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Datasheet

Ortustech

COM32H3P71ULC

OR-20-041

Specifications for
Blanview TFT-LCD Monitor
(3.2" WVGA 480 x RGB x 800 Portrait)

Version 1.0

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

MODEL COM32H3P71ULC

| |
|---------------------|
| Customer's Approval |
| Signature: |
| Name: |
| Section: |
| Title: |
| Date: |

ORTUSTECH

TOPPAN PRINTING CO.,LTD.
Electronics Division
Ortus Subdivision

Approved by

_____ *S. Epuohi*

Checked by

_____ *T. Matsumaki*

Prepared by

_____ *M. Tojo*

Version History

| Ver. | Date | Page | Description |
|------|-------------|---|--|
| 0.0 | Dec.21,2020 | - | - Tentative issue |
| 1.0 | May.14,2021 | - | - First issue |
| △ ×6 | | P.7 | 3.1 Dimensions |
| | | Add | Specifications |
| | | P.35 | 14.1 Optical Characteristics |
| | | Add | White Chromaticity Range |
| | | Add | 14.2 Temperature Characteristics |
| | | P.38 | Specification |
| | | Add | 16. Reliability Test |
| P.40 | Add | Applied voltage (Surface discharge test) | |
| | Add | number of failures / number of examinations | |
| P.44 | Add | 17. Packing Specifications | |
| | Add | Packing Specifications | |
| | | | 18.5 Precautions for Peeling off the Protective film |
| | | | Work Method |

1. Application

This Specification is applicable to 80.5mm (3.2 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 a mechanical design manner, especial attention in housing design to prevent arcuation/flexure or 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

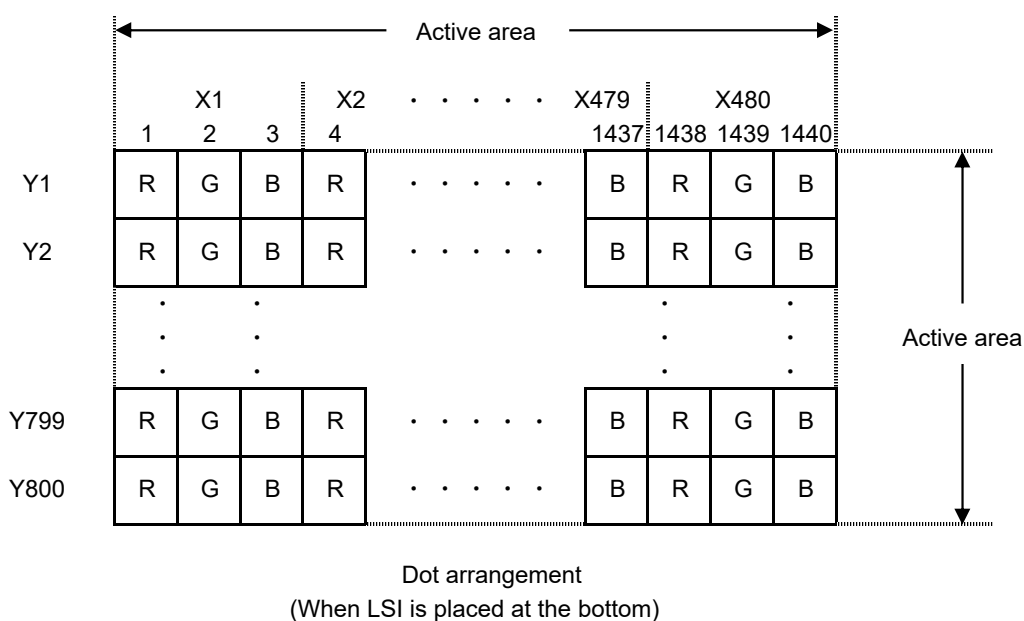
2.1 Features of the Product

- 3.2 inch diagonal display, 1,440 [H] x 800 [V] dots.
- 8-bit 16,777,216 color display capability.
- System Interface (Register setting)
- Serial Peripheral Interface (SPI)
- RGB interface with 24-bit data bus (VSYNC, HSYNC, ENABLE, DOTCLK, D23-0)
- Internal booster for various voltage levels to drive LC

| | 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 |

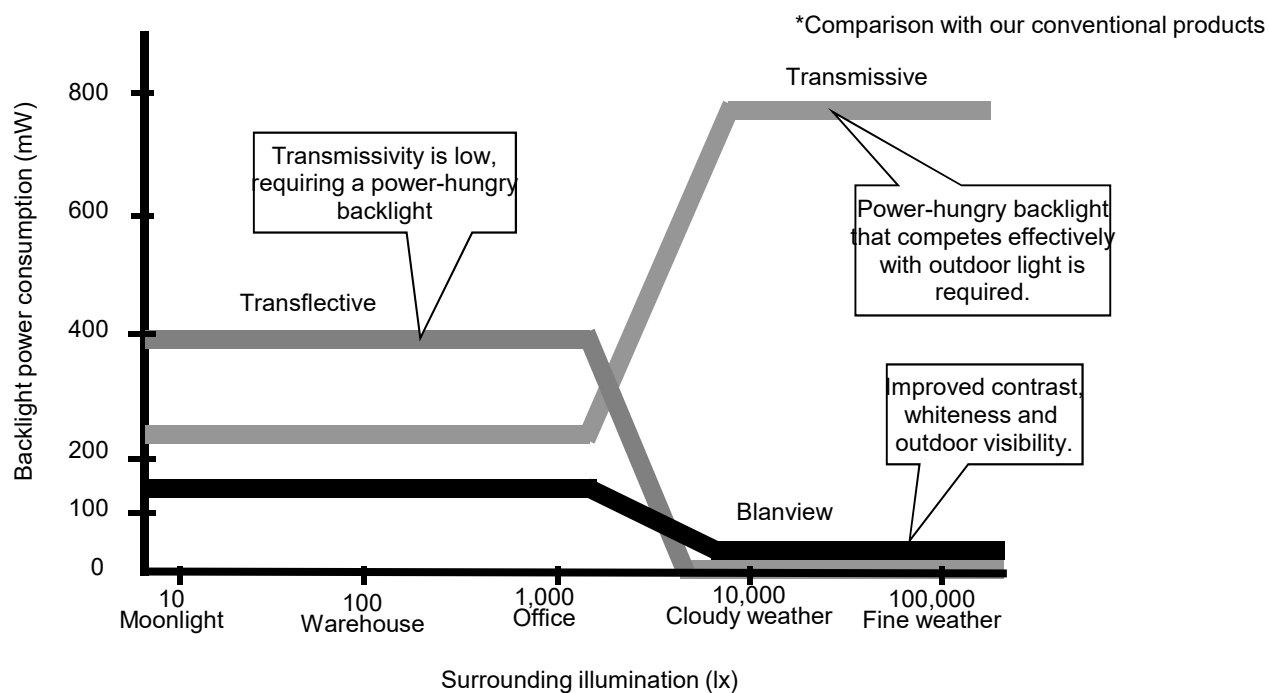
2.2 Display Method

| Items | Specifications | Remarks |
|---------------------|---|----------------------------|
| Display type | 16,777,216 colors. Blanview, Normally Black | |
| Driving method | a-Si TFT Active matrix Line-scanning, Non-interlace | |
| Dot arrangement | RGB stripe arrangement | Refer to "Dot arrangement" |
| Signal input method | Register : Serial Peripheral Interface (SPI) Data : 24 bit RGB interface | |
| Backlight type | Long life & High bright white LED. | |
| NTSC ratio | 35% | |



<Features of Blanview>

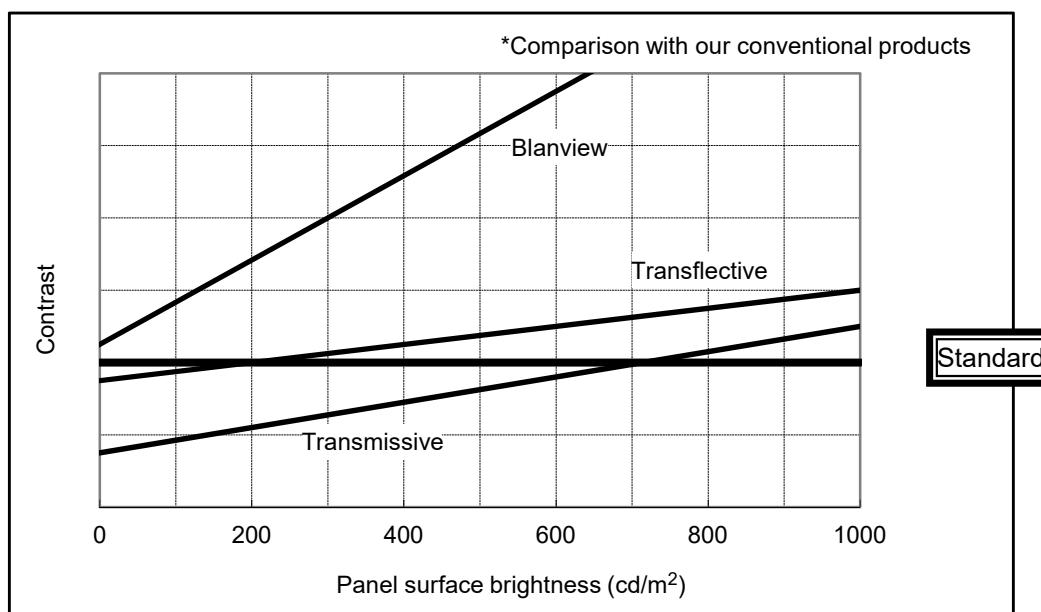
- Backlight power consumption required to assure visibility. (equivalent to 3.5"QVGA)



