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SPECIFICATION

DEVICE SPECIFICATION FOR

# TFT-LCD Module

MODEL No.

# LQ070Y3DG02

NECAT Registration No. AL1-002522-001

☐ CUSTOMER'S APPROVAL

DATE

BY

PRESENTED

BY

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# RECORDS OF REVISION

LQ070Y3DG02

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LD-22802A | Aug.18.2010 | - | - | | 1st Issue |
| LD-22802B | Sep.14.2010 | 1 | — | Added user's registration No. to cover | 2nd Issue |
| | | | P.7 | Corrected Note 6-1) => 6-2) | |
| | | | P.18 | Corrected Note 9-5) Defination of Uniformity | |
| | | | P.18 | Revised 10.Touch panel characteristics | |
| | | | P.22 | Revised Electro static discharge test conditions | |
| | | | P.22 | Corrected [Check items] corresponding No. | |

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Table of contents

1. Applicable Scope

This specification applies to a color TFT-LCD Module “LQ070Y3DG02”.

2. General Description

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC, Input FPC, a back light unit and touch panel.

Graphics and texts can be displayed on a 800 x 480 x BGR dots panel with about 16.7M colors by supplying 24bit data signals (8bit x RGB), four timing signals, logic (Typ. +1.8V), analog (Typ. +2.85V) supply voltages for TFT-LCD panel driving and supply voltage for back light.

Optimum viewing direction is 6 o'clock. The direction of grey scale inversion is 6 o'clock. The direction of contrast reduction is 12 o'clock.

White-LED Backlight-driving DC/DC converter is not built in this module.

3. Mechanical (Physical) Specifications

| Item | Specifications | Unit |
|---|---|---|
| Screen size | 17.8 (7.0” type) diagonal | cm |
| Active area | 152.4 (H) ×91.44(V) | mm |
| Pixel format | 800 (H) x 480 (V) | Pixel |
| | 1Pixel =B+G+R dots | - |
| Pixel pitch | 0.1905 (H) x 0.1905 (V) | mm |
| Pixel configuration | B,G,R horizontal stripes | - |
| Display mode | Normally White | - |
| Surface hardness | 3H | - |
| Surface treatment | Anti glare | - |

| Parameter | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Unit outline dimensions [Note 3-1] | Width | 164.6 | 164.9 | 165.2 | mm |
| | Height | 103.7 | 104.0 | 104.3 | mm |
| | Depth | — | 5.0 | 5.3 | mm |
| Mass | | — | 160 | 175 | g |

Note 3-1) The above-mentioned table indicates module sizes without some projections and FPC.

For detailed measurements and tolerances, please refer to 19. Outline Dimensions.

## 4. Input Terminal Names and Functions

Recommendation CN：[HIROSE] FH35-51S-0.3SHW(50) or FH35R-51S-0.3SHW(50)

| Pin No. | Symbol | I/O | Description | Remarks |
|---|---|---|---|---|
| 1 | VCI | - | Voltage input pin for Analog Circuit | |
| 2 | VCI | - | Voltage input pin for Analog Circuit | |
| 3 | GND | - | Ground | |
| 4 | GND | - | Ground | |
| 5 | VDDIO | - | Voltage input pin for Logic I/O | |
| 6 | GND | - | Ground | |
| 7 | B7 | I | BLUE data signal(MSB) | |
| 8 | B6 | I | BLUE data signal | |
| 9 | B5 | I | BLUE data signal | |
| 10 | B4 | I | BLUE data signal | |
| 11 | B3 | I | BLUE data signal | |
| 12 | B2 | I | BLUE data signal | |
| 13 | B1 | I | BLUE data signal | |
| 14 | B0 | I | BLUE data signal(LSB) | |
| 15 | GND | - | Ground | |
| 16 | G7 | I | GREEN data signal(MSB) | |
| 17 | G6 | I | GREEN data signal | |
| 18 | G5 | I | GREEN data signal | |
| 19 | G4 | I | GREEN data signal | |
| 20 | G3 | I | GREEN data signal | |
| 21 | G2 | I | GREEN data signal | |
| 22 | G1 | I | GREEN data signal | |
| 23 | G0 | I | GREEN data signal(LSB) | |
| 24 | GND | - | Ground | |
| 25 | R7 | I | RED data signal(MSB) | |
| 26 | R6 | I | RED data signal | |
| 27 | R5 | I | RED data signal | |
| 28 | R4 | I | RED data signal | |
| 29 | R3 | I | RED data signal | |
| 30 | R2 | I | RED data signal | |
| 31 | R1 | I | RED data signal | |
| 32 | R0 | I | RED data signal(LSB) | |
| 33 | GND | - | Ground | |
| 34 | VSYNC | I | Frame synchronization signal | |
| 35 | HSYNC | I | Line synchronization signal | |
| 36 | GND | - | Ground | |
| 37 | DOTCLK | I | Dot-clock signal | |

| Pin No. | Symbol | I/O | Description | Remarks |
|---|---|---|---|---|
| 38 | GND | - | Ground | |
| 39 | DEN | I | Display enable signal | |
| 40 | RESB | I | System Reset | |
| 41 | SHUT | I | Sleep mode control | |
| 42 | N.C | | N.C | Note 4-1) |
| 43 | XR | O | Touch Panel Right Electrode | |
| 44 | YB | O | Touch Panel Bottom Electrode | |
| 45 | XL | O | Touch Panel Left Electrode | |
| 46 | YT | O | Touch Panel Top Electrode | |
| 47 | N.C | | N.C | Note 4-1) |
| 48 | LED_A | - | Power supply for LED (Anode) | |
| 49 | LED_C3 | - | Power supply for LED3 (Cathode) | |
| 50 | LED_C2 | - | Power supply for LED2 (Cathode) | |
| 51 | LED_C1 | - | Power supply for LED1 (Cathode) | |

Note 4-1) this pin should be opened.

5. Absolute Maximum Ratings

| Item | Symbol | Conditions | Rated value | Unit | Remarks |
|---|---|---|---|---|---|
| Input voltage | VI | Ta = 25°C | -0.3 ~ $V_{DDIO}$+0.3 | V | Note 5-1 |
| Logic I/O power supply voltage | $V_{DDIO}$ | Ta = 25°C | -0.3 ~ +4.6 | V | |
| Analog power supply voltage | $V_{CI}$ | Ta = 25°C | -0.3 ~ +4.6 | V | |
| Temperature for storage | Tstg | - | -30 ~ +70 | °C | Note 5-2 |
| Temperature for operation | Topr | - | -20 ~ +60 | °C | Note 5-3 |
| LED input electric current | $I_F$ | Ta = 25°C | 35 | mA | Note 5-4 |
| LED electricity consumption | $P_{LED}$ | Ta = 25°C | 123 | mW | Note 5-4 |

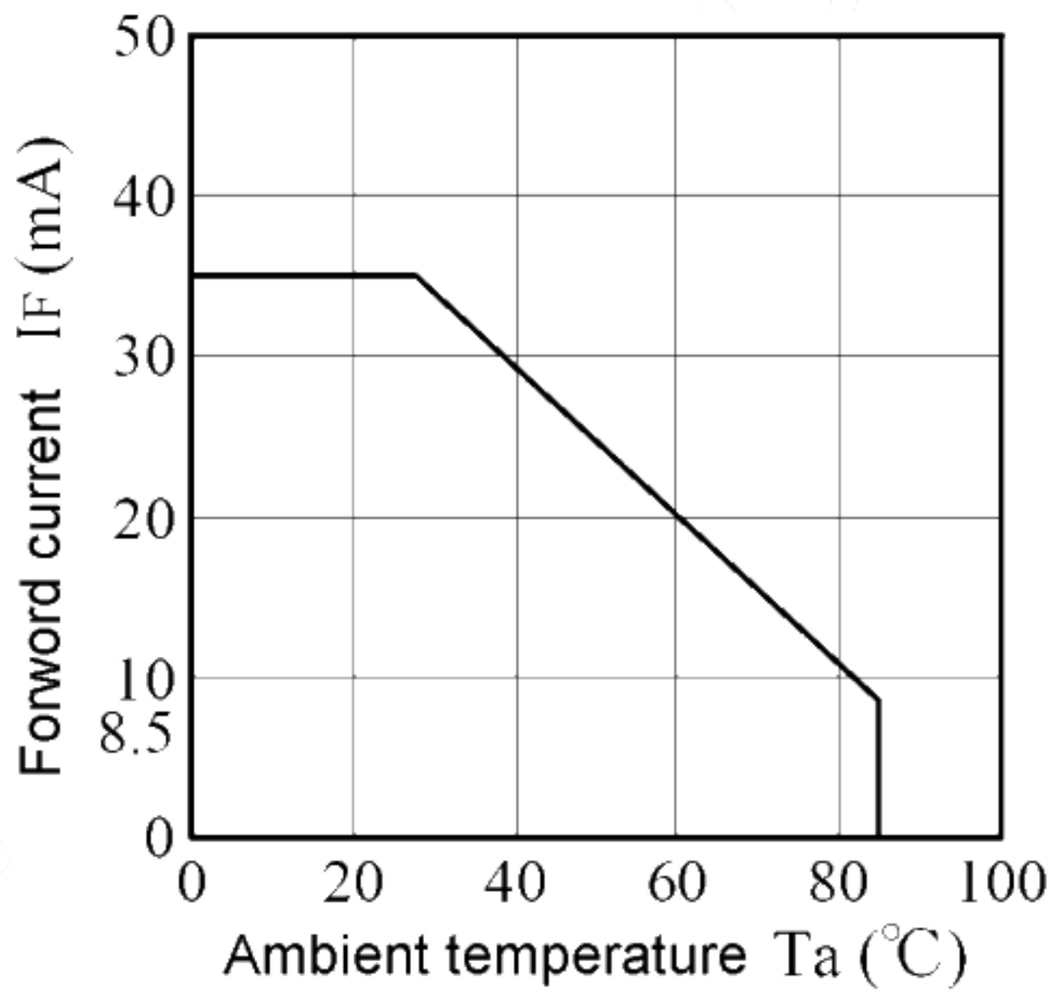
Note 5-1) RESB, SHUT, DEN, B7~B0, G7~G0, R7~R0, VSYNC, HSYNC, DOTCLK

Note 5-2) Humidity: 90%RH Max.

Note 5-3) Ambient temperature

Note 5-4) Power consumption of one LED (Ta = 25°C). (use 24 pieces LED)

Ambient temperature and the maximum input are fulfilling the following operating conditions.




Ambient temperature and the maximum input

# 6. Electrical Characteristics

## 6-1. TFT LCD Panel Driving

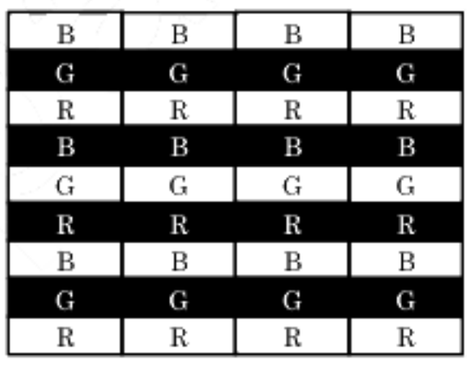
Ta = 25°C

| Item | | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Logic I/O power supply | DC voltage | VDDIO | +1.6 | +1.8 | +2.0 | V | |
| | DC current | IVDDIO | - | 10 | 50 | μA | Note 6-2,6 |
| | | | | 1 | 5 | μA | Note 6-3,5 |
| Analog power supply | DC voltage | VCI | +2.7 | +2.85 | +3.3 | V | Note 6-7 |
| | DC current | IVCI | - | 45 | 90 | mA | Note 6-1,6 |
| | | | | 175 | 210 | μA | Note 6-3,5 |
| Permissive input Ripple voltage | | $V_{RFVDDIO}$ | - | - | 100 | mVp-p | Note 6-3 |
| | | $V_{RFVCI}$ | - | - | 100 | mVp-p | Note 6-3 |
| Logic Input Voltage | High | $V_{IH}$ | 0.7 * $V_{DDIO}$ | - | $V_{DDIO}$ | V | Note 6-4 |
| | Low | $V_{IL}$ | 0 | - | 0.3 * $V_{DDIO}$ | V | Note 6-4 |
| Logic input Current | | $I_{IH}$ / $I_{IL}$ | -1 | - | 1 | μA | Note 6-4 |

