

Specifications for

TFT-LCD Monitor

Version 1.0

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

MODEL COM65T6M13KSC

Customer's Approval

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ORTUSTECH

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1. APPLICATION

This Specification is applicable to 16.56cm (6.5 inch) TFT-LCD back-light monitor for non-military use.

- ◎ ORTUS TECHNOLOGY 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 ORTUS TECHNOLOGY shall not grant to Purchaser any right to use any patent or other intellectual property rights owned by third parties. Since this Specification contains ORTUS TECHNOLOGY'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 ORTUS TECHNOLOGY'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 ORTUS TECHNOLOGY 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 a mechanical design manner, especial attention in housing design to prevent arcuation/flexure or caused by stress to the LCD module shall be considered.
- ◎ ORTUS TECHNOLOGY 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.
- ◎ ORTUS TECHNOLOGY 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, ORTUS TECHNOLOGY and Purchaser shall discuss them in good faith and seek solution.
- ◎ ORTUS TECHNOLOGY 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 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 |

2. Outline Specifications

2.1 Features of the Product

- 6.5" diagonal with resolution of 1,920[H]x480[V] dots.
- 6-bit 262,144 color display capability.
- 3.3V voltage[TFT-LCD module] + (12)V voltage[Backlight] is required.
- Built in Timing generator (TG)
- Long life & high brightness LED back-light and built in LED driver.
- All-in-one type monitor with lead-free mounting. (Response to Phase 3A)

2.2 Display Method

| Items | Specifications | Remarks |
|---------------------|---|-----------------|
| Display type | TN type 262,144 colors Transmissive type, Normally white | |
| Driving method | a-Si TFT Active matrix Line-scanning, Non-interlace | |
| Dot arrangement | RGB stripe arrangement | Refer to fig. 1 |
| Signal input method | 6-bit RGB, parallel input | |
| Backlight type | Long life & High bright white LED. | |

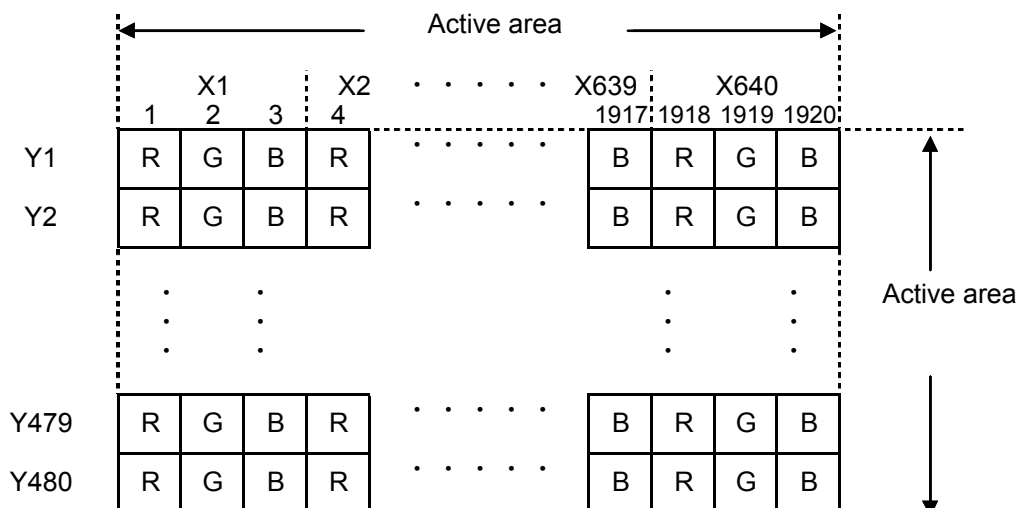


Fig 1 Dot arrangement

(When "Product Number" logo on the front case is placed at the top left)

3. DIMENSIONS AND SHAPE

3.1 Dimensions

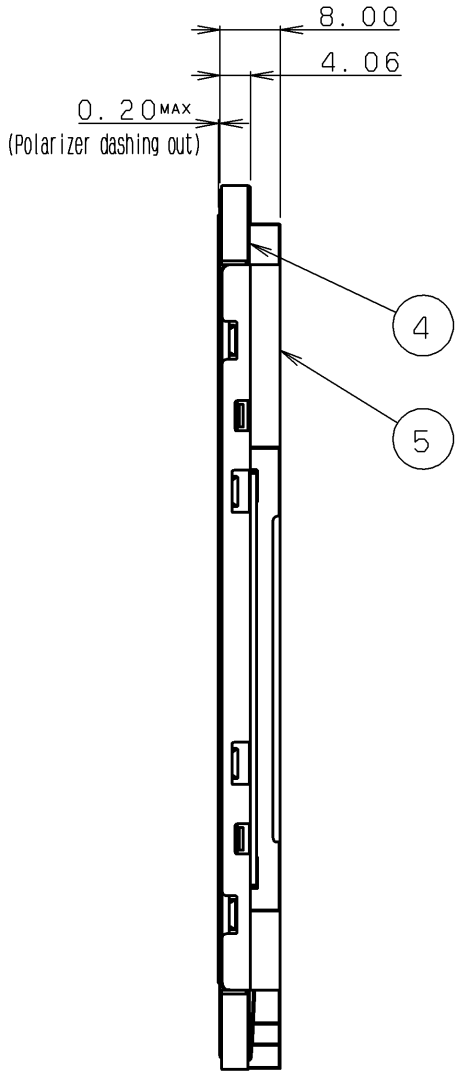
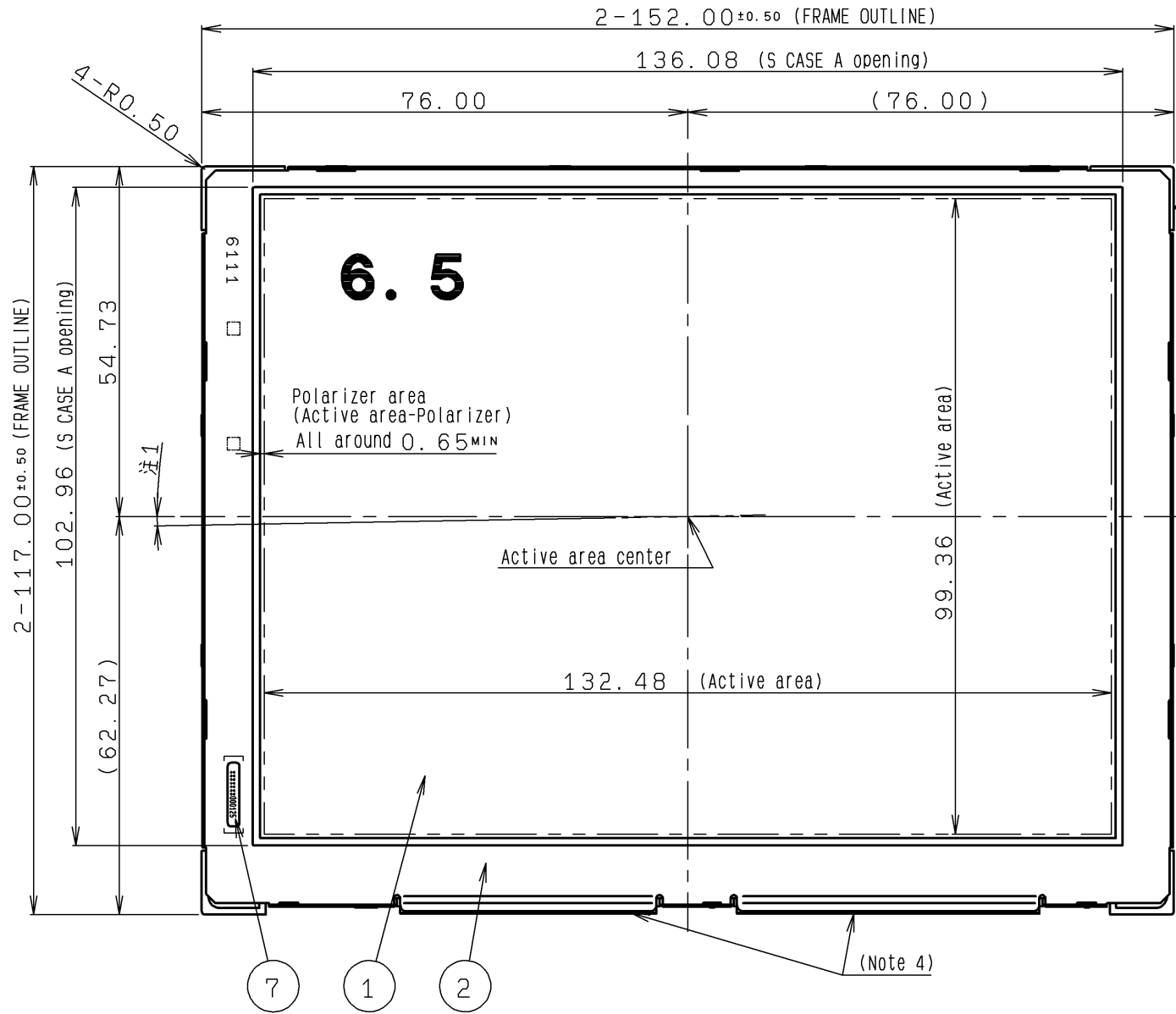
| Items | Specifications | Unit | Remarks |
|-----------------------------------|---------------------------------|------|------------------|
| Outline dimensions | 152.00[H] × 117.00[V] × 8.00[D] | mm | |
| Active area | 132.48[H] × 99.36[V] | mm | 16.56cm diagonal |
| Number of dots | 1,920[H] × 480[V] | dot | |
| Dot pitch | 69.00[H] × 207.00[V] | μm | |
| Surface hardness of the polarizer | 3 | H | Load: 2.0N |
| Weight | 160 | g | |

