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| | MOBILE LIQUID CRYSTAL DISPLAY GROUP<br>SHARP CORPORATION | APPLICABLE GROUP<br>MOBILE LIQUID CRYSTAL DISPLAY GROUP |
| | SPECIFICATION | |

Revised : Jun. 19. 2008

DEVICE SPECIFICATION FOR

# TFT-LCD Module

MODEL No.

# LQ050W1LA0A

☐ CUSTOMER'S APPROVAL

DATE _____

BY _____

PRESENTED

BY K. Shiono

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SHARP CORPORATION

# RECORDS OF REVISION

LQ050W1LA0A

| ^SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|---|---|---|---|---|---|
| LD-20132A | Mar.06.2008 | - | - | | 1st Issue |
| LD-20132B | Jun.19.2008 | 1 | 7 | 5. Absolute Maximum Ratings<br>Touch panel input voltage<br>Added: Remark [Note 3] | 2nd Issue |
| | | | 9 | 6-2. Backlight driving<br>LED life time<br>Added: Typ.15000H | |
| | | | 12 | 7. Touch panel characteristics<br>Input voltage<br>Revised: Max. 7.0V → 5.5V | |
| | | | 20 | 16. Reliability Test Items<br>Touch panel testing apparatus<br>Revised: 4.9N → 2.4N | |
| | | | 21 | 17. Label<br>1) Module Bar cord label<br>Revised： 1) Module label | |
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In case of using the device for applications such as control and safety equipment for transportation(aircraft, trains, automobiles, etc. ), rescue and security equipment and various safety related equipment which require higher reliability and safety, take into consideration that appropriate measures such as fail-safe functions and redundant system design should be taken.

Do not use the device for equipment that requires an extreme level of reliability, such as aerospace applications, telecommunication equipment(trunk lines), nuclear power control equipment and medical or other equipment for life support.

SHARP assumes no responsibility for any damage resulting from the use of the device, which does not comply with the instructions, and the precautions specified in these specification sheets.

Confirm "13. Handling Precautions " item when you use the device.

Contact and consult with a SHARP sales representative for any questions about this device.

Table of contents

1. Application

This specification applies to a color TFT-LCD module, LQ050W1LA0A.

2. Overview

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 ICs, a control circuit and power supply circuit, a backlight unit, and a touch panel. Graphics and texts can be displayed on a 1024×3×600 dots panel with 262,144 colors by using LVDS (Low Voltage Differential Signaling) to interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight.

In this TFT-LCD panel , low reflection / color filters of excellent color performance and backlights of high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

Optimum viewing direction is 6 o'clock.

Backlight-driving LED controller is built in this module.

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|---|---|---|
| Display size | 12.6 (5.0") Diagonal | cm |
| Active area | 109.1 (H)×63.9 (V) | mm |
| Pixel format | 1024 (H)×600 (V) | pixel |
| | (1 pixel = R+G+B dots) | |
| Pixel pitch | 0.106 (H)×0.106 (V) | mm |
| Pixel configuration | R,G,B vertical stripe | |
| Display mode | Normally white | |
| Surface treatment | Glare and hard-coating (2H) | |

| Parameter | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Unit outline dimensions [Note 1] | Width | 118.7 | 119.0 | 119.3 | mm |
| | Height | 76.0 | 76.3 | 76.6 | mm |
| | Depth | — | 5.4 | 5.6 | mm |
| Mass | | — | 67 | 72 | g |

[Note 1] Outline dimensions is shown in Fig.2

Excluding Touch Panel FPC.

4. Input Terminals

4 - 1. Symbol

CN1 (LVDS signals,+3.3V DC power supply,B/L power supply,B/L control signal and TP signal)

| Pin No. | Symbol | Pin No. | Symbol |
|---|---|---|---|
| 2 | TP_X2 | 1 | TP_Y2 |
| 4 | TP_X1 | 3 | TP_Y1 |
| 6 | GND | 5 | GND |
| 8 | SHTDB | 7 | BLVcc |
| 10 | BRT | 9 | BLVcc |
| 12 | GND | 11 | BLVcc |
| 14 | CKIN+ | 13 | GND |
| 16 | CKIN- | 15 | GND |
| 18 | RxIN2+ | 17 | GND |
| 20 | RxIN2- | 19 | GND |
| 22 | RxIN1+ | 21 | GND |
| 24 | RxIN1- | 23 | GND |
| 26 | RxIN0+ | 25 | Vcc |
| 28 | RxIN0- | 27 | Vcc |
| 30 | GND | 29 | Vcc |

4 - 2. Function

| Pin No. | Symbol | Function | Remark |
|---|---|---|---|
| Power Supply | | | |
| 25 | Vcc | +3.3V power supply | |
| 27 | Vcc | +3.3V power supply | |
| 29 | Vcc | +3.3V power supply | |
| 7 | BLVcc | +5.0～20V power supply (For Backlight driver) | |
| 9 | BLVcc | +5.0～20V power supply (For Backlight driver) | |
| 11 | BLVcc | +5.0～20V power supply (For Backlight driver) | |
| 5 | GND | | |
| 6 | GND | | |
| 12 | GND | | |
| 13 | GND | | |
| 15 | GND | | |
| 17 | GND | | |
| 19 | GND | | |
| 21 | GND | | |
| 23 | GND | | |
| 30 | GND | | |

| LVDS signal | | | |
|---|---|---|---|
| 14 | CK IN+ | Receiver signal of LVDS CLK (+) | [Note 1] |
| 16 | CK IN- | Receiver signal of LVDS CLK (-) | [Note 1] |
| 18 | RxIN2+ | Receiver signal of LVDS CH2 (+) | [Note 1] |
| 20 | RxIN2- | Receiver signal of LVDS CH2 (-) | [Note 1] |
| 22 | RxIN1+ | Receiver signal of LVDS CH1 (+) | [Note 1] |
| 24 | RxIN1- | Receiver signal of LVDS CH1 (-) | [Note 1] |
| 26 | RxIN0+ | Receiver signal of LVDS CH0 (+) | [Note 1] |
| 28 | RxIN0- | Receiver signal of LVDS CH0 (-) | [Note 1] |
| B/L control signal | | | |
| 8 | SHTDB | Backlight ON/OFF control signal | |
| 10 | BRT | Backlight dimming control signal | |
| Touch Panel signal | | | |
| 1 | TP_Y2 | Touch panel Y Bottom terminal | |
| 2 | TP_X2 | Touch panel X Left terminal | |
| 3 | TP_Y1 | Touch panel Y Top terminal | |
| 4 | TP_X1 | Touch panel X Right terminal | |

[Note 1] Relation between RxINi(i=0,1,2) and actual data is shown in following section (4-2)(7-2).

[Note 2] The shielding case is connected with signal GND.