Note 6-1) VDDIO = +1.8V, VCI= +2.85V, $f_{VSYNC}$ = 60Hz

Typical current situation : All White , All Black

Max current situation : Green / Magenta horizontal stripe

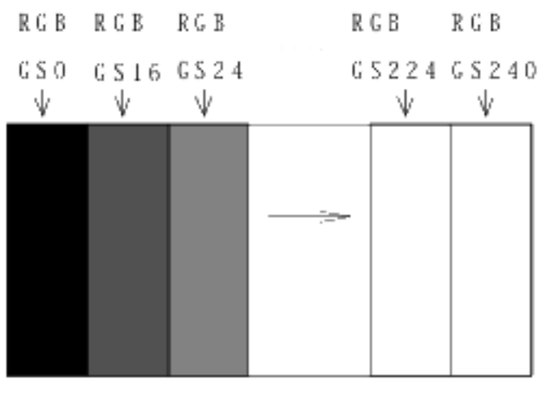



Green / Magenta horizontal stripe

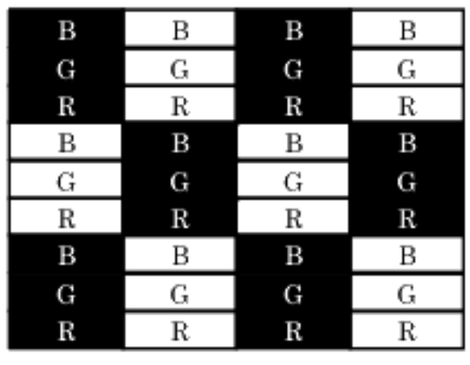
1 Note 6-2) VDDIO = +1.8V, VCI= +2.85V, $f_{VSYNC}$ = 60Hz

Typical current situation : 16-gray-bar pattern

Max current situation : Black & White checker flag pattern




16-gray-bar pattern

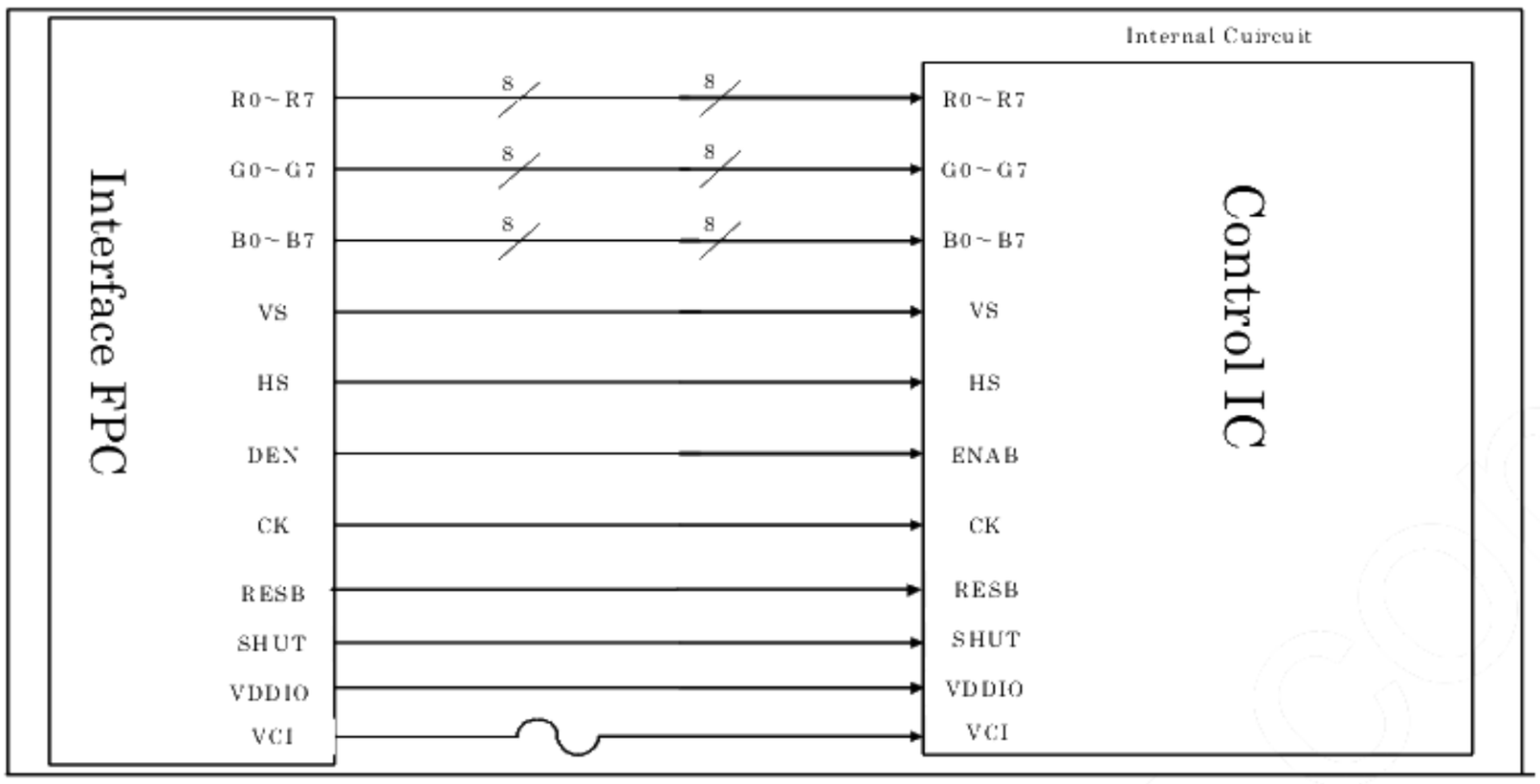



Black & White checker flag pattern

Note 6-3) VDDIO = +1.8V, VCI = +2.85V

Note 6-4) RESB, SHUT, DEN, B7~B0, G7~G0, R7~R0, VSYNC, HSYNC, DOTCLK

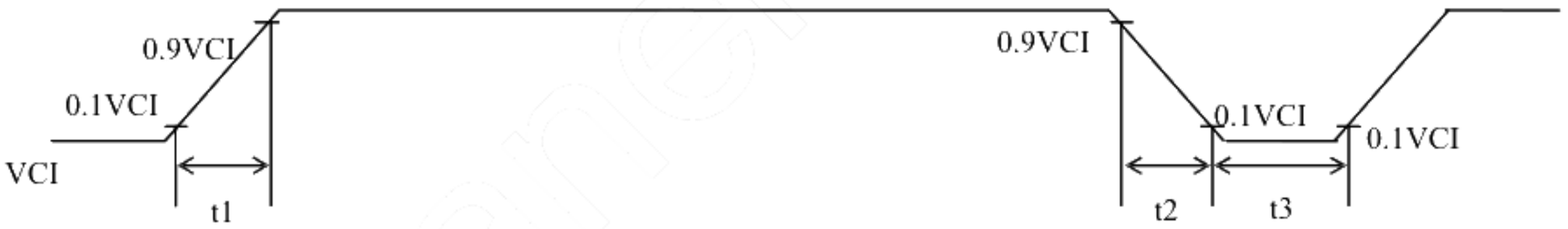
Interface block diagram of the LCD




Note 6-5) Sleep mode : SHUT="H"

Note 6-6) Please install the overcurrent protection (ex. Fuse) in the terminal VDDIO and the terminal VCI.

Note 6-7) On-off conditions for supply voltage




| Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|
| t1 | 0 | 10 | ms | |
| t2 | 0 | 400 | ms | |
| t3 | 200 | — | ms | |

[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

VCI-dip conditions

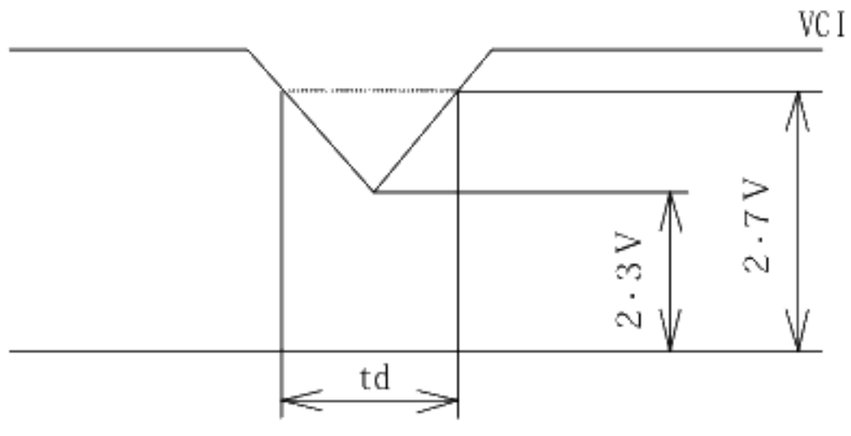
1) 2.3 V≦VCI＜2.7 V

td≦10 ms

Under above condition, the display image should return to an appropriate figure after VCI voltage recovers.

2) VCI＜2.3 V

VCI-dip conditions should also follow the On-off conditions for supply voltage.



## 6-2. Back light driving

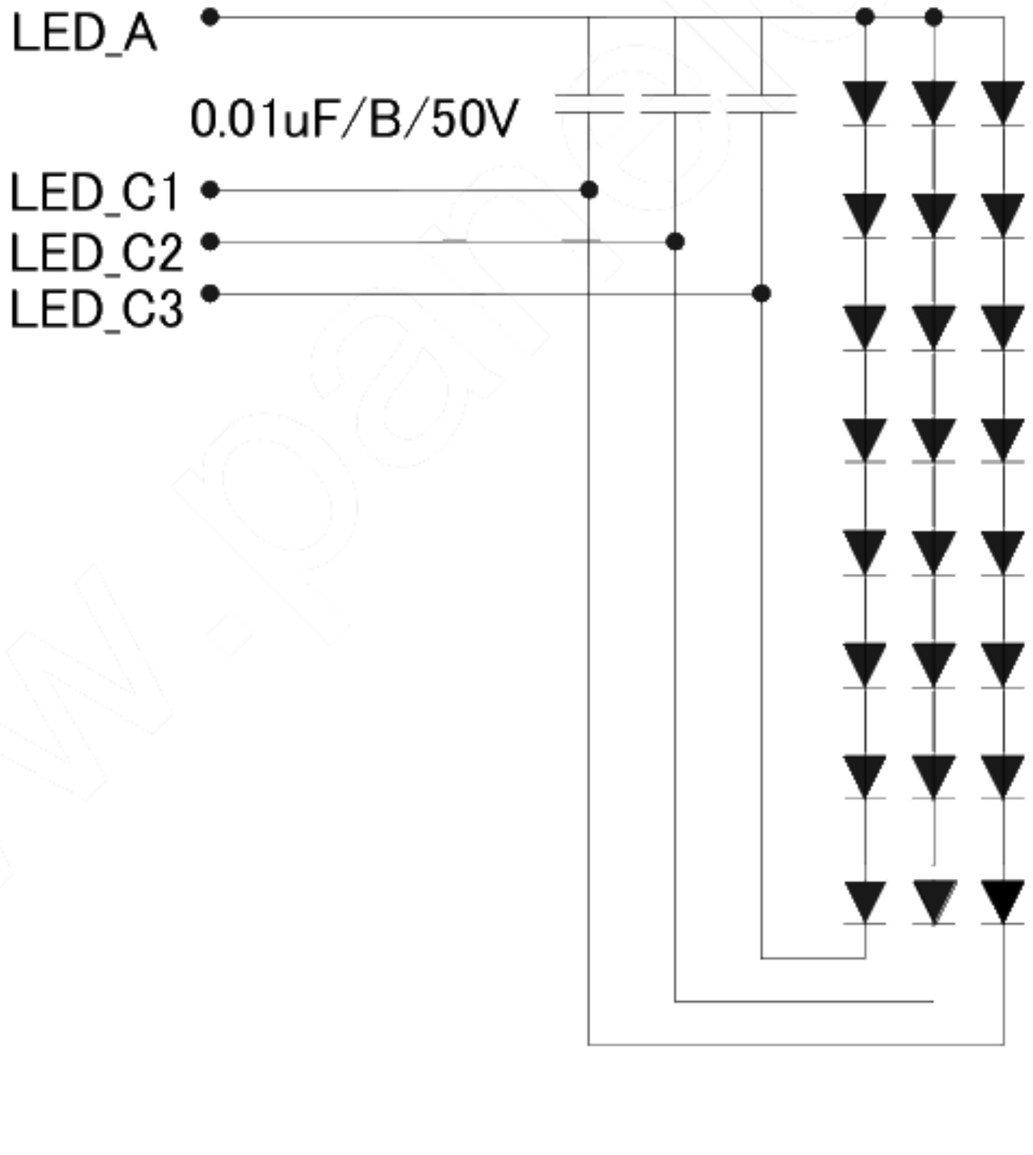
The back light system has 24 pieces LED (3 strings of 8 LEDs each)

Ta=25°C

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Rated Voltage | $V_{BL}$ | - | 25.6 | 28.0 | V | For 1 strings |
| Rated Current | $I_L$ | - | 20.0 | - | mA | For 1 strings |
| Power consumption | $W_L$ | - | 1.54 | - | W | For 3 strings |
| LED life time | $L_L$ | 10000 | — | — | Hour | [Note] |

[Note 3] LED life time is defined as the time when Brightness becomes 50 % of the original value. under the condition of Ta = 25℃ and $I_L$ = 20 mA, and continuous lighting.