- 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

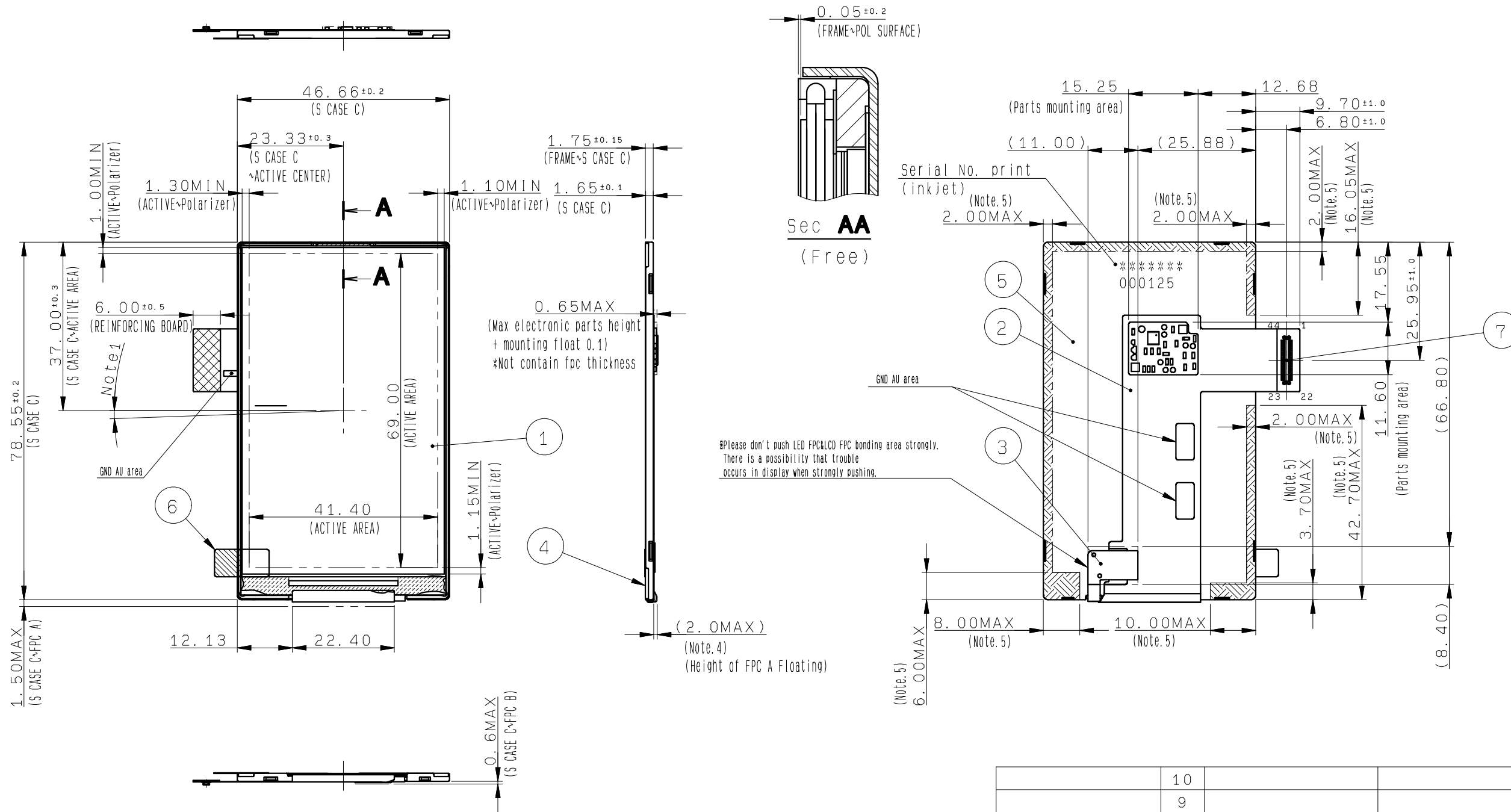
A 3.1 Dimensions

| Items | Specifications | Unit | Remarks |
|-----------------------------------|-------------------------------|------|------------------------------------|
| Outline dimensions | 46.66[H] × 78.55[V] × 1.75[D] | mm | Exclude FPC cable and parts on FPC |
| Active area | 41.40[H] × 69.00[V] | mm | 80.5mm diagonal |
| Number of dots | 1440[H] × 800[V] | dot | |
| Dot pitch | 28.75[H] × 86.25[V] | μm | |
| Surface hardness of the polarizer | 3 | H | Load: 2.0 N |
| Weight | 14.7 | g | Include FPC cable |

3.2 Outward Form

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

(8/47)
20TLM052
Issue: May.14,2021



- Note 1. Angular deviation of LCD cell from the TFT-LCD monitor's reference axis shall be less than [±40°].
- Note 2. 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 3. In order to realize thin module structure, double-sided adhesive tapes are used to fix LCD panels. As these tapes do not guarantee to permanently fix the panels, LCD panel may rize from the module when shipped from factory. So please make sure to design the system to hold the edges of LCD panel by the soft material such as sponge when LCD module is assembled into the cabinet.
- Note 4. In order to realize thin module structure, double-sided adhesive tapes are used to fix FPC at S CASE C. As these tapes do not guarantee to permanently fix the FPC near the bending area, FPC may rize from the module when shipped from factory.
- Note 5. In case TFT-LCD monitor is fixed to the case of your product, it's recommended that monitor is fixed in to area.
- Note 6. Recommended FPC connector. For FPC A: Panasonic AXE544127

| | 10 | | | |
|---------------|------|-----------|--------------|---------------------------|
| | 9 | | | |
| | 8 | | | |
| CONNECTOR | 7 | | AXE644124 | Panasonic |
| R TAPE | 6 | | | |
| S CASE C | 5 | | | SUS (t=0.2) |
| FRAME | 4 | | | PC |
| FPC B | 3 | | | Use of LED |
| FPC A | 2 | | | Use of LCD |
| TFT-LCD PANEL | 1 | | | Glass thickness=0.2t±0.2t |
| PART NAME | ITEM | PART CODE | MODEL NUMBER | REMARK |

| | | | | |
|-------------|------------------------|---------------------|-------------------|--|
| APPROVED 尾木 | GENERAL TOLERANCE ±0.5 | SCALE 1/1 | UNIT mm | TOPPAN TOPPAN PRINTING CO., LTD. DO NOT DUPLICATE, CONFIDENTIAL AND PROPRIETARY |
| CHECKED 加藤 | ISSUE (Y:M:D) 21:04:20 | MODEL COM32H3P71U** | | |
| CHECKED | NAME | | DRAWING No. | |
| DESIGN 梅野聖也 | | | REV. SHEET DIV. | |
| DRAW 梅野聖也 | | OUTLINE-D3P71 | RJD601633D301 # / | 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 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 | 32AKC (Made in Japan) 32ALC (Made in Malaysia) | | |
| d | Serial number | | | |

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

•Made in Japan

1E32AKC000125

means "manufactured in May 2021, 3.2" AK type, C specifications, serial number 000125"

•Made in Malaysia

1E32ALC000125

means "manufactured in May 2021, 3.2" AL type, C specifications, serial number 000125"

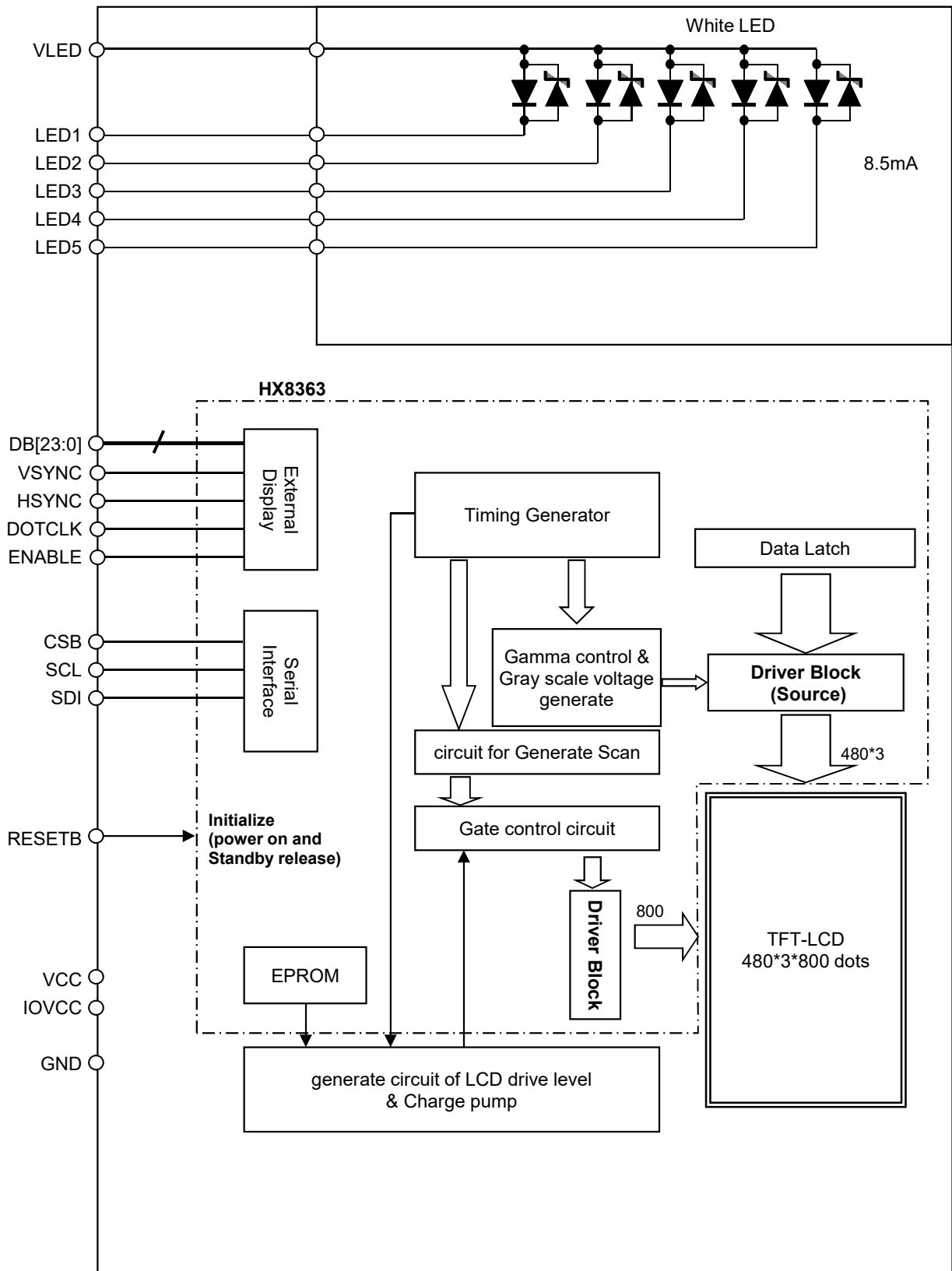
2) Location of Serial № print (S-print)