Using connector : (DF30FB-30DS-0.4V (HIROSE))

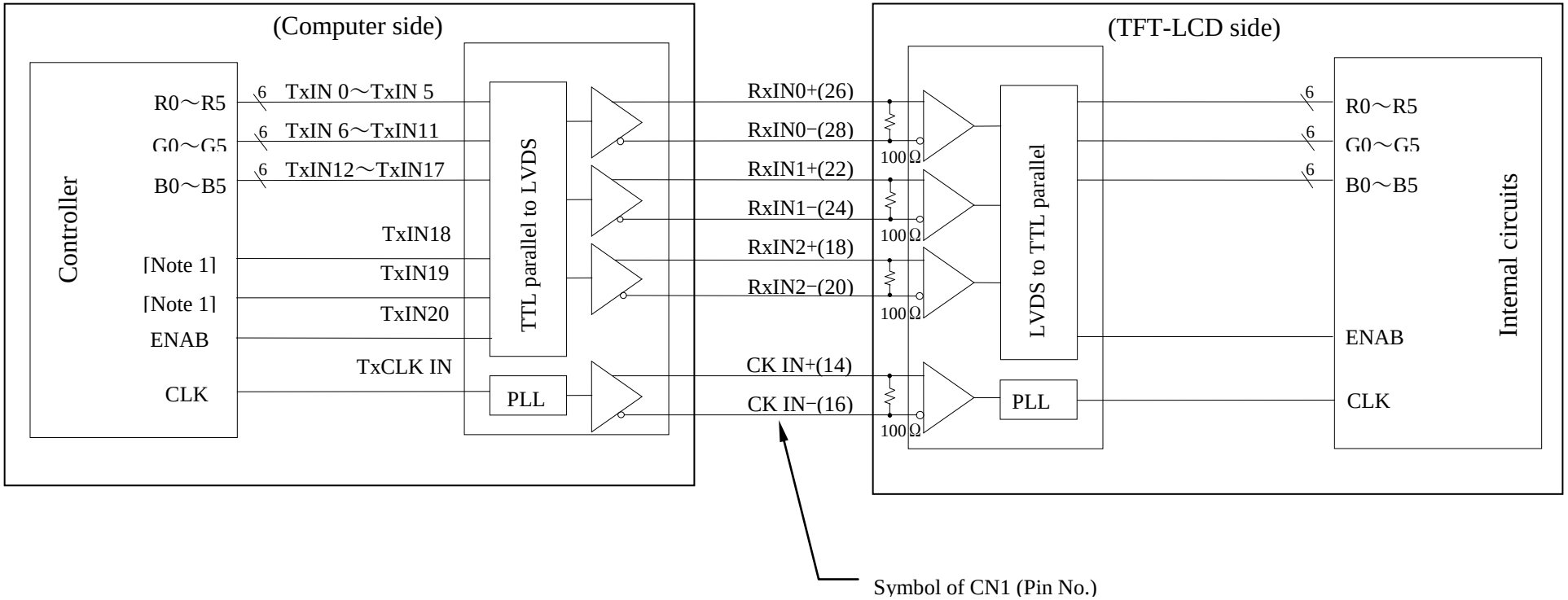
Corresponding connector : (DF30FB-30DP-0.4V (HIROSE))

(Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

4 - 3. LVDS interface block diagram

Using receiver : Single LVDS interface contained in a control IC

Corresponding Transmitter : THC63LVDM63A (THINE) or equivalent




[Note 1] Do not use at high-impedance TxIN 18 - 19.

5. Absolute Maximum Ratings

| Parameter | Symbol | Condition | Ratings | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | | Min. | Max. | | |
| Input voltage | $V_I$ | Ta=25℃ | -0.3 | Vcc+0.3 | V | [Note 1] |
| +3.3V supply voltage | Vcc | Ta=25℃ | 0 | +4.0 | V | |
| LED power supply voltage | BLVcc | Ta=25℃ | 0 | +28.0 | V | |
| LED bright control signal | BRT | Ta=25℃ | 0 | +5.0 | V | |
| LED ON/OFF signal | SHTDB | Ta=25℃ | 0 | +5.0 | V | |
| Storage temperature (ambient) | Tstg | — | -25 | +70 | ℃ | [Note 2] |
| Operating temperature (Panel surface) | Topa | — | 0 | +60 | ℃ | |
| Touch panel input voltage | Vtp | Ta=25℃ | 0 | 7.0 | V | [Note 3] |

[Note 1] LVDS signals

[Note 2] Humidity：95%RH Max. at Ta≦+40℃.

Maximum wet-bulb temperature at +39℃ or less at Ta>+40℃.

No condensation.

[Note 3] TP_X1,TP_Y1,TP_X2,TP_Y2：When touch panel controller is connected.


6. Electrical Characteristics

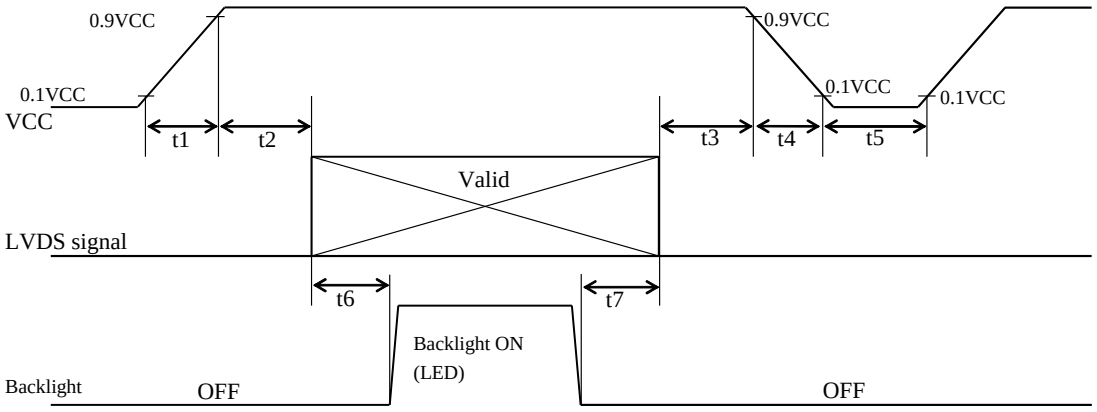
6 - 1. TFT-LCD panel driving

Ta＝+25℃

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Supply voltage | | Vcc | +3.0 | +3.3 | +3.6 | V | [Note 2] |
| Current dissipation | | Icc | — | 120 | 160 | mA | [Note 3] |
| Permissive input ripple voltage | | $V_{RP}$ | — | — | 100 | $mV_{P-P}$ | Vcc = +3.3V |
| Input voltage range | | $V_I$ | 0 | | 2.4 | V | LVDS signals |
| Differential input threshold voltage | High | $V_{TH}$ | — | — | +100 | mV | $V_{CM}$ = +1.2V [Note 1] |
| | Low | $V_{TL}$ | –100 | — | — | mV | |
| Input current (High) | | $I_{OH}$ | — | — | ±10 | μA | $V_I$ = +2.4V Vcc = +3.6V |
| Input current (Low) | | $I_{OL}$ | — | — | ±10 | μA | $V_I$ = 0V Vcc = 3.6V |
| Termination resistor | | $R_T$ | — | 100 | — | Ω | Differential input |

[Note 1] $V_{CM}$ : Common mode voltage of LVDS driver.

[Note 2] On-off conditions for supply voltage



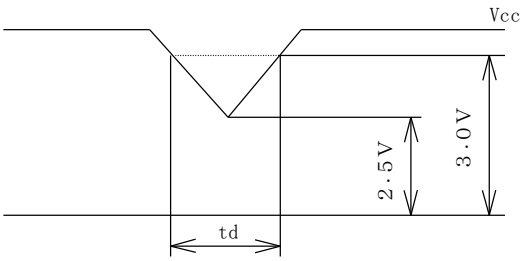

| Symbol | Min. | Max. | Remark | |
|---|---|---|---|---|
| t1 | 0 | 10 | ms | |
| t2 | 0 | 1 | s | |
| t3 | 0 | 1 | s | |
| t4 | 0 | 400 | ms | |
| t5 | 200 | — | ms | |
| t6 | 180 | — | ms | *1 |
| t7 | 5 | — | ms | *1 |

*1 : As for the power sequence for backlight, it is recommended to apply above mentioned input timing. If the backlight is lit on and off at a timing other than shown above, displaying image may get disturbed. This is due to variation of output signal from timing generator when LVDS signal is changed from on to off or vice versa, but has no harm to the module itself.

