1. Application

This Specification is applicable to 87.9mm (3.5 inch) Blanview TFT-LCD monitor for non-military use.

◎ TOPPAN PRINTING makes no warranty or assume no liability that use of this Product and/or any information including drawings in this Specification by Purchaser is not infringing any patent or other intellectual property rights owned by third parties, and TOPPAN PRINTING shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains TOPPAN PRINTING's confidential information and copy right, Purchaser shall use them with high degree of care to prevent any unauthorized use, disclosure, duplication, publication or dissemination of TOPPAN PRINTING's confidential information and copy right.

◎ If Purchaser intends to use this Products for an application which requires higher level of reliability and/or safety in functionality and/or accuracy such as transport equipment (aircraft, train, automobile, etc.), disaster-prevention/security equipment or various safety equipment, Purchaser shall consult TOPPAN PRINTING on such use in advance.

◎ This Product shall not be used for application which requires extremely higher level of reliability and/or safety such as aerospace equipment, telecommunication equipment for trunk lines, control equipment for nuclear facilities or life-support medical equipment.

◎ It must be noted as an mechanical design manner, especial attention in housing design to prevent arcuation/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.

◎ TOPPAN PRINTING is not responsible for any nonconformities and defects that are not specified in this specifications.

◎ If any issue arises as to information provided in this Specification or any other information, TOPPAN 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

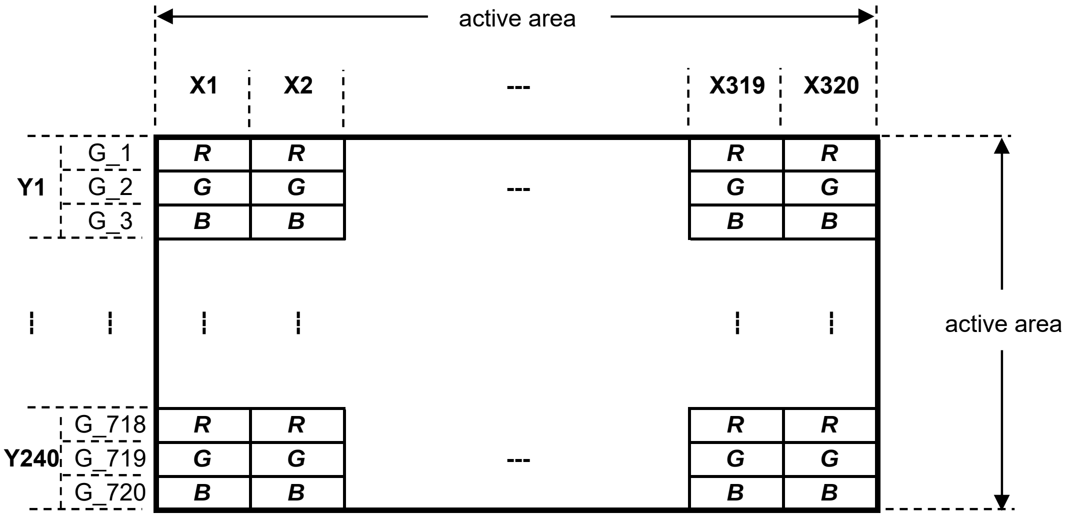
### 2.1 Features of the Product

- 3.5 inch diagonal display, 320 [H] x 240RGB [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.
- Long life & high bright white LED back-light.
- 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

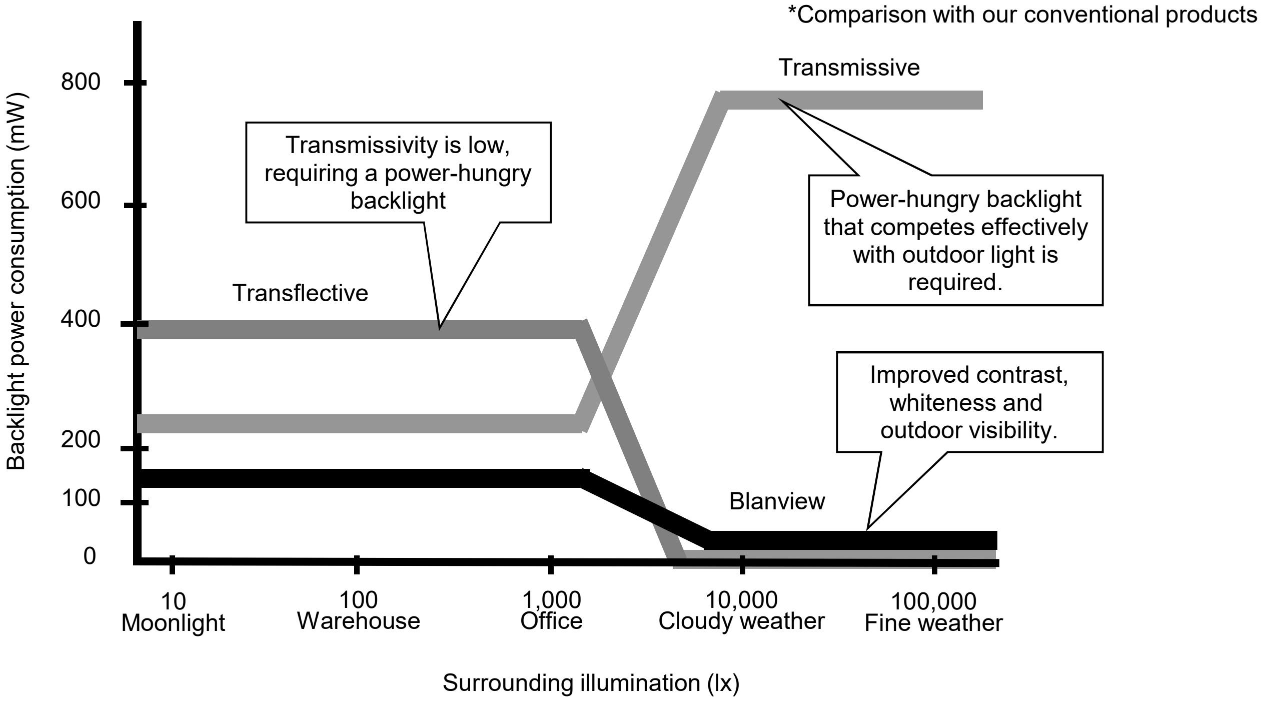
| Items | Specifications | Remarks |
|---|---|---|
| Display type | VA type 16,777,216 colors.<br>Blanview, Normally black. | |
| Driving method | a-Si TFT Active matrix.<br>Line-scanning, Non-interlace. | |
| Dot arrangement | RGB horizontal stripe arrangement. | Refer to "Dot arrangement". |
| Signal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



Dot arrangement (FPC cable placed downside)

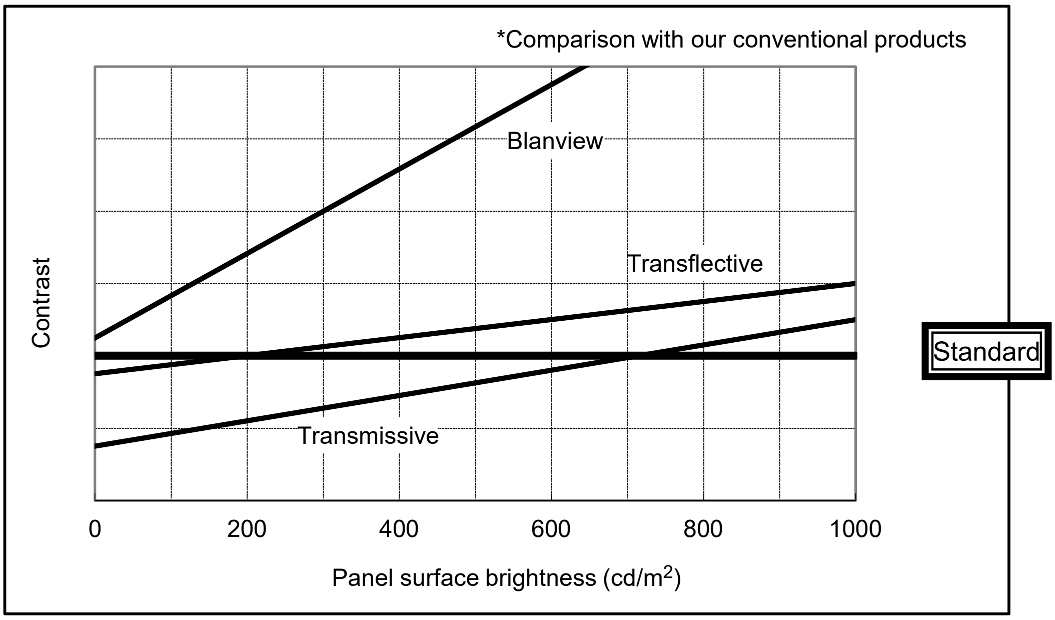
<Features of Blanview>

- Backlight power consumption required to assure visibility.