3.2 Outward Form

Front

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

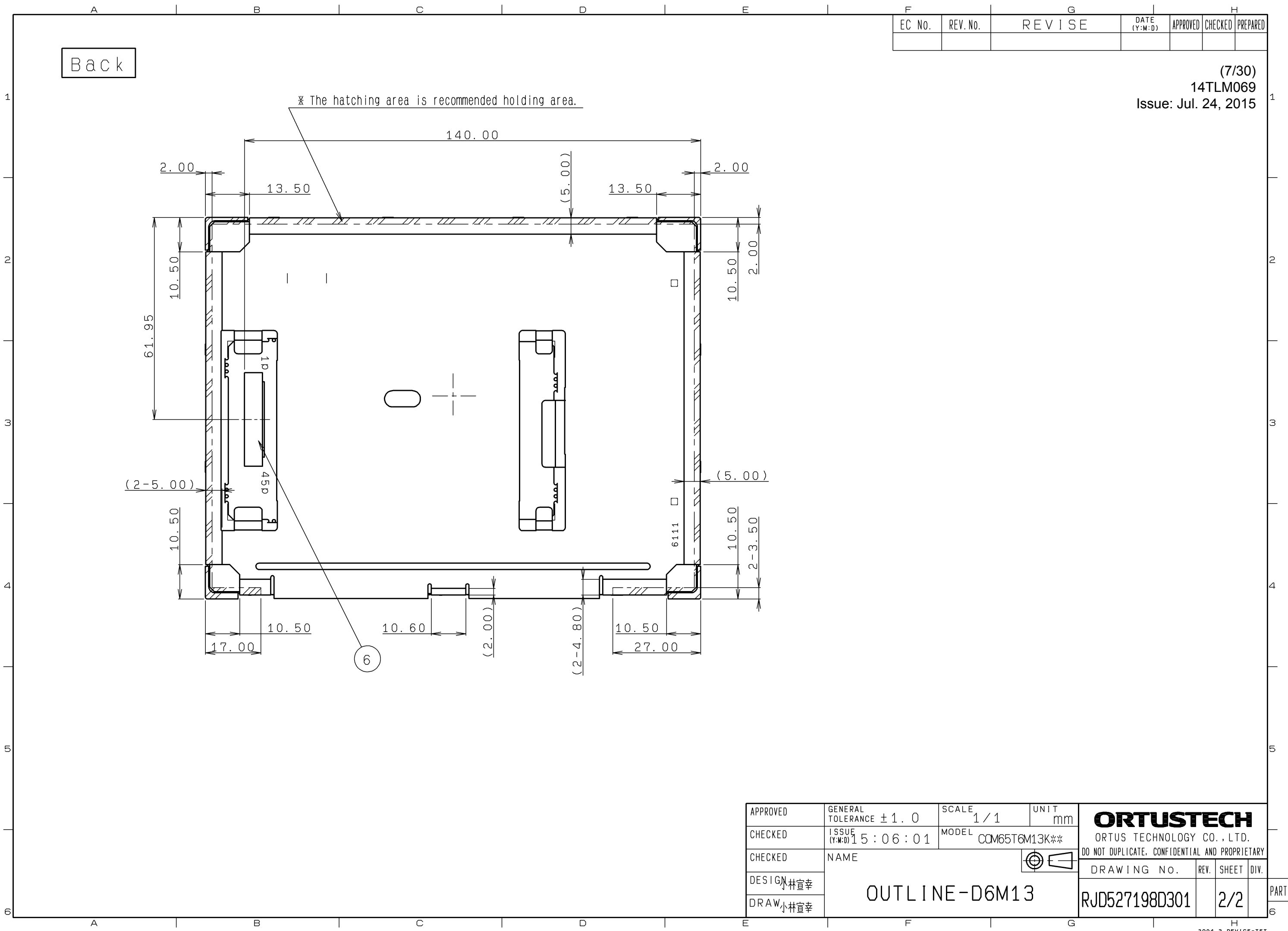
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- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±50°].
- Note 2. S label is affixed the area shown in the drawing.
The thickness of the S label will be added to that of S case's surface.
- Note 3. Protective film is affixed on front surface of the screen.
Location tolerance of the protective film shall be ±1.5 mm to the polarizing film.
- Note 4. Exercise care not to apply any forces to the cable holder of the S case A.
- Note 5. Refer to "11.CRITERIA OF JUDGMENT" about the appearance specification of a polarizer.

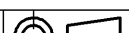
| | | | |
|---------------|------|---|-------------------------------|
| | 8 | | |
| S LABEL | 7 | | (10X1.85X0.075t) |
| CONNECTOR | 6 | 04 6240 045 023 846+(FFC)(Kyocera Connector Products) | pitch0.5x45pin(Lower contact) |
| S CASE D | 5 | | |
| S CASE C | 4 | | |
| FRAME | 3 | | |
| S CASE A | 2 | | |
| TFT-LCD PANEL | 1 | Glass substrate thickness=0.5t | |
| PART NAME | ITEM | MATERIAL GRADE | REMARK |

| | | | | | | | |
|-------------|------------------------|---------------------|---------|--|------|-------|------|
| APPROVED | GENERAL TOLERANCE ±1.0 | SCALE 1/1 | UNIT mm | ORTUSTECH ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE. CONFIDENTIAL AND PROPRIETARY | | | |
| CHECKED | ISSUE (Y:M:D) 15:06:01 | MODEL CCM65T6M13K** | | | | | |
| CHECKED | NAME | | | DRAWING NO. | REV. | SHEET | DIV. |
| DESIGN 小林宣幸 | OUTLINE-D6M13 | | | RJD527198D301 | | 1/2 | PART |
| DRAW 小林宣幸 | | | | | | | |



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

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14TLM069
Issue: Jul. 24, 2015

| | | | | | | | | |
|-------------|-------------------------------|---------------------|---|--|--|------|-------|------|
| APPROVED | GENERAL TOLERANCE ± 1. 0 | SCALE 1 / 1 | UNIT mm | ORTUSTECH ORTUS TECHNOLOGY CO., LTD. DO NOT DUPLICATE. CONFIDENTIAL AND PROPRIETARY | | | | |
| CHECKED | ISSUE (Y:M:D) 1 5 : 0 6 : 0 1 | MODEL CCM65T6M13K** | | | | | | |
| CHECKED | NAME | |  | DRAWING NO. | | REV. | SHEET | DIV. |
| DESIGN 小林宣幸 | OUTLINE-D6M13 | | | RJD527198D301 | | | 2/2 | PART |
| DRAW 小林宣幸 | | | | | | | | 6 |

3.3 SERIAL LABEL (S-LABEL)

1) Display Items

S-label indicates the least significant digit of manufacture year (1digit), manufacture month with below alphabet (1letter), model code (4characters or 5characters), serial number (6digits).

* Contents of Display

* * (or) *
 a b c c d

| | | | | |
|---|---|--|----------------------------------|----------------------------------|
| | Contents of display | | | |
| a | The least significant digit of manufacture year | | | |
| b | Manufacture month | Jan-A Feb-B Mar-C Apr-D | May-E Jun-F Jul-G Aug-H | Sep-I Oct-J Nov-K Dec-L |
| c | Model code | 65ZC (Made in Japan) 65AAC (Made in Malaysia) | | |
| d | Serial number | | | |

* Example of indication of Serial label (S-label)

• Made in Japan

6E65ZC000125

means "manufactured in May 2016, 6.5" Z type , C specifications, serial number 000125"

• Made in Malaysia

6E65AAC000125

means "manufactured in May 2016, 6.5" AA type , C specifications, serial number 000125"

2) Location of Serial Label (S-label)

Refer to 3.2 "Outward Form".