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

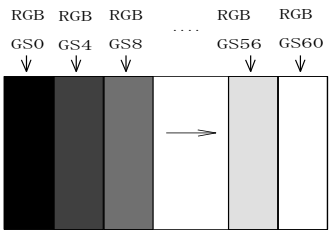
Vcc-dip conditions

1) 2.5 V≦Vcc＜3.0 V
   td≦10 ms
   Under above condition, the display image should return to an appropriate figure after Vcc voltage recovers.
2) Vcc＜2.5 V
   Vcc-dip conditions should also follow the On-off conditions for supply voltage




[Note 3] Typical current situation : 16-gray-bar pattern.
Vcc=+3.3V

Maximum current situation : Vcc=+3.6V



6 - 2. Backlight driving

△1

The backlight system is edge-lighting type with LED.

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Supply voltage range | BLVcc | +5.0 | +7.4 | +20.0 | V | [Note 1] |
| Current dissipation | — | — | 125 | 240 | mA | [Note 1,2] |
| | — | — | — | 100 | uA | [Note 3] |
| Permissive input ripple voltage | — | — | — | 100 | $mV_{P-P}$ | [Note 1] |
| Input signal voltage range | — | 0 | — | 5.0 | V | [Note 4] |
| Input signal High level threshold | — | 2.7 | — | — | V | [Note 4] |
| Input signal Low level threshold | — | — | — | 0.2 | V | [Note 4] |
| PWM frequency | $f_{PWM}$ | 200 | 300 | 400 | Hz | [Note 4,5] |
| PWM Duty ratio | $D_{PWM}$ | 1 | — | 100 | % | [Note 4,5] |
| LED life time | — | 10000 | 15000 | — | Hour | [Note 6] |

[Note 1] BLVcc

[Note 2] Typ: BLVcc = 7.4V , Max: BLVcc = 5.0V ; $D_{PWM}$ =100%

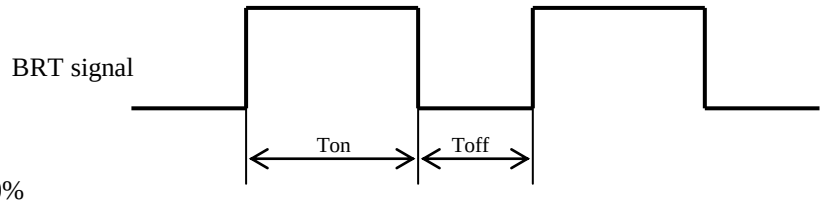
[Note 3] BLVcc = 7.4V,SHTBD="Lo"

[Note 4] BRT,SHTDB

[Note 5] PWM dimming control signal (BRT)

$f_{PWM}$ = 1 / (Ton + Toff)

$D_{PWM}$ = Ton / (Ton + Toff)




Maximum Luminance: $D_{PWM}$ = 100%

In case of using the low frequency, the deterioration of display quality, flicker, etc, may occur.

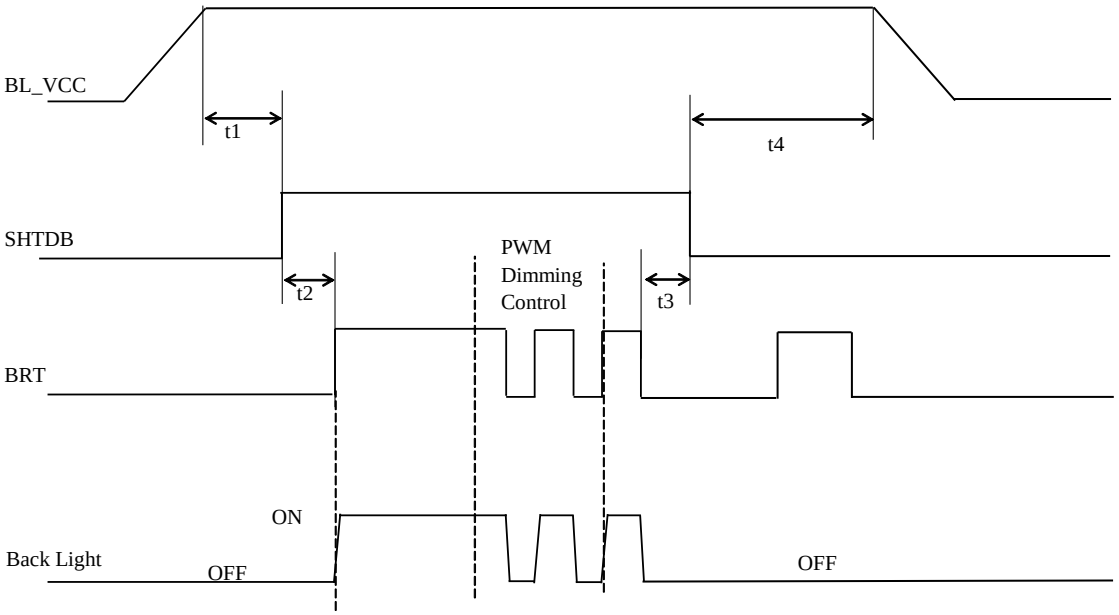
[Note 6] $D_{PWM}$ = 100% Ta=25℃ continuous operation

LED life time is defined as the time when Brightness becomes 50 % of the original value under standard condition.

[Note 7] Backlight ON/OFF function

| SHTDB | BRT | Backlight |
|---|---|---|
| "Lo" | — | OFF |
| "Hi" | "Lo" | OFF |
| | "Hi" | ON |

[Note 8] Power supply input sequence




| Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|
| t1 | 0 | — | ms | |
| t2 | 0 | — | ms | |
| t3 | 0 | — | ms | |
| t4 | 0 | — | ms | |