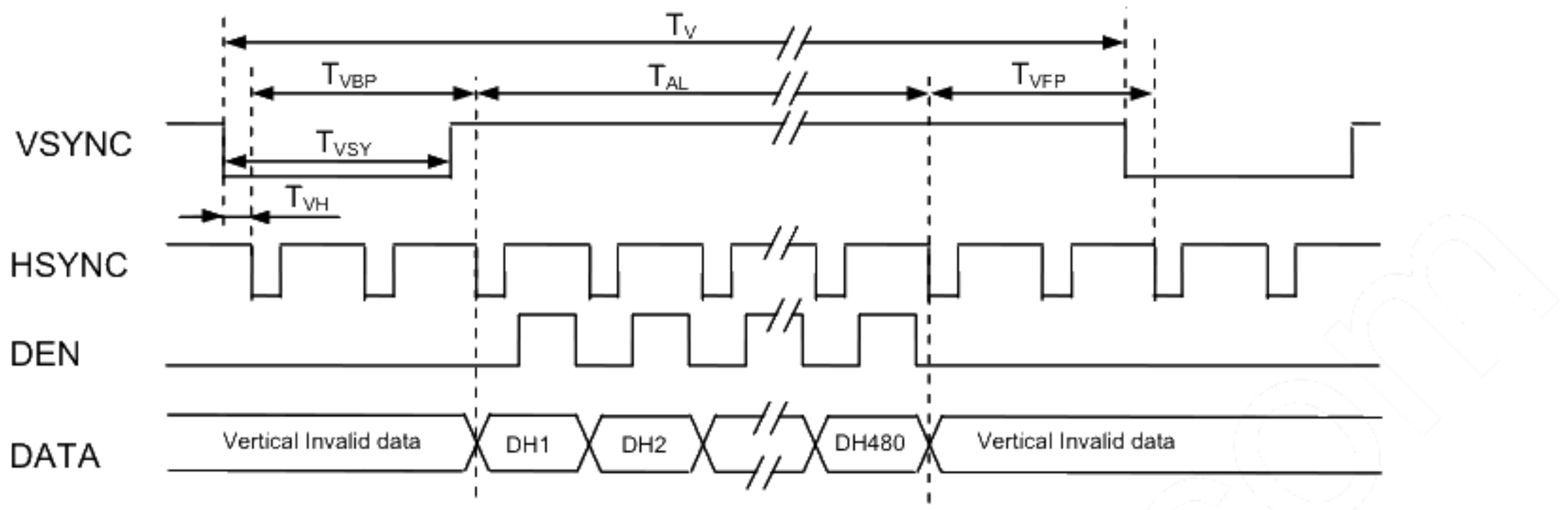
[LED-FPC circuit]



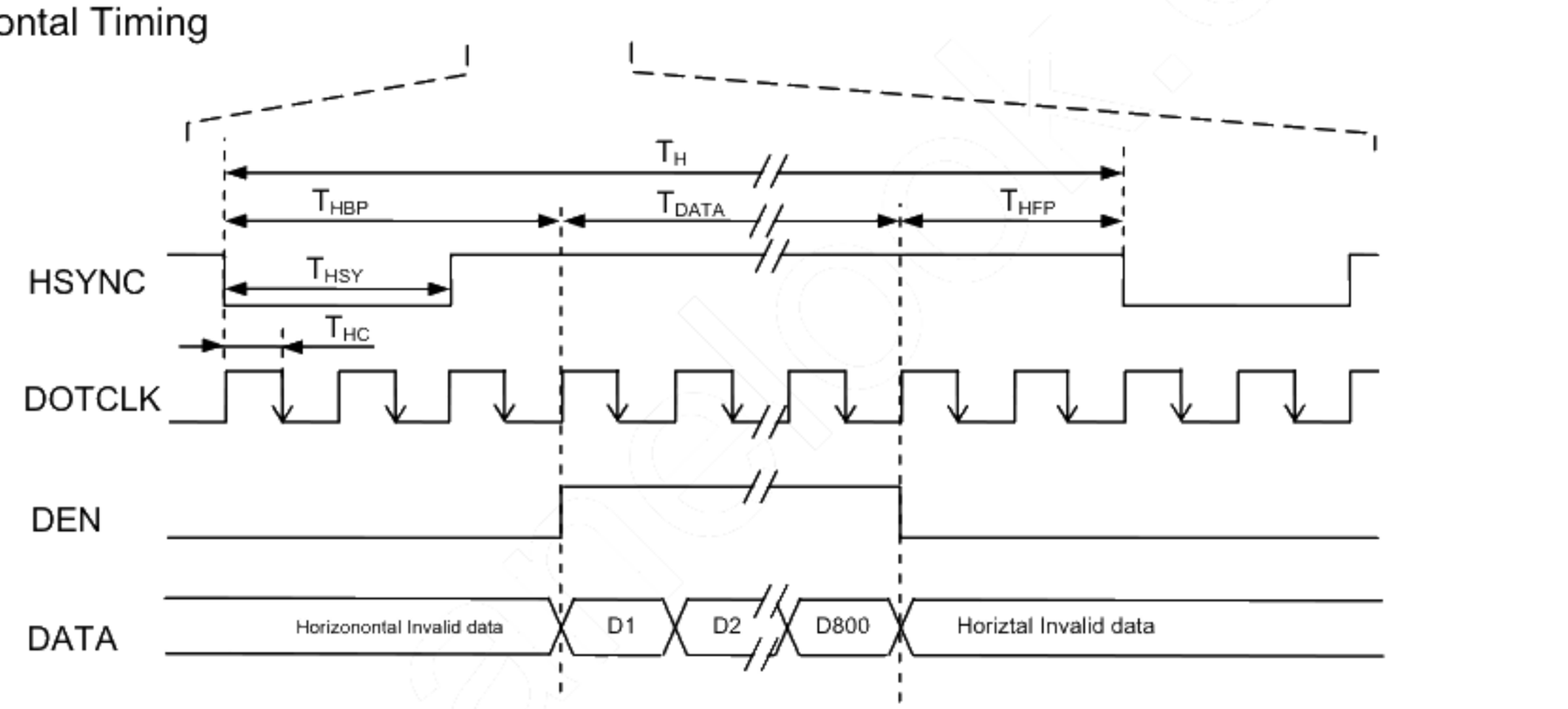
# 7. Timing characteristics of input signals