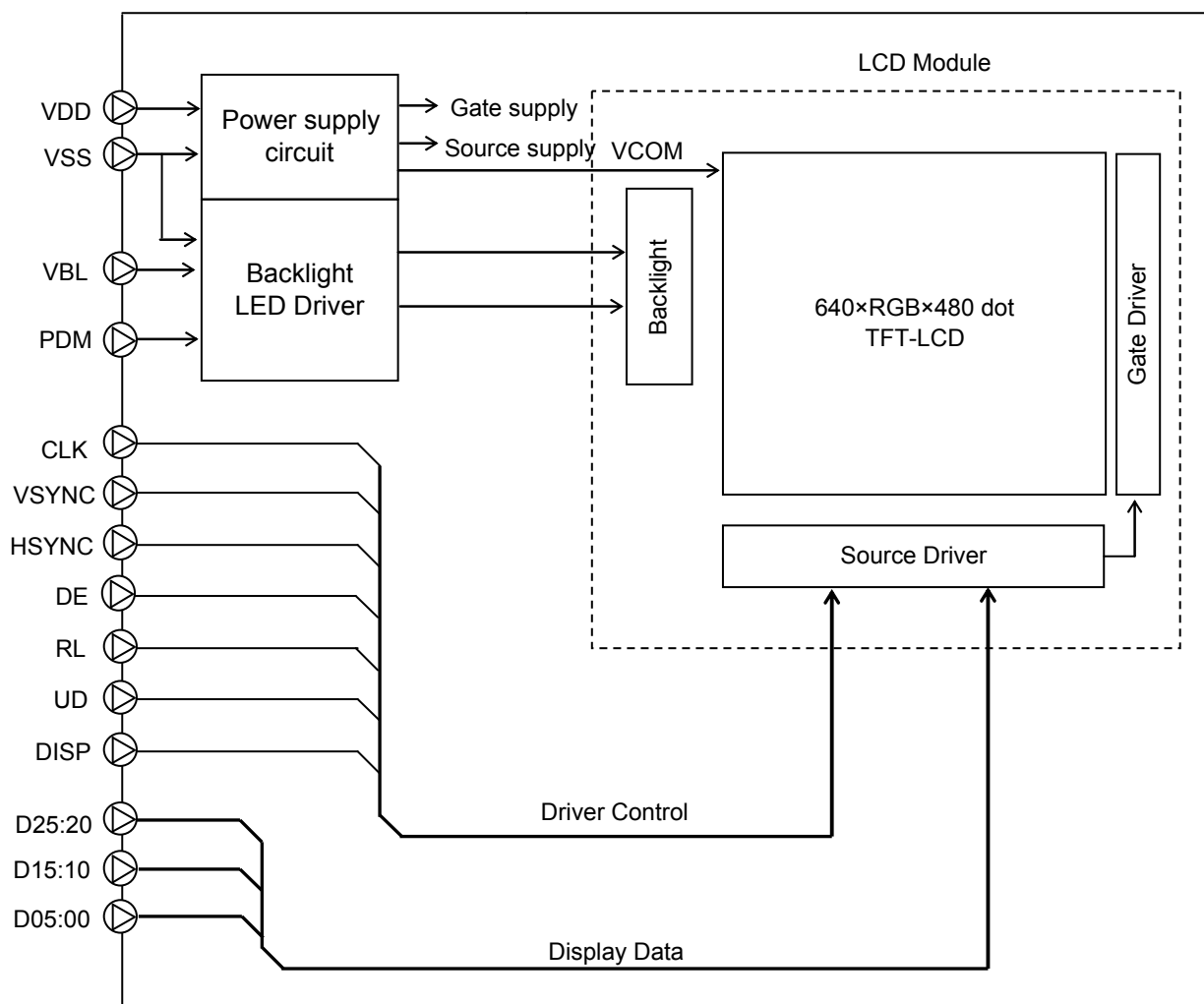
4. PIN ASSIGNMENT

| No. | Symbol | PIN treatment | Functions |
|-----|--------|---------------|---|
| 1 | VSS | — | GND. |
| 2 | CLK | — | Clock signal.Latching data at the rising edge. |
| 3 | VSS | — | GND. |
| 4 | HSYNC | — | Horizontal sync signal. (Low active) |
| 5 | VSYNC | — | Vertical sync signal. (Low active) |
| 6 | VSS | — | GND. |
| 7 | TEST1 | pull-down | Short to VSS |
| 8 | TEST2 | | Short to VSS |
| 9 | D20 | | Display data(B). 00h: Black D20:LSB D25:MSB |
| 10 | D21 | | |
| 11 | D22 | | |
| 12 | D23 | | |
| 13 | D24 | | |
| 14 | D25 | | Driver has internal gamma conversion. |
| 15 | VSS | — | GND. |
| 16 | TEST3 | pull-down | Short to VSS |
| 17 | TEST4 | | Short to VSS |
| 18 | D10 | | Display data(G). 00h: Black D10:LSB D15:MSB |
| 19 | D11 | | |
| 20 | D12 | | |
| 21 | D13 | | |
| 22 | D14 | | |
| 23 | D15 | | Driver has internal gamma conversion. |
| 24 | VSS | — | GND. |
| 25 | TEST5 | pull-down | Short to VSS |
| 26 | TEST6 | | Short to VSS |
| 27 | D00 | | Display data(R). 00h: Black D00:LSB D05:MSB |
| 28 | D01 | | |
| 29 | D02 | | |
| 30 | D03 | | |
| 31 | D04 | | |
| 32 | D05 | | Driver has internal gamma conversion. |
| 33 | VSS | — | GND. |
| 34 | RL | — | Horizontally Flipped (right/left) Signal. (Lo: Horizontally Flipped Display, Hi: Normal display) |
| 35 | VDD | — | Power supply input |
| 36 | VDD | — | Power supply input |
| 37 | DISP | pull-up | Display on/off control signal(Lo : display off, Hi: display on) |
| 38 | DE | pull-down | Input data effective signal. (It is effective for the period of "Hi") |
| 39 | UD | — | Vertically Flipped (up/down) Signal. (Lo: Normal display,Hi: Vertically Flipped Display) |
| 40 | VSS | — | GND. |
| 41 | VBL | — | Power supply input(Backlight) |
| 42 | VBL | — | Power supply input(Backlight) |
| 43 | PDM | — | Brightness control pulse signal (Lo:0%(Backlight off) brightness, Hi:100%) |
| 44 | VSS | — | GND |
| 45 | VSS | — | GND |

- Used connector: KYOCERA CONNECTOR PRODUCTS 6240 series [04 6240 045 023 846+]
- Please refer to the section "3.2 Outward Form" for pin assignment.
- The corrosion phenomenon by the different kind metal uniting is generated according to the system requirements, and there is a possibility of becoming a loose connection.
Please select very carefully, and design the FPC cable used.

5. Block Diagram

Each arrow shows signal flow.



6. ABSOLUTE MAXIMUM RATING

VSS=0V

| Item | Symbol | Condition | Rating | | Unit | Applicable terminal |
|------------------------------|--------|-----------|--|---------|------|---|
| | | | MIN | MAX | | |
| Supply voltage | VDD | Ta=25°C | -0.3 | 6.0 | V | VDD |
| Input voltage for logic | VI | | -0.3 | VDD+0.3 | V | CLK, VSYNC, HSYNC, DE, D[25:00], RL, UD, DISP |
| Supply voltage for Backlight | VBL | | — | 14.0 | V | VBL |
| Input voltage for Backlight | VIP | | — | 7.0 | V | PDM |
| Storage temperature range | Tstg | | -30 | 80 | °C | |
| Storage humidity range | Hstg | | Non condensing in an environmental moisture at or less than 40°C 90%RH | | % | |

Note: Please input the logic signal after turning on VDD.
Do not input the logic signal while blocking VDD.

Absolute maximum ratings is parametric values, should never be exceed any value at any moment.

Beyond which, it could be suffered from changes in characteristics and never be restored.

Moreover, it could even be suffered from permanent destruction.

Therefore, please note enough the fluctuation of input voltage, the characteristics of connected parts,

I/O signal line surge, and ambient temperature, on designing the circuit.

7. 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=3.0~3.6V | 0 | — | VDD | V | CLK,VSYNC, HSYNC,DE, D[25:00],RL,UD, DISP |
| Supply voltage for Backlight | VBL | | 10.8 | 12.0 | 13.2 | V | VBL |
| Input voltage for Backlight | VIP | | 0 | — | VDD | V | PDM |
| Operational temperature range | Top | Note1 Note2 | -20 | +25 | +70 | °C | Panel surface temperature |
| Operating humidity range | Hop | Ta ≤ 30°C | 20 | — | 80 | % | |
| | | Ta > 30°C | Non condensing in an environmental moisture at or less than 30°C80%RH | | | | |

Note 1: The temperature within the display will increase due to the heat radiated from the back light while in operation.