- 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)



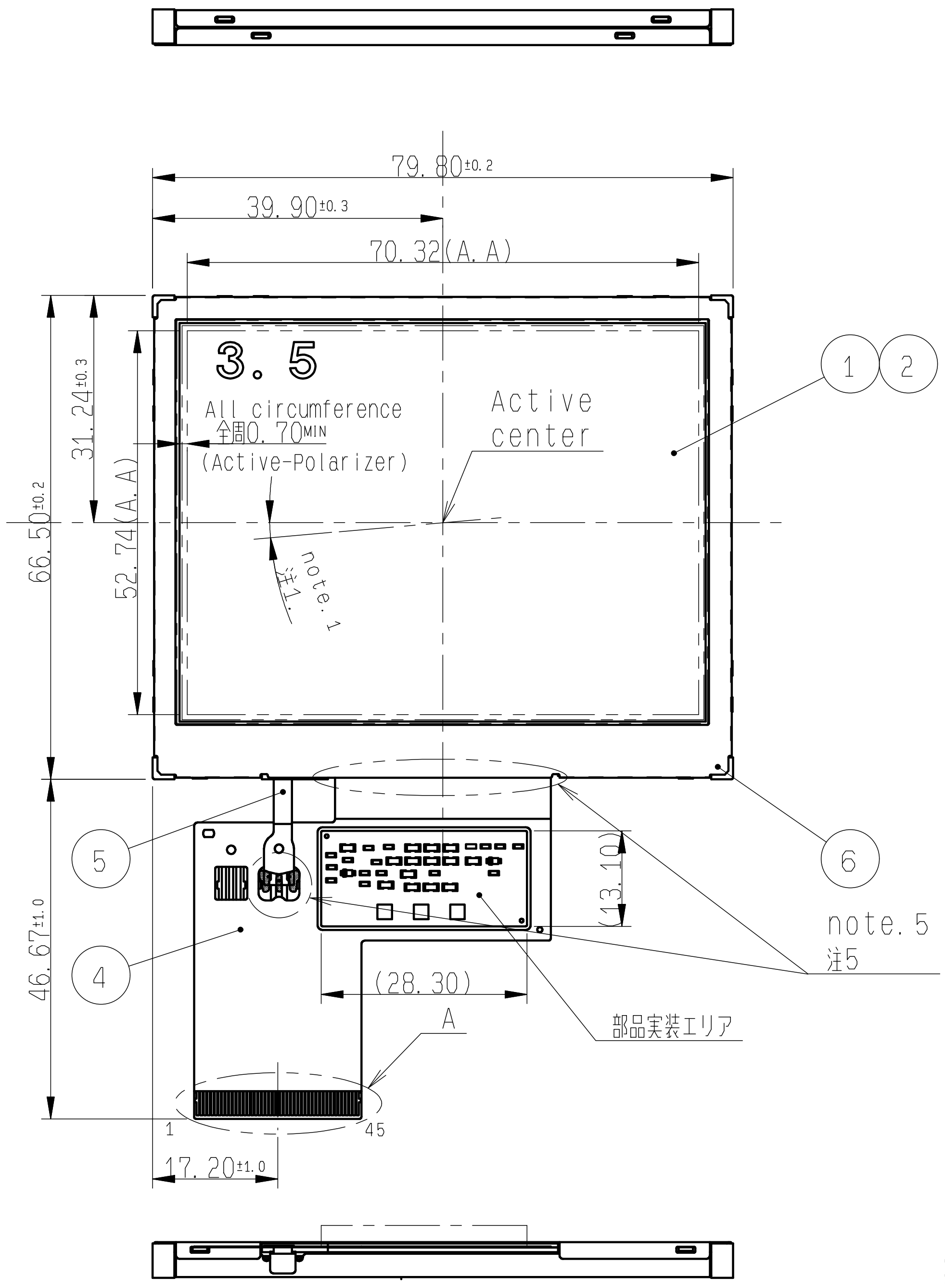
## 3. Dimensions and Shape

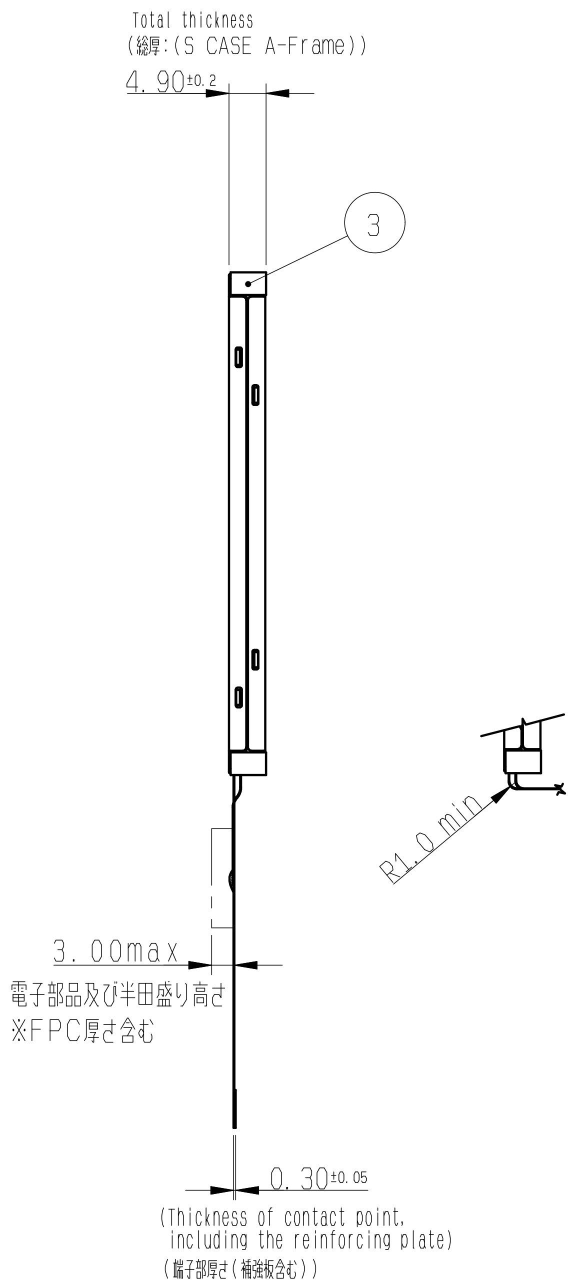
### △A 3.1 Dimensions

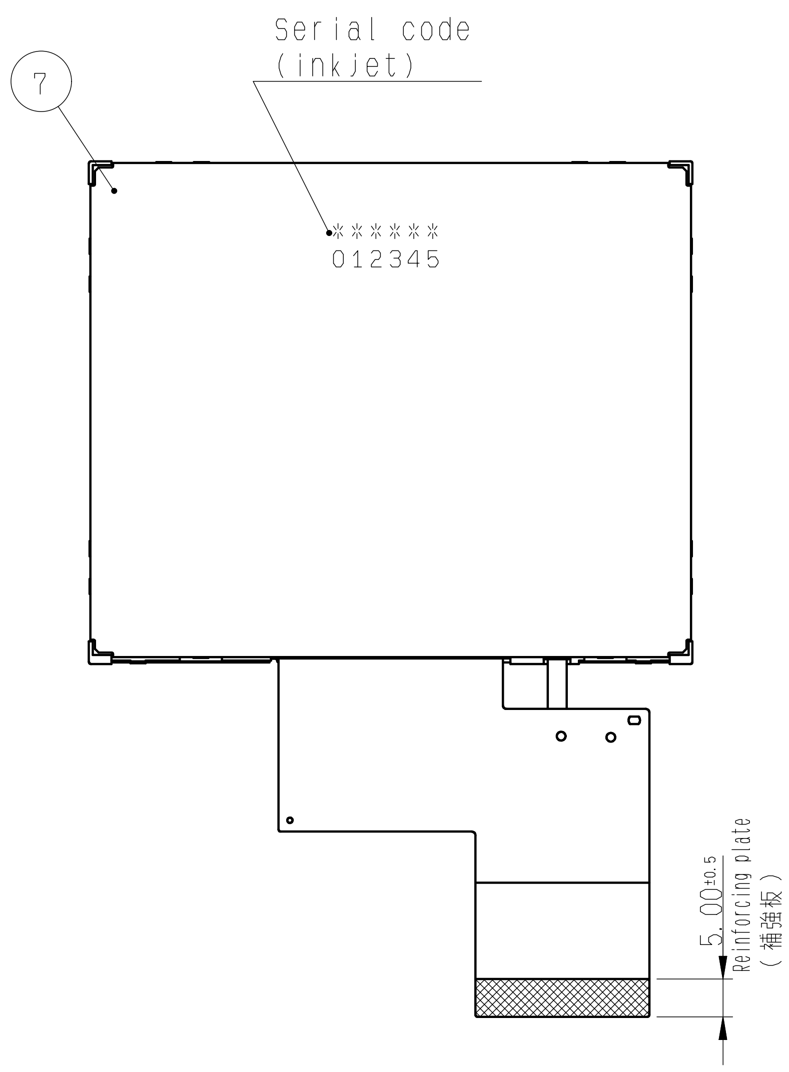
| Items | Specifications | Unit | Remarks |
|---|---|---|---|
| Outline dimensions | 79.80[H] × 66.50[V] × 4.90[D] | mm | Exclude FPC cable. |
| Active area | 70.32[H] × 52.74[V] | mm | 87.9 mm diagonal. |
| Number of dots | 320[H] × 720[V] | dot | |
| Dot pitch | 219.75[H] × 73.25[V] | μm | |
| Surface hardness of the polarizer | 2 | H | Load:2.94N |
| Weight | 40 | g | Include FPC cable. |

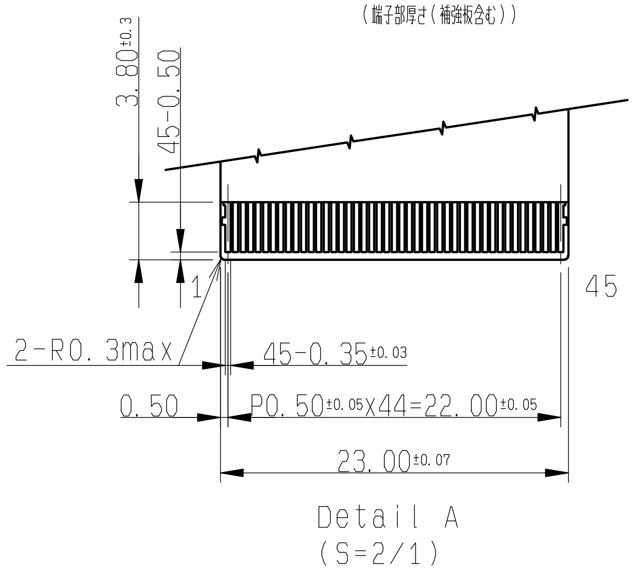
## 3.2 Outward Form

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


79.80±0.2
39.90±0.3
70.32(A.A)
66.50±0.2
31.24±0.3
52.74(A.A)
46.67±1.0
3.5
All circumference
全周0.70MIN
(Active-Polarizer)
Active
center
note.1
注1.
①
②
⑤
⑥
④
(13.10)
(28.30)
A
note.5
注5
部品実装エリア
1
45
17.20±1.0


Total thickness
(総厚:(S CASE A-Frame))
4.90±0.2
③
R1.0 min
3.00max
電子部品及び半田盛り高さ
※FPC厚さ含む
0.30±0.05
(Thickness of contact point,
including the reinforcing plate)
(端子部厚さ(補強板含む))


Serial code
(inkjet)
⑦
******
012345
5.00±0.5
Reinforcing plate
(補強板)


3.80±0.3
45-0.50
1
45
2-R0.3max
45-0.35±0.03
0.50
P0.50±0.05X44=22.00±0.05
23.00±0.07

Detail A
(S=2/1)

note Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than【±50′】.