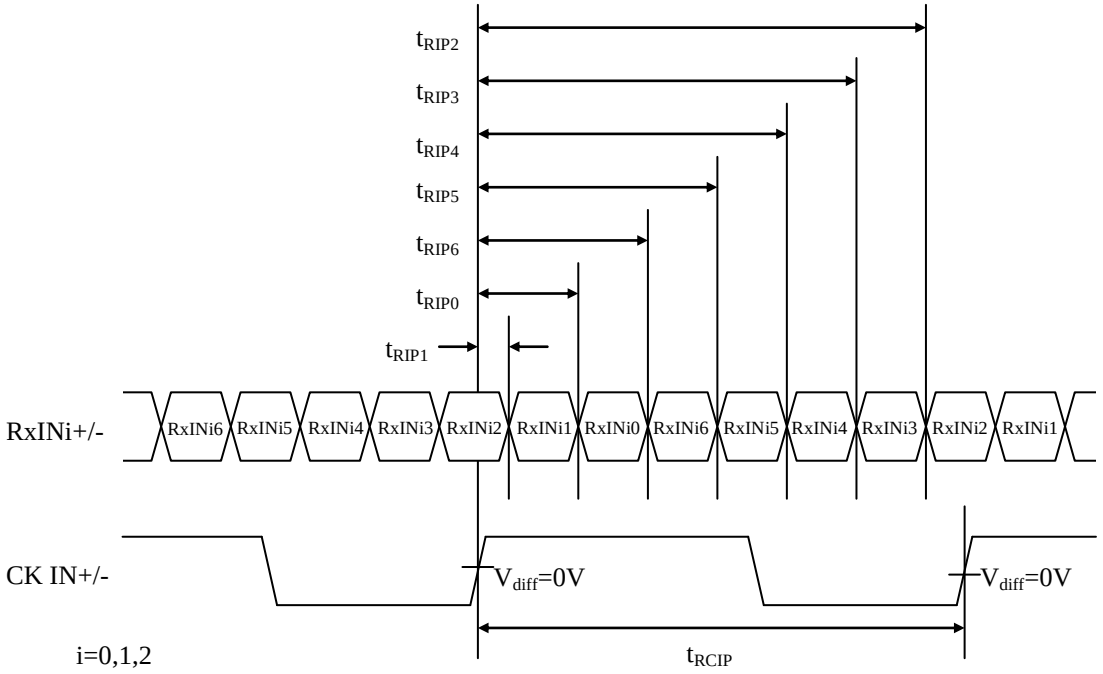
6 - 3. LVDS input specification

6 - 3 - 1. AC characteristics

VCC=+3.0V～+3.6V, Ta＝0℃～+60℃

| Parameter | Symbol | Min | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Data Position 0 (tRCIP=20.48ns) | $t_{RIPI}$ | -0.25 | 0.0 | +0.25 | ns |
| Input Data Position 1 (tRCIP=20.48ns) | $t_{RIP0}$ | $t_{RCIP}$/7-0.25 | $t_{RCIP}$/7 | $t_{RCIP}$/7+0.25 | ns |
| Input Data Position 2 (tRCIP=20.48ns) | $t_{RIP6}$ | 2 $t_{RCIP}$/7-0.25 | 2 $t_{RCIP}$/7 | 2 $t_{RCIP}$/7+0.25 | ns |
| Input Data Position 3 (tRCIP=20.48ns) | $t_{RIP5}$ | 3 $t_{RCIP}$/7-0.25 | 3 $t_{RCIP}$/7 | 3 $t_{RCIP}$/7+0.25 | ns |
| Input Data Position 4 (tRCIP=20.48ns) | $t_{RIP4}$ | 4 $t_{RCIP}$/7-0.25 | 4 $t_{RCIP}$/7 | 4 $t_{RCIP}$/7+0.25 | ns |
| Input Data Position 5 (tRCIP=20.48ns) | $t_{RIP3}$ | 5 $t_{RCIP}$/7-0.25 | 5 $t_{RCIP}$/7 | 5 $t_{RCIP}$/7+0.25 | ns |
| Input Data Position 6 (tRCIP=20.48ns) | $t_{RIP2}$ | 6 $t_{RCIP}$/7-0.25 | 6 $t_{RCIP}$/7 | 6 $t_{RCIP}$/7+0.25 | ns |
| Phase Lock Loop Set | $t_{RPLL}$ | — | — | 10 | ms |
| Input Clock Period | $t_{RCIP}$ | 18.52 | 20.48 | 20.83 | ns |

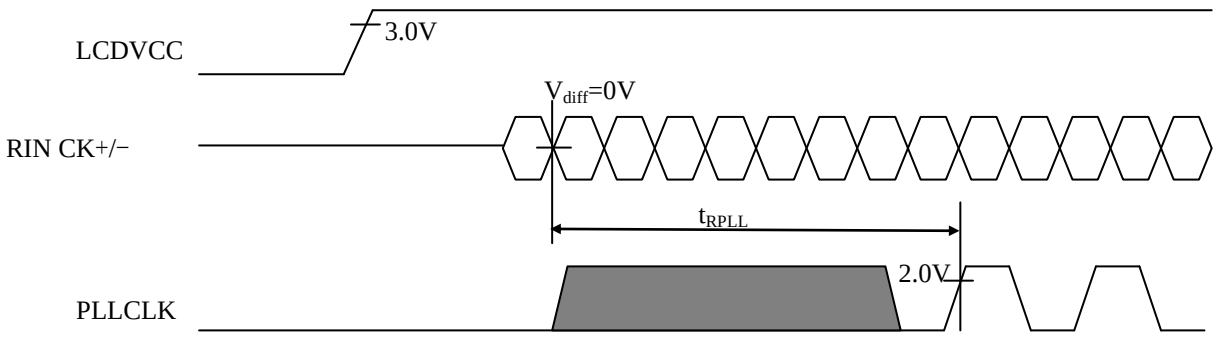
LVDS input timing



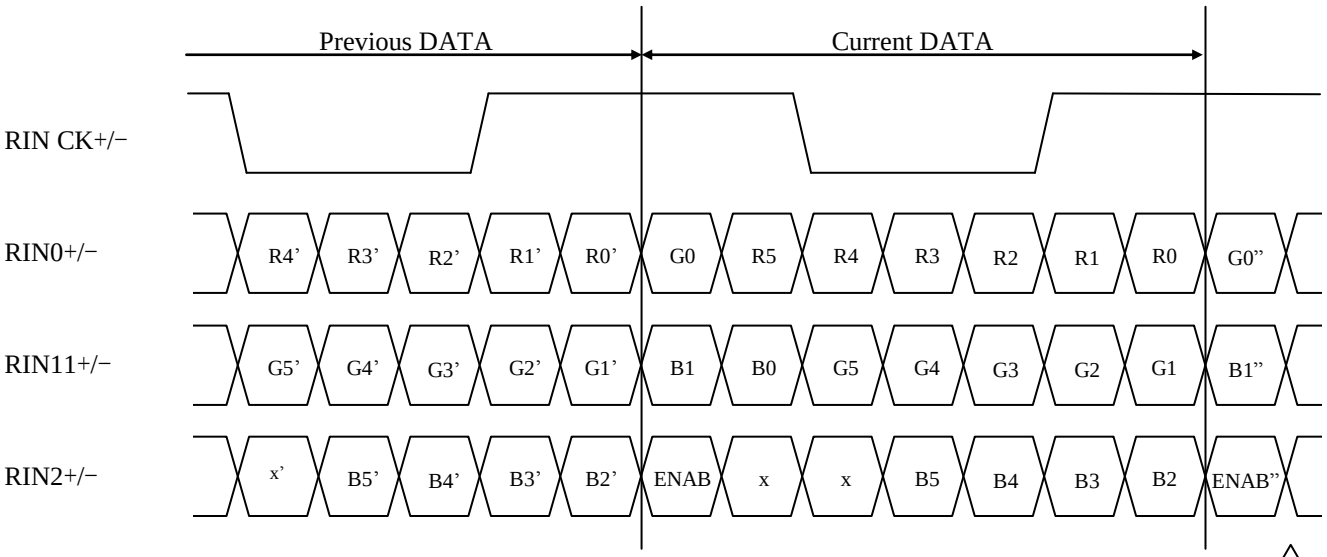

※Note

Vdiff=(RxINi+)-(RxINi-), (CK IN+)-(CK IN-)

LVDS phase lock loop set



6 - 3 - 2. LVDS data

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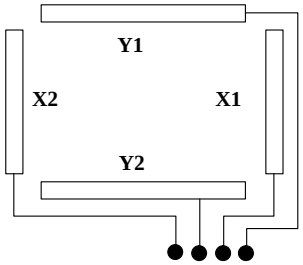
7. Touch panel characteristics

| Parameter | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| Input voltage | - | 5.0 | 5.5 | V | [Note 2] |
| Resistor between terminals(TP_X1-TP_X2) | 250 | 510 | 850 | Ω | |
| Resistor between terminals(TP_Y1-TP_Y2) | 100 | 180 | 300 | Ω | |
| Line linearity(X direction) | - | - | 1.5 | % | |
| Line linearity(Y direction) | - | - | 1.5 | % | |
| Insuration resistance | 20 | - | - | MΩ | at DC15V |
| Minimum tension for detecting | - | - | 0.8 | N | |
| Chattering | - | - | 10 | ms | |

[Note 1] Wiring diagram of touch panel

[Note 2] When touch panel controller is connected.