Necessary measures have to be taken in the product design to make sure that the display has proper ventilation so that temperature on any surface of this display should not exceed 70°C.

Note 2: Allowance ON Duty of LED changes depending on the ambient temperature.

Do not exceed Allowable ON Duty shown on the chart below.

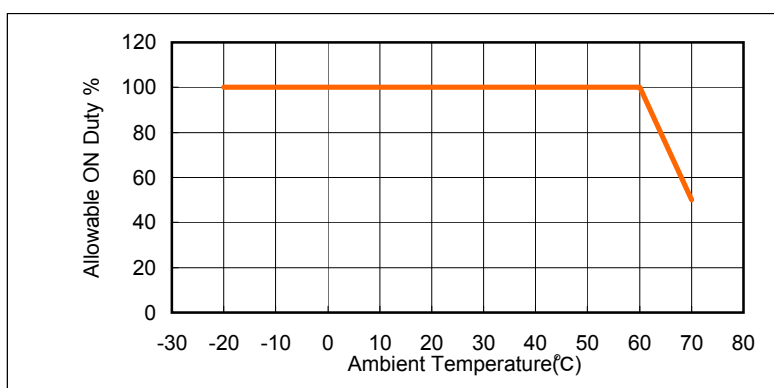


Fig. 2: Allowable ON Duty

8. CHARACTERISTICS

8.1 Electrical characteristics

8.1.1 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 | | 0.7×VDD | — | VDD | V | CLK, VSYNC, HSYNC, DE, D[25:00], RL, UD, DISP |
| | VIL | | 0 | — | 0.3×VDD | V | |
| Pull down resister value | Rpd | | 300 | 450 | 600 | kΩ | DE, D[25:00] |
| Pull up resister value | Rpu | | 300 | 450 | 600 | kΩ | DISP |
| Current consumption | IDD | fCLK=25MHz Color bar display | — | 165 | 330 | mA | VDD |

8.1.2 Backlight

(Unless otherwise noted, Ta=25° C, VBL=12.0V, VDD=3.3V, VSS=0V)

| Item | Symbol | Condition | Rating | | | Unit | Applicable terminal |
|--------------------------------|--------|---|--------|----------|-----|------|---------------------|
| | | | MIN | TYP | MAX | | |
| Input voltage for BACKLight | VIPH | | 1.4 | — | VDD | V | PDM |
| | VIPL | | 0 | — | 0.2 | V | |
| Operating Current | IBL | Brightness control ON Duty=100% | — | 106 | 212 | mA | VBL |
| Estimated Life of LED | LL | Note1 Brightness control ON Duty=100% | — | (50,000) | — | hr | |

Note1: Life is defined as the brightness decrease to half of its initial brightness.

This number is for reference, and not a guaranteed spec.This presumption value shows the estimated life expectancy in LED side light single purpose operation.It is different from presumption with the monitoring because the environment is different.Life is depend on environmental temperature. Especially using high temperature decreases life.

8.2 AC CHARACTERISTICS

8.2.1 Display Module

(Unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$, $V_{SS}=0\text{V}$)

| Item | Symbol | Condition | Rating | | | Unit | Applicable terminal |
|-------------------|--------|-----------------------------|--------|-----|-----|------|---------------------|
| | | | MIN | TYP | MAX | | |
| CLK frequency | fCLK | | — | 25 | 27 | MHz | CLK |
| CLK Low period | tw1L | $0.3 \times V_{DD}$ or less | 14.8 | — | — | ns | CLK |
| CLK High period | tw1H | $0.7 \times V_{DD}$ or more | 14.8 | — | — | ns | CLK |
| Setup time | tsp | | 10 | — | — | ns | CLK, DE, D[25:00] |
| Hold time | thd | | 10 | — | — | ns | HSYNC, VSYNC |
| VSYNC pulse width | tw2H | | 1 | 3 | 5 | H | VSYNC |
| HSYNC pulse width | tw3H | | 5 | 30 | — | CLK | HSYNC |

8.2.2 Backlight

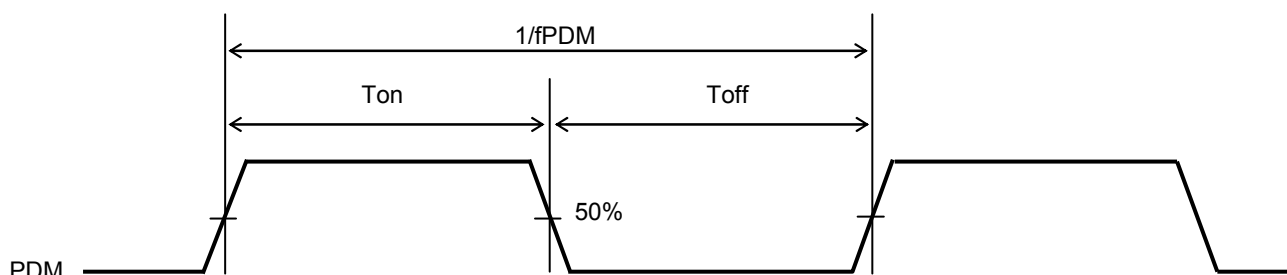
(Unless otherwise noted, $T_a=25^{\circ}\text{C}$, $V_{DD}=3.3\text{V}$, $V_{BL}=12.0\text{V}$, $V_{SS}=0\text{V}$)

| Item | Symbol | Condition | Rating | | | Unit | Applicable terminal |
|-------------------|--------|--|--------|-----|-----|------|---------------------|
| | | | MIN | TYP | MAX | | |
| PDM frequency | fPDM | | 100 | 200 | 300 | Hz | PDM |
| Backlight ON duty | ONduty | $100 \times T_{on} / (T_{on} + T_{off})$ | 20 | — | 100 | % | |

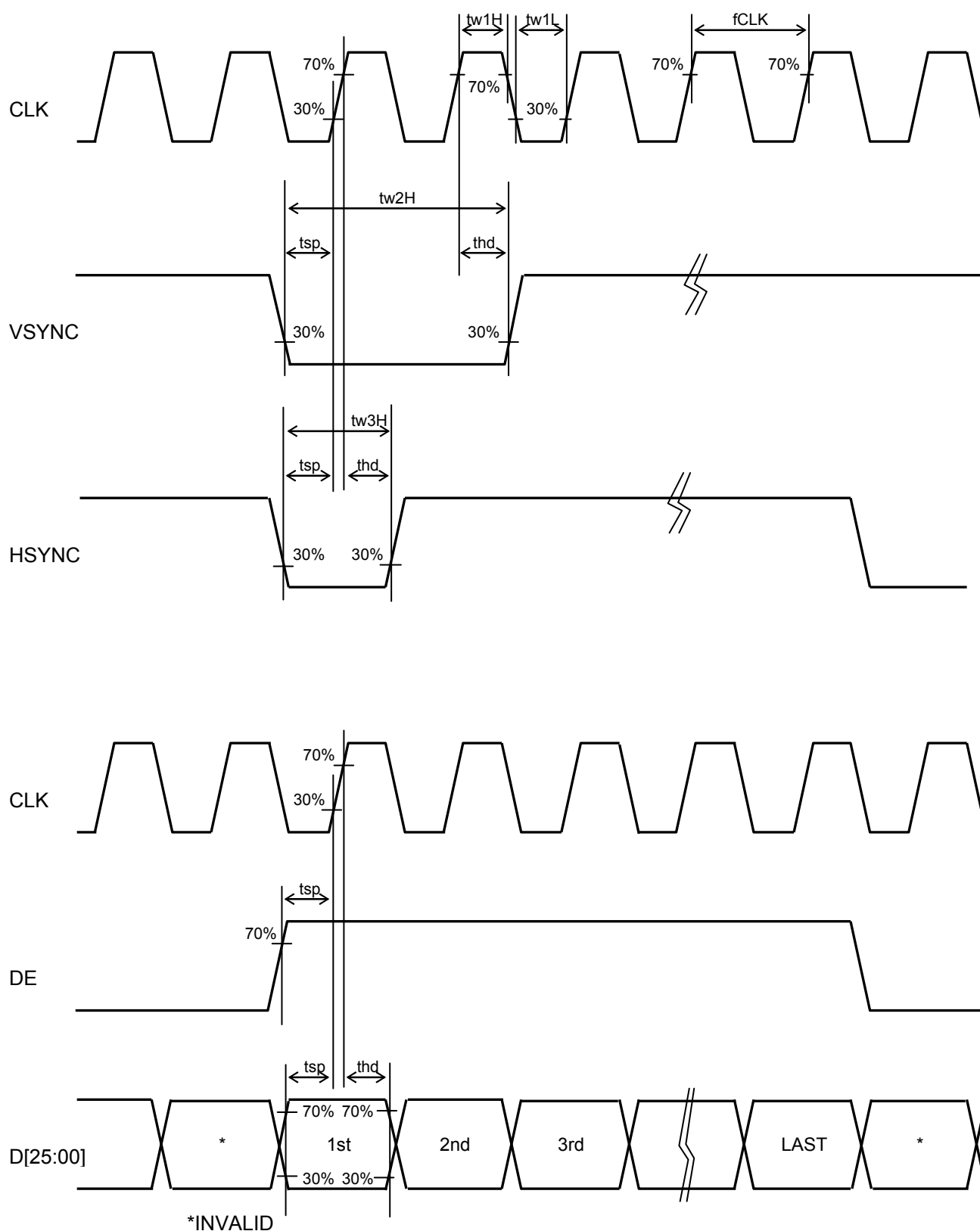
NOTE:

The interference fringes might be generated by optical interference with the PDM frequency and the VSYNC frequency on the screen.