注1. TFT-LCD PANELの角度ズレは、モニター基準軸に対し【±50′】以下とする。

Protective film is affixed on front surface of the screen.
Protective film is not protrude from the outline of the monitor.

2. 保護膜が表面側に貼られます。
保護膜はモニター外形からはみ出さないものとする。

Recommended FPC connectors
HIROSE : FH12A-45S-0.5SH(55)(Top Contact)
FPC pin assignment differs from a position of Datum Pin of recommrnded FPC connector.
Please notice the difference when designing your circuit with much care.

3. FPCの推奨コネクターの規格を下記に示す。
HIROSE : FH12A-45S-0.5SH(55)(上接点タイプ)
FPCの端子配列が、推奨コネクタ基準ピンと異なってます。
回路設計におかれましては、充分ご注意願います。

Burrs direction of S CASE is outward.(Burrs size is less than 0.03mm.)

4. S CASEのバリ方向は外側になります。(MAX0.03mm)

Don't stress to FPC bonding srea & the solder srea.

5. FPCの圧着部及び半田接続部には負荷が掛からないようご注意願います。

| PART NAME | ITEM | PART CODE | MODEL NUMBER | REMARK |
|---|---|---|---|---|
| S CASE C | 7 | | SUS (t=0.20) | |
| S CASE A | 6 | | SUS (t=0.15) | |
| FPC B | 5 | | | Use of LED |
| FPC A | 4 | | Au/Ni plating<br>Au/Niメッキ | Use of LCD |
| Frame | 3 | | PC | |
| Polarizer | 2 | | | |
| TFT-LCD PANEL | 1 | | Glass thickness=0.50+0.50t | |

| | | | |
|---|---|---|---|
| APPROVED 尾木 | GENERAL TOLERANCE ±0.5 | SCALE 1/1 | UNIT mm |
| CHECKED 加藤 | ISSUE (Y:M:D) 20:06:24 | MODEL COM35H3P58U※※ | |
| CHECKED | NAME OUTLINE-D3P58 | | |
| DESIGN 前田創 | | | |
| DRAW 前田創 | | | |

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| DRAWING No. | REV. | SHEET | DIV. |
|---|---|---|---|
| RJD600507D301 | | / | |

ASS'Y

## 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 | 35QFC (Made in Japan)<br>35QGC (Made in Malaysia) | | |
| d | Serial number | | | |

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

・Made in Japan

1H35QFC000125

means "manufactured in August 2021, 3.5" QF type, C specifications, serial number 000125"

・Made in Malaysia

1H35QGC000125

means "manufactured in August 2021, 3.5" QG type, C specifications, serial number 000125"

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

Refer to 3.2 "Outward Form".

3)Others

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

## 4. Pin Assignment

| No. | Symbol | Function |
|---|---|---|
| 1 | VSS | GND. |
| 2 | VSS | GND. |
| 3 | VDD | Power supply. |
| 4 | VDD | Power supply. |
| 5 | D00 | Display data(R).<br>00h: Black<br>D00:LSB D07:MSB<br>Driver has internal gamma conversion.<br>Connect unused pins to GND. |
| 6 | D01 | |
| 7 | D02 | |
| 8 | D03 | |
| 9 | D04 | |
| 10 | D05 | |
| 11 | D06 | |
| 12 | D07 | |
| 13 | D10 | Display data(G).<br>00h: Black<br>D10:LSB D17:MSB<br>Driver has internal gamma conversion.<br>Connect unused pins to GND. |
| 14 | D11 | |
| 15 | D12 | |
| 16 | D13 | |
| 17 | D14 | |
| 18 | D15 | |
| 19 | D16 | |
| 20 | D17 | |
| 21 | D20 | Display data(B).<br>00h: Black<br>D20:LSB D27:MSB<br>Driver has internal gamma conversion.<br>Connect unused pins to GND. |
| 22 | D21 | |
| 23 | D22 | |
| 24 | D23 | |
| 25 | D24 | |
| 26 | D25 | |
| 27 | D26 | |
| 28 | D27 | |
| 29 | VSS | GND. |
| 30 | CLK | Clock signal.Latching data at the falling edge. |
| 31 | STBYB | Standby signal input. (Hi:Normal operation, Lo:Standby operation) |
| 32 | HSYNC | Horizontal sync signal input. (Low active) |
| 33 | VSYNC | Vertical sync signal input. (Low active) |
| 34 | DE | Input data effective signal. (It is effective for the period of "Hi") |
| 35 | NC | OPEN. |
| 36 | VSS | GND. |
| 37 | NC | OPEN. |
| 38 | NC | OPEN. |
| 39 | NC | OPEN. |
| 40 | NC | OPEN. |
| 41 | BLL2 | Backlight drive (cathode side) |
| 42 | BLL1 | Backlight drive (cathode side) |
| 43 | BLH | Backlight drive (anode side) |
| 44 | LR | Left/Right Display reverse(Hi or OPEN:normal display, Low:inversion display) |
| 45 | UD | Up/Down Display reverse(Hi or OPEN:normal display, Low:inversion display) |

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

## 5. Absolute Maximum Rating

VSS=0V

| Item | Symbol | Condition | Rating | | Unit | Applicable terminal |
|---|---|---|---|---|---|---|
| | | | MIN | MAX | | |
| Supply voltage | VDD | Ta=25°C | -0.3 | 5.0 | V | VDD |
| Input voltage for logic | VI | | -0.3 | VDD+0.3 | V | CLK,VSYNC,HSYNC,DE D[27:20],D[17:10],D[07:00], STBYB,LR,UD |
| LED direction current of order | IL | | -- | 200 | mA | BLH - BLL1/BLL2 |
| 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 3.6V | 0 | -- | VDD | V | CLK,VSYNC,HSYNC, DE,D[27:20],D[17:10], D[07:00],STBYB,LR,UD |
| Operating temperature range | Top | Note | -30 | 25 | 85 | °C | Panel surface temperature |
| Operating humidity range | Hop | Ta≦40°C | 20 | -- | 85 | % | |
| | | Ta>40°C | Non condensing in an environmental moisture at or less than 40°C85%RH. | | | | |

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

# 7. Characteristics

## 7.1 DC Characteristics

### 7.1.1 Display Module

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

| Item | Symbol | Condition | Rating | | | Unit | Applicable terminal |
|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | |
| Input voltage for logic | VIH | VDD=3.0 to 3.6V | 0.7×VDD | -- | VDD | V | CLK,VSYNC,HSYNC,<br>DE,D[27:20],D[17:10],<br>D[07:00],STBYB,<br>LR,UD |
| | VIL | | 0 | -- | 0.3×VDD | V | |
| Pull up resister value | Rpu | | -- | 100 | -- | kΩ | LR,UD |
| Current consumption | IDD | Input Timing = TYP<br>Color bar display | -- | 22 | 44 | mA | VDD |

### 7.1.2 Backlight

| Item | Symbol | Condition | Rating | | | Unit | Applicable terminal |
|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | |
| Forward current | IL1 | Ta=25°C | -- | 18.0 | 32.0 | mA | BLH - BLL1 |
| | IL2 | Note1 | -- | 18.0 | 32.0 | mA | BLH - BLL2 |
| Forward voltage | VF1 | Ta=25°C | 7.47 | 7.90 | 8.49 | V | BLH - BLL1 |
| *Reference value | VF2 | IL1=IL2=18.0mA | 7.47 | 7.90 | 8.49 | V | BLH - BLL2 |
| Estimated Life of LED | LL | Ta=25°C<br>IL1=IL2=18.0mA,Note2 | -- | 50,000 | -- | hrs | |

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

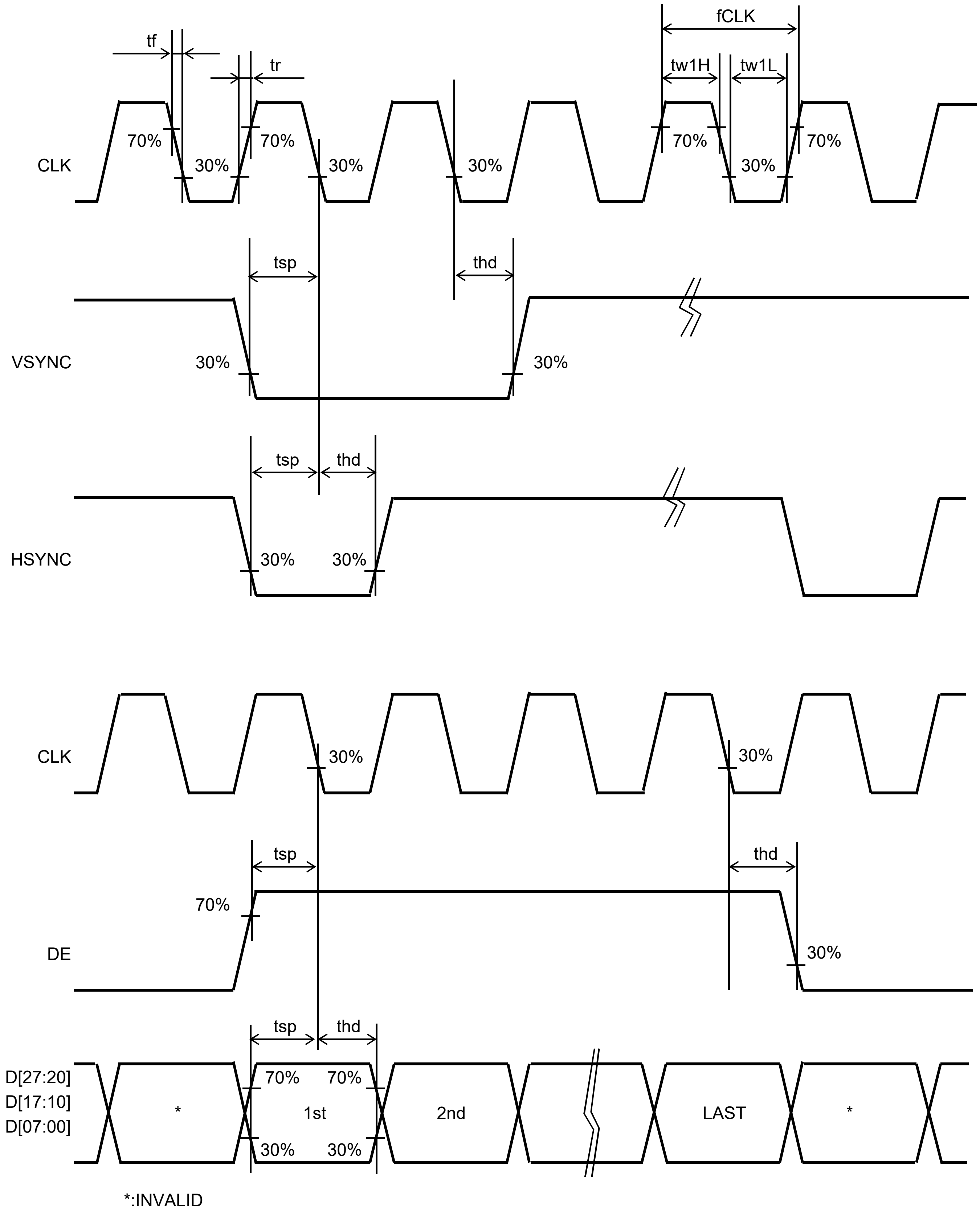
Note2: - The lifetime of the LED is defined as a period till the brightness of the LED decreases to the half of its initial value.
- This figure is given as a reference purpose only, and not as a guarantee.
- This figure is estimated for an LED operating alone.
  As the performance of an LED may differ when assembled as a monitor together with a TFT panel due to different environmental temperature.
- Estimated lifetime could vary on a different temperature and usually higher temperature could reduce the life significantly.