## 7-1. 24-bit RGB Interface Timing Diagram & Transaction Example

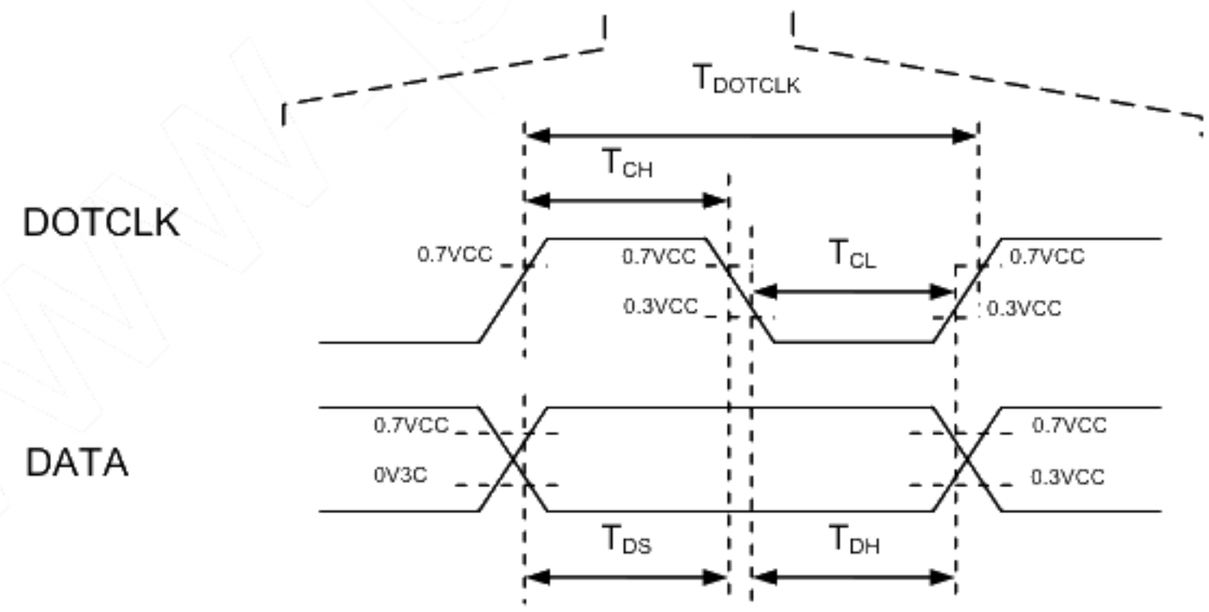
### Vertical Timing




### Horizontal Timing



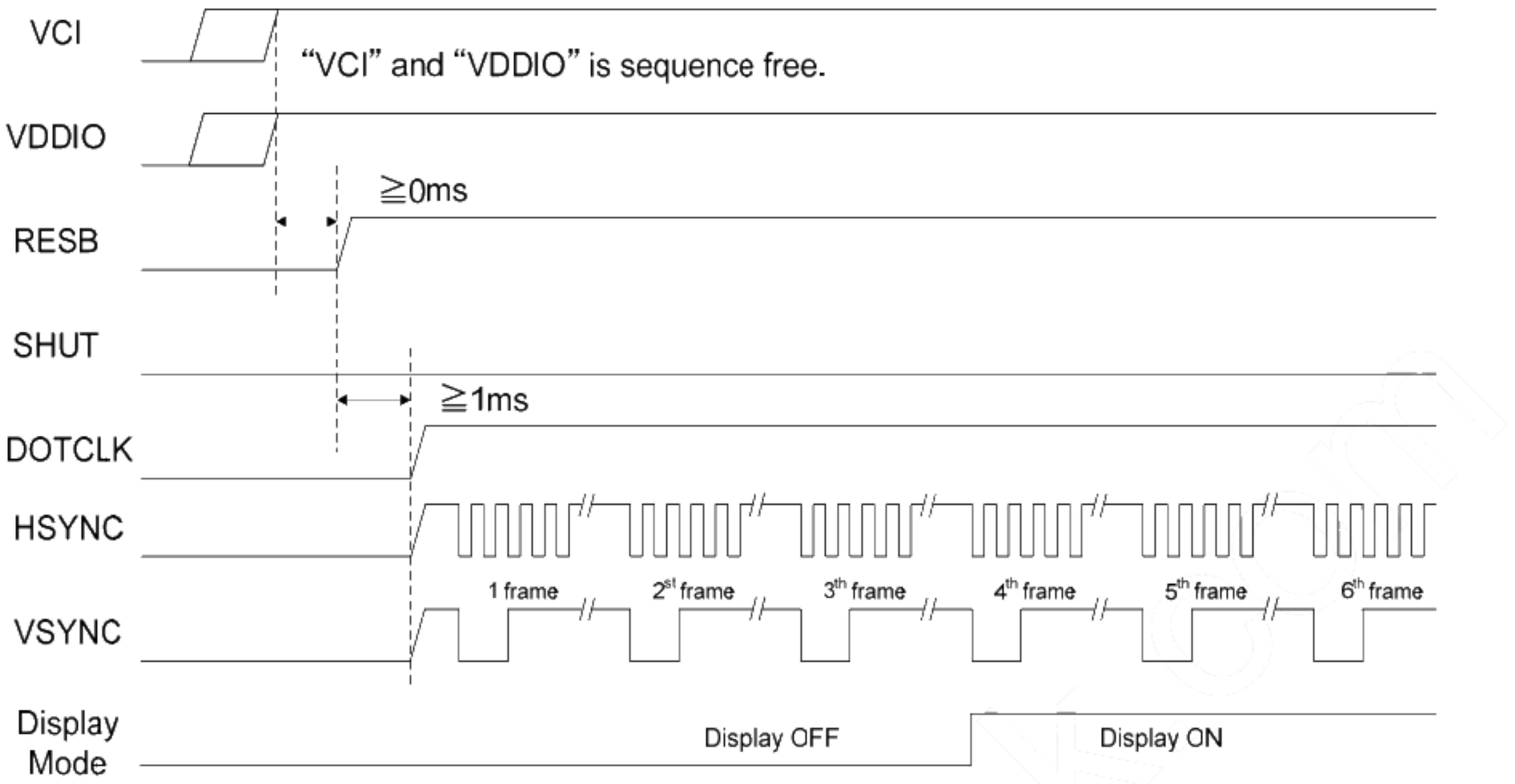

### Pixel clock Timing



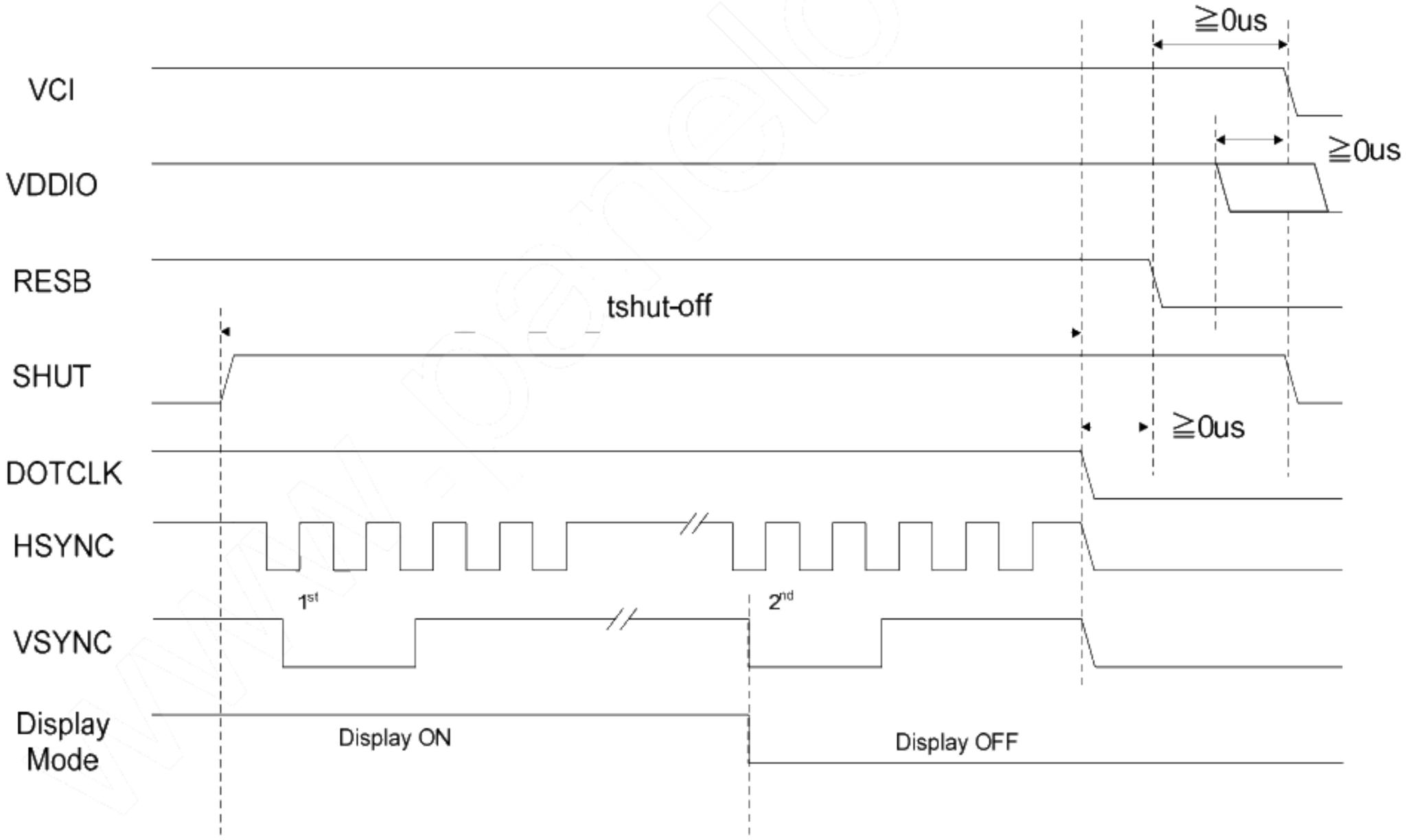
Ta=25°C

| Characteristics | | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| DOTCLK | Frequency | $1/t_{DOTCLK}$ | 31.95 | 33.26 | 34.60 | MHz |
| | "H" Period | $t_{CH}$ | 8 | - | - | ns |
| | "L" Period | $t_{CL}$ | 8 | - | - | ns |
| | Setup Time | $t_{DS}$ | 6 | - | - | ns |
| | Hold time | $t_{DH}$ | 6 | - | - | ns |
| Horizontal | One Line Period | $t_H$ | 1024 | 1056 | 1088 | $t_{DOTCLK}$ |
| | Active Data Period | $t_{data}$ | - | 800 | - | $t_{DOTCLK}$ |
| | Sync Width | $t_{HSY}$ | 5 | 128 | 186 | $t_{DOTCLK}$ |
| | Back Porch | $t_{HBP}$ | - | 215 | - | $t_{DOTCLK}$ |
| | Front Porch | $t_{HFP}$ | - | 64 | - | $t_{DOTCLK}$ |
| | Setup time | $t_{HC}$ | 6 | - | - | ns |
| Vertical | One Field Period | $t_V$ | - | 525 | - | $t_H$ |
| | Active Line Period | $t_{AL}$ | - | 480 | - | $t_H$ |
| | Sync Width | $t_{VSY}$ | 2 | - | - | $t_H$ |
| | Back Porch | $t_{VBP}$ | - | 35 | - | $t_H$ |
| | Front Porch | $t_{VFP}$ | 5 | - | - | $t_H$ |
| | setup time | $t_{VH}$ | 0 | - | $T_H$ - 4 | $t_{DOTCLK}$ |

7-2. Power ON Sequence




7-3. Power OFF Sequence



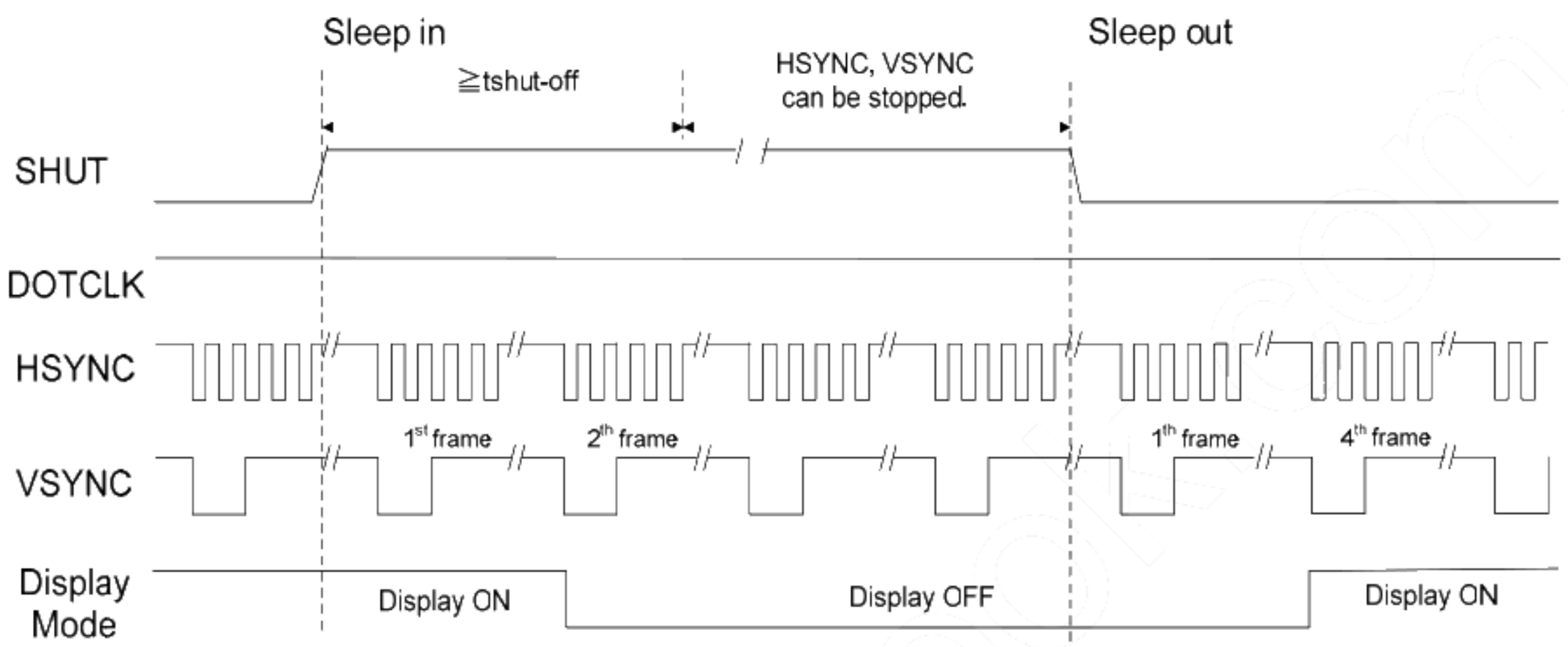

| Characteristics | Symbol | Target Min | Target Typ | Target Max | Units |
|---|---|---|---|---|---|
| Rising edge of SHUT to display off | tshut-off | 1 | - | - | frame |
| | | 16.7 | - | - | msec |

Note7-1): DOTCLK must be maintained at least 2 frames after the rising edge of SHUT.

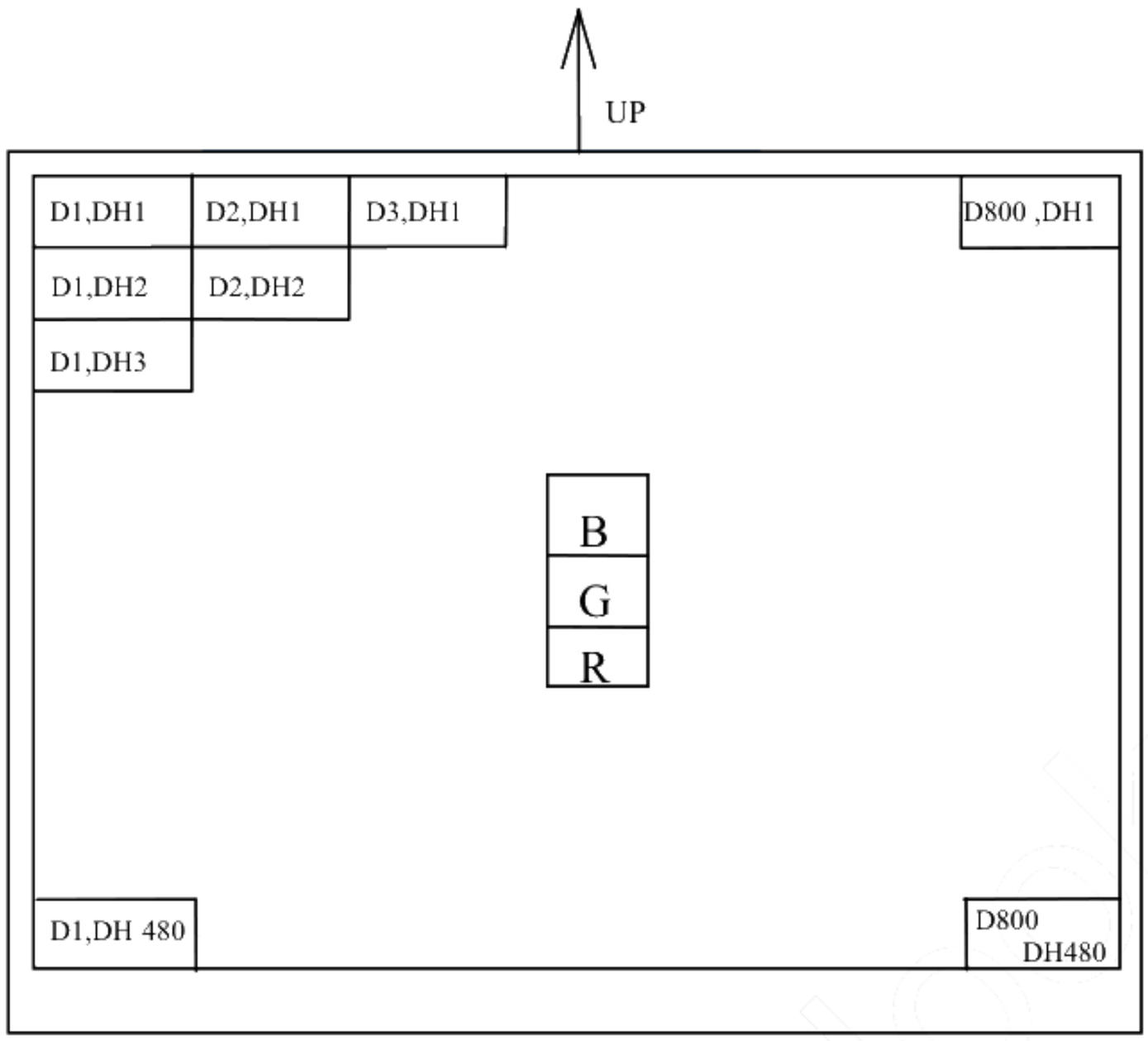
Note7-2): Display become off at the 2nd falling edge of VSYNC after the falling edge of SHUT.

Note7-3): If RESET signal is necessary for power down, provide it after the 2-frames-cycle of the SHUT period.