Please evaluate it enough in all operating temperature limits when you set the PDM frequency.



Switching Waveform Characteristics



8.3 INPUT TIMING CHARACTERISTICS

| Item | Symbol | Rating | | | Unit | Applicable terminal |
|---------------------------|--------|--------|-----|---------------|------|-------------------------|
| | | MIN | TYP | MAX | | |
| CLK frequency | fCLK | — | 25 | 27 | MHz | CLK |
| VSYNC signal cycle time | tv | — | 525 | — | H | VSYNC,HSYNC |
| VSYNC frequency Note1 | fVSYNC | 54 | 60 | 66 | Hz | VSYNC |
| VSYNC pulse width | tw2H | 1 | 3 | 5 | H | VSYNC,HSYNC |
| Vertical back porch | tvb | — | 35 | — | H | VSYNC,HSYNC,DE,D[25:00] |
| Vertical display period | tvdp | — | 480 | — | H | VSYNC,HSYNC,DE,D[25:00] |
| HSYNC signal cycle time | th | — | 800 | — | CLK | HSYNC,CLK |
| HSYNC pulse width | tw3H | 5 | 30 | — | CLK | HSYNC,CLK |
| Horizontal back porch | thb | 112 | — | 144 Note 2 | CLK | HSYNC,CLK,DE,D[25:00] |
| Horizontal display period | thdp | — | 640 | — | CLK | HSYNC,CLK,DE,D[25:00] |
| DE pulse width | tw4H | — | 640 | — | CLK | DE,CLK |

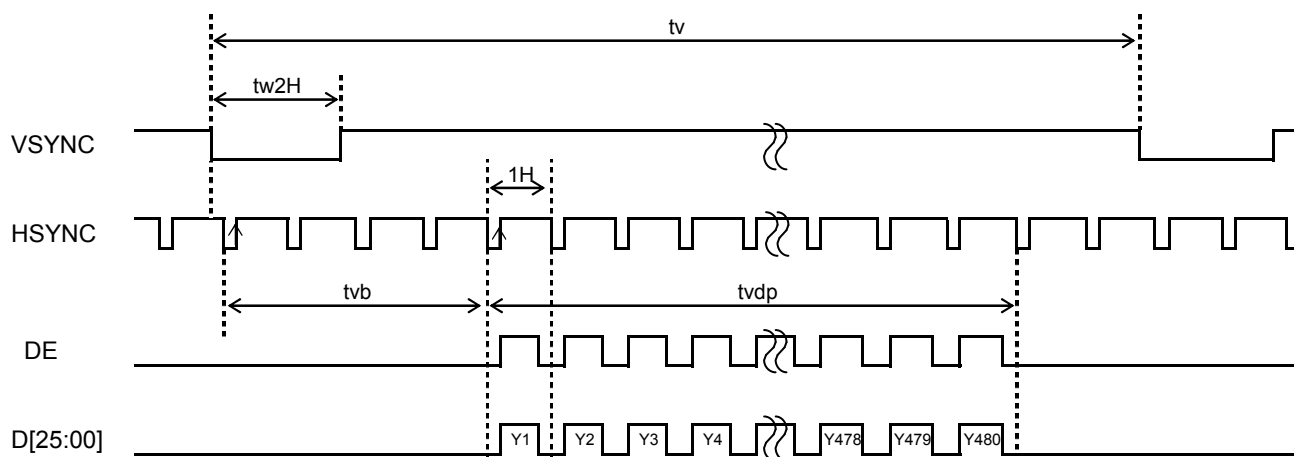
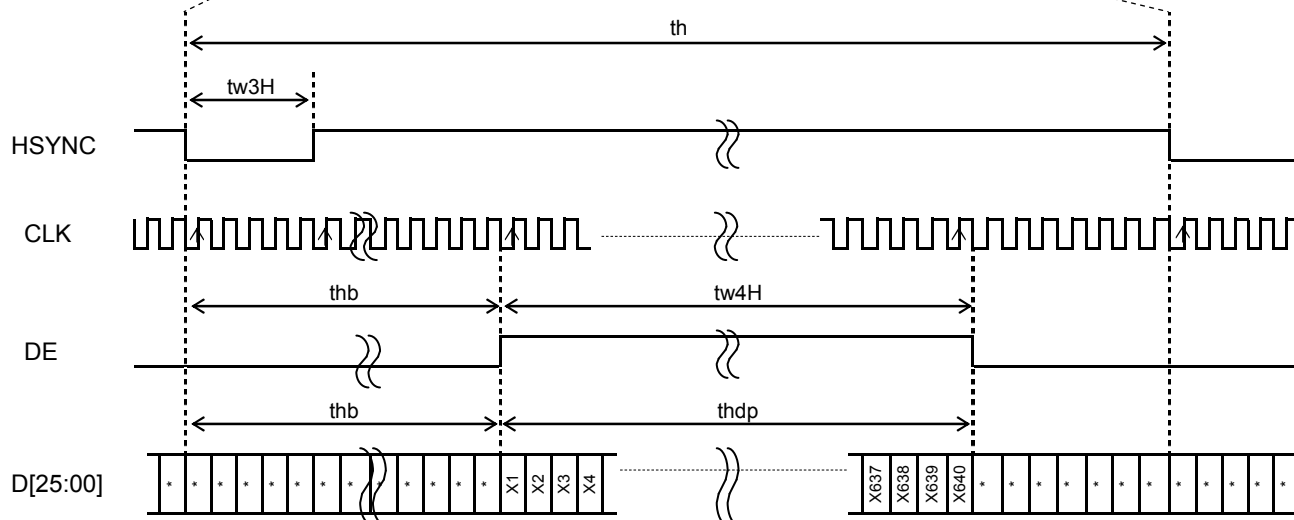
Note1: The characteristic of this item is recommended standard.