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. Block Diagram



5.FPC Terminals

| № | Symbol | Details | Remark | IO |
|----|--------|--------------------------------|---|----|
| 1 | LED5 | Backlight LED Cathode5 | | P |
| 2 | LED4 | Backlight LED Cathode4 | | P |
| 3 | LED3 | Backlight LED Cathode3 | | P |
| 4 | LED2 | Backlight LED Cathode2 | | P |
| 5 | LED1 | Backlight LED Cathode1 | | P |
| 6 | VLED | Power supply for Backlight LED | | P |
| 7 | VLED | Power supply for Backlight LED | | P |
| 8 | DB7 | B_Data | MSB | I |
| 9 | DB6 | | | I |
| 10 | DB5 | | | I |
| 11 | DB4 | | | I |
| 12 | DB3 | | | I |
| 13 | DB2 | | | I |
| 14 | DB1 | | | I |
| 15 | DB0 | | LSB | I |
| 16 | DB15 | G_Data | MSB | I |
| 17 | DB14 | | | I |
| 18 | DB13 | | | I |
| 19 | DB12 | | | I |
| 20 | DB11 | | | I |
| 21 | DB10 | | | I |
| 22 | DB9 | | | I |
| 23 | DB8 | | LSB | I |
| 24 | DB23 | R_Data | MSB | I |
| 25 | DB22 | | | I |
| 26 | DB21 | | | I |
| 27 | DB20 | | | I |
| 28 | DB19 | | | I |
| 29 | DB18 | | | I |
| 30 | DB17 | | | I |
| 31 | DB16 | | LSB | I |
| 32 | GND | GROUND | | P |
| 33 | HSYNC | HSYNC | | I |
| 34 | VSYNC | VSYNC | | I |
| 35 | RESETB | LCD Reset | L:Initialize Power_ON Reset is Required when Turning on the Power | I |
| 36 | DOTCLK | DOTCLK | | I |
| 37 | CSB | 3-Wire SPI Chip Select | | I |
| 38 | SCL | 3-Wire SPI clock | | I |
| 39 | SDI | 3-Wire SPI DATA input | | I |
| 40 | ENABLE | ENABLE | | I |
| 41 | IOVCC | Power | | P |
| 42 | VCC | Power | | P |
| 43 | VCC | Power | | P |
| 44 | GND | GROUND | | P |

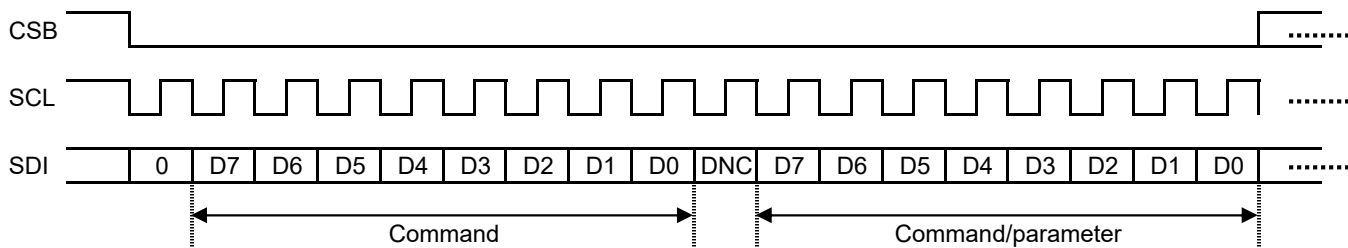
- Recommended connector: Panasonic corporation : AXE544127
- Please make sure to check a consistency between pin assignment in "3.2 Outward Form" and your connector pin assignment when designing your circuit.
Inconsistency in input signal assignment may cause a malfunction.
- Since FPC cable has gold plated terminals, gilt finish contact shoe connector is recommended.

6. Serial Data Transfer Interface

Instructions are transferred using 3 wire serial data transfer interface. The 3 wire serial bus uses chip select line (CSB), serial input data (SDI) and serial transfer clock line (SCL).

The 3 wire serial data packet is consists of control bit DNC and transmission byte. If the control bit is low, the transmission byte is command byte. If the control bit is high, the transmission byte is stored to command register. DNC should be transferred first , followed by MSB of transmission byte.

The serial interface is initialized when CSB is high, and the falling edge of CSB enables the serial interface.



7. Instruction list

(1)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-------|----------------------|-----|---------|----|----|----|----|----|----|----|
| 00 | NOP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 01 | SWRESET | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 06 | RDRED | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 07 | RDGREEN | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 08 | RDBLUE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 0A | RDDPM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 0B | RDDMADCTL | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 0C | RDDCOLMOD | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 0D | RDDIM | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 0E | RDDSM | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 0F | RDDSDR | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 10 | SLPIN | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 11 | SLPOUT | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 20 | INVOFF | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 21 | INVON | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 26 | GAMSET | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| | initial recommend | 1 | GC[7:0] | | | | | | | |
| 28 | DISPOFF | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | initial recommend | - | - | - | - | - | - | - | - | - |
| 29 | DISPON | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| | initial recommend | - | - | - | - | - | - | - | - | - |

(3)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
|-----------|-------------|------------|------------|----|----|----|---------|----|----|----|--------|
| B4 | SETRGBIF | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | |
| | | 1 | - | - | - | - | NW[1:0] | | - | - | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 1 | SON[7:0] | | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| | 1 | SOFF[7:0] | | | | | | | | | |
| | initial | - | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | |
| | 1 | EQS[7:0] | | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | |
| | 1 | EQON[7:0] | | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | 1 | GDON[7:0] | | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | 1 | GDOFF[7:0] | | | | | | | | | |
| initial | - | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | |
| recommend | - | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | | |
| 1 | GVSSP1[7:0] | | | | | | | | | | |
| initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | | |
| recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| 1 | GVSSP2[7:0] | | | | | | | | | | |
| initial | - | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | | |
| recommend | - | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | | |
| B9 | SETRGBIF | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | |
| | | 1 | EXTC1[7:0] | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | 1 | EXTC2[7:0] | | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | recommend | - | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | |
| | 1 | EXTC3[7:0] | | | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | recommend | - | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | |
| | C1 | SETDGLUT | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | | 1 | - | - | - | - | - | - | - | DGC_EN |
| initial | | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| 1 | | D1[7:0] | | | | | | | | | |
| initial | | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | | - | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | |
| 1 | | D2[7:0] | | | | | | | | | |
| initial | | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| recommend | | - | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | |
| 1 | | D3[7:0] | | | | | | | | | |
| initial | | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | | |
| 1 | D4[7:0] | | | | | | | | | | |
| initial | - | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | | |
| recommend | - | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | | |

(4)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----------|-----------|----------|----------|----|----|----|----|----|----|----|
| C1 | SETDGCLUT | 1 | D5[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| | | 1 | D6[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| | | 1 | D7[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 |
| | | 1 | D8[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| | | 1 | D9[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | | 1 | D10[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| | | 1 | D11[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| | | 1 | D12[7:0] | | | | | | | |
| initial | - | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | |
| | 1 | D13[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | |
| | 1 | D14[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | 1 | D15[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | |
| | 1 | D16[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| | 1 | D17[7:0] | | | | | | | | |
| initial | - | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | |
| | 1 | D18[7:0] | | | | | | | | |
| initial | - | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | |
| recommend | - | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | |
| | 1 | D19[7:0] | | | | | | | | |
| initial | - | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | |
| recommend | - | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | |
| | 1 | D20[7:0] | | | | | | | | |
| initial | - | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | |
| recommend | - | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | |
| | 1 | D21[7:0] | | | | | | | | |
| initial | - | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | 1 | D22[7:0] | | | | | | | | |
| initial | - | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | |

SETDGCLUT continues to the next page.

(5)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-------|-----------|-----|----------|----|----|----|----|----|----|----|
| C1 | SETDGCLUT | 1 | D23[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | 1 | D24[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| | | 1 | D25[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |
| | | 1 | D26[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| | | 1 | D27[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | 1 | D28[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| | | 1 | D29[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |
| | | 1 | D30[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| | | 1 | D31[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | | 1 | D32[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | | 1 | D33[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D34[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | D35[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | D36[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D37[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D38[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| | | 1 | D39[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| | | 1 | D40[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |

SETDGCLUT continues to the next page.

(6)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----------|-----------|----------|----------|----|----|----|----|----|----|----|
| C1 | SETDGCLUT | 1 | D41[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D42[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D43[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D44[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 |
| | | 1 | D45[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | 1 | D46[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | 1 | D47[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | D48[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| | | 1 | D49[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| | | 1 | D50[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | | 1 | D51[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1 | D52[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| recommend | - | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | |
| | 1 | D53[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | |
| | 1 | D54[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | |
| | 1 | D55[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| | 1 | D56[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | |
| | 1 | D57[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | |
| | 1 | D58[7:0] | | | | | | | | |
| initial | - | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | |
| recommend | - | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | |

SETDGCLUT continues to the next page.

(7)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-------|-----------|-----|----------|----|----|----|----|----|----|----|
| C1 | SETDGCLUT | 1 | D59[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| | | 1 | D60[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | | 1 | D61[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | | 1 | D62[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D63[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| | | 1 | D64[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| | | 1 | D65[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| | | 1 | D66[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| | | 1 | D67[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| | | 1 | D68[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | | 1 | D69[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| | | 1 | D70[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| | | 1 | D71[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | 1 | D72[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| | | 1 | D73[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| | | 1 | D74[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | | 1 | D75[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D76[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

SETDGCLUT continues to the next page.

(8)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-------|-----------|-----|----------|----|----|----|----|----|----|----|
| C1 | SETDGCLUT | 1 | D77[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | D78[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D79[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D80[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | | 1 | D81[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| | | 1 | D82[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | | 1 | D83[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D84[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D85[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D86[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| | | 1 | D87[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| | | 1 | D88[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| | | 1 | D89[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| | | 1 | D90[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| | | 1 | D91[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| | | 1 | D92[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| | | 1 | D93[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D94[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |

SETDGCLUT continues to the next page.

(9)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-------|-----------|-----|-----------|----|----|----|----|----|----|----|
| C1 | SETDGCLUT | 1 | D95[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D96[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | 1 | D97[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 |
| | | 1 | D98[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 |
| | | 1 | D99[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | 1 | D100[7:0] | | | | | | | |
| | initial | - | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | 1 | D101[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | | 1 | D102[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| | | 1 | D103[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| | | 1 | D104[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| | | 1 | D105[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D106[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |
| | | 1 | D107[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D108[7:0] | | | | | | | |
| | initial | - | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D109[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |
| | | 1 | D110[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D111[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | | 1 | D112[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |

SETDGCLUT continues to the next page.