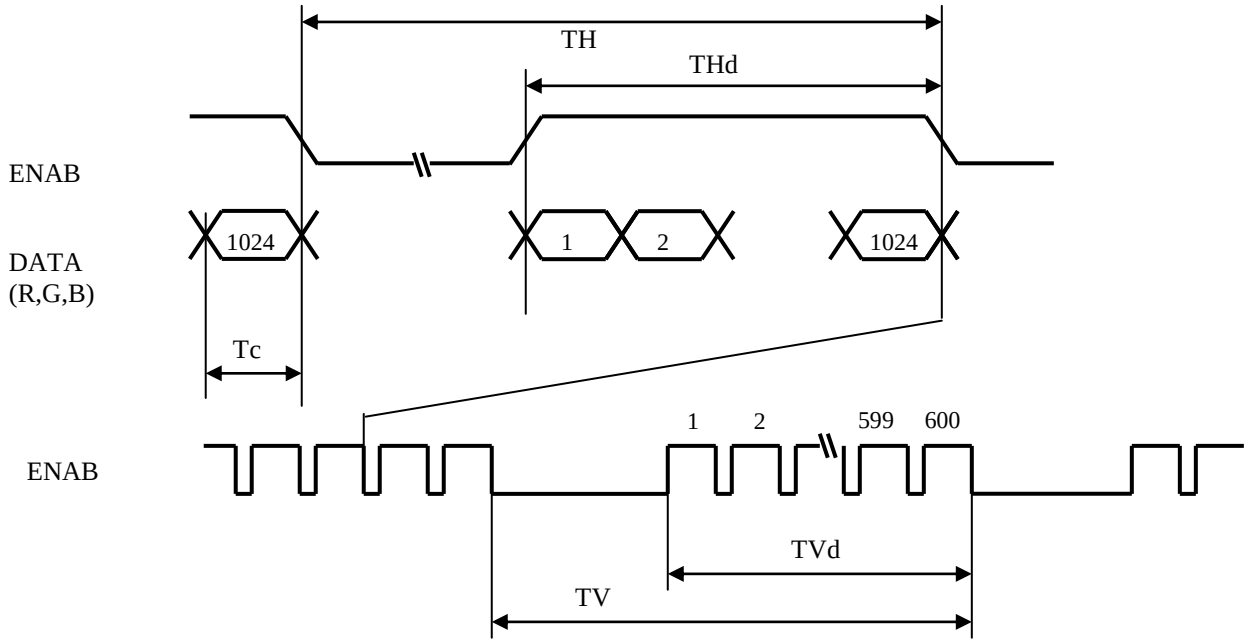

8. Timing Characteristics of Input Signals

8 - 1. Timing characteristics

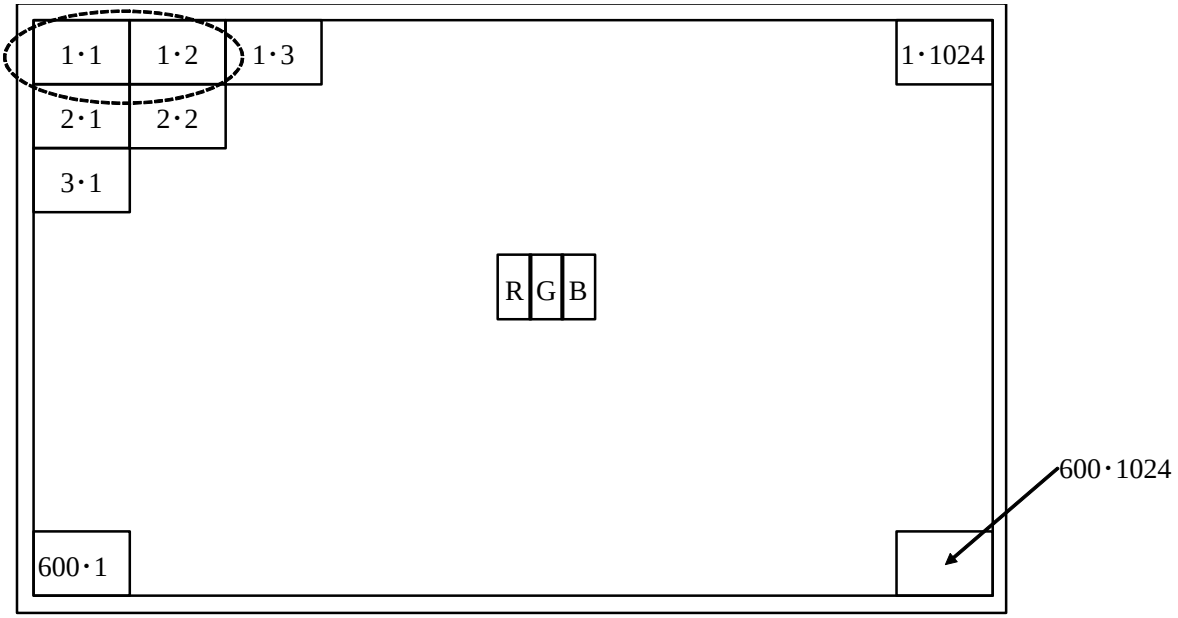
Vcc=+3.0V～+3.6V, Ta＝0℃～+60℃

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|
| Clock | Frequency | 1/Tc | 48 | 48.836 | 54 | MHz | [Note 1] |
| Data enable Signal | Horizontal period | TH | 1260 | 1312 | 1408 | clock | |
| | | | 24.512 | 26.865 | — | μs | |
| | Horizontal period (High) | THd | 1024 | 1024 | 1024 | clock | |
| | Vertical period | TV | 603 | 621 | 900 | Line | |
| | | | 16.069 | 16.683 | — | ms | |
| | Vertical period (High) | TVd | 600 | 600 | 600 | line | |

[Note 1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.




8 - 2. Input data signals and display position on the screen




Display position of input data(V・ H)

9. Input Signals, Basic Display Colors and Gray Scale of Each Color

| | Colors & Gray scale | Data signal | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Gray Scale | R0 | R1 | R2 | R3 | R4 | R5 | G0 | G1 | G2 | G3 | G4 | G5 | B0 | B1 | B2 | B3 | B4 | B5 |
| Basic Color | Black | — | 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 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | — | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | — | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | — | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | — | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| Gray Scale of Red | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | ↓ | | | | ↓ | | | | | | ↓ | | | | | | ↓ | | |
| | ↓ | ↓ | | | | ↓ | | | | | | ↓ | | | | | | ↓ | | |
| | Brighter | GS61 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↓ | GS62 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | GS63 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | ↓ | | | | ↓ | | | | | | ↓ | | | | | | ↓ | | |
| | ↓ | ↓ | | | | ↓ | | | | | | ↓ | | | | | | ↓ | | |
| | Brighter | GS61 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↓ | GS62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | GS63 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 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 |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| | ↑ | ↓ | | | | ↓ | | | | | | ↓ | | | | | | ↓ | | |
| | ↓ | ↓ | | | | ↓ | | | | | | ↓ | | | | | | ↓ | | |
| | Brighter | GS61 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| | ↓ | GS62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| | Blue | GS63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |

0 : Low level voltage, 1 : High level voltage

Each basic color can be displayed in 64 gray scales from 6 bit data signals. According to the combination of total 18 bit data signals, the 262,144-color display can be achieved on the screen.