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

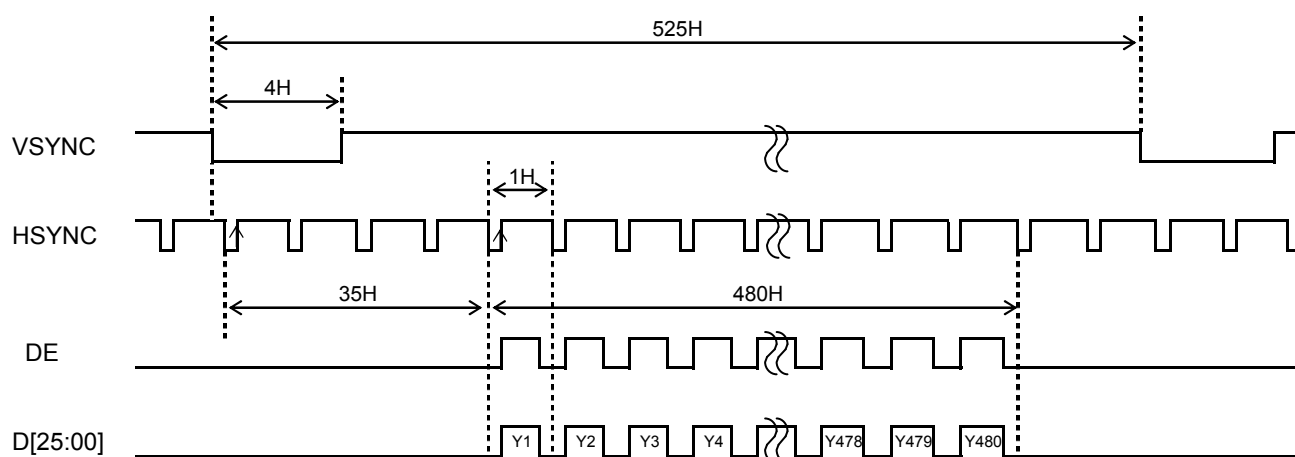
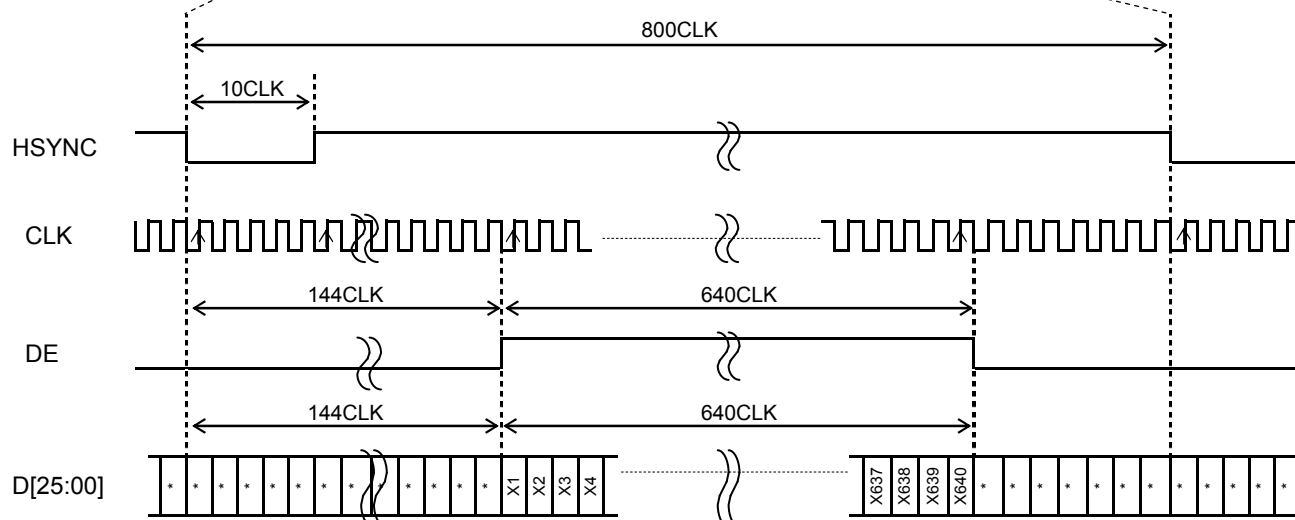
when it comes off from this characteristic and it is used.

Note2: When "DE" keeps "Lo" for 144CLK or longer,start capturing data automatically from 144CLK.

8.4 Driving Timing Chart

I . Vertical Timing**II . Horizontal Timing**

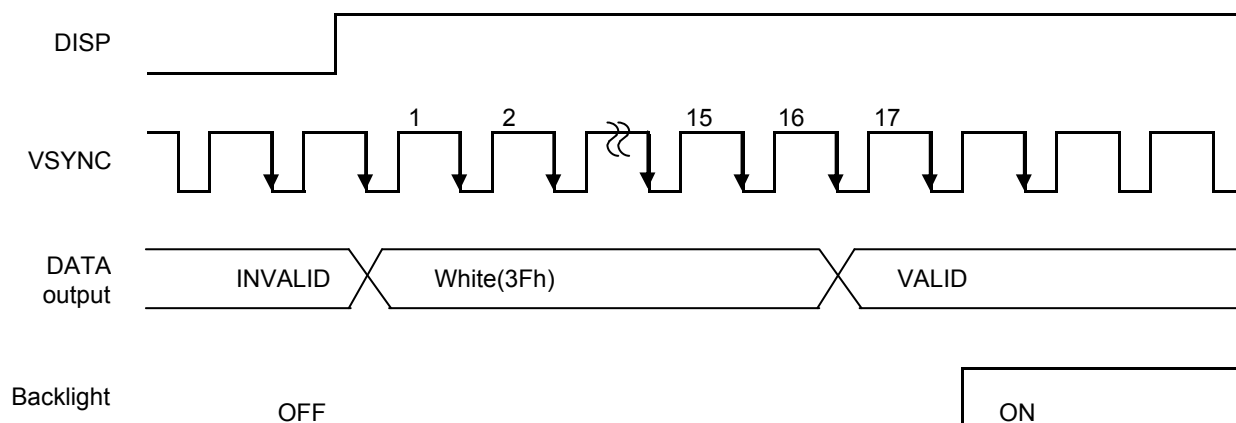
8.5 Example of Driving Timing Chart (fCLK=25MHz)

I . Vertical Timing**II . Horizontal Timing**

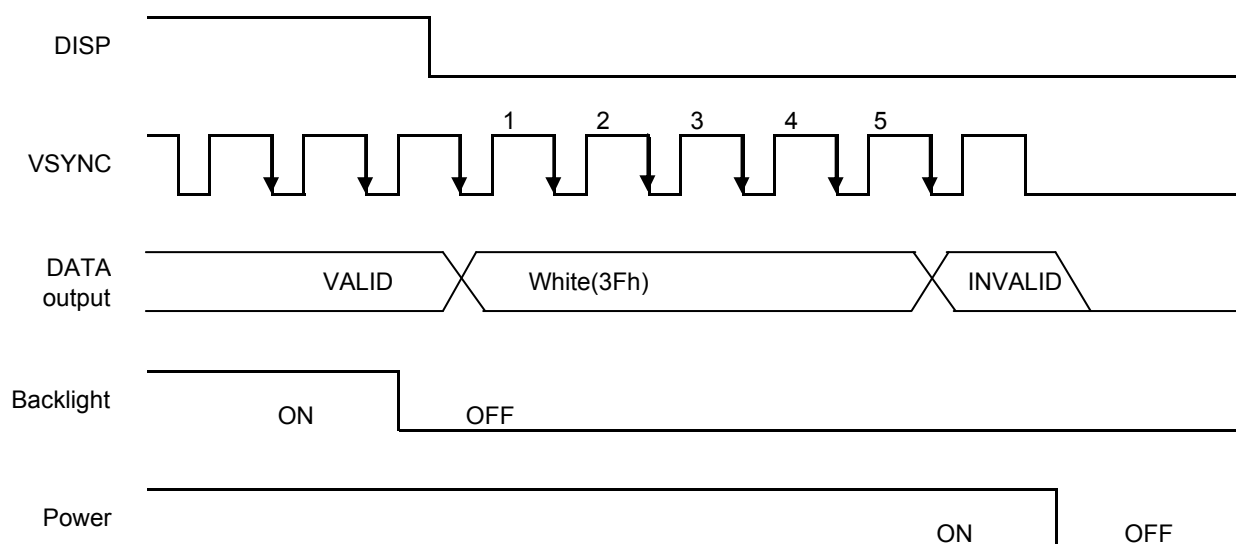
9. DISPLAY ON/OFF SEQUENCE

It explains the Display on/off sequence.

After Display on, "White" data is outputted for 16-Frames first, from the falling edge of the following VSYNC signal.



After Display off, "White" data is outputted for 5-Frames first, from the falling edge of the following VSYNC signal. Please turn off the power supply promptly after OFF of "DISP".



10. CHARACTERISTICS

10.1 Optical Characteristics

< Measurement Condition >

Measuring instruments: CS1000 (KONICA MINOLTA) , LCD7200(OTSUKA ELECTRONICS) , EZcontrast160D (ELDIM)

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

Optimized VCOMDC

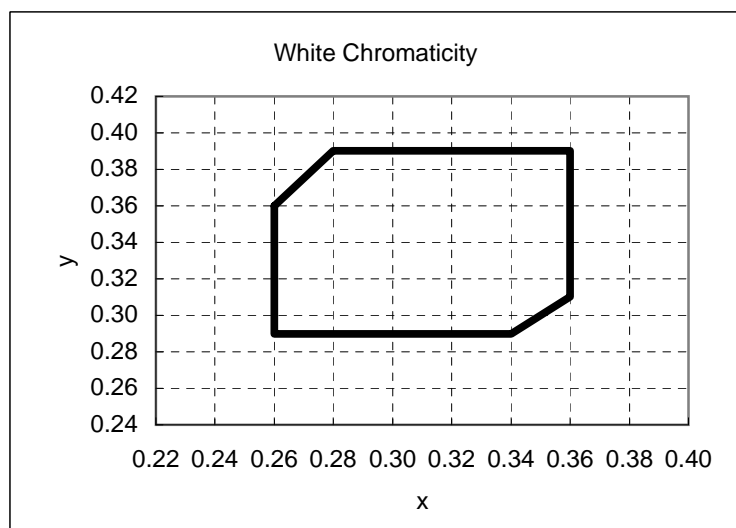
Backlight: VBL=12.0V (Brightness control ON Duty=100%)

Measured temperature: Ta = 25° C

| Item | | Symbol | Condition | MIN | TYP | MAX | Unit | Note No. | Remark |
|-------------------------|-----------|--------|-------------------------|--|-----|-----|-------------------|----------|--------|
| Response time | Rise time | TON | [Data]=3Fh→00h | — | — | 40 | ms | 1 | ※ |
| | Fall time | TOFF | [Data]=00h→3Fh | — | — | 60 | ms | | |
| Contrast ratio | | CR | [Data]=3Fh/00h | 240 | 400 | — | | 2 | |
| Viewing angle | Left | θL | [Data]=3Fh/00h CR≥10 | 80 | — | — | deg | 3 | ※ |
| | Right | θR | | 80 | — | — | deg | | |
| | Up | φU | | 80 | — | — | deg | | |
| | Down | φD | | 80 | — | — | deg | | |
| White Chromaticity | | x | [Data]=3Fh | White chromaticity range | | | | 4 | |
| | | y | | | | | | | |
| Burn-in | | | | No noticeable burn-in image shall be observed after 2 hours of window pattern display. | | | | 5 | |
| Center brightness | | | [Data]=3Fh | 280 | 400 | — | cd/m ² | 6 | |
| Brightness distribution | | | [Data]=3Fh | 70 | — | — | % | 7 | |

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

※ Measured in the form of LCD module.