7-4. Sleep mode Sequence



7-5. Input Data Signals and Display Position on the screen




Display position of input data (H, V)

## 8. Input Signals, Basic Colors and Gray Scale of Each Color

| | Colors & Gray Scale | Gray Scale | Date signal | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |
| | | | LSB | | | | | | | MSB | LSB | | | | | | | MSB | LSB | | | | | | | MSB |
| Basic Color | Black | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Gray Scale of Red | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ Darker | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | | | ↓ | | | | | | | ↓ | | | | | | | ↓ | | | | | |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | ↓ | | | | | | | ↓ | | | | | |
| | Brighter ⇩ | GS253 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | GS254 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | GS255 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Green | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ Darker | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | | | ↓ | | | | | | | ↓ | | | | | | | ↓ | | | | | |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | ↓ | | | | | | | ↓ | | | | | |
| | Brighter ⇩ | GS253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | GS254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | GS255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Blue | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ Darker | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ⇧ | ↓ | | | | | ↓ | | | | | | | ↓ | | | | | | | ↓ | | | | | |
| | ⇩ | ↓ | | | | | ↓ | | | | | | | ↓ | | | | | | | ↓ | | | | | |
| | Brighter ⇩ | GS253 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | GS254 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Blue | GS255 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

0: Low level voltage, 1: High level voltage, X: Don't care

Each basic color can be displayed in 256 gray scales from 8 bit data signals.
According to the combination of 24 bit data signals, the 16.7M color display can be achieved on the screen.

9. Optical Characteristics

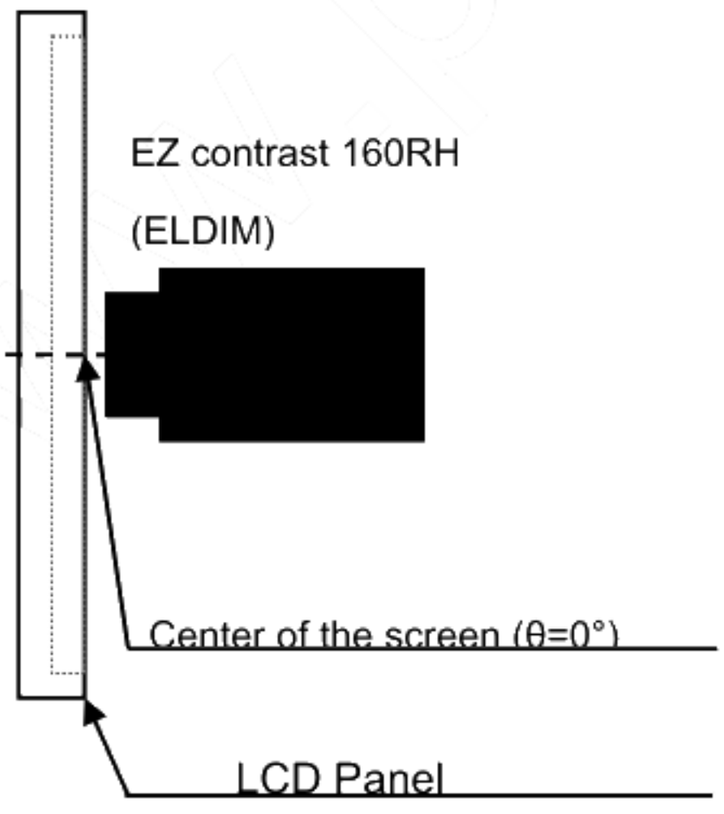
Module characteristics

Ta = 25°C, $V_{DDIO}$ = +1.8V, $V_{CI}$ = +2.85V

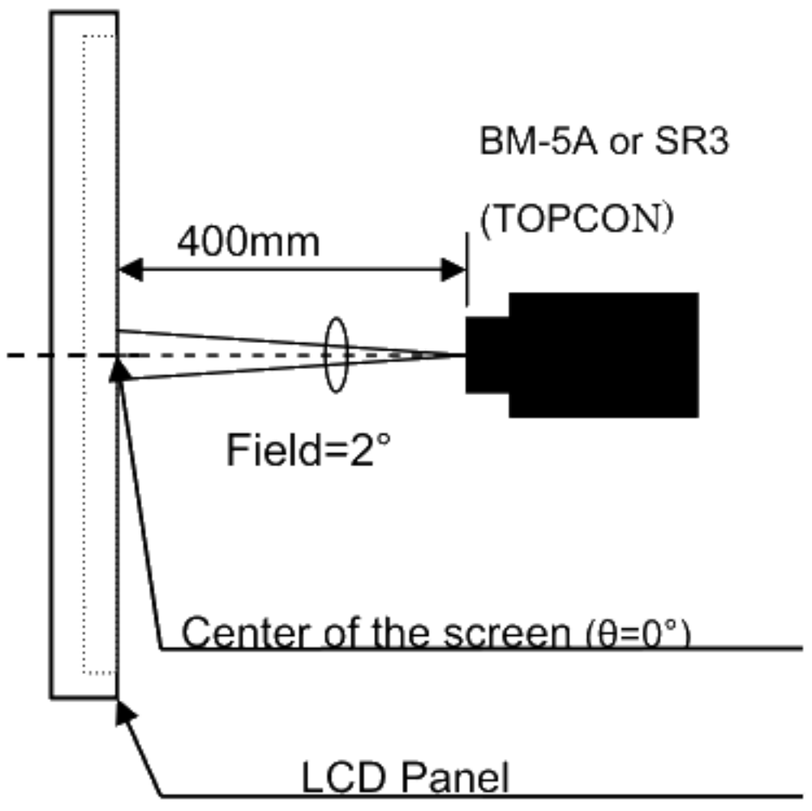
| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing Angle range | Horizontal | θ21 | CR＞10 | - | 65 | - | deg. | [Note9-1,9-4] |
| | | θ22 | | - | 65 | - | deg. | |
| | Vertical | θ11 | | - | 50 | - | deg. | |
| | | θ12 | | - | 60 | - | deg. | |
| Contrast ratio | | CRn | θ=0° | 300 | — | — | | [Note9-2,9-4] |
| | | CRo | Optimum viewing angle | 300 | 450 | — | | |
| Response Time | Rise + Decay | τr+τd | θ=0° | - | 35 | 40 | ms | [Note9-3,9-4] |
| Chromaticity of White | | x | | 0.283 | 0.313 | 0.343 | - | [Note9-4] |
| | | y | | 0.299 | 0.329 | 0.359 | - | |
| NTSC ratio | | S | | 40 | 48 | - | % | [Note9-4] |
| Luminance of white | | $Y_{L1}$ | | 220 | 280 | - | cd/m² | ILED=20mA [Note9-4] |
| White Uniformity | | | δW | - | 1.10 | 1.30 | - | [Note9-5] |

* The optical characteristics measurements are operated under a stable luminescence ($I_{LED}$ = 20mA) and a dark condition. (Refer to Fig.9-1)

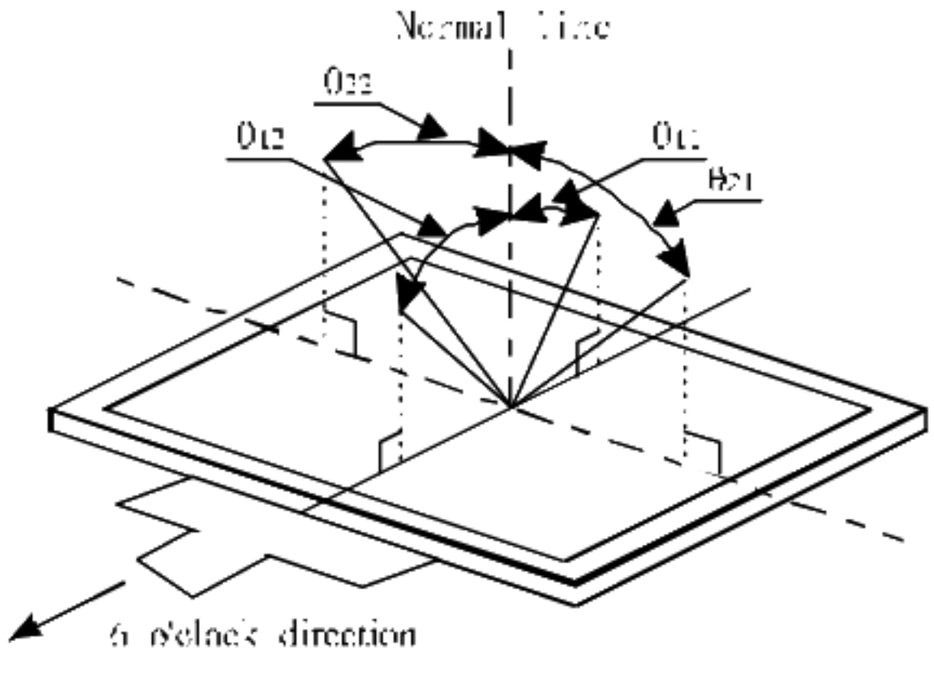
・Measuring Viewing Angle Range




・ Other Measurements



Note9-1) Definitions of viewing angle range



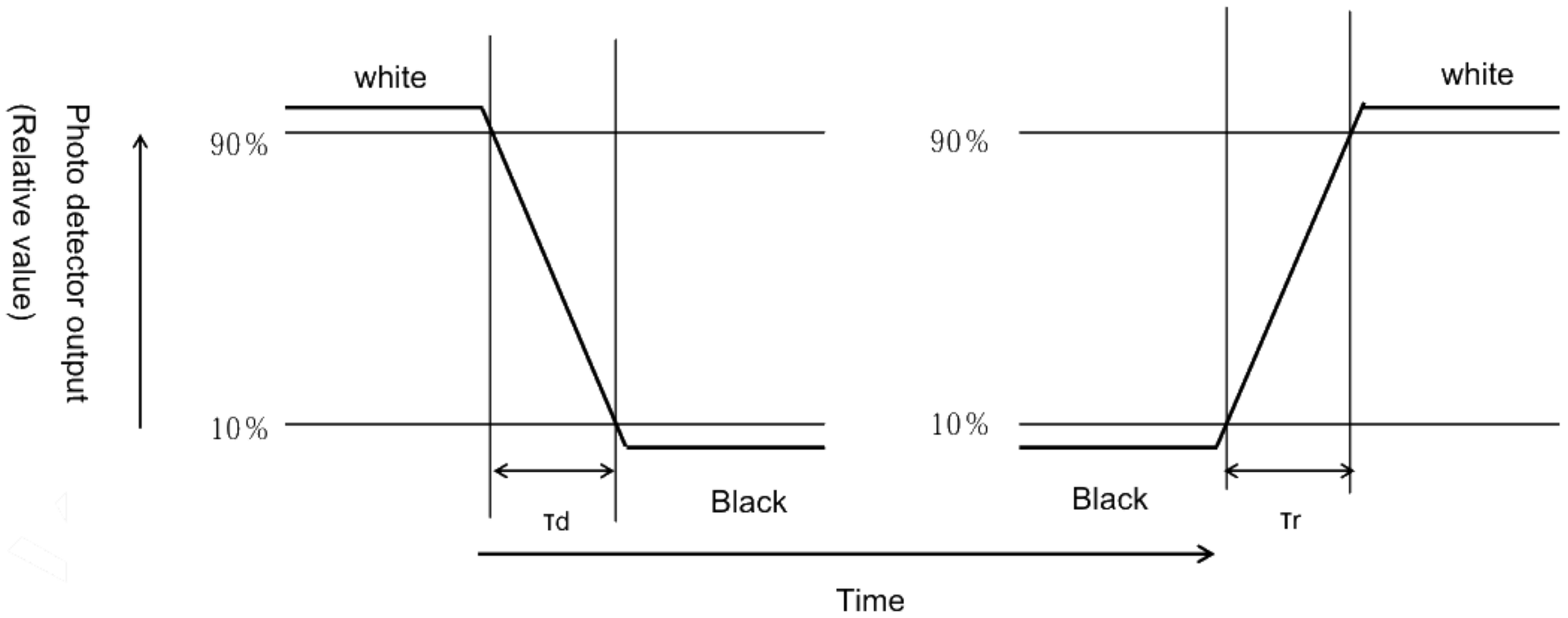

Note9-2) Definition of contrast ratio

The contrast ratio is defined as the following

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

Note9-3) Definition of response time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”

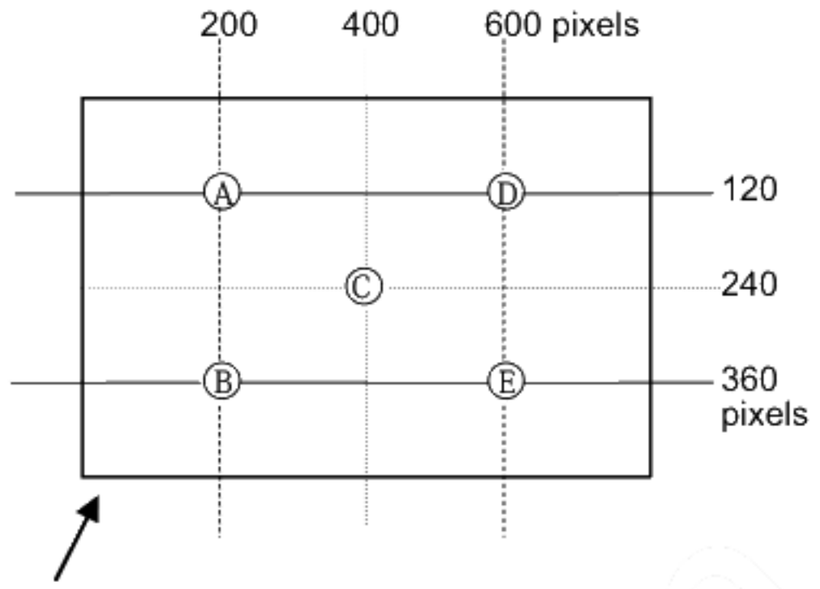



Note9-4) This shall be measured at center of the screen.