(10)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-----------|-----------|-----------|-----------|----|----|----------|----------|----------|-----------|-----------|
| C1 | SETDGCLUT | 1 | D113[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| | | 1 | D114[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 |
| | | 1 | D115[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| | | 1 | D116[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | | 1 | D117[7:0] | | | | | | | |
| | initial | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | D118[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | D119[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | | 1 | D120[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D121[7:0] | | | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | D122[7:0] | | | | | | | |
| initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | 1 | D123[7:0] | | | | | | | | |
| initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | 1 | D124[7:0] | | | | | | | | |
| initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | |
| | 1 | D125[7:0] | | | | | | | | |
| initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| | 1 | D126[7:0] | | | | | | | | |
| initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| CC | SETDGCLUT | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| | | 1 | - | - | - | SM_PANEL | SS_PANEL | GS_PANEL | REV_PANEL | BGR_PANEL |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |

(11)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | |
|-------|--------------------|-----|---------------|------------|--------------|--------------|----|----|--------------|----|--|
| E0 | SET SIP READ INDEX | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | |
| | | 1 | - | - | - | G1_VRP0[5:0] | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | |
| | recommend | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | | 1 | G1_CGMP0[1:0] | | G1_VRP1[5:0] | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| | recommend | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |
| | | 1 | G1_CGMP1[1:0] | | G1_VRP2[5:0] | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | recommend | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | |
| | | 1 | G1_CGMP2[1:0] | | G1_VRP3[5:0] | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | |
| | recommend | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | |
| | | 1 | G1_CGMP3[1:0] | | G1_VRP4[5:0] | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | |
| | recommend | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | |
| | | 1 | G1_CGMP5 | G1_CGMP4 | G1_VRP5[5:0] | | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | |
| | recommend | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | |
| | | 1 | - | G1_PRP0[6] | - | G1_PKP0[4:0] | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | |
| | recommend | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | |
| | | 1 | G1_PRP0[5:4] | | - | G1_PKP1[4:0] | | | | | |
| | initial | - | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | |
| | recommend | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | |
| | | 1 | G1_PRP0[3:2] | | - | G1_PKP2[4:0] | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| | recommend | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | |
| | | 1 | G1_PRP0[1:0] | | - | G1_PKP3[4:0] | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | recommend | - | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | | 1 | - | G1_PRP1[6] | - | G1_PKP4[4:0] | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | | 1 | G1_PRP1[5:4] | | - | G1_PKP5[4:0] | | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | |
| | recommend | - | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | | 1 | G1_PRP1[3:2] | | - | G1_PKP6[4:0] | | | | | |
| | initial | - | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | |
| | | 1 | G1_PRP1[1:0] | | - | G1_PKP7[4:0] | | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | |
| | recommend | - | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | |
| | | 1 | - | | | | | | G1_PKP8[4:0] | | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| | | 1 | - | | | | | | G1_VRN0[5:0] | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | |
| | recommend | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | |
| | | 1 | G1_CGMN0[1:0] | | G1_VRN1[5:0] | | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | |
| | recommend | - | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | |

SET SPI READ INDEX continues to the next page.

(12)

| (Hex) | Register | DNC | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|-------|--------------------|-----|----------------|------------|--------------|--------------|----|----|----|----|
| | | 1 | G1_CGMN1[1:0] | | G1_VRN2[5:0] | | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 |
| | recommend | - | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 |
| | | 1 | G1_CGMN2[1:0] | | G1_VRN3[5:0] | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| | | 1 | G1_CGMN3[1:0] | | G1_VRN4[5:0] | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| | recommend | - | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | G1_CGMN5 | G1_CGMN4 | G1_VRN5[5:0] | | | | | |
| | initial | - | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| | recommend | - | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | | 1 | - | G1_PRN0[6] | - | G1_PKN0[4:0] | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | recommend | - | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| | | 1 | G1_PRN0[5:4] | | - | G1_PKN1[4:0] | | | | |
| | initial | - | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 |
| | recommend | - | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
| | | 1 | G1_PRN0[3:2] | | - | G1_PKN2[4:0] | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | recommend | - | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| | | 1 | G1_PRN0[1:0] | | - | G1_PKN3[4:0] | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| | recommend | - | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| | | 1 | - | G1_PRN1[6] | - | G1_PKN4[4:0] | | | | |
| | initial | - | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| | | 1 | G1_PRN1[5:4] | | - | G1_PKN5[4:0] | | | | |
| | initial | - | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| | recommend | - | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | | 1 | G1_PRN1[3:2] | | - | G1_PKN6[4:0] | | | | |
| | initial | - | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| | recommend | - | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| | | 1 | G1_PRN1[1:0] | | - | G1_PKN7[4:0] | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | recommend | - | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
| | | 1 | - | - | - | G1_PKN8[4:0] | | | | |
| | initial | - | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| | recommend | - | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| FE | SET SPI READ INDEX | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | | 1 | CMD_ADD[7:0] | | | | | | | |
| | initial | - | - | - | - | - | - | - | - | - |
| | recommend | - | - | - | - | - | - | - | - | - |
| FF | SPIREAD | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | 1 | CMD_DATA1[7:0] | | | | | | | |
| | initial | - | - | - | - | - | - | - | - | - |
| | recommend | - | - | - | - | - | - | - | - | - |
| | | 1 | ... | | | | | | | |
| | initial | - | - | - | - | - | - | - | - | - |
| | recommend | - | - | - | - | - | - | - | - | - |
| | | 1 | CMD_DATAN[7:0] | | | | | | | |
| | initial | - | - | - | - | - | - | - | - | - |
| | recommend | - | - | - | - | - | - | - | - | - |

8. Sequence

Power on sequence

| No | | Function | DNC | Command/Parameter |
|----|------------------------------------|------------------------------------|-----|-------------------|
| | | RESETB=0 | | |
| | Wait | wait 1 msec or more | | |
| | Power on | IOVCC, VCC on | | |
| | Wait | wait 10 msec or more | | |
| | | RESETB=1 | | |
| | Wait | wait 10 msec or more | | |
| | RGB signals | RGB signals start | | |
| | Wait | wait 2 frames or more | | |
| 1 | Enable extended commands | Enable extended commands | 0 | B9h |
| | | Parameter 1 | 1 | FFh |
| | | Parameter 2 | 1 | 83h |
| | | Parameter 3 | 1 | 63h |
| 2 | Set power | Set power | 0 | B1h |
| | | Parameter 1 | 1 | 81h |
| | | Parameter 2 | 1 | 24h |
| | | Parameter 3 | 1 | 04h |
| | | Parameter 4 | 1 | 02h |
| | | Parameter 5 | 1 | 02h |
| | | Parameter 6 | 1 | 03h |
| | | Parameter 7 | 1 | 10h |
| | | Parameter 8 | 1 | 10h |
| | | Parameter 9 | 1 | 34h |
| | | Parameter 10 | 1 | 3Ch |
| | | Parameter 11 | 1 | 3Fh |
| | | Parameter 12 | 1 | 3Fh |
| 3 | Sleep out | Sleep out | 0 | 11h |
| | Wait | wait 5 msec or more | | |
| 4 | Display inversion off | Display inversion off | 0 | 20h |
| 5 | Memory access control | Memory access control | 0 | 36h |
| | | Parameter 1 | 1 | 00h |
| 6 | Interface pixel format | Interface pixel format | 0 | 3Ah |
| | | Parameter 1 | 1 | 70h |
| | Wait | wait 120 msec or more | | |
| 7 | Set power | Set power | 0 | B1h |
| | | Parameter 1 | 1 | 78h |
| | | Parameter 2 | 1 | 24h |
| | | Parameter 3 | 1 | 04h |
| | | Parameter 4 | 1 | 02h |
| | | Parameter 5 | 1 | 02h |
| | | Parameter 6 | 1 | 03h |
| | | Parameter 7 | 1 | 10h |
| | | Parameter 8 | 1 | 10h |
| | | Parameter 9 | 1 | 34h |
| | | Parameter 10 | 1 | 3Ch |
| | | Parameter 11 | 1 | 3Fh |
| | | Parameter 12 | 1 | 3Fh |
| 8 | Set RGB interface related register | Set RGB interface related register | 0 | B3h |
| | | Parameter 1 | 1 | 01h |
| 9 | Set display waveform cycle | Set display waveform cycle | 0 | B4h |
| | | Parameter 1 | 1 | 00h |
| | | Parameter 2 | 1 | 08h |
| | | Parameter 3 | 1 | 56h |
| | | Parameter 4 | 1 | 07h |
| | | Parameter 5 | 1 | 01h |
| | | Parameter 6 | 1 | 01h |
| | | Parameter 7 | 1 | 4Dh |
| | | Parameter 8 | 1 | 01h |
| | | Parameter 9 | 1 | 42h |

| No | | Function | DNC | Command/Parameter |
|----|---------------------------------|---------------------------------|-----|-------------------|
| 10 | Set panel | Set panel | 0 | CCh |
| | | Parameter 1 | 1 | 0Bh |
| 11 | Set gamma curve related setting | Set gamma curve related setting | 0 | E0h |
| | | Parameter 1 | 1 | 01h |
| | | Parameter 2 | 1 | 48h |
| | | Parameter 3 | 1 | 4Dh |
| | | Parameter 4 | 1 | 4Eh |
| | | Parameter 5 | 1 | 58h |
| | | Parameter 6 | 1 | F6h |
| | | Parameter 7 | 1 | 0Bh |
| | | Parameter 8 | 1 | 4Eh |
| | | Parameter 9 | 1 | 12h |
| | | Parameter 10 | 1 | D5h |
| | | Parameter 11 | 1 | 15h |
| | | Parameter 12 | 1 | 95h |
| | | Parameter 13 | 1 | 55h |
| | | Parameter 14 | 1 | 8Eh |
| | | Parameter 15 | 1 | 11h |
| | | Parameter 16 | 1 | 01h |
| | | Parameter 17 | 1 | 48h |
| | | Parameter 18 | 1 | 4Dh |
| | | Parameter 19 | 1 | 55h |
| | | Parameter 20 | 1 | 5Fh |
| | | Parameter 21 | 1 | FDh |
| | | Parameter 22 | 1 | 0Ah |
| | | Parameter 23 | 1 | 4Eh |
| | | Parameter 24 | 1 | 51h |
| | | Parameter 25 | 1 | D3h |
| | | Parameter 26 | 1 | 17h |
| | | Parameter 27 | 1 | 95h |
| | | Parameter 28 | 1 | 96h |
| | | Parameter 29 | 1 | 4Eh |
| | | Parameter 30 | 1 | 11h |
| | Wait | wait 5 msec or more | | |
| 12 | Display on | Display on | 0 | 29h |

Power off sequence

| No | | Function | DNC | Command/Parameter |
|----|-------------|-----------------------|-----|-------------------|
| 1 | Display off | Display off | 0 | 28h |
| | Wait | wait 5 msec or more | | |
| 2 | Sleep in | Sleep in | 0 | 10h |
| | Wait | wait 2 frames or more | | |
| 3 | RGB signals | RGB signals stop | | |

↓
Power off

Sleep sequence

| No | | Function | DNC | Command/Parameter |
|----|-------------|-----------------------|-----|-------------------|
| 1 | Sleep in | Sleep in | 0 | 10h |
| | Wait | wait 2 frames or more | | |
| 2 | RGB signals | RGB signals stop | | |