【White Chromaticity Range】

| x | y |
|------|------|
| 0.26 | 0.36 |
| 0.26 | 0.29 |
| 0.34 | 0.29 |
| 0.36 | 0.31 |
| 0.36 | 0.39 |
| 0.28 | 0.39 |

10.2 Temperature Characteristics

< Measurement Condition >

Measuring instruments: CS1000 (KONICA MINOLTA) , LCD7200(OTSUKA ELECTRONICS)

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

Optimized VCOMDC

Backlight: VBL=12.0V(Brightness control ON Duty=100%)

| Item | | | Specification | | Remark |
|-----------------|-----------|------|--|-----------------|--|
| | | | Ta= -20° C | Ta=70° C | |
| Contrast ratio | | CR | 40 or more | 40 or more | |
| 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. | | Use the criteria for judgment specified in the section 11. |

※ Measured in the form of LCD module.

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]:3Fh,1Ch,00h(3steps)
 Observation distance 30 cm
 Illuminance 200 to 350 lx
 Backlight VBL=12.0V(Brightness control ON Duty=100%)

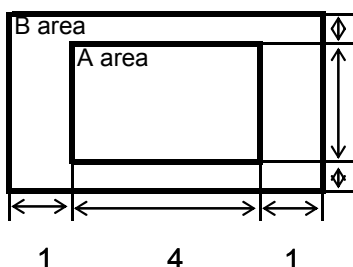
| Defect item | | Defect content | Criteria | |
|-----------------|--|--|--|------------|
| Display Quality | Line defect | Black, white or color line, 3 or more neighboring defective dots | Not exists | |
| | Dot defect | Uneven brightness on dot-by-dot base due to defective TFT or CF, or dust is counted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

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

Permissible number: N

Table 1

| Area | High bright dot | Low bright dot | Dark dot | Total | Criteria |
|-------|-----------------|----------------|----------|-------|--|
| A | 0 | 2 | 2 | 3 | Permissible distance between same color bright dots (includes neighboring dots): 3 mm or more |
| B | 2 | 4 | 4 | 6 | Permissible distance between same color high bright dots (includes neighboring dots): 5 mm or more |
| Total | 2 | 4 | 4 | 7 | |



1 Division of A and B areas

B area: Active area

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

11.2 Screen and Other Appearance

Testing conditions

Illuminance

1200~2000 lx

Observation distance

30cm

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

12. RELIABILITY TEST

| Test item | | Test condition | | number of failures /number of examinations |
|-------------------------------|---|--|------------|---|
| Durability test | High temperature storage | Ta=80°C | 240hr | 0/3 |
| | Low temperature storage | Ta=-30°C | 240hr | 0/3 |
| | High temperature & high humidity test | Ta=60°C, RH=90% non condensing ※1 | 240hr | 0/3 |
| | High temperature operation | Tp=70°C | 240hr | 0/3 |
| | Low temperature operation | Tp=-20°C | 240hr | 0/3 |
| | High temp & humid operation | Tp=40°C, RH=90% non condensing ※1 | 240hr | 0/3 |
| | Thermal shock storage | -30°C→80°C(30min/30min) | 100 cycles | 0/3 |
| Mechanical environmental test | Electrostatic discharge test (Non operation) | Confirms to EIAJ ED-4701/300 C=200pF, R=0Ω, V=±200V 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 Each 5 times of discharge in both polarities on the center of screen with the case grounded. | | 0/3 |
| | Vibration test | Total amplitude 1.5mm, f=10 ~55Hz, X,Y,Z directions for each 2 hours | | 0/3 |
| | Impact test | Use ORTUS TECHNOLOGY original jig (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 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. 1 time to each 6 surfaces, 3 edges, 1 corner | | 0/1 Packing |

Note: Ta=ambient temperature Tp=Panel temperature

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

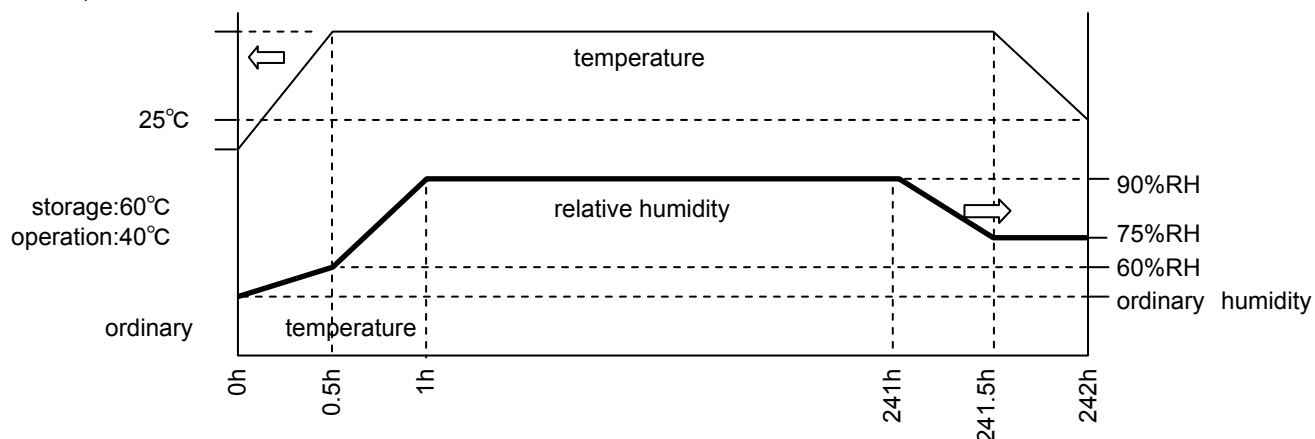
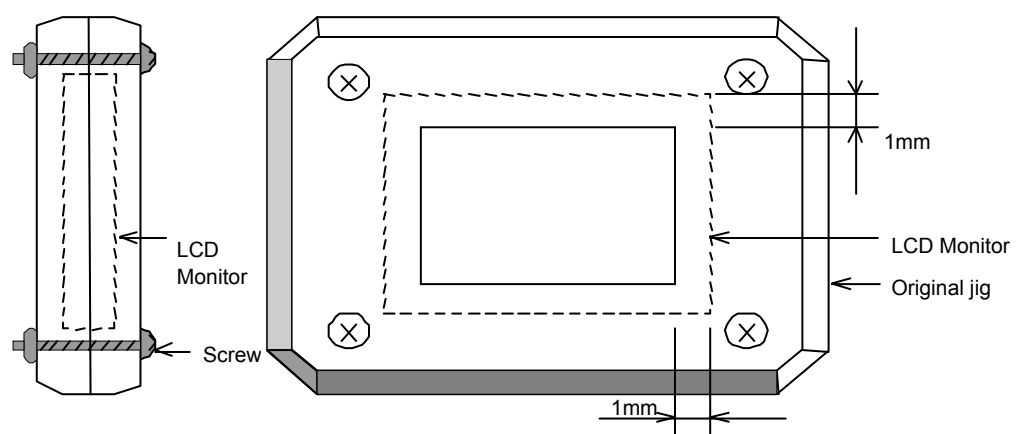


Table2.Reliability Criteria

Measure the parameters after leaving the monitor at the ordinary temperature
for 24 hours or more after the test completion.