## 7.2 AC Characteristics

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

| Item | Symbol | Condition | Rating | | | Unit | Applicable terminal |
|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | |
| CLK frequency | fCLK | | 5.5 | 5.6 | 8.8 | 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,<br>DE,D[27:20],D[17:10],<br>D[07:00] |
| Hold time | thd | | 16.0 | -- | -- | ns | |

Switching Waveform Characteristics


tf
tr
fCLK
tw1H
tw1L
CLK
70%
30%
VSYNC
tsp
thd
HSYNC
DE
D[27:20]
D[17:10]
D[07:00]
*
1st
2nd
LAST
*:INVALID

## 7.3 Input Timing Characteristics

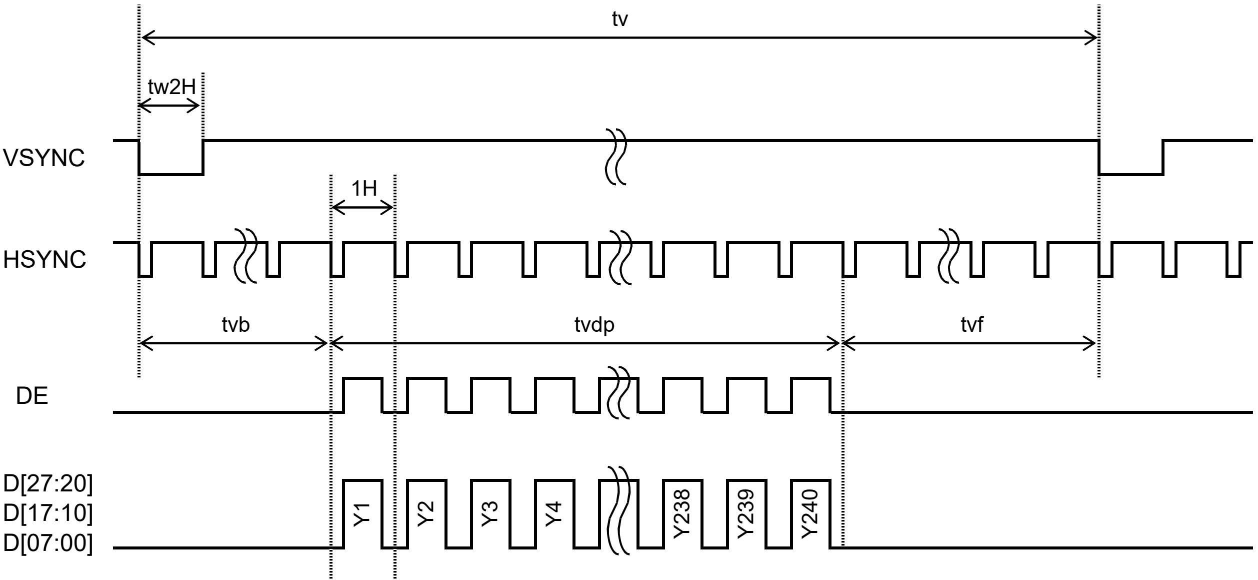
(Unless otherwise noted, Ta=25˚C,VDD=3.3V,VSS=0V)

| Item | Symbol | Rating | | | Unit | Applicable terminal |
|---|---|---|---|---|---|---|
| | | MIN | TYP | MAX | | |
| CLK frequency | fCLK | 5.5 | 5.6 | 8.8 | MHz | CLK |
| VSYNC frequency Note | fVSYNC | 54 | 60 | 66 | Hz | VSYNC |
| VSYNC signal cycle time | tv | 245 | 256 | 364 | H | VSYNC,HSYNC |
| VSYNC pulse width | tw2H | 1 | -- | -- | H | |
| Vertical back porch | tvb | tw2H + 2 | 8 | 31 | H | |
| Vertical front porch | tvf | 2 | 8 | 93 | H | |
| Vertical display period | tvdp | 240 | | | H | VSYNC,HSYNC,DE,D[27:20],D[17:10],D[07:00] |
| HSYNC frequency | fHSYNC | 15.36 | | | Khz | HSYNC |
| HSYNC signal cycle time | th | 359 | 365 | 574 | 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 | 320 | | | CLK | DE,D[27:20],D[17:10],D[07:00],CLK |
| DE pulse width | tw4H | 320 | | | CLK | DE,CLK |

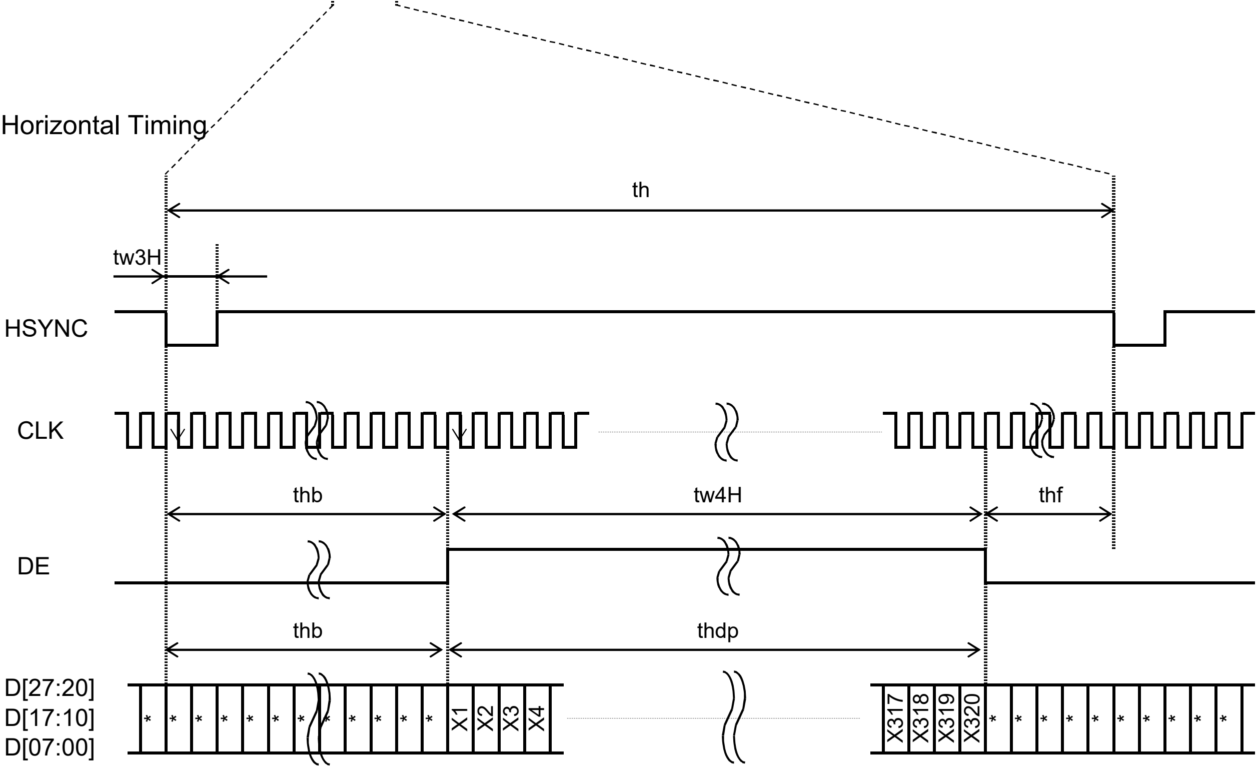
Note: The characteristics and values in the chart indicate recommended specifications. In the case that the product might be used NOT in compliant with the specifications, it is highly recommended to use the product after adequate verifications could be implemented and at your own risk.