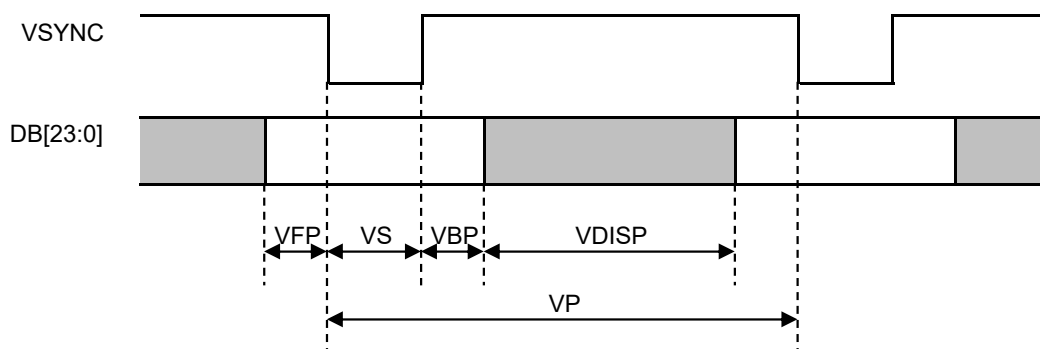
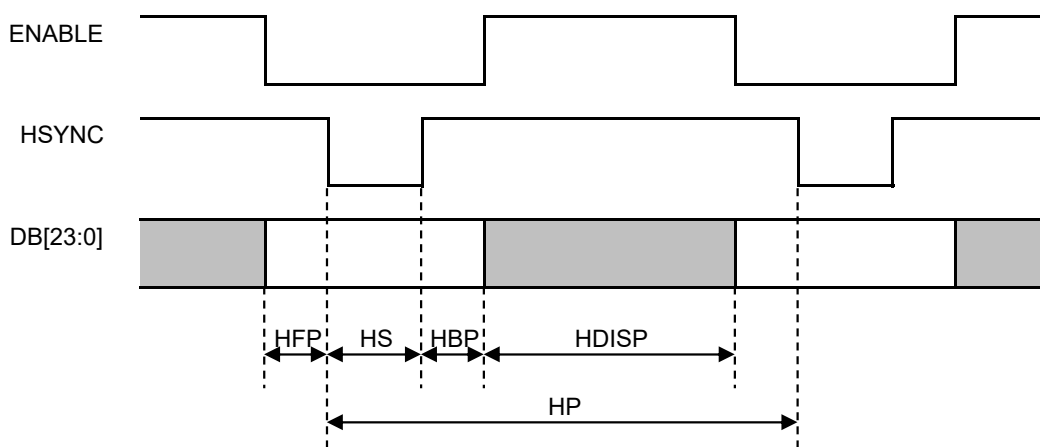
Sleep release sequence

| No | | Function | DNC | Command/Parameter |
|----|-------------|-----------------------|-----|-------------------|
| 1 | RGB signals | RGB signals start | | |
| | Wait | wait 2 frames or more | | |
| 2 | Sleep out | Sleep out | 0 | 11h |

9. RGB Interface

Recommended RGB interface timing

| Item | Symbol | Recommended | Unit |
|--------------------------|--------|-------------|--------|
| Vertical cycle | VP | 806 | Line |
| Vertical low pulse width | VS | 2 | Line |
| Vertical front porch | VFP | 2 | Line |
| Vertical back porch | VBP | 2 | Line |
| Vertical active area | VDISP | 800 | Line |
| Vertical refresh rate | VRR | 60 | Hz |
| HS cycle | HP | 508 | DOTCLK |
| HS low pulse width | HS | 10 | DOTCLK |
| Horizontal back porch | HBP | 10 | DOTCLK |
| Horizontal front porch | HFP | 8 | DOTCLK |
| Horizontal active area | HDISP | 480 | DOTCLK |
| Pixel clock frequency | DCK | 24.57 | MHz |

Vertical timingHorizontal timing

10. Absolute Maximum Rating

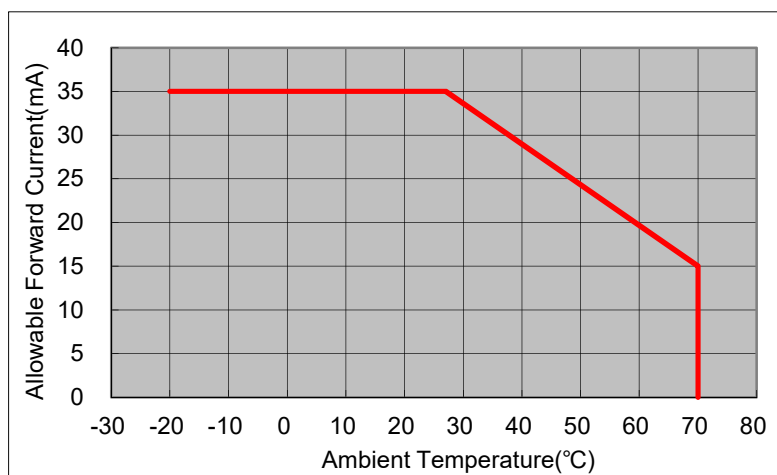
| Item | Symbol | Condition | Rating | | Unit | Terminal |
|------------------------|--------|-----------|--------|-----------|------|---|
| | | | MIN | MAX | | |
| Power supply voltage | VCC | | -0.3 | 4.6 | V | VCC |
| IO logic voltage | IOVCC | | -0.3 | 4.6 | V | IOVCC |
| Input voltage | VI | | -0.3 | IOVCC+0.3 | V | RESETB, SDI, SCL, CSB, VSYNC, HSYNC, DOTCLK, ENABLE, DB[23:0] |
| LED Forward current | IL25 | Ta=25°C | — | 35 | mA | VLED – LEDn |
| | IL70 | Ta=70°C | — | 15 | mA | |
| Storage temperature | Tstg | | -30 | +80 | °C | |

11. Recommended Operating Conditions

| Item | Symbol | Rating | | | Unit | Terminal |
|--------------------------------------|--------|--------|------|------|------|---|
| | | MIN | TYP | MAX | | |
| Supply voltage | VCC | 2.6 | 2.7 | 2.9 | V | VCC |
| IO logic voltage | IOVCC | 1.7 | 1.8 | 1.9 | V | IOVCC (VCC ≥ IOVCC) |
| Operation temperature | Top | -20 | +25 | +70 | °C | Temperature at the surface of the display |
| LED Forward current | IL25 | — | 8.5 | 35 | mA | VLED – LEDn |
| Forward current | IL70 | — | — | 15 | mA | |
| Forward voltage (Reference value) | VL | 2.57 | 2.73 | 2.86 | V | |

Note1: This monitor is operable in this temperature range. With regard to optical characteristics, refer to Item 14."Characteristics".

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



12. Electrical Characteristics

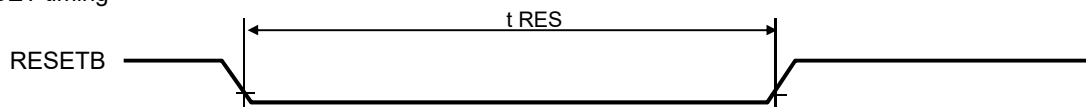
12.1 DC Characteristics

| Items | Symbol | Condition | Rating | | | Unit | Terminal |
|--------------------------|--------|---------------------------------------|-----------|------|-----------|------|---|
| | | | MIN | TYP | MAX | | |
| High level input voltage | VIH1 | | 0.7 IOVCC | | IOVCC | V | RESETB, SDI, SCL, CSB, VSYNC, HSYNC, |
| Low level input voltage | VIL1 | | 0 | | 0.3 IOVCC | V | DOTCLK, ENABLE, DB[23:0] |
| Current Consumption | ICC1 | VCC=2.7V, IOVCC=1.8V Still image * | | 12.0 | | mA | VCC |
| | ICC2 | VCC=2.7V, IOVCC=1.8V stand by | | 10 | | μA | |
| | IOICC1 | VCC=2.7V, IOVCC=1.8V Still image * | | 110 | | μA | IOVCC |
| | IOICC2 | VCC=2.7V, IOVCC=1.8V stand by | | 1 | | μA | |

* A still image (color bar) on display, when accessing to the driver by RGB interface mode.

12.2 AC Characteristics

RESET timing



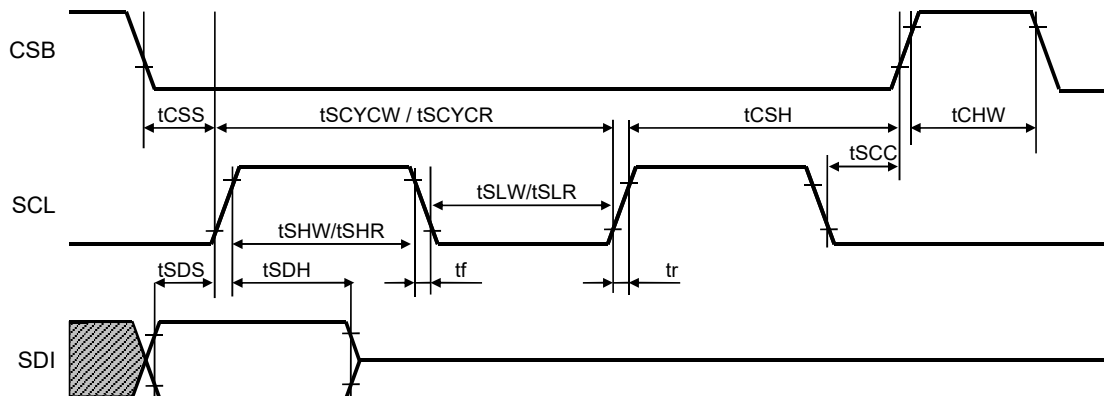
Reset low pulse width shorter than 10us do not make reset. It means undesired short pulse such as glitch, bouncing noise or electrostatic discharge do not cause irregular system reset. Please refer to the table below.