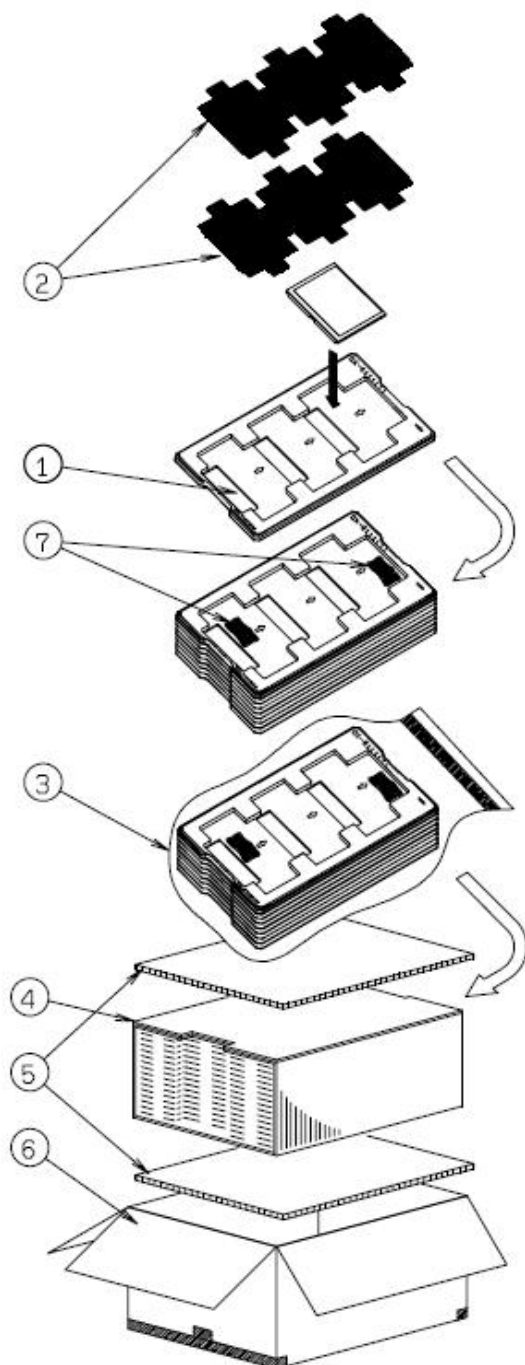
| item | Standard | Remarks |
|-----------------|---------------------------------------|---|
| Display quality | No visible abnormality shall be seen. | As criteria of 11"CRITERIA OF JUDGMENT". |
| Contrast ratio | 40 or more | |

ORTUS TECHNOLOGY Original Jig

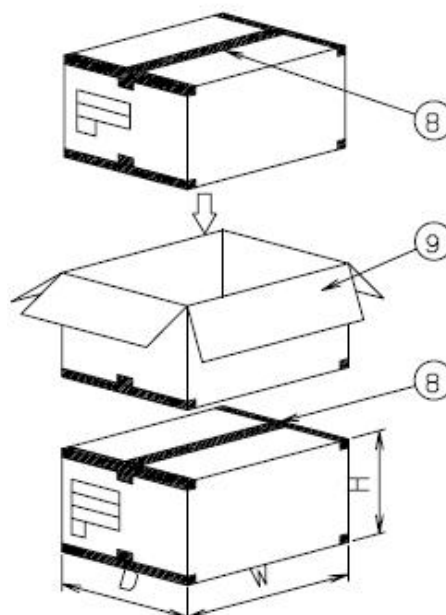


13. PACKING SPECIFICATIONS

(S=FREE)



- Step 1 Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward.(3products per tray)
Antistatic foam sheet is to be placed on the products in the tray.
- Step 2 Each tray needs to be same orientation respect to the tray below or above it and the trays be in a stack of 7.
One empty tray is to be put on the top of stack of 7 trays.
- Step 3 2 packs of moisture absorbers are to be placed on the top tray as shown in the drawing.
Put piled trays into a sealing bag.
Vacuum and seal the sealing bag with the vacuum sealing machine.
- Step 4 The stack of trays in the plastic back is to be inserted into a inner carton.
- Step 5 A corrugated board is to be placed on the top and on the bottom of the inner carton.
The two corrugated boards and the inner carton is to be inserted into an outer carton.
- Step 6 The 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 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.
The extra outer carton needs to sealed with packing tape as shown in the drawing.
- Step 8 The model number, quantity of products, and shipping date are to be printed on the extra outer carton.
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 | PP |
| ② Antistatic foam sheet | |
| ③ Sealing bag | |
| ④ Inner carton | Corrugated cardboard |
| ⑤ Inner board | Corrugated cardboard |
| ⑥ Outer carton | Corrugated cardboard |
| ⑦ Drier | Moisture absorber |
| ⑧ Packing tape | |
| ⑨ Extra outer carton | Corrugated cardboard |

| Dimension of extra outer carton | |
|--|--------------|
| D : Approx. | (338mm) |
| W : Approx. | (549mm) |
| H : Approx. | (198mm) |
| Quantity of products packed in one carton: | 3pcsx7=21pcs |
| Gross weight : Approx. | 6.6Kg |

14. HANDLING INSTRUCTION

14.1 Cautions for Handling LCD panels

**Caution**

- (1) Do not make an impact on the LCD panel glass because it may break and you may get injured from it.
- (2) If the glass breaks, do not touch it with bare hands.
(Fragment of broken glass may stick you or you cut yourself on it.)
- (3) If you get injured, receive adequate first aid and consult a medical doctor.
- (4) Do not let liquid crystal get into your mouth.
(If the LCD panel glass breaks, try not let liquid crystal get into your mouth even toxic property of liquid crystal has not been confirmed.)
- (5) If liquid crystal adheres, rinse it out thoroughly.
(If liquid crystal adheres to your cloth or skin, wipe it off with rubbing alcohol or wash it thoroughly with soap. If liquid crystal gets into eyes, rinse it with clean water for at least 15 minutes and consult an eye doctor.)
- (6) If you scrap this products, follow a disposal standard of industrial waste that is legally valid in the community, country or territory where you reside.
- (7) Do not connect or disconnect this product while its application products is powered on.
- (8) Do not attempt to disassemble or modify this product as it is precision component.
- (9) For protection your circuit, we recommend you to add excess current protection circuit to power supply.

**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 polarizer 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,
Properly set up equipment, jigs and machines, and keep working area clean and tidy for handling the TFT monitors.
- 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 connector .
Otherwise, it may cause poor contact or deteriorate reliability of the connector.
- 7) 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.
- 8) The volume attached to the monitor is set to the optimal value at the time of shipment from our factory, so please do not change it.

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 connector while power supply is switch on.
Plug the connector 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 3 months
- Unpacking To protect the TFT monitors from static damage during unpacking, keep room humidity more than 50%RH and implement effective countermeasures against static electricity such as establishing a ground (an earth) before unpacking.
- Maximum piling up 7 cartons

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.

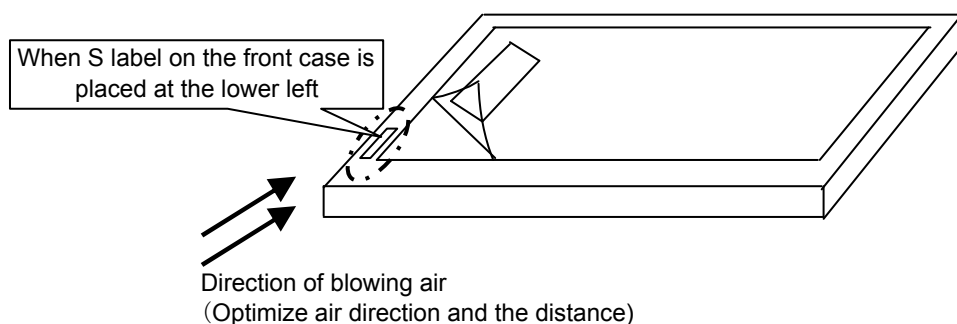
A) Work Environment

- 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. Anti-static treatment should be implemented to work area's floor.
- c) Use a room shielded against outside dust with sticky floor mat laid at the entrance to eliminate dirt.

B) Work Method

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

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



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> | LCD7200 | <p>Black display [Data]=00h White display [Data]=3Fh TON Rise time TOFF Fall time</p> |
| 2 | Contrast ratio | <p>Measure maximum luminance Y1([Data]=3Fh) and minimum luminance Y2([Data]=00h) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values. Contrast ratio = Y1/Y2 Diameter of measuring point: 8mmφ</p> | CS1000 | |
| 3 | Viewing angle Horizontalθ Verticalφ | Move the luminance meter from right to left and up and down and determine the angles where contrast ratio is 10. | EZcontrast160D | |
| 5 | White chromotically | Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = 3Fh Color matching faction: 2°view | CS1000 | |
| 6 | Burn-in | Visually check burn-in image on the screen after 2 hours of "window display" ([Data]=3Fh/00h). | | At optimized VCOMDC |
| 7 | Center brightness | Measure the brightness at the center of the screen. | CS1000 | |
| 8 | Brightness distribution | <p>(Brightness distribution) = 100 x B/A % A : max. brightness of the 9 points B : min. brightness of the 9 points</p> | CS1000 | |