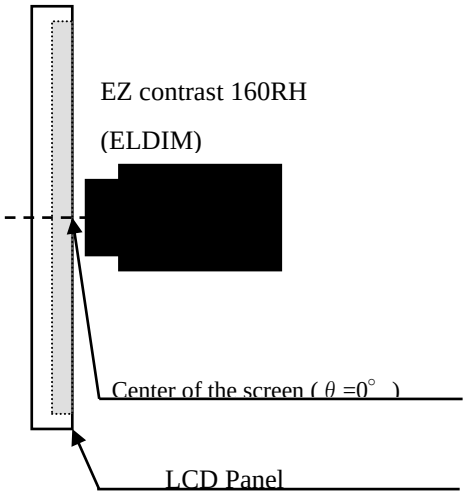
10. Optical Characteristics

Ta=+25℃, Vcc=+3.3V

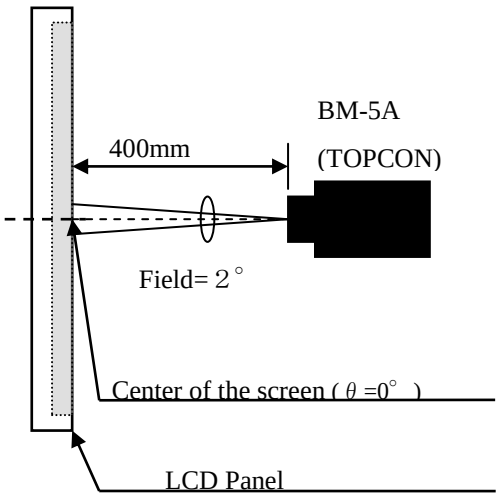
| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| Viewing angle range | Horizontal | $\theta$ 21, $\theta$ 22 | CR>10 | 60 | 70 | — | Deg. | [Note 1,3,6] |
| | Vertical | $\theta$ 11 | | 40 | 50 | — | Deg. | |
| | | $\theta$ 12 | | 50 | 60 | | | |
| Contrast ratio | | CRn | $\theta$ =0° | 300 | — | — | | [Note 2,4,6] |
| | | CRo | Optimum viewing angle | 300 | 450 | — | | |
| Response time | | $\tau$ r+ $\tau$ d | $\theta$ =0° | — | 30 | 60 | ms | [Note 2,4,6] |
| Chromaticity of white | | x | | 0.264 | 0.314 | 0.364 | | [Note 2,6] |
| | | y | | 0.284 | 0.334 | 0.384 | | |
| Luminance of white [Note 2,6] | | $Y_{LI}$ | | 250 | 350 | — | cd/m$^2$ | $D_{PWM}$ = 100% |
| White Uniformity | | $\delta_W$ | | — | 1.10 | 1.30 | | [Note 2,7] |

※ The measurement shall be executed 30 minutes after lighting at rating. Condition : $D_{PWM}$ = 100%
The optical characteristics shall be measured in a dark room or equivalent.

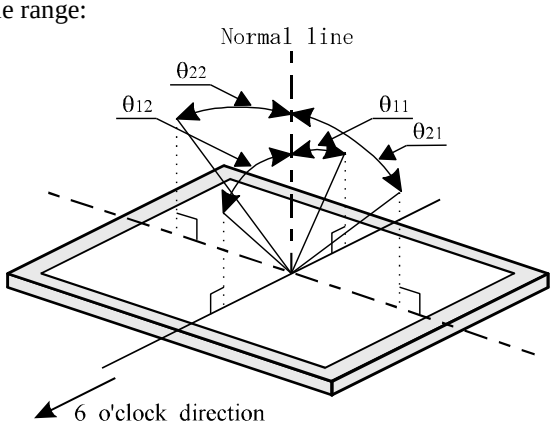
[Note 1] Measuring Viewing Angle Range




[Note 2] Other Measurements



[Note 3] Definitions of viewing angle range:



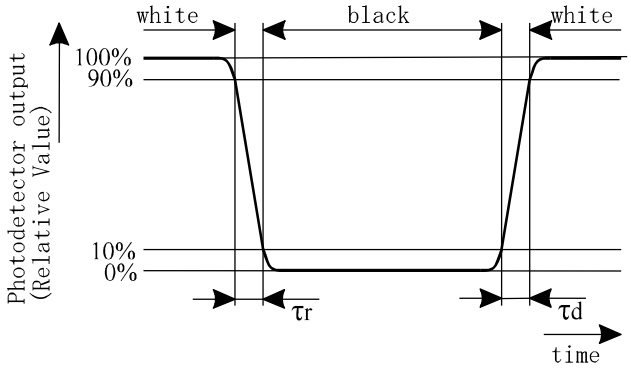

[Note 4] Definition of contrast ratio:

The contrast ratio is defined as the following.

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

[Note 5] 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" .

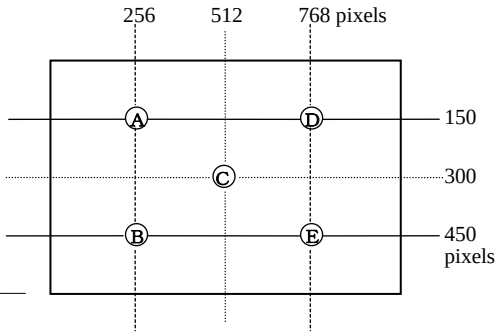



[Note 6] This shall be measured at center of the screen.

[Note 7] Definition of white uniformity:

White uniformity is defined as the following with five measurements (A～E).

$$\delta w = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$




11. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

12. Design guidance for touchpanel(T/P)

12 - 1. Example of housing design

(1)If an 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.4)

(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.

12 - 2. Mounting on display and housing bezel

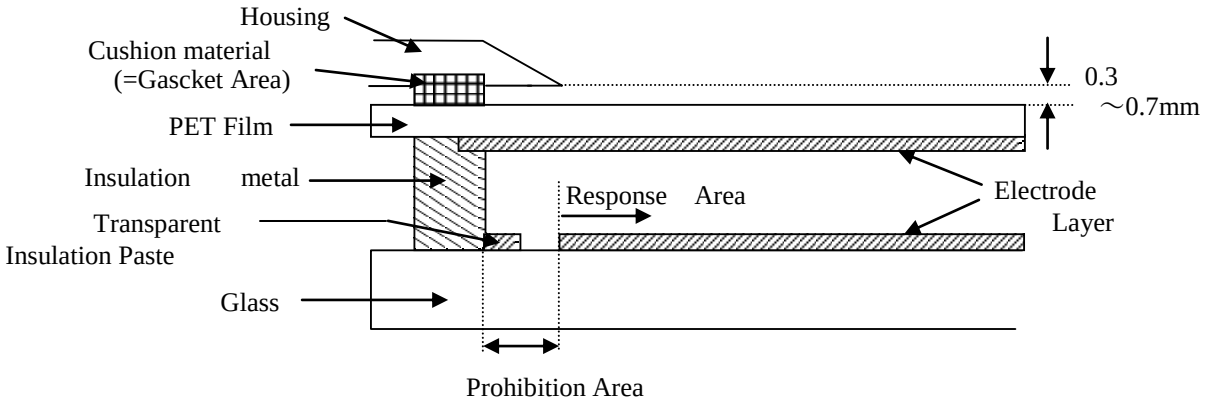
(1)In all cases, the T/P should be supported from the backside of the glass.

(2)Do not to use an adhensive-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 Touchpanel sometimes distorts touch panel itself.



13. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.

b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

c) Since the touch panel surface is easily damaged, pay attention not to scratch it.

d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

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

g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.

h) This module has its circuitry PCBs on the rear side and should be handled carefully in order not to be stressed.

i) 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..

j) 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.

k) Connect GND of module bezel to stabilize against EMI and external noise.

l) 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.

m) 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.

n) Disassembling the module can cause permanent damage and should be strictly avoided.
Do not peel off the tapes, and do not remove an internal connector.
The final form of the module is Figure 2.

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

p) Please handle carefully not to charge excessive stress onto the back of the module. Excessive stress may cause unrepairable damage to the module.

q) Don't give stress on the surface of the touch panel continuously. It causes unevenness (in such cases as the Newton’s Ring) in the touch panel surface.

r) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.

14. Packing Form

| | |
|---|---|
| Piling number of cartons | Max. 8 |
| Package quantity in one carton | 100pcs |
| Carton size | 575mm(W)×360mm(D)×225mm(H) |
| Total mass of one carton filled with full modules | 10.8kg |
| Packing form | Fig.1 |

15. Storage condition

Temperature 0～40℃
Humidity 60% or less
(no condensation)
Storage term 1 year
Precautions

・Direct sunlight
Store it in the packing box or the darkroom to avoid direct sunlight.

・Atmosphere
Do not store in a place the causticity gas may occur or near the volatile solvent.

・Condensation

・Do not put directly on the floor, and keep the wrapping box on the palette or the stand to avoid the condensation. Moreover, arrange it in a constant direction correctly to improve ventilation under the palette.

・Keep it separate from the wall in the storage warehouse.

・Note that ventilation is improved and consider the installation such as ventilators in the warehouse.

・Manage so that there is no rapid temperature change more than natural environment.

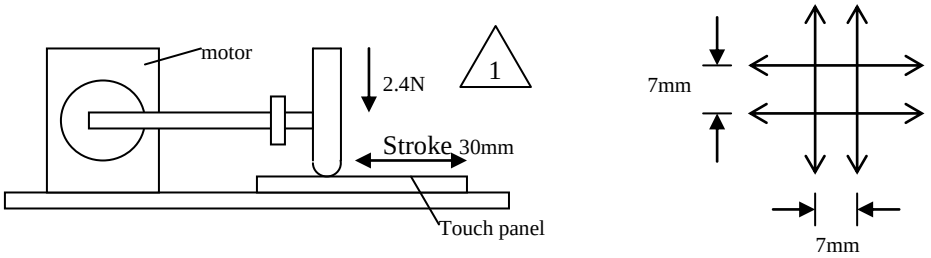
16. Reliability Test Items

| No. | Test item | Conditions |
|---|---|---|
| 1 | High temperature storage test | Ta = 70℃ 240h |
| 2 | Low temperature storage test | Ta = -25℃ 240h |
| 3 | High temperature<br>& high humidity operation test | Ta = 40℃ ; 95 %RH 240h<br>(No condensation) |
| 4 | High temperature operation test | Tp = 60℃ 240h<br>(Panel surface temperature) |
| 5 | Low temperature operation test | Ta = 0℃ 240h |
| 6 | Thermal Shock Test<br>(non- operating) | +70°C(1hours) ⇔ -20 °C(1hours) 2hours per cycle<br>Temperature change time:10℃/minute<br>Tested for 5 cycles |
| 7 | Vibration test<br>(non- operating) | Frequency range: 10～55～10Hz<br>Stroke: 1.5mm<br>Sweep time: 1minutes<br>Test period: 2 hour for each direction of X,Y,Z |
| 8 | Shock test<br>(non- operating) | Max. gravity : 980 m/s2<br>Pulse width : 6 ms, sine wave<br>Direction : ±X,±Y,±Z<br>3 times for each direction. |
| 9 | Point activation test<br>(Touch panel) | Hit it 1,000,000 times with a silicon rubber of R8 HS 60.<br>Hitting force :4.9N<br>Hitting speed : 3 times per second |
| 10 | Writing friction resistance test<br>(Touch panel) | Write according to the right illustration in the under –mentioned conditions:<br>Pen : 0.8R Polyacetal stylus<br>Load : 2.4N<br>Speed : 3 strokes per second<br>Stroke : 30mm<br>Frequency : 50000 times |
| 11 | ESD | ±200V,200pF(0Ω) 1time/each terminal |

[Result Evaluation Criteria] Under the display quality test conditions with normal operation state, these shall be no change, which may affect practical display function.

[Normal operation state] Temperature : +15～+35℃, Humidity : 45～75%, Atmospheric pressure : 86～106kPa

[Touch panel testing apparatus]

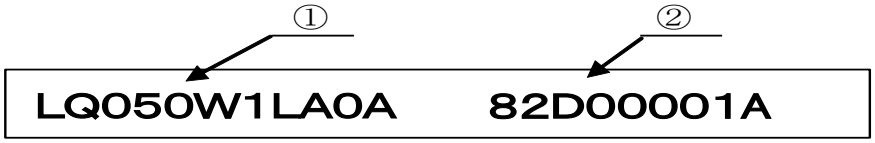


17. Label

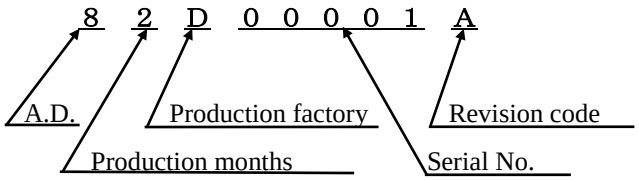
1

1) Module label:

Notation: ①Model No. ②Serial No.




Serial No.

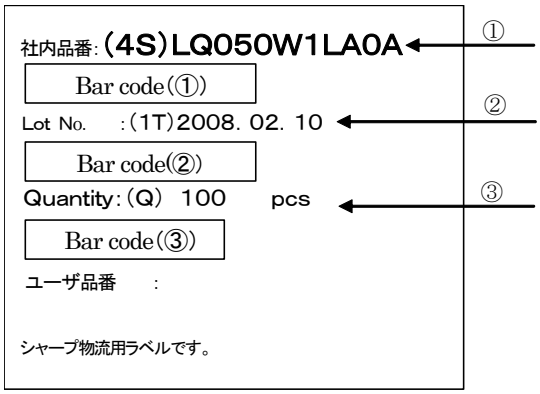



(Production months)

1-9(Jan.-Sep.),X(Oct.),Y(Nov.),Z(Dec)

2) Packing bar code label

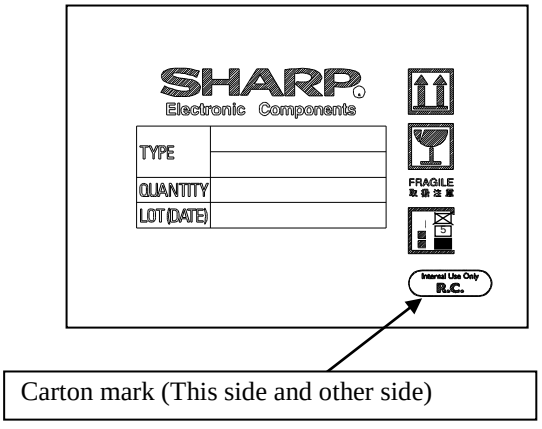
Notation/ Bar code: ①Model No. ②Date ③Quantity




18. RoHS Regulations

This component comply with RoHS Regulations.