RESET timing spec

| Item | Symbol | Condition | Rating | | | Unit |
|-----------------------|--------|-----------|--------|-----|-----|------|
| | | | MIN | TYP | MAX | |
| Reset low pulse width | tRES | | 10 | - | - | μs |

| tRES Pulse | Action |
|----------------------|----------------|
| Shorter than 5μs | No reset |
| Longer than 10μs | Reset |
| Between 5μs and 10μs | Not determined |

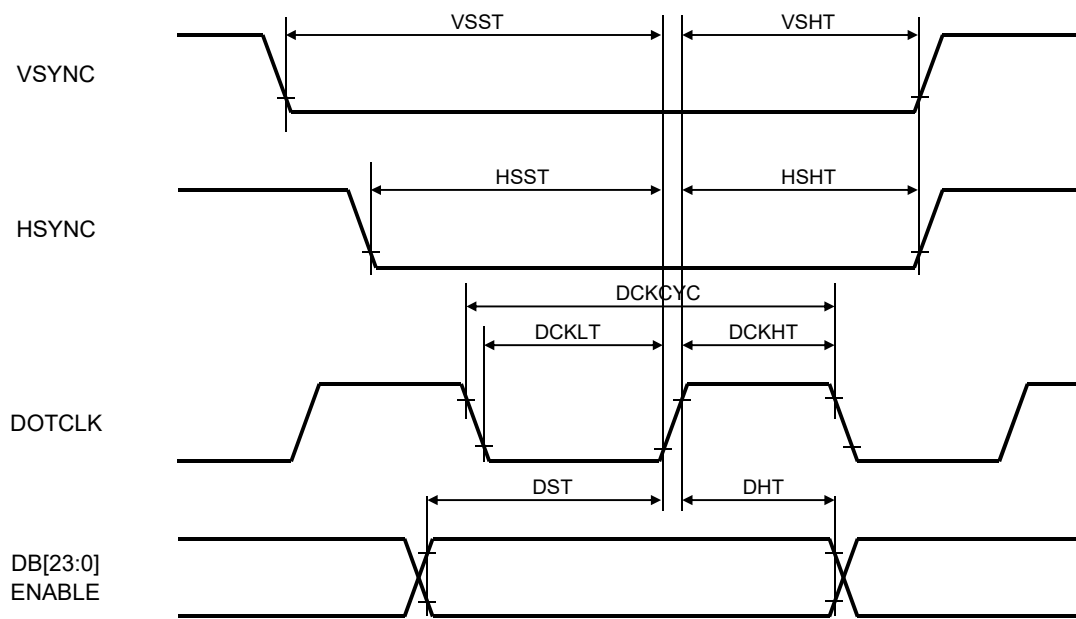
Serial Peripheral Interface(SPI)



| Item | Symbol | Condition | Rating | | | Unit |
|---------------------------|--------|-----------|--------|-----|-----|------|
| | | | MIN | TYP | MAX | |
| Serial Clock Write Cycle | tSCYCW | | 100 | | - | ns |
| Serial Clock Read Cycle | tSCYCR | | 200 | | - | ns |
| Pulse Width High at Write | tSHW | | 50 | | - | ns |
| Pulse Width High at Read | tSHR | | 100 | | - | ns |
| Pulse Width Low at Write | tSLW | | 50 | | - | ns |
| Pulse Width Low at Read | tSLR | | 100 | | - | ns |
| Time between SCL~CSB | tSCC | | 50 | | - | ns |
| CSB Setup Time at Write | tCSS | | 50 | | - | ns |
| CSB Setup Time at Read | tCSS | | 100 | | - | ns |
| CSB Hold Time at Write | tCSH | | 50 | | - | ns |
| CSB Hold Time at Read | tCSH | | 100 | | - | ns |
| CSB Pulse Width High | tCHW | | 100 | | - | ns |
| SDI Setup Time | tSDS | | 50 | | - | ns |
| SDI Hold Time | tSDH | | 50 | | - | ns |
| Rising/Falling Time | tr, tf | | - | | 10 | ns |

Remarks 1. All timing data is specified at 30 to 70% of VCCIO.

24 bit RGB interface



| Item | Symbol | Condition | Rating | | | Unit |
|------------------------------|--------|---------------------------------|--------|-----|------|------|
| | | | MIN | TYP | MAX | |
| VSYNC Setup Time | VSST | | 10 | - | - | ns |
| VSYNC Hold Time | VSHT | | 10 | - | - | ns |
| HSYNC Setup Time | HSST | | 10 | - | - | ns |
| HSYNC Hold Time | HSHT | | 10 | - | - | ns |
| DOTCLK Clock Cycle | DCKCYC | Frame Frequency= 50 to 70 Hz | 31 | - | 49.2 | ns |
| DOTCLK Low Time | DCKLT | | 10 | - | - | ns |
| DOTCLK High Time | DCKHT | | 10 | - | - | ns |
| Data Setup Time for DB[23:0] | DST | | 10 | - | - | ns |
| Data Hold Time for DB[23:0] | DHT | | 10 | - | - | ns |

Note: (1) Signal rise and fall times are equal to or less than 20 ns.

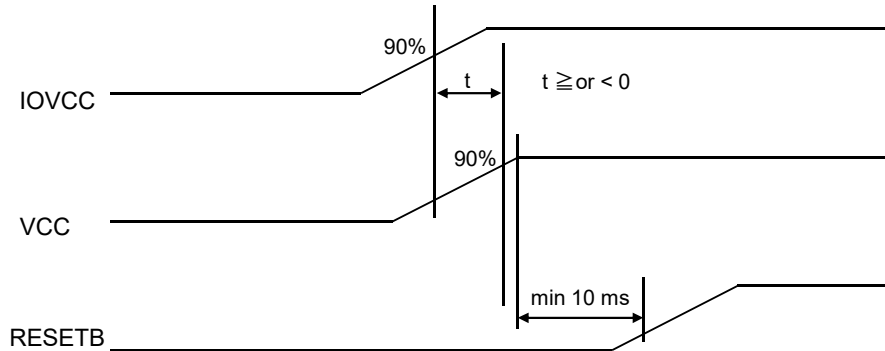
(2) Input signals are measured by $0.30 \times IOVCC$ for low state and $0.70 \times IOVCC$ for high state.

13. External Power on / off Sequence

13.1 External Power On sequence

VCC and IOVCC can be applied in any order.

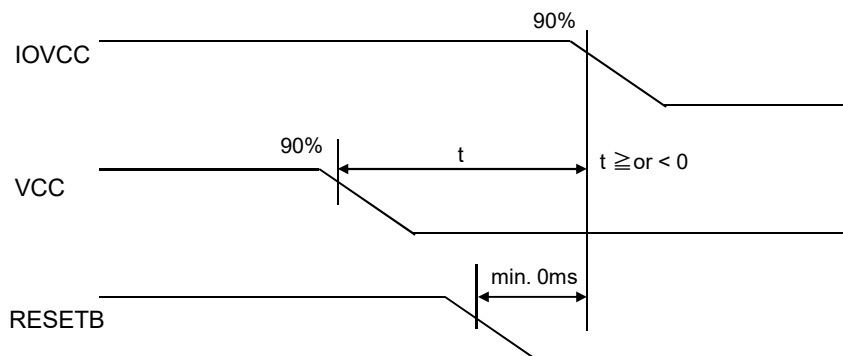
RESETB must be kept low for minimum 10 msec after both VCC and IOVCC have reached it's target voltage.



13.2 External Power Off sequence

VCC and IOVCC can be powered down in any order.

If the module is in "Sleep In" mode, IOVCC and VCC can be powered down minimum 0 msec after RESETB has been released.



14. Characteristics

14.1 Optical Characteristics

< Measurement Condition >

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

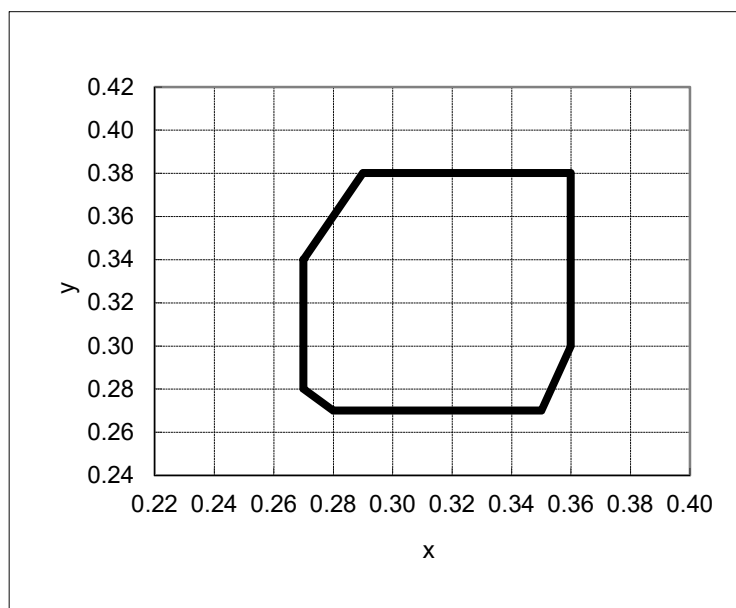
Driving condition: VCC = 2.7V, VCCIO=1.8V, Optimized VCOMDC

Backlight: IL=8.5mA

Measured temperature: Ta=25° C

| Item | | Symbol | Condition | MIN | TYP | MAX | Unit | Note No. | Remark |
|-------------------------|---------------|--------|---------------------------------|--|-----|-----|-------------------|----------|--------|
| Response time | Rise time | TON | [Data]= 00h→FFh | — | — | 40 | ms | 1 | |
| | Fall time | TOFF | [Data]= FFh→00h | — | — | 60 | ms | | |
| Contrast ratio | Backlight ON | CR | [Data]= FFh / 00h | 420 | 700 | — | | 2 | |
| | Backlight OFF | | | — | 2.4 | — | | | |
| 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 | | White chromaticity range | | | | 4 | |
| | | y | | | | | | | |
| Burn-in | | | | No noticeable burn-in image shall be observed after 2 hours of window pattern display. | | | | 5 | |
| Center brightness | | | [Data]=FFh | 240 | 380 | — | cd/m ² | 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 |
|------|------|
| 0.27 | 0.34 |
| 0.27 | 0.28 |
| 0.28 | 0.27 |
| 0.35 | 0.27 |
| 0.36 | 0.30 |
| 0.36 | 0.38 |
| 0.29 | 0.38 |



14.2 Temperature Characteristics

< Measurement Condition >

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

Driving condition: VCC = 2.7V, VCCIO=1.8V, Optimized VCOMDC

Backlight: IL=8.5mA

| Item | | | Specification | | Remark |
|-----------------|-----------|---|------------------|-----------------|--------|
| | | | Ta=-20°C | Ta=70°C | |
| Contrast ratio | CR | 200 or more | 200 or more | Backlight ON | |
| Response time | Rise time | TON | 400 msec or less | 30 msec or less | |
| | Fall time | TOFF | 600msec or less | 50 msec or less | |
| Display Quality | | No noticeable display defect or nonuniformity should be observed. | | | |

15. Criteria of Judgment

15.1 Defective Display and Screen Quality

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

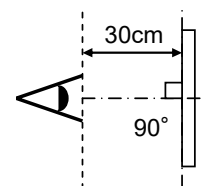
Driving Signal Raster Patter (RGB, white, black)

Signal condition [Data]:00h, 90h, FFh (3steps)