## 7.4 Driving Timing Chart

-Vertical Timing

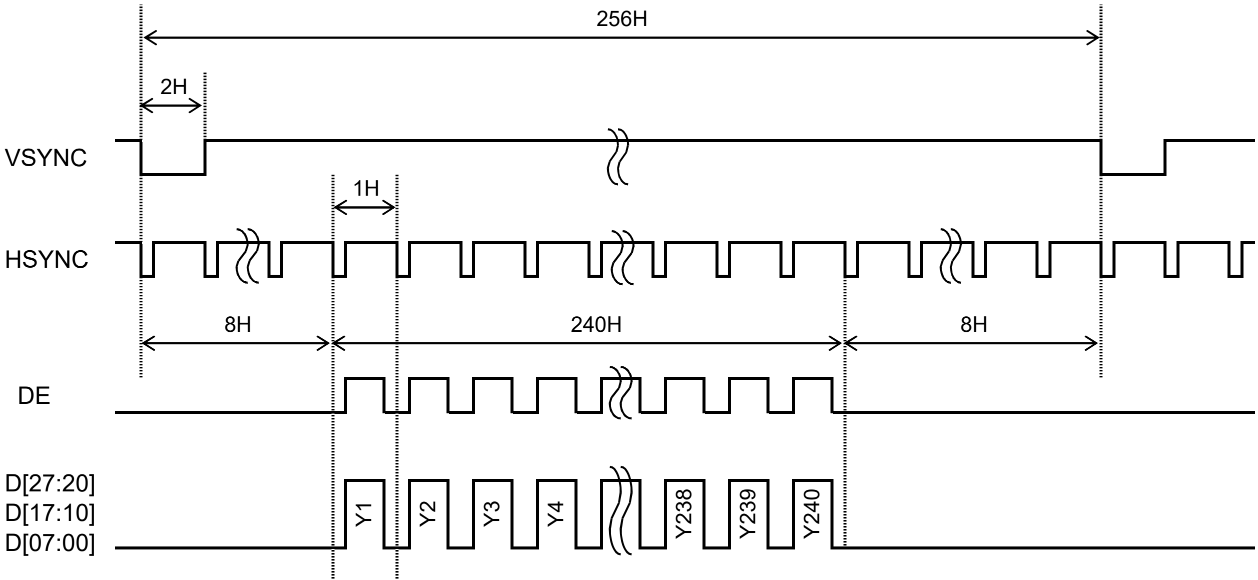

tv
tw2H
VSYNC
1H
HSYNC
tvb
tvdp
tvf
DE
D[27:20]
D[17:10]
D[07:00]
Y1
Y2
Y3
Y4
Y238
Y239
Y240

-Horizontal Timing

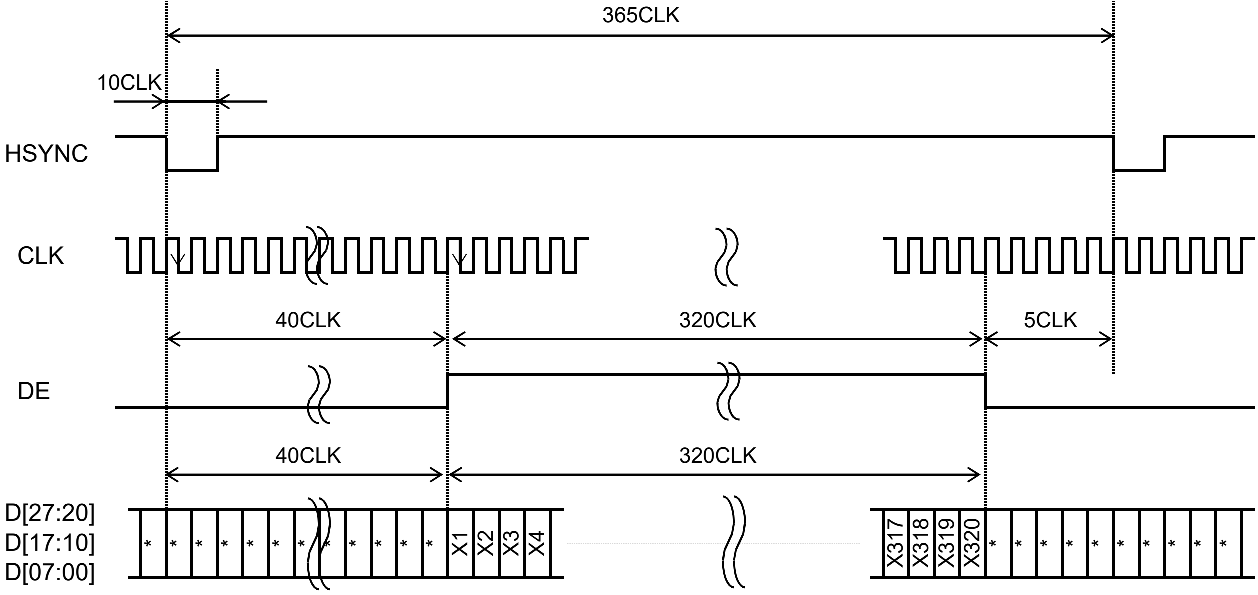

th
tw3H
HSYNC
CLK
thb
tw4H
thf
DE
thb
thdp
D[27:20]
D[17:10]
D[07:00]
*
X1
X2
X3
X4
X317
X318
X319
X320