Note9-5) Definition of Uniformity △1

$$Uniformity = \frac{\text{Maximum Brightness}}{\text{Minimum Brightness}} \times 100\,(\%)$$

The brightness should be measured on the 5-point as shown in the right figure.




10. Touch panel characteristics △1

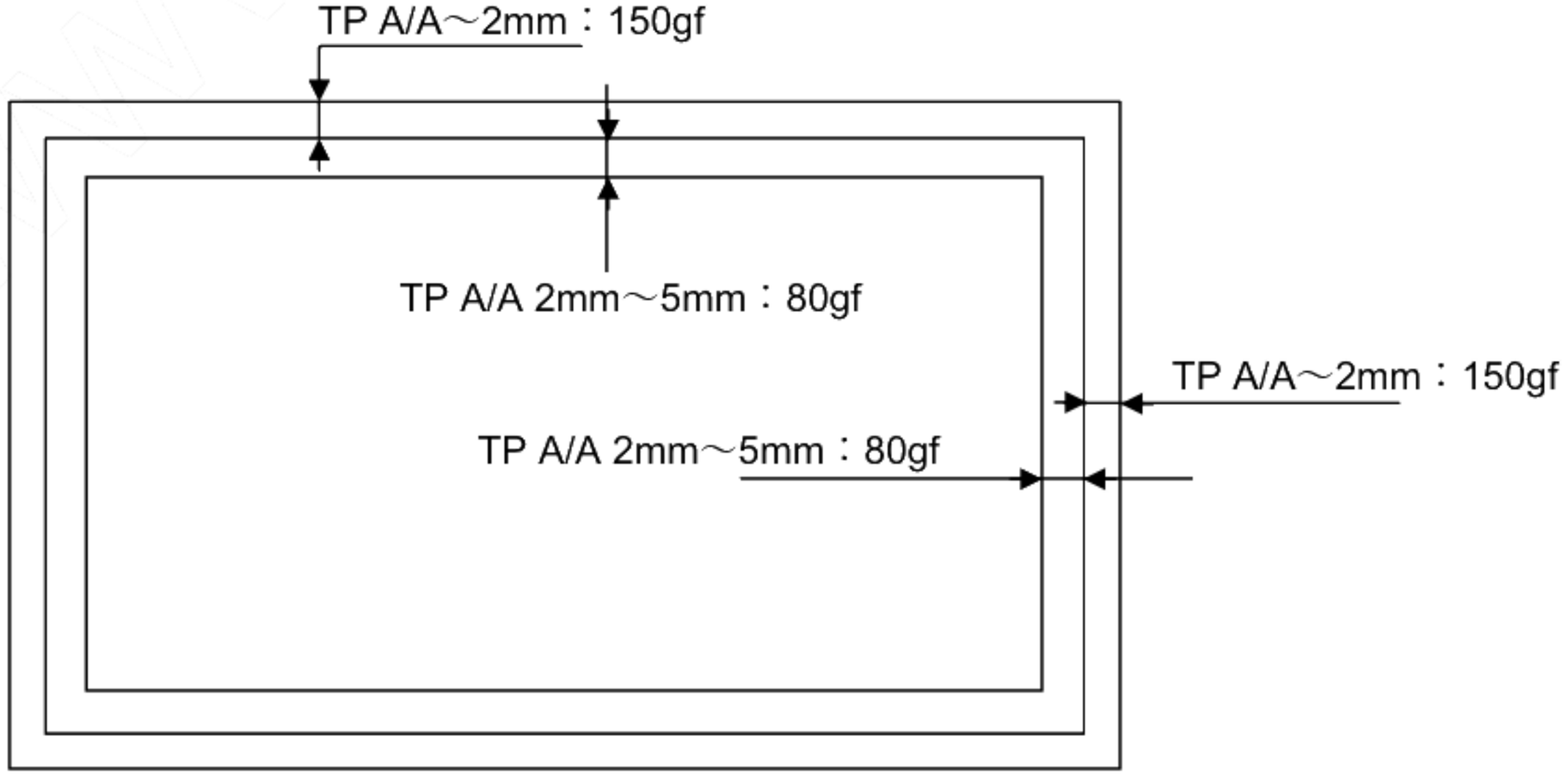
| Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Input voltage | - | - | 7.0 | V | |
| Resistor between terminals(XL-XR) | 100 | 750 | 900 | Ω | Provisional specification |
| Resistor between terminals(YU-YD) | 100 | 250 | 900 | Ω | |
| Line linearity(X direction) | -1.5 | - | 1.5 | % | |
| Line linearity(Y direction) | -1.5 | - | 1.5 | % | |
| Insuration resistance | 10 | - | - | MΩ | at DC25V |
| Minimum tension for detecting | - | (TBD) | 0.45 | N | NOTE10-2) |
| | - | (TBD) | 0.8 | N | NOTE10-3) |
| | - | (TBD) | 1.5 | N | NOTE10-4) |
| Puffiness | - | (0.18) | 0.4 | mm | |

Note10-1) For use of finger input. The typical resister values are reference.

Note10-2) 5mm～center inside of Touch panel Active area edge with 0.8mm stylus pen point.

Note10-3) 2～5mm inside of Touch panel Active area edge with 0.8mm stylus pen point.

Note10-4) 0～2mm inside of Touch panel Active area edge with 0.8mm stylus pen point.



11. Handling of modules

11-1. Insertion and removal of FPC

1) Be sure to turn off the power supply and the signals when inserting or removing the FPC.
2) Please do not put an excessive stress on FPC when inserting the FPC.

11-2. Handling of FPC

1) The bend radius of the FPC should be more than (0.5mm), and it should be bent evenly.
2) Do not dangle the LCD module by holding the FPC.

11-3. Mounting of the module

1) The module should be held on to the plain surface. Do not put any warping or twisting stress on it.
2) Please connect module bezel to GND so that static electricity is not charged to a module.
3) Design guidance for touch panel (T/P)
   a) Example of housing design
      (1) If a consumer will put a palm on housing in normal usage, care should be taken as follows.
      (2) Keep the gap, for example 0.3 to 0.7mm, between bezel edge and T/P surface.
      The reason is to avoid the bezel edge from contacting T/P surface that may cause a “short” with bottom layer. (See Fig.11-1)
      (3) Insertion a cushion material is recommended.
      (4) The cushion material should be limited just on the busbar insulation paste area.
      If it is over the transparent insulation paste area, a ”short” may be occurred.
      (5) There is one where a resistance film is left in the T/P part of the end of the pole.
      Design to keep insulation from the perimeter to prevent from mis-operation and so on.
   b) Mounting on display and housing bezel
      (1) In all cases, the T/P should be supported from the backside of the Plastic.
      (2) Do not to use an adhesive-tape to bond it on the front of T/P and hang it to the housing bezel.
      (3) Never expand the T/P top layer (PET-film) like a balloon by internal air pressure.
      The life of the T/P will be extremely short.
      (4) Top layer, PET, dimension is changing with environmental temperature and humidity.
      Avoid a stress from housing bezel to top layer, because it may cause “waving”.
      (5) The input to the touch panel sometimes distorts touch panel itself.
      (6) The material of housing bezel is SUS430.

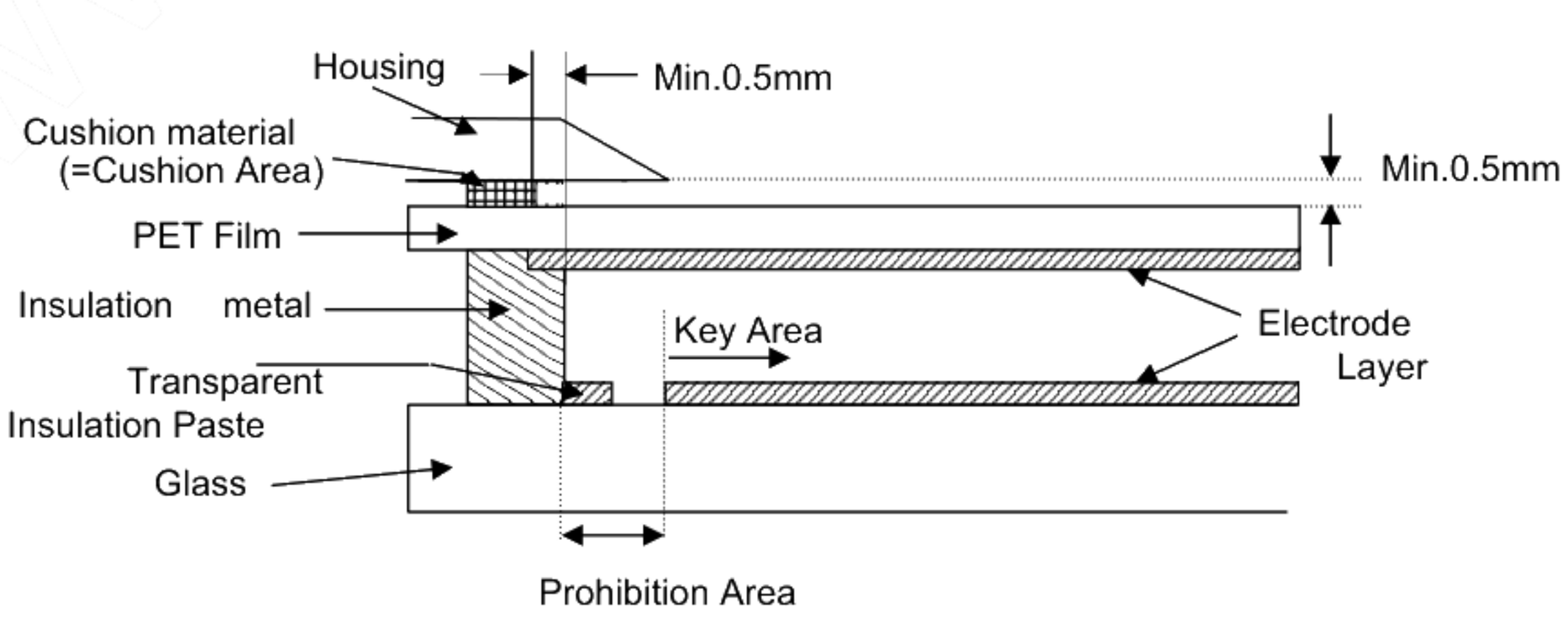



Fig.11-1

11-4. Cautions in assembly / Handling pre cautions.

As the polarizer can be easily scratched, be most careful in handling it.

1) Work environments in assembly.

Working under the following environments is desirable:

a) Implement more than 1MΩ conductive treatment (by placing a conductive mat or applying conductive paint) on the floor or tiles.

b) No dusts come in to the working room. Place an adhesive, anti-dust mat at the entrance of the room.

c) Humidity of 50 to 70% and temperature of 15 to 27°C are desirable.

d) All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.

e) Use a blower for electrostatic removal. Set it in a direction slightly tilt downward so that each Module can be well subjected to its wind. Set the blower at an optimum distance between the blower and the module.

2) How the remove dust on the polarizer

a) Blow out dust by the use of an N2 blower with antistatic measures taken. Use of an ionized air Gun is recommendable.

b) When the panel surface is soiled, wipe it with soft cloth.

3) In the case of the module's metal part (shield case) is stained, wipe it with a piece of dry, soft cloth. If rather difficult, give a breath on the metal part to clean better.

4) If water dropped, etc. remains stuck on the polarizer for a long time, it is apt to get discolored or cause stains. Wipe it immediately.

5) As a glass substrate is used for the TFT-LCD panel, if it is dropped on the floor or hit by something hard, it may be broken or chipped off.

6) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.

7) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

8) Protect sheet is attached to the module surface to prevent it from being scratched. Peel the sheet off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc.

9) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.

10) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

11) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the specification may not be satisfied.

12) Disassembling the module can cause permanent damage and should be strictly avoided.

13) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

11-5. Others

1) Regarding storage of LCD modules, avoid storing them at direct sunlight-situation.

You are requested to store under the following conditions:

(Environmental conditions of temperature/humidity for storage)

a) Temperature: 0 to 40°C

b) Relative humidity : 95% or less

- As average values of environments (temperature and humidity) for storing, use the following control guidelines:

Summer season: 20 to 35°C, 85% or less Winter season: 5 to 15°C, 85% or less

- If stored under the conditions of 40°C and 95% RH, cumulative time of storage must be less than 240 hours.

2) If stored at temperatures below the rated values, the inner liquid crystal may freeze, causing cell destruction. At temperatures exceeding the rated values for storage, the liquid crystal may become isotropic liquid, making it no longer possible to come back to its original state in some cases.

3) If the LCD is broken, do not drink liquid crystal in the mouth. If the liquid crystal adheres to a hand or foot or to clothes, immediately cleanse it with soap.

4) If a water drop or dust adheres to the polarizer, it is apt to cause deterioration. Wipe it immediately.