Observation distance 30 cm

Illuminance 200 to 350 lx

Backlight IL=8.5mA



| Defect item | Defect content | Criteria | |
|---|------------------|--|--|
| Display Quality | Line defect | Black, white or color line, 3 or more neighboring defective dots | |
| | 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) | |
| | | 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]=90h Invisible through 5% ND filter at [Data]=00h | |
| Screen Quality | Stain | Uneven brightness (white stain, black stain etc) | |
| | Foreign particle | Point-like | $0.25\text{mm} < \varphi$ |
| | | | $0.20\text{mm} < \varphi \leq 0.25\text{mm}$ |
| | | | $\varphi \leq 0.20\text{mm}$ |
| | Liner | $3.0\text{mm} < \text{length and } 0.08\text{mm} < \text{width}$ | |
| $\text{length} \leq 3.0\text{mm or width} \leq 0.08\text{mm}$ | | | |
| Others | | | |

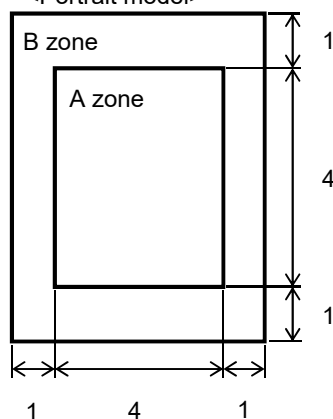
φ (mm): Average diameter = (major axis + minor axis)/2

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

<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)

15.2 Screen and Other Appearance

Testing conditions

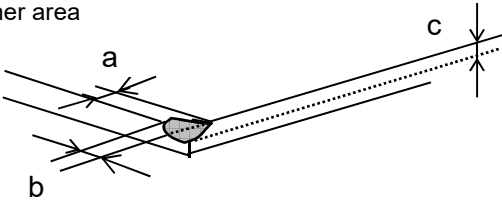
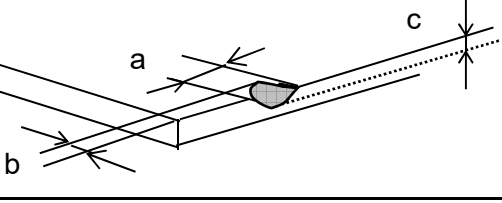
Observation distance

30cm

Illuminance

1200~2000 lx

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

| Item | Appearance | Criteria |
|----------------|--|--|
| Glass chipping | Corner area  | Unit:mm $a \leq 3$ $b \leq 3$ $c \leq t$ (t: glass thickness) $a, b \leq 0.5$ is acceptable Maximum permissible number of chipping off on a side is 2. |
| | Others  | Unit:mm $a \leq 5$ $b \leq 1$ $c \leq t$ (t:glass thickness) $a, b \leq 0.5$ is acceptable Maximum permissible number of chipping off on a side is 5. |
| | Progressive crack | None |



16. Reliability Test

| Test item | | Test condition | | number of failures /number of examinations |
|-------------------------------|---|--|------------|---|
| Durability test | High temperature storage | Ta=80° C | 240hrs | 0/3 |
| | Low temperature storage | Ta=-30° C | 240hrs | 0/3 |
| | High temperature & high humidity storage | Ta=60° C, RH=90% non condensing | 240hrs | 0/3 |
| | High temperature operation | Tp=70° C | 240hrs | 0/3 |
| | Low temperature operation | Tp=-20° C | 240hrs | 0/3 |
| | High temp & humid operation | Tp=40° C, RH=90% non condensing | 240hrs | 0/3 |
| | Thermal shock storage | -30←→80° C(30min/30min) | 100 cycles | 0/3 |
| | Lightfastness | Xenon Blackpanel 63±3° C non-shower 450W/m ² (300~700nm) non-operating Integral dose 800MJ/m ² | | 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=±6kV 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 TOPPAN PRINTING 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 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 | | 0/1Packing |
| | Packing drop test | Drop from 75cm high. 1 time to each 6 surfaces, 3 edges, 1 corner | | 0/1Packing |

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.)

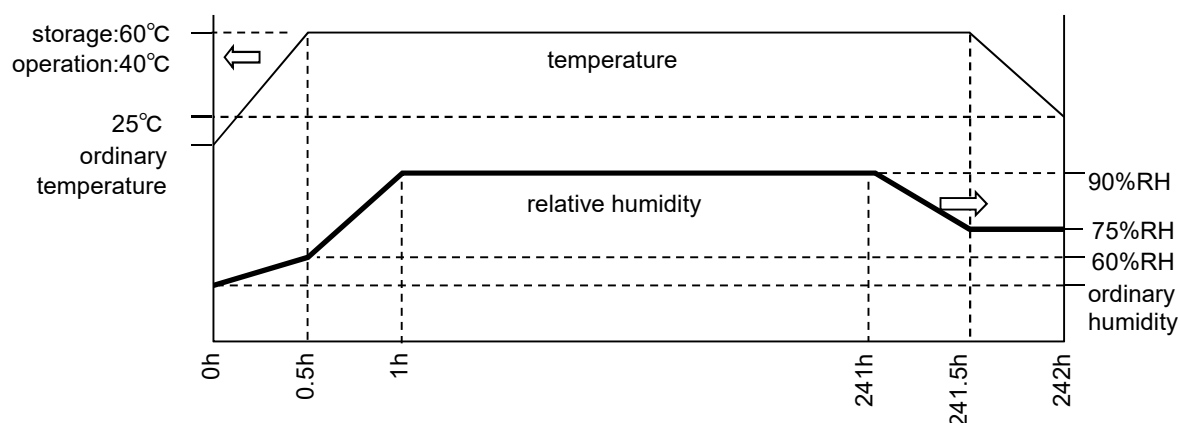
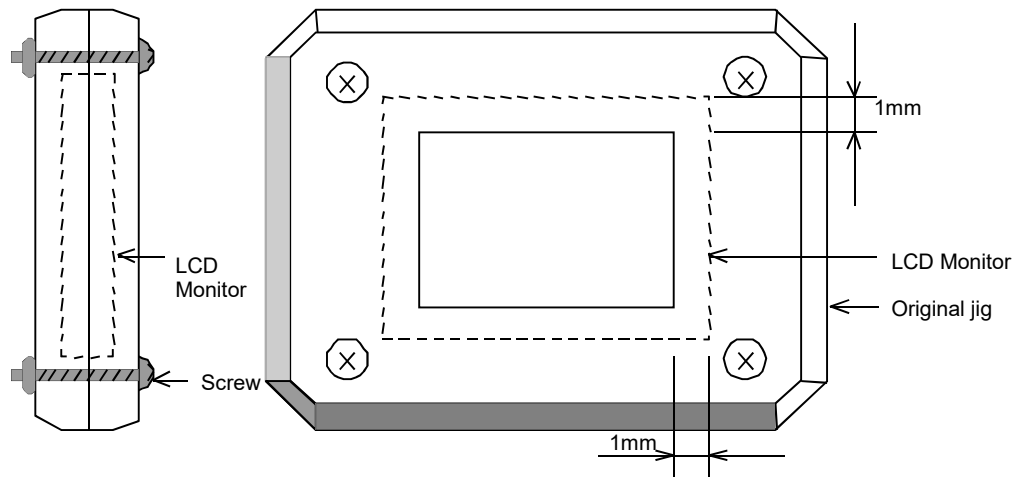


Table2.Reliability Criteria

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

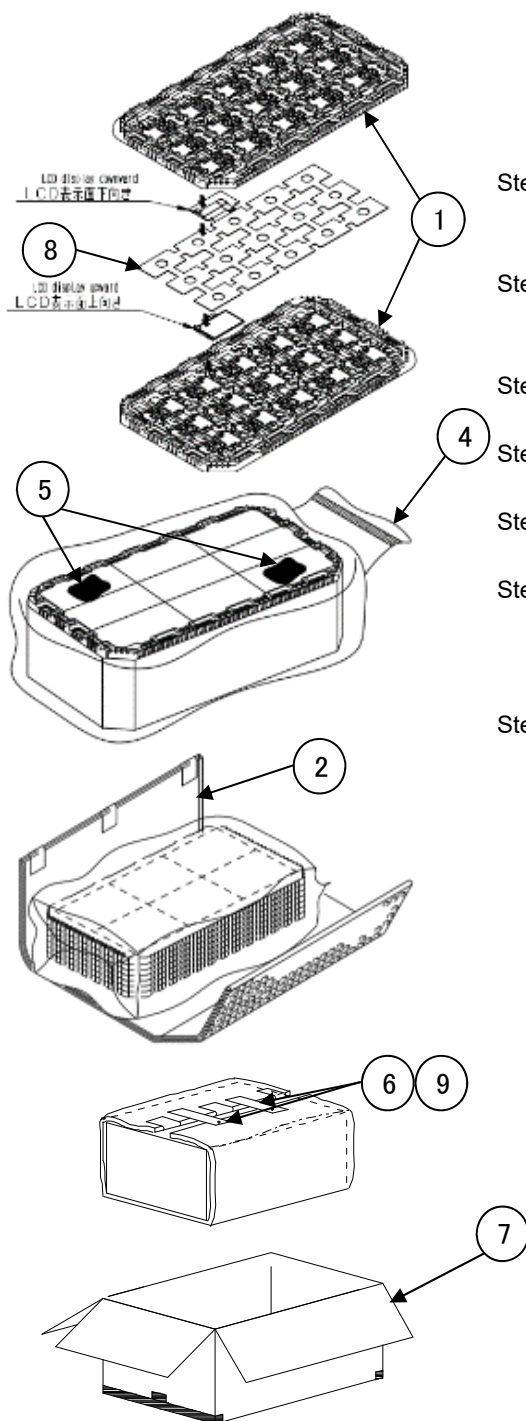
| item | Standard | Remarks |
|-----------------|--|--------------|
| Display quality | No visible abnormality shall be seen. (Except for unevenness by PoI deterioration.) | |
| Contrast ratio | 200 or more | Backlight ON |

TOPPAN PRINTING Original Jig





17. Packing Specifications



Step1. Each product is to be placed in one of the cut-outs of the tray with the display surface facing upward. (15products 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 downward.(30products per tray)

Step2. The trays be in a stack of 9.(Rotate 180 degrees for each step)
One empty tray is to be put on the top of stack of 9 trays.

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

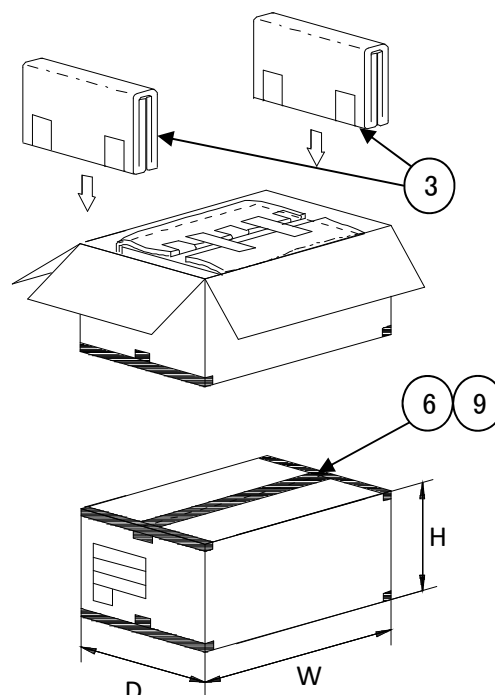
Step4. Vacuum and seal the sealing bag with the vacuum sealing machine.