Carton mark




Carton mark (This side and other side)

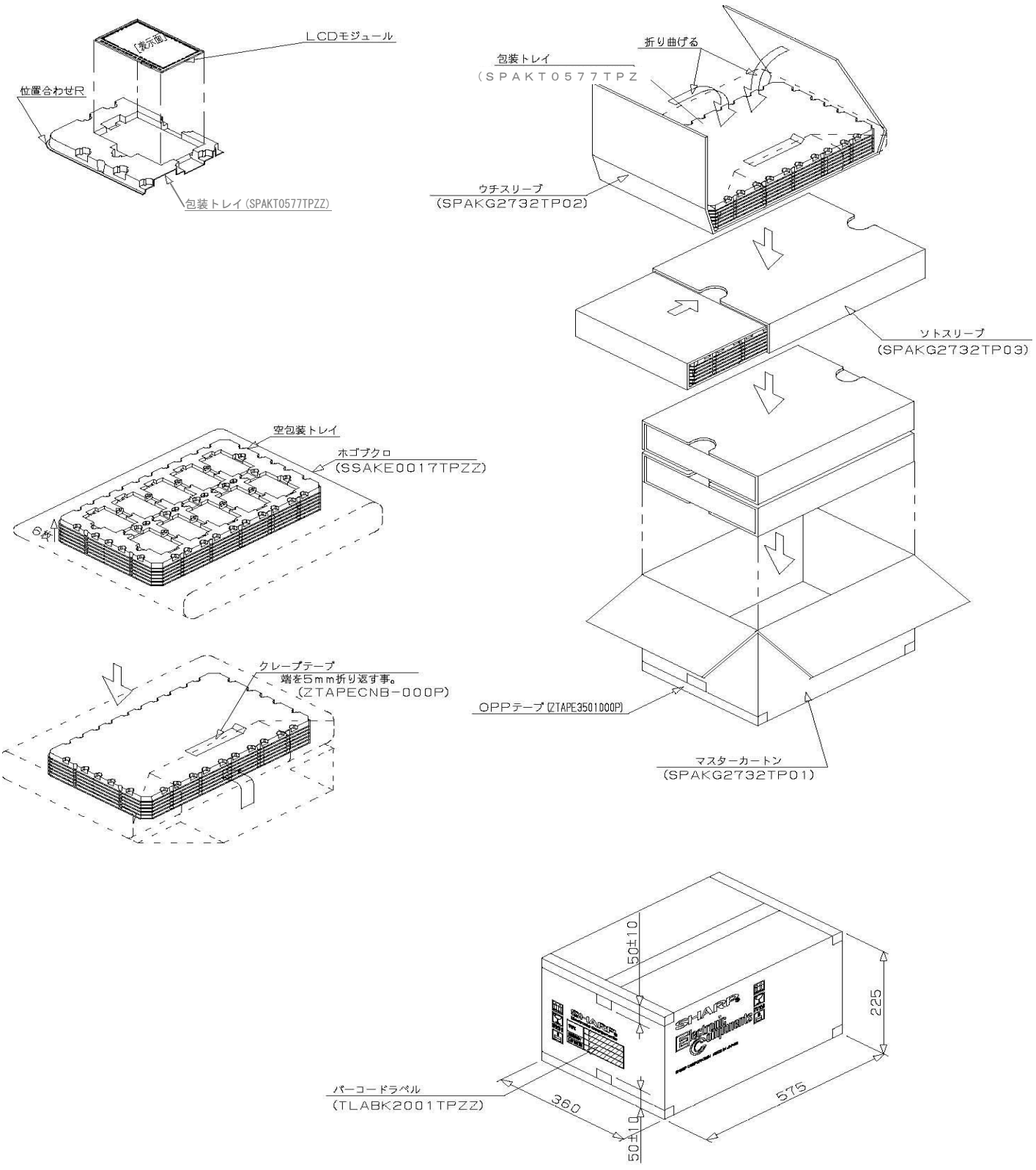
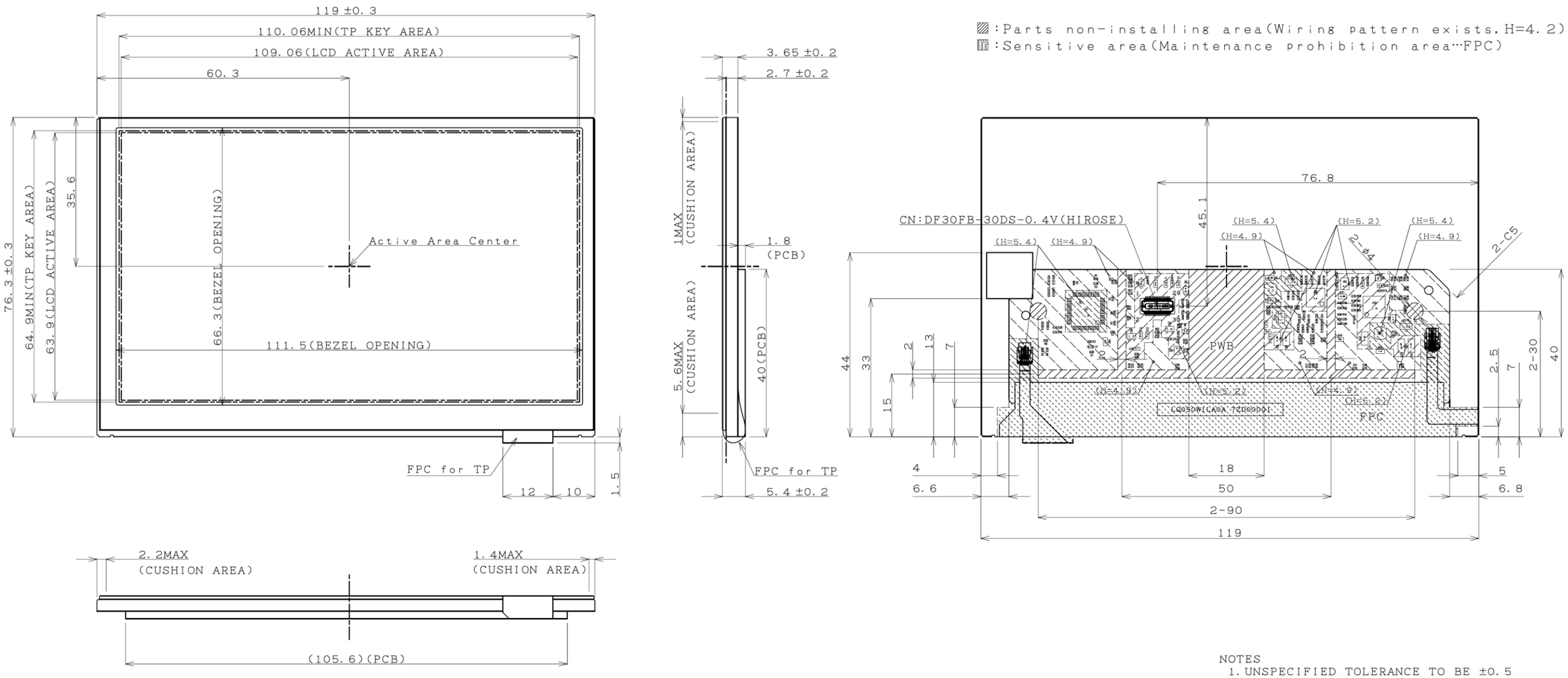



**Fig. 1 Packing form**




NOTES
1. UNSPECIFIED TOLERANCE TO BE ±0.5
2. WARP AND FLATING FOR
PCB AND CHASSIS ARE EXCLUDED FROM
THICKNESS AND DIMENSION OF THE UNIT.

D/N:2D-078-142-03

**Fig. 2 Outline Dimensions**