5) Be sure to observe other caution items for ordinary electronic parts and components.

6) If local pressure joins T/P surface for a long time, it will become the cause of generating of Newton's ring.

12. Reliability test items ①

| No. | Test item | Conditions |
|---|---|---|
| 1 | High temperature storage test | Ta = 70°C 240h |
| 2 | Low temperature storage test | Ta = -30°C 240h |
| 3 | High temperature<br>& high humidity operation test | (Ta = 40°C ; 95%RH 240h)<br>(No condensation) |
| 4 | High temperature operation test | Ta = 60°C 240h |
| 5 | Low temperature operation test | Ta = -20°C 240h |
| 6 | Vibration test<br>(non- operating) | Frequency range: 10 to 55Hz<br>Sweep: 1.5mm<br>Sweep time: 1minute<br>Test period: 2 hours for each direction of X,Y,Z |
| 7 | Shock test | Direction: ±X, ±Y, ±Z, Time: 3 times for each direction.<br>Impact value: 980m/s², Action time 6ms |
| 8 | Writing Test (Center of product)<br>(Touch panel) | Write 100,000 times straight line on the Film<br>with a stylus pen(R0.8 polyacetal tip)<br>Change every 20,000 times.<br>Force : 250gf<br>Speed: 60 mm/sec |
| 9 | Point activation test<br>(Touch panel) | Pit 1,000,000 times with a R8.0 Silicon Rubber.<br>Force : 250gf<br>Speed : 2 times/sec |
| 10 | Electro static discharge test | (non-operating)<br>±200V/200pF(0Ω ) to Terminals(Contact)<br>(1 time for each terminals)<br>±15kV/150pF(330Ω) to Housing bezel or T/P(Contact)<br>±20kV/150pF(330Ω) to Housing bezel or T/P(in Air)<br>(operating)<br>±4kV/150pF(330Ω) to Housing bezel or T/P(Contact)<br>±8kV/150pF(330Ω) to Housing bezel or T/P(in Air) |

*Note Ta = Ambient temperature

[Check items] ①

(a)Test No.1 to No.7, No.10

In the standard condition, there shall be no practical problems that may affect the display function.

(b)Test No.8, No.9, No.10

The characteristic is a range of the specification of “10 Touch panel characteristics”.

13. Display Grade

The standard regarding the grade of color LCD displaying modules should be based on the incoming inspection standard.

14. Delivery Form

14-1. Carton storage conditions

・Environments

Temperature: 0～40°C

Humidity: 65% RH or less (at 40°C)

There should be no dew condensation even at a low temperature and high humidity.

・Packing form: As shown in Figure.

*Cartons are weak against damp, and they are apt to be smashed easily due to the compressive pressure applied when piled up. The above environmental conditions of temperature and humidity are set in consideration of reasonable pile-up for storage.

14-2. Packing Form

| | |
|---|---|
| Piling number of cartons | Max.8 |
| Package quantity in one carton | 40pcs |
| Carton size | 360 (W)×575(D)×225(H) mm |
| Total mass of one carton filled with full modules | 10.4 kg |
| Packing form | Fig.14-2 |

15. Lot No. marking

1) Module label:

Notation: ①Model No. ②Serial No.

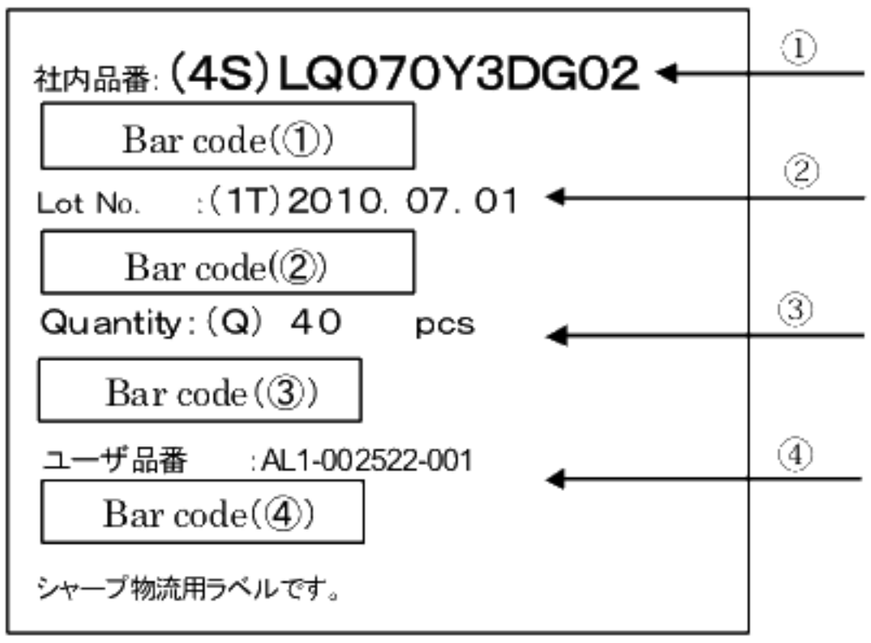



[Note] Production year ： 0(2010)、1(2011)、2(2012)、・・・・

Production Month： 1(Jan)、2(Feb)、・・・、9(Sep)、X(Oct)、Y(Nov)、Z(Dec)

2) Packing bar code label

Notation/ Bar code: ①Model No. ②Date ③Quantity ④User Part No.




16. LCD module packing carton

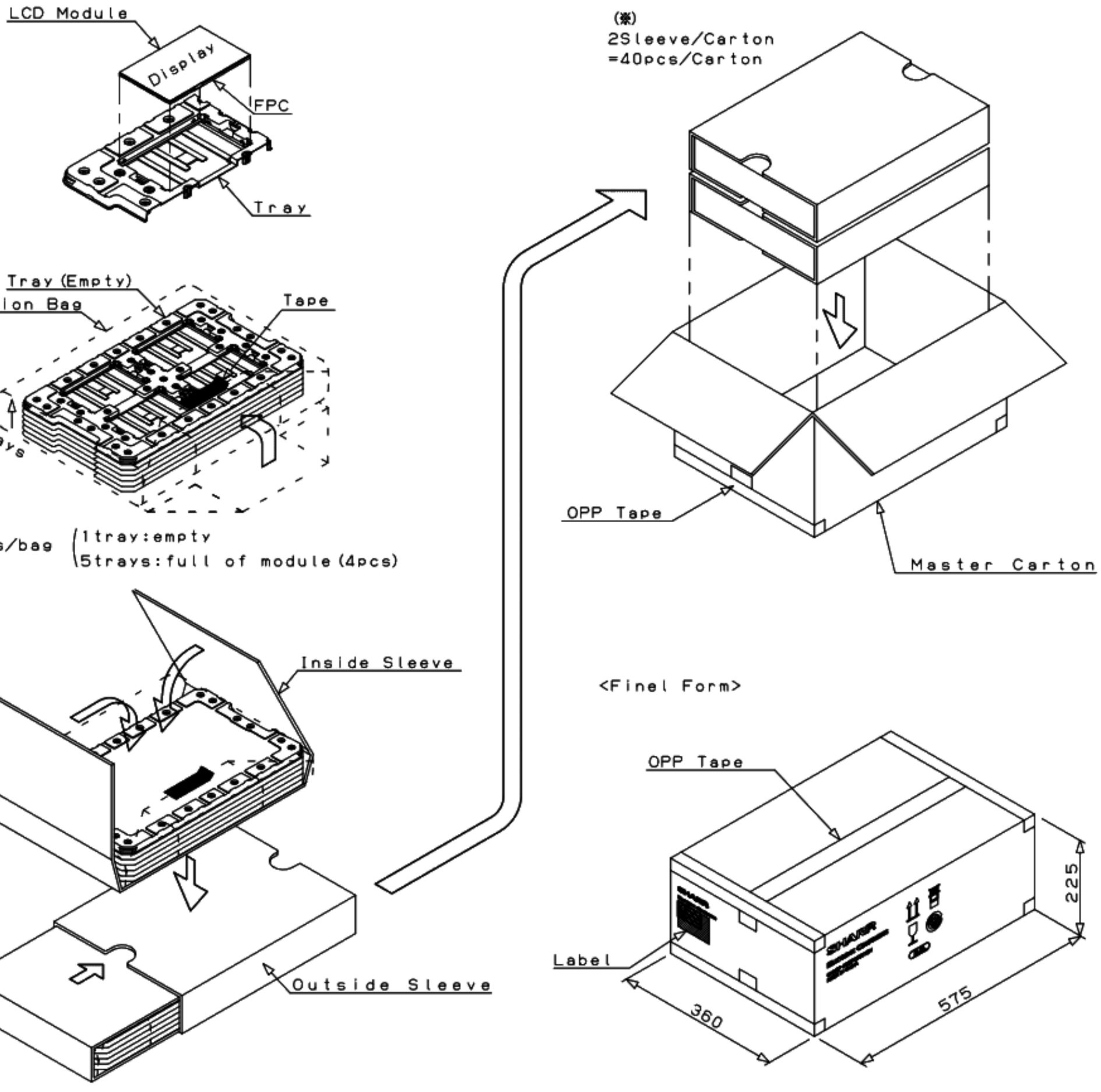



Fig.14-2

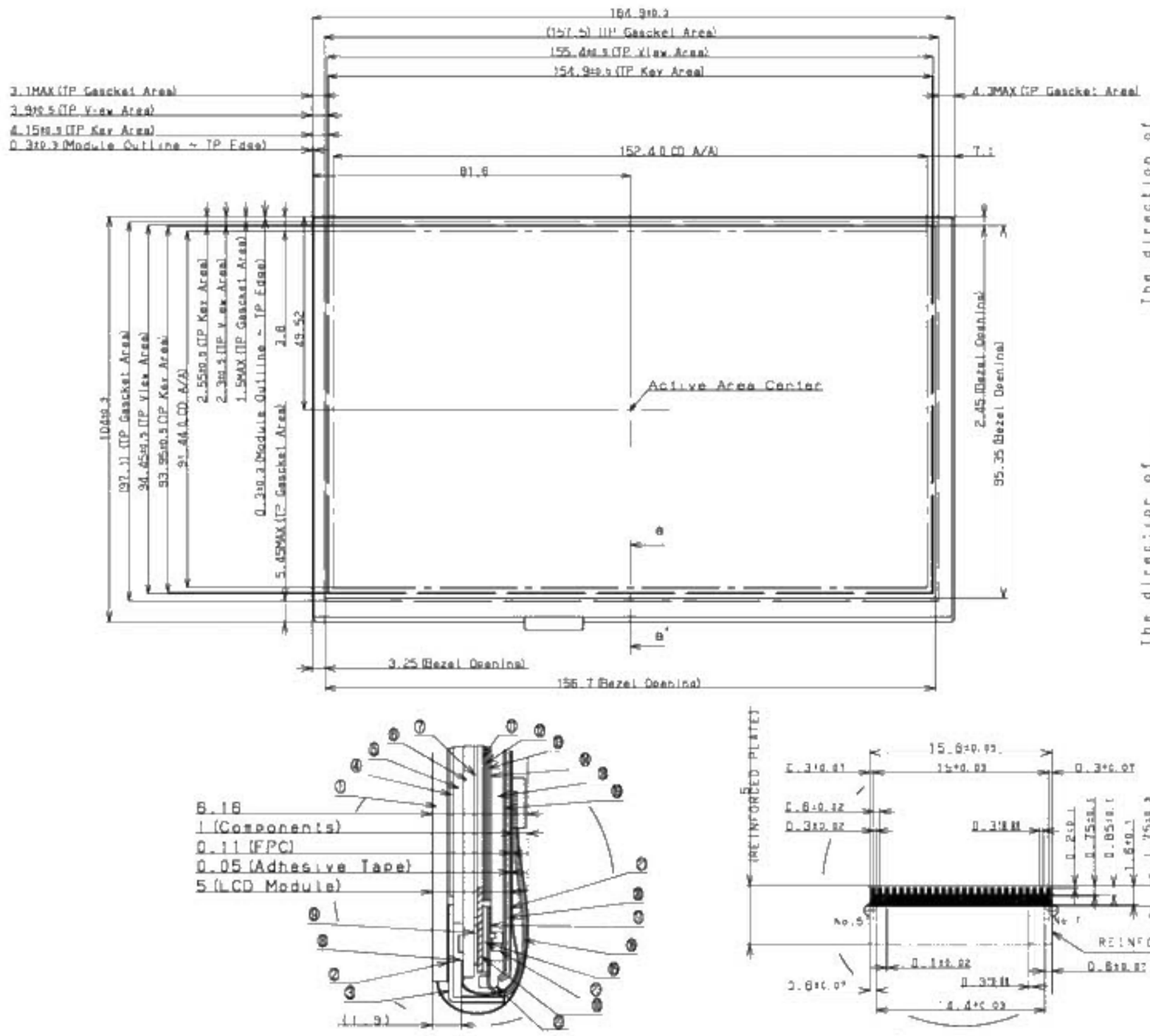
17. RoHS.Regulations

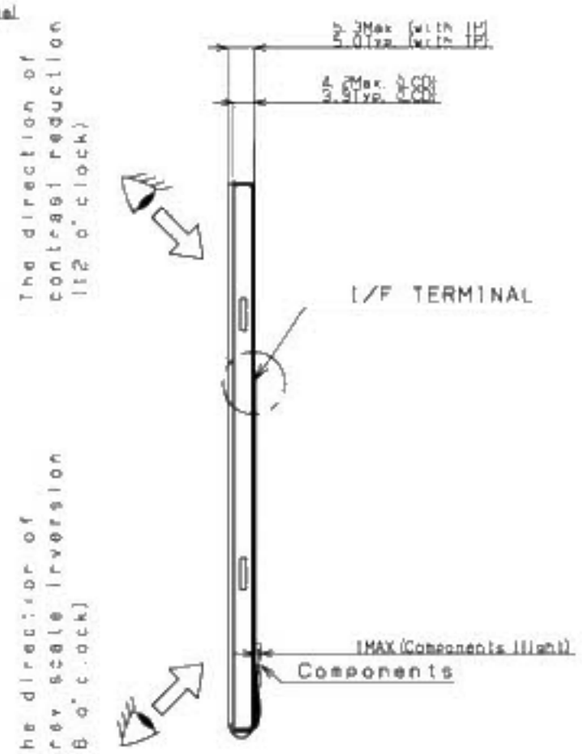
This LCD module is compliant with RoHS Directive.