7.5 Example of Driving Timing Chart (fCLK=5.6MHz)

-Vertical Timing

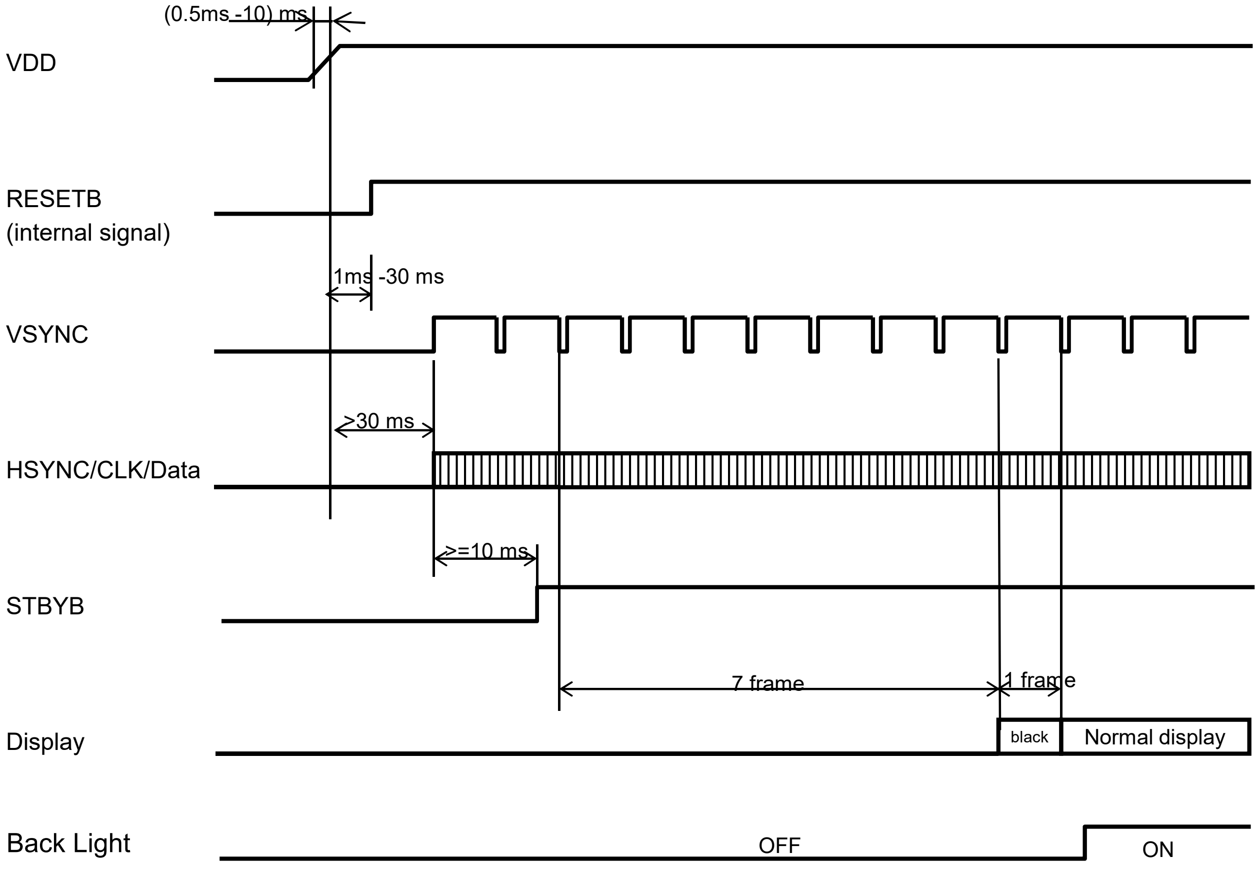

256H
2H
VSYNC
1H
HSYNC
8H
240H
8H
DE
D[27:20]
D[17:10]
D[07:00]
Y1
Y2
Y3
Y4
Y238
Y239
Y240

-Horizontal Timing

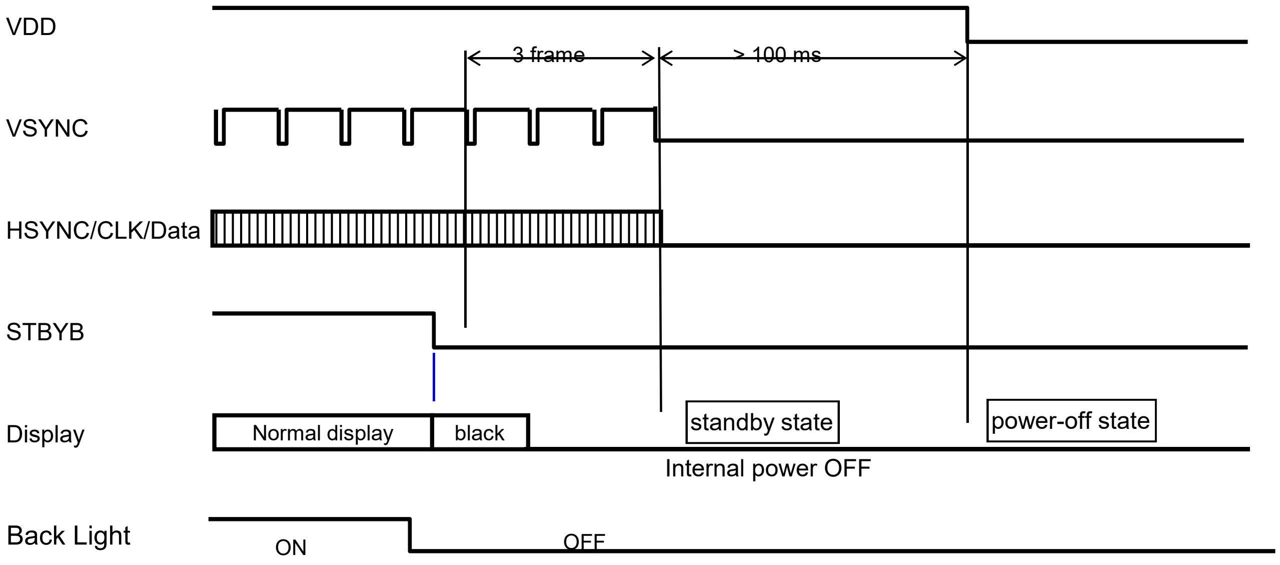

365CLK
10CLK
HSYNC
CLK
40CLK
320CLK
5CLK
DE
40CLK
320CLK
D[27:20]
D[17:10]
D[07:00]
X1
X2
X3
X4
X317
X318
X319
X320

## 8. Power ON/OFF Sequence

### 8.1 Power ON Sequence

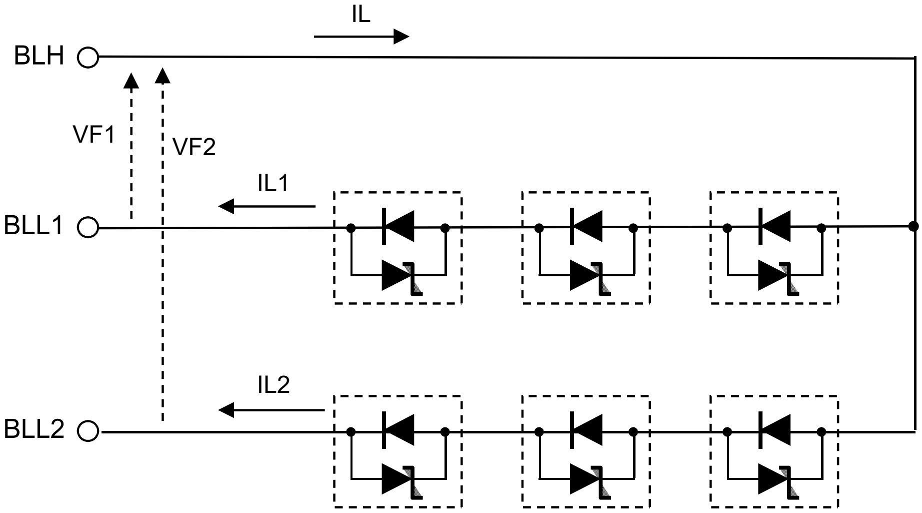

(0.5ms -10) ms
VDD
RESETB
(internal signal)
1ms -30 ms
VSYNC
>30 ms
HSYNC/CLK/Data
>=10 ms
STBYB
7 frame
1 frame
Display
black
Normal display
Back Light
OFF
ON

### 8.2 Standby / Power OFF Sequence


VDD
3 frame
> 100 ms
VSYNC
HSYNC/CLK/Data
STBYB
Display
Normal display
black
standby state
power-off state
Internal power OFF
Back Light
ON
OFF

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

## 9. LED Circuit


IL
BLH
VF1
VF2
IL1
BLL1
IL2
BLL2

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

## 10. Characteristics

### 10.1 Optical Characteristics

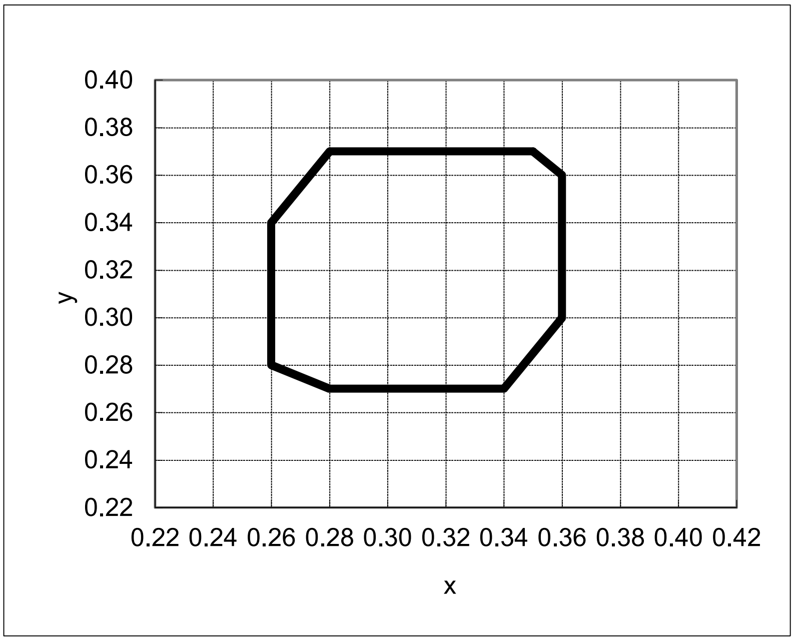
< Measurement Condition >

| | |
|---|---|
| Measuring instruments: | CS2000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS）,EZcontrastXL88（ELDIM） |
| Driving condition: | VDD=3.3V,GND=0V<br>Optimized VCOMDC |
| Backlight: | IL1=IL2=18.0mA |
| Measured temperature: | Ta=25°C |

| Item | | Symbol | Condition | MIN | TYP | MAX | Unit | Note No. | Remark |
|---|---|---|---|---|---|---|---|---|---|
| Response time | Rise time + Fall time | TON + TOFF | [Data]= 00h→FFh→00h | — | — | 100 | ms | 1 | |
| Contrast ratio | Backlight ON | CR | [Data]= FFh / 00h | 350 | 700 | — | | 2 | |
| | Backlight OFF | | | — | 2.0 | — | | | |
| Viewing angle | Left | θL | [Data]= FFh / 00h CR≧10 | 80 | — | — | deg | 3 | |
| | Right | θR | | 80 | — | — | deg | | |
| | Up | φU | | 80 | — | — | deg | | |
| | Down | φD | | 80 | — | — | deg | | |
| White Chromaticity | | x | [Data]=FFh | White chromaticity range | | | | 4 | |
| | | y | | | | | | | |
| Burn-in | | | | No noticeable burn-in image should be observed after 2 hours of window pattern display. | | | | 5 | |
| Center brightness | | | [Data]=FFh | 400 | 600 | — | cd/m² | 6 | |
| Brightness distribution | | | [Data]=FFh | 70 | — | — | % | 7 | |

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

Ⓐ



White Chromaticity Range

【White Chromaticity Range】

| x | y |
|---|---|
| 0.35 | 0.37 |
| 0.28 | 0.37 |
| 0.26 | 0.34 |
| 0.26 | 0.28 |
| 0.28 | 0.27 |
| 0.34 | 0.27 |
| 0.36 | 0.30 |
| 0.36 | 0.36 |

## Ⓐ 10.2 Temperature Characteristics

< Measurement Condition >

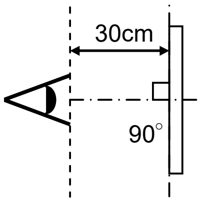
| | |
|---|---|
| Measuring instruments: | CS2000（KONICA MINOLTA）, LCD7200(OTSUKA ELECTRONICS) |
| Driving condition: | VDD=3.3V,GND=0V<br>Optimized VCOMDC |
| Backlight: | IL1=IL2=18.0mA |

| Item | | | Specification | | Remark |
|---|---|---|---|---|---|
| | | | Ta=-30°C | Ta=85˚C | |
| Contrast ratio | | CR | 200 or more | 200 or more | Backlight ON |
| Response time | Rise time + Fall time | TON + TOFF | 1500 ms or less | 80 ms 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 Patter (RGB, white, black) |
| Signal condition | [Data]: FFh, 94h, 00h (3steps) |
| Observation distance | 30 cm |
| Illuminance | 200 to 350 lx |
| Backlight | IL1=IL2=18.0mA |



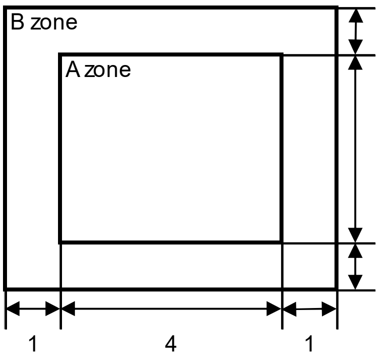
| Defect item | | Defect content | | Criteria |
|---|---|---|---|---|
| Display Quality | Line defect | Black, white or color line, 3 or more neighboring defective dots | | Not exists |
| | Dot defect | Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted as dot defect (brighter dot, darker dot)<br>High bright dot: Visible through 2% ND filter at [Data]=00h<br>Low bright dot: Visible through 5% ND filter at [Data]=00h<br>Dark dot: Appear dark through white display at [Data]= 94h | | Refer to table 1 |
| | | Invisible through 5% ND filter at [Data]=00h | | ignored |
| Screen Quality | Stain | Uneven brightness (white stain, black stain etc) | | Invisible through 1% ND filter |
| | Foreign particle | Point-like | 0.25mm< φ | N=0 |
| | | | 0.20mm< φ ≦0.25mm | N≦2 |
| | | | φ ≦0.20mm | Ignored |
| | | Liner | 3.0mm<length and 0.08mm<width | N=0 |
| | | | length≦3.0mm or width≦0.08mm | Ignored |
| | Others | | | Use boundary sample for judgment when necessary |

φ(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 | |

<Landscape model>



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

## 11.2 Screen and Other Appearance

Testing conditions

| | |
|---|---|
| Observation distance | 30cm |
| Illuminance | 1200～2000 lx |

| Item | | Criteria | Remark |
|---|---|---|---|
| Polarizer | Flaw<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 | |