Step5. Put the sealing bag in the center of the 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 with black ink.
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 | Anti-static air bubble sheet |
| ③ B SHEET D | Anti-static air bubble sheet |
| ④ Sealing bag | |
| ⑤ Drier | Moisture absorber |
| ⑥ Packing tape | |
| ⑦ Outer carton | Corrugated cardboard |
| ⑧ FOAM SHEET | Anti-static polyethylene |
| ⑨ Packing tape | |

| Dimension of outer carton | |
|--|----------|
| D : Approx. | (356 mm) |
| W : Approx. | (664 mm) |
| H : Approx. | (182 mm) |
| Quantity of products packed in one carton: | 270 |
| Gross weight : Approx. | 6.8 kg |

18. Handling Instruction

18.1 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.

18.2 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 18.5 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) It is recommended to employ the structure of which polarizer peripheral area of LCD panel being pressed by cushioning materials, in order to prevent a cause of display brightness unevenness.
- 10) By reason of this model is made by thin glass, this model LCD is breakable.
Please apply fitting of protection LCD surface. (ex. Covered acrylic board on LCD surface)

18.3 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.

18.4 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.



18.5 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.

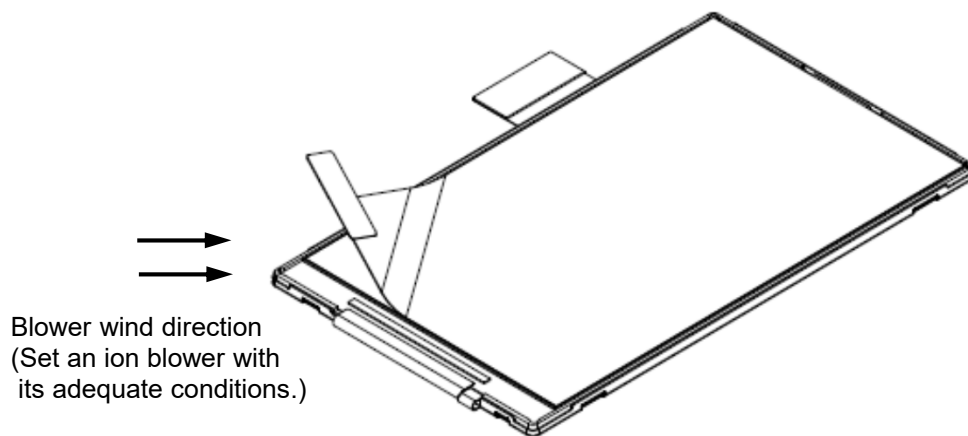
A) Work Environment

- 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 left when LSI is placed at the bottom.
Optimize direction of the blowing air and the distance between the TFT monitors and the electrostatic neutralization blower.
- b) Peel off the R tape slowly (spending more than 2 secs to complete) by pulling it to opposite direction.



18.6 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)

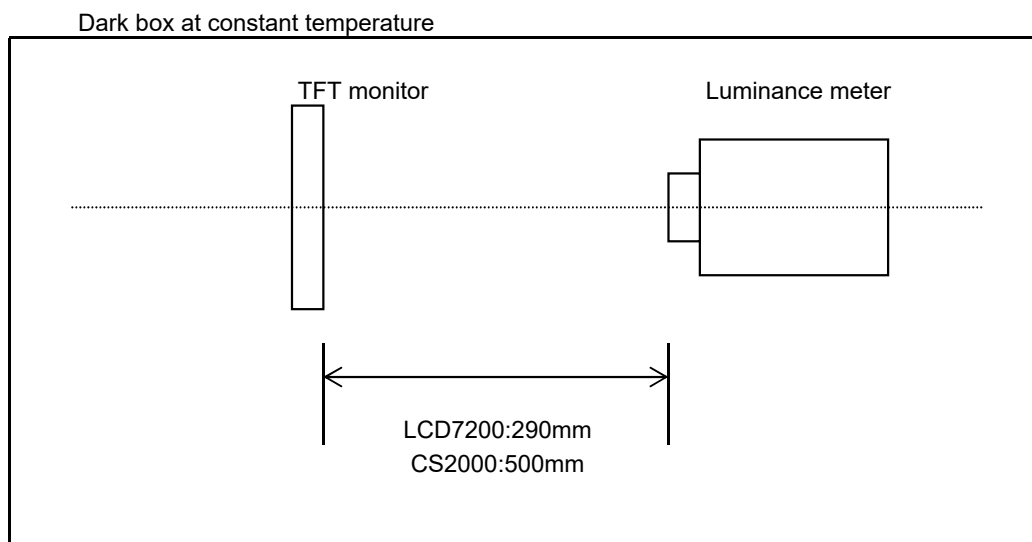
Measuring instruments: CS2000 (KONICA MINOLTA), LCD7200 (OTSUKA ELECTRONICS), EZcontrastXL88 (ELDIM)

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.

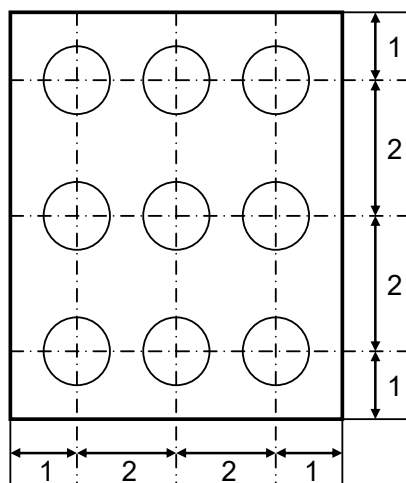
Measurement point: At the center of the screen unless otherwise specified



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>

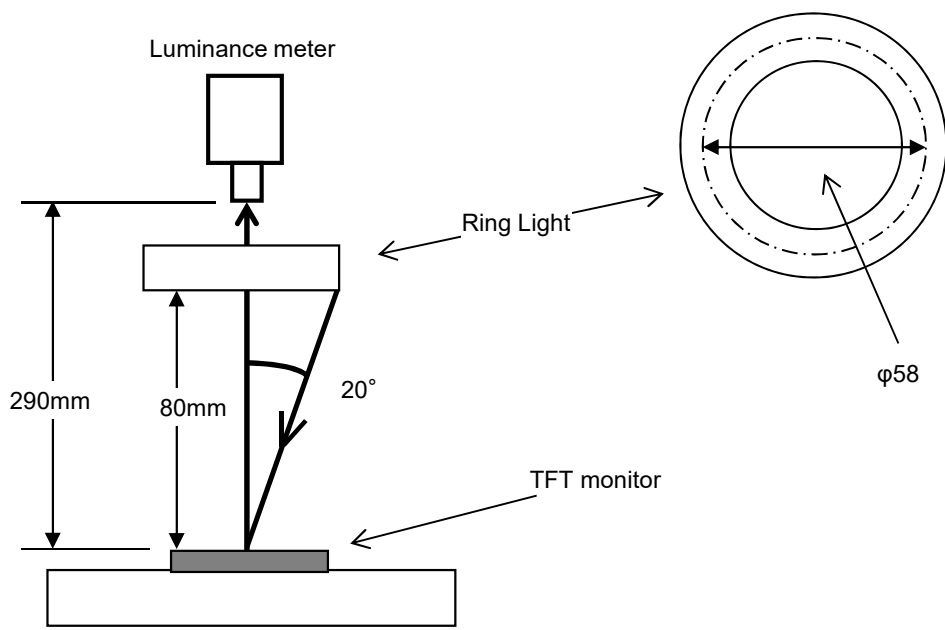


Dimensional ratio of active area

Backlight IL=8.5mA

Measurement Condition (Contrast ratio Backlight OFF only)

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



2. Test Method

| Notice | Item | Test method | Measuring instrument | Remark |
|--------|---|--|----------------------|---|
| 1 | Response time | <p>Measure output signal waves with a brightness meter when the raster or window pattern is changed over from white to black and from black to white</p> <p 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 [Data]=00h White display [Data]=FFh TON Rise time TOFF Fall time |
| 2 | Contrast ratio | <p>Measure maximum luminance Y1([Data]=FFh) and minimum luminance Y2([Data]=00h) at the center of the screen by displaying raster or window pattern. Then calculate the ratio between these two values.</p> <p 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 LCD7200 | Backlight ON Backlight OFF |
| 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. | EZcontrastXL88 | |
| 4 | White chromaticity | <p>Measure chromaticity coordinates x and y of CIE1931 colorimetric system at [Data] = FFh</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]=00h/FFh). | | At optimized VCOMDC |
| 6 | Center brightness | Measure the brightness at the center of the screen. | CS2000 | |
| 7 | Brightness distribution | <p>(Brightness distribution) = 100 x B/A %</p> <p>A : max. brightness of the 9 points</p> <p>B : min. brightness of the 9 points</p> | CS2000 | |

Our company network supports you worldwide with offices in Germany, Austria, Switzerland, the UK and the USA. For more information please contact:

Headquarters

Germany



FORTEC Elektronik AG

Augsburger Str. 2b
82110 Germering

Phone: +49 89 894450-0
E-Mail: info@forteca.de
Internet: www.forteca.de

Fortec Group Members

Austria



Distec GmbH Office Vienna

Nuschinggasse 12
1230 Wien

Phone: +43 1 8673492-0
E-Mail: info@distec.de
Internet: www.distec.de

Germany



Distec GmbH

Augsburger Str. 2b
82110 Germering

Phone: +49 89 894363-0
E-Mail: info@distec.de
Internet: www.distec.de

Switzerland



ALTRAC AG

Bahnhofstraße 3
5436 Würenlos

Phone: +41 44 7446111
E-Mail: info@altrac.ch
Internet: www.altrac.ch

United Kingdom



Display Technology Ltd.

Osprey House, 1 Osprey Court
Hichingbrooke Business Park
Huntingdon, Cambridgeshire, PE29 6FN

Phone: +44 1480 411600
E-Mail: info@displaytechnology.co.uk
Internet: www.displaytechnology.co.uk

USA



Apollo Display Technologies, Corp.

87 Raynor Avenue,
Unit 1 Ronkonkoma,
NY 11779

Phone: +1 631 5804360
E-Mail: info@apolloDisplays.com
Internet: www.apolloDisplays.com