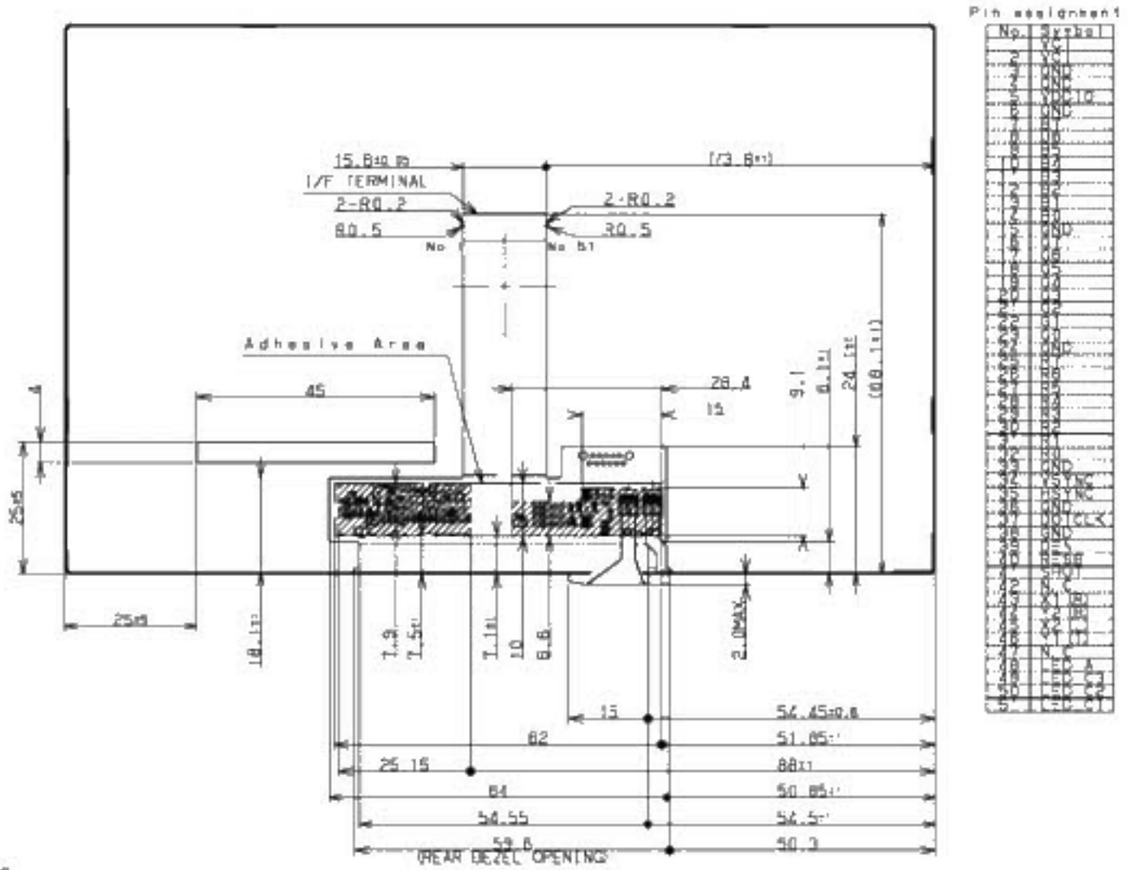
18. Others

7) Disassembling the module can cause permanent damage and you should be strictly avoided.
8) Please be careful that you don’t keep the screen displayed fixed pattern image for a long time, since retention may occur.
9) If you pressed down a liquid crystal display screen with your finger and so on, the alignment disorder of liquid crystal will occur. And then It will become display fault.
Therefore, be careful not to touch the screen directly, and to consider not stressing to it.
10) If any problem arises regarding the items mentioned in this specification sheet or otherwise, it should be discussed and settled mutually in a good faith for remedy and/or improvement.

## 19. Outline Dimension



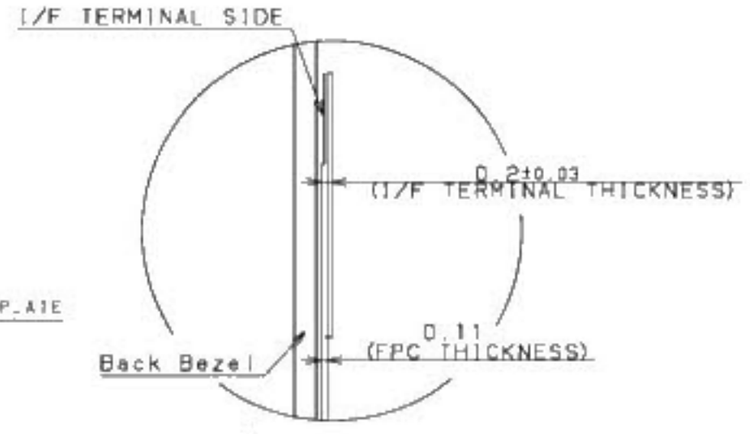




a-a' section
(SCALE 4/1)




I/F TERMINAL
FRONT VIEW
(perspective view
from display side)
(SCALE 3/1)




I/F TERMINAL
SIDE VIEW
(SCALE 10/1)

| | Parts Name | Materials | Thickness |
|---|---|---|---|
| ① | Touch Panel | - | 1.2 |
| ② | Adhesive Tape (TP) | #7041 (TERAOKA) | 0.1 |
| ③ | Front Bezel | SUS430 | 0.2 |
| ④ | Front Polarizer | - | 0.22 |
| ⑤ | CF Glass | - | 0.5 |
| ⑥ | TFT Glass | - | 0.5 |
| ⑦ | Rear Polarizer | - | 0.22 |
| ⑧ | Pins -FPC | - | 0.1 |
| ⑨ | Gasket | PET | 0.28 |
| ⑩ | Adhesive Tape (Panel) | #7694+PET+#7041 (TERAOKA) | 0.3 |
| ⑪ | Upper Diffusion Sheet | PBS-633 (KIMOTO) | 0.12 |
| ⑫ | Under Lens Sheet | HLAS 2.2C (LMS) | 0.15 |
| ⑬ | Under Lens Sheet | HLAS 2.2C (LMS) | 0.15 |
| ⑭ | Under Diffusion Sheet | BS 530 (KIMOTO) | 0.12 |
| ⑮ | Reflection Plate | MCPET-188SCL | 0.3 |
| ⑯ | LGP-FPC | - | 0.1 |
| ⑰ | Adhesive Tape (LED-FPC) | #5605SB (NITTO) | 0.05 |
| ⑱ | Light Source Plate | - (1838) (LMS) | 0.8 |
| ⑲ | Reflection Sheet | UX-150 (TEIJIN) | 0.15 |
| ⑳ | Rear Bezel | SUS430 | 0.2 |
| ㉑ | Adhesive Tape (Panel-FPC) | #7041 (TERAOKA) | 0.05 |
| ㉒ | Mold Frame | (1831) (LMS) | - |
| ㉓ | LED | 4SW-88-81 (NICHIA) | - |

<Thickness of I/F terminal surface coating>
Ni : 1~6μm Au : 0.03~0.3μm

Recommendation CN:
FH35-51S-0.3SH (50) (HIROSE)
FH35R-51S-0.3SH (50) (HIROSE)

NOTES
1. UNSPECIFIED TOLERANCE TO BE ±0.5
2. WARP AND FLATNESS FOR FPC AND CHASSIS ARE EXCLUDED FROM THICKNESS AND DIMENSION OF THE UNIT.
3. THE TOUCH PANEL DOES NOT STICK OUT FROM THE MODULE OUTLINE

D/N:2D-102-057-01
Panel/2: Assy※

Fig 7.0" WVGA OUTLINE DIMENSIONS

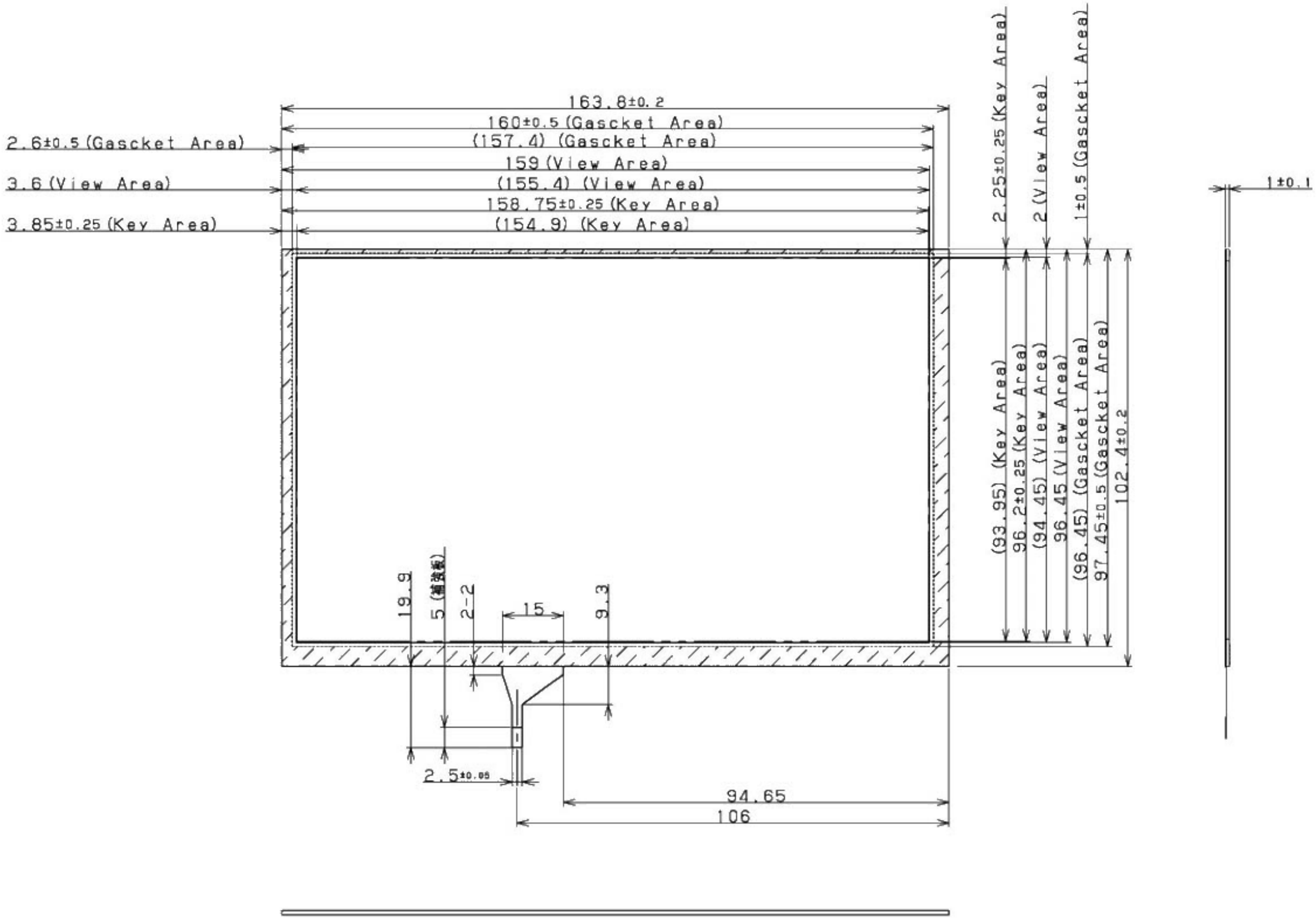



Fig 7.0" WVGA OUTLINE DIMENSIONS

※1) 指示なき寸法公差は±0.3
※2) ( ) 内は参考寸法
D/N:2D-102-057-11
Page2/2: タッチパネル