12. Reliability Test

| Test item | | Test condition | number of failures / number of examinations |
|---|---|---|---|
| Durability test | High temperature storage | Ta=95°C 500hrs | 0 / 3 |
| | Low temperature storage | Ta=-40°C 500hrs | 0 / 3 |
| | High temperature & high humidity storage | Ta=60°C, RH=90% 500hrs<br>non condensing ※ | 0 / 3 |
| | High temperature operation | Tp=85°C 500hrs | 0 / 3 |
| | Low temperature operation | Tp=-30°C 500hrs | 0 / 3 |
| | High temperature & high humidity operation | Tp=40°C, RH=90% 500hrs<br>non condensing ※ | 0 / 3 |
| | Thermal shock storage | -40←→95°C(30min/30min) 100cycles | 0 / 3 |
| | Lightfastness | Xenon Blackpanel 63±3°C non-shower<br>450W/m$^2$（300～700nm） non-operating<br>Integral dose 800MJ/㎡ | 0 / 3 |
| Mechanical environmental test | Electrostatic discharge test (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 and other terminals. | 0 / 3 |
| | Surface discharge test (Non operation) | C=250pF, R=100Ω, V=±12kV<br>Each 5 times of discharge in both polarities on the center of screen with the case grounded. | 0 / 3 |
| | FPC tension test | Pull the FPC with the force of 3N for 10 sec. in the direction -90-degree to its original direction. | 0 / 3 |
| | FPC bend test | Pull the FPC with the force of 3N for 10 sec. in the direction -180-degree to its original direction. Reciprocate it 3 times. | 0 / 3 |
| | Vibration test | Total amplitude 1.5mm, f=10～55Hz, X,Y,Z directions for each 2 hours | 0 / 3 |
| | Impact test (Non operation) | Use TOPPAN PRINTING original jig (see next page) (see next page)and make an impact with peak acceleration of 1000m/s$^2$ 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. | 0 / 3 |
| Packing test | Packing vibration -proof test | Acceleration of 19.6m/s$^2$ with frequency of 10→55→10Hz, X,Y, Zdirection for each 30 minutes | 0 / 1 packing |
| | Packing drop test | Drop from 75cm high.<br>1 time to each 6 surfaces, 3 edges, 1 corner | 0 / 1 packing |

Note:Ta=ambient temperature Tp=Panel temperature

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

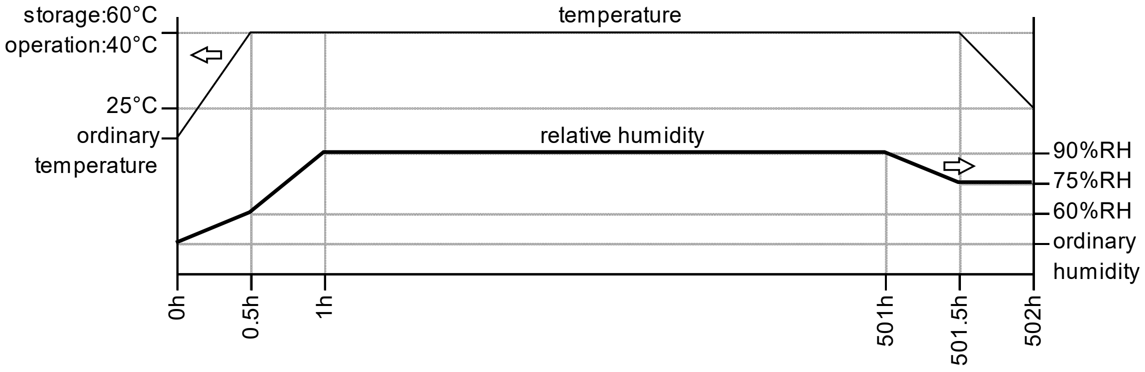
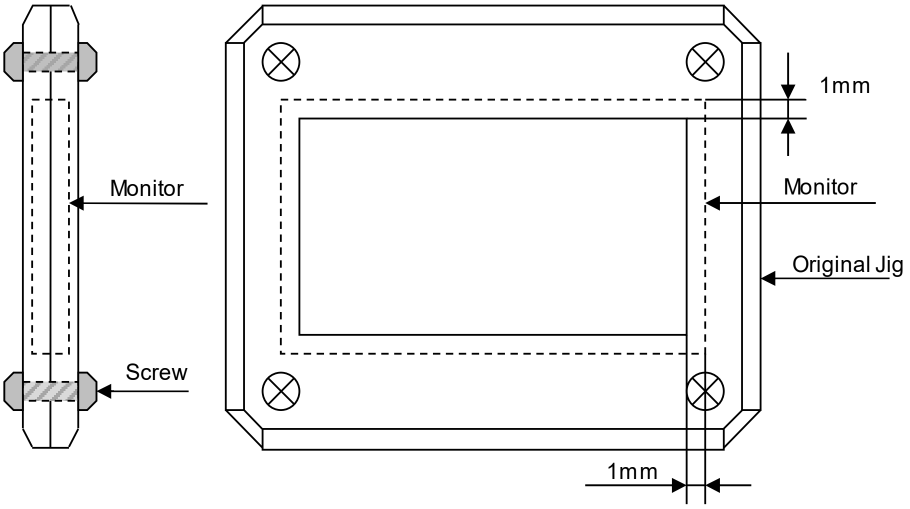


Table2.Reliability Criteria

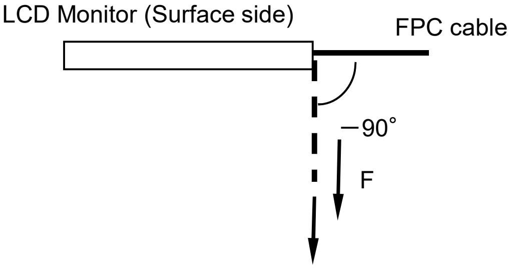
The parameters should be measured after leaving the monitor at the ordinary temperature for 24 hours or more after the test completion.

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

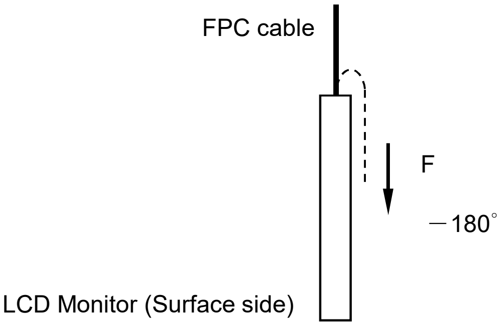
TOPPAN PRINTING Original Jig


Monitor
Screw
1mm
Monitor
Original Jig
1mm

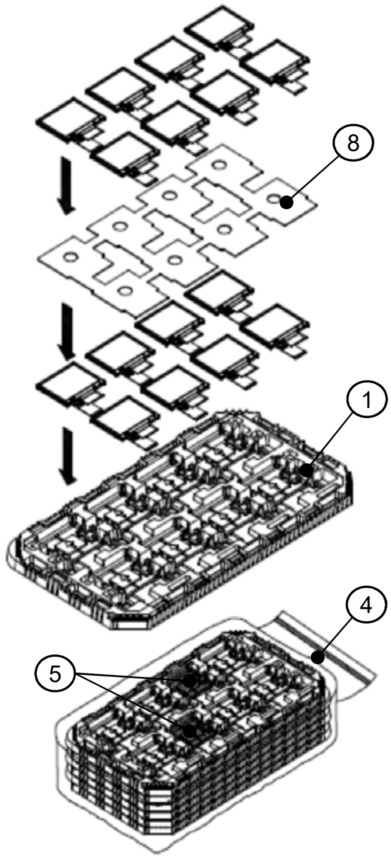
Tension Test Method for FPC cable


LCD Monitor (Surface side)
FPC cable
−90°
F

Bend Test Method for FPC cable


FPC cable
F
−180°
LCD Monitor (Surface side)

## 13. Packing Specifications



Step1. Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward. (8 products per tray)
Foam sheet is to be placed on the products in the tray.
Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.(16 products per tray)

Step2. The trays be in a stack of 5.(Rotate 180 degrees for each step)
One empty tray is to be put on the top of stack of 5 trays.

Step3. 2 packs of moisture absorbers are to be placed on the top tray as shown in the drawing. Put piled trays into a sealing bag.

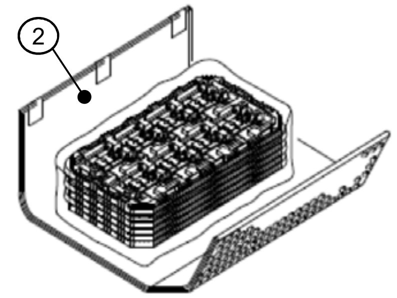
Step4. Vacuum and seal the sealing bag with the vacuum sealing machine.

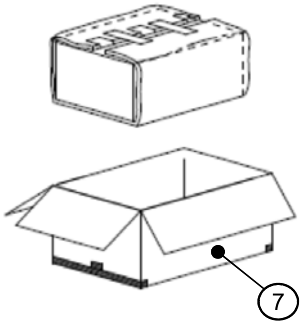
Step5. The stack of trays in the sealing bag is to be wrapped with a bubble cushioning sheet.

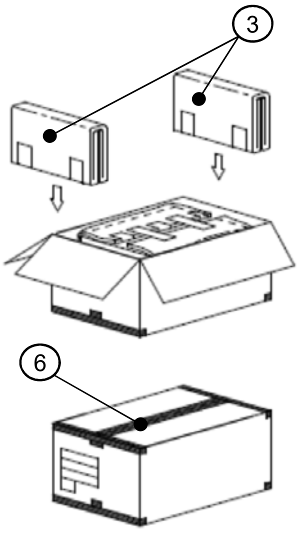
Step6. The wrapped trays are placed in the outer carton.

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

Step8. The model number, quantity of products, and shipping date are to be printed on the outer carton.
If necessary, shipping labels or impression markings are to be put on the outer carton.







Remark: The return of packing materials is not required.

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

| Dimension of outer carton | | |
|---|---|---|
| D : Approx. | (356mm) | |
| W : Approx. | (664mm) | |
| H : Approx. | (182mm) | |
| Quantity of products packed in one carton: | | 80 |
| Gross weight : Approx. | | 5.4 kg |

## 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 devices on the FPC are damageable to electrostatic discharge, because the terminals of the devices are exposed.
Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors.
Designate an appropriate operating area, and set equipment, tools, and machines properly when handling this product.

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

## 14.2 Precautions for Handling

1) Wear finger tips at incoming inspection and for handling the TFT monitors to keep display quality and keep the working area clean.
Do not touch the surface of the monitor as it is easily scratched.

2) Wear grounded wrist-straps and use electrostatic neutralization blowers to prevent static charge and discharge when handling the TFT monitors as the LED in this TFT monitors is damageable to electrostatic discharge.
Designate an appropriate operating area, and set equipment, tools, and machines properly when handling this product.

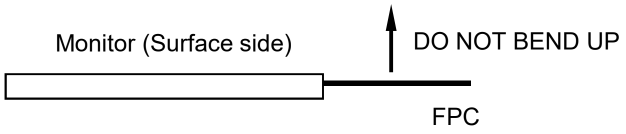
3) Avoid strong mechanical shock including knocking, hitting or dropping to the TFT monitors for protecting their glass parts. Do not use the TFT monitors that have been experienced dropping or strong mechanical shock.

4) Do not use or storage the TFT monitors at high temperature and high humidity environment.
Particularly, never use or storage the TFT monitors at a location where condensation builds up.

5) Avoid using and storing TFT monitors at a location where they are exposed to direct sunlight or ultraviolet rays to prevent the LCD panels from deterioration by ultraviolet rays.

6) Do not stain or damage the contacts of the FPC cable .
FPC cable needs to be inserted until it can reach to the end of connector slot.
During insertion, make sure to keep the cable in a horizontal position to avoid an oblique insertion.
Otherwise, it may cause poor contact or deteriorate reliability of the FPC cable.

7) Do not bend or pull the FPC cable or carry the TFT monitor by holding the FPC cable.
Especially, it will cause mechanical damage or critical defect if FPC is pull up or bent up to short of display.



8) Peel off the protective film on the TFT monitors during mounting process.
Refer to the section 14.5 on how to peel off the protective film.
We are not responsible for electrostatic discharge failures or other defects occur when peeling off the protective film.

9) Please make it to the structure to suppress surroundings of the front polarizer for the display irregularity prevention.

## 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<br>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. |
| ・ Maximum piling up | 7 cartons |

*Conditions to storage after unpacking

Storage environment

| | |
|---|---|
| ・ Temperature | 0 to 40˚C |
| ・ Humidity | 60%RH or less<br>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<br>Storage goods on original tray made by TOPPAN PRINTING. |

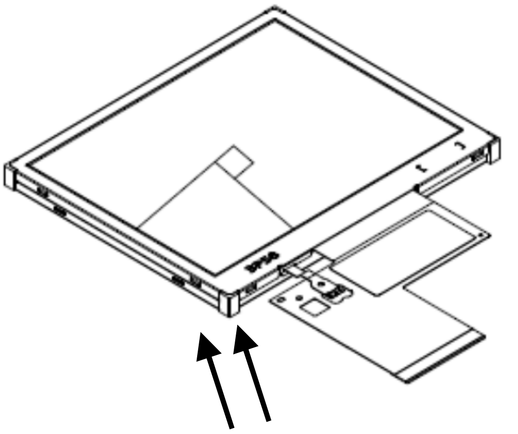
## 14.5 Precautions for Peeling off the Protective film

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, Temperature15 to 27°C
- b) Operators should wear conductive shoes, conductive clothes, conductive finger tips and grounded wrist-straps. 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 left 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.



Direction of blowing air
（Optimize air direction and the distance)

## 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.

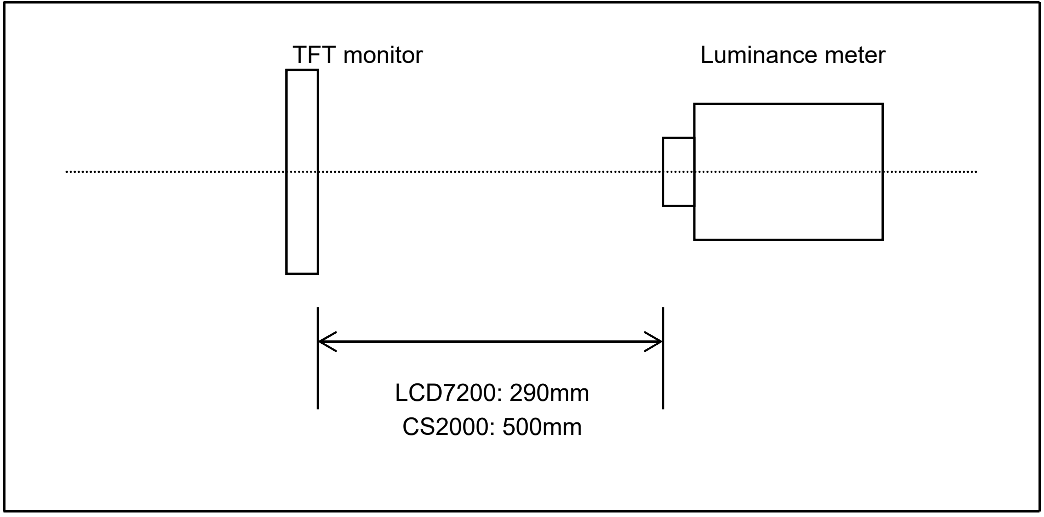
## APPENDIX

### 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 |

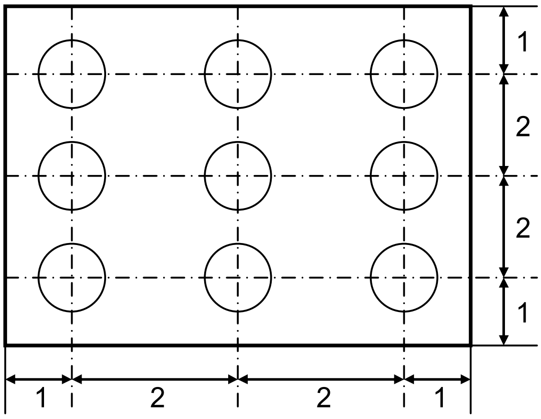
Dark box at constant temperature



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

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

<Landscape model>

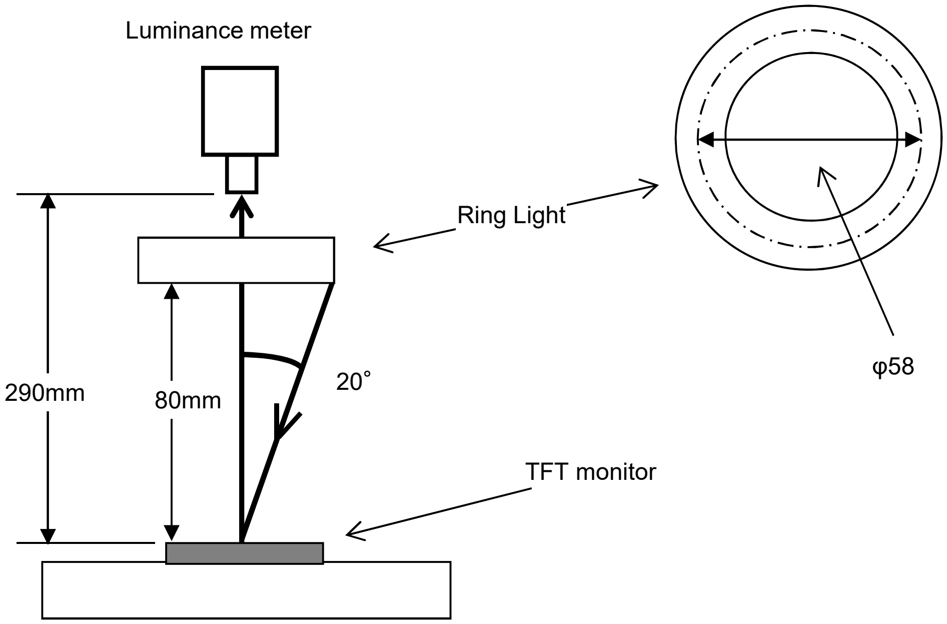


Dimensional ratio of active area

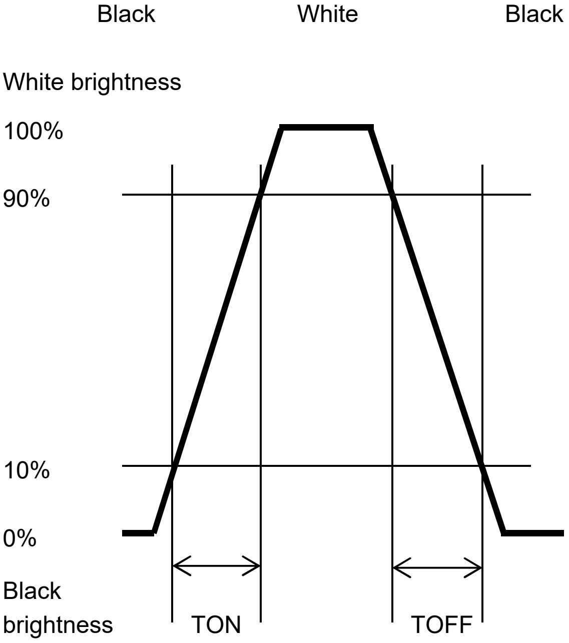
Backlight IL1=IL2=18.0mA

Measurement Condition (Contrast ratio Backlight OFF only)

| | |
|---|---|
| Measuring instruments: | LCD7200(OTSUKA ELECTRONICS),Ring Light(40,000 lx,φ58) |
| Driving condition: | Refer to the section "Optical Characteristics" |
| Measured temperature: | 25˚C unless specified |
| Measurement system: | See the chart below. |
| Measurement point: | At the center of the screen. |


Luminance meter
Ring Light
290mm
80mm
20˚
TFT monitor
φ58

2. Test Method

| Notice | Item | Test method | Measuring instrument | Remark |
|---|---|---|---|---|
| 1 | Response time | Measure output signal waveform by the luminance meter when raster of window pattern is changed from white to black and from black to white.<br> Black<br>White<br>Black<br>White brightness<br>100%<br>90%<br>10%<br>0%<br>Black brightness<br>TON<br>TOFF | LCD7200 | Black display<br>[Data]=00h<br>White display<br>[Data]=FFh<br>TON<br>Rise time<br>TOFF<br>Fall time |
| 2 | Contrast ratio | Measure maximum luminance Y1([Data]=FFh) and minimum luminance Y2([Data]=00h) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values.<br>Contrast ratio = Y1/Y2<br>Diameter of measuring point: 7.8mmφ(CS2000)<br>Diameter of measuring point: 3mmφ(LCD7200) | CS2000<br>LCD7200 | Backlight ON<br>Backlight OFF |
| 3 | Viewing angle<br>Horizontalθ<br>Verticalφ | Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is 10. | EZcontrastXL88 | |
| 4 | White chromaticity | Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = FFh<br>Color matching function: 2°view<br>Measurement angle: 1° | CS2000 | |
| 5 | Burn-in | Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=FFh/00h ). | | At optimized VCOMDC |
| 6 | Center brightness | Measure the brightness at the center of the screen. | CS2000 | |
| 7 | Brightness distribution | (Brightness distribution) = 100 x B/A %<br>A : max. brightness of the 9 points<br>B : min. brightness of the 9 points | CS2000 | |

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