



ELECTRONICS

Preliminary

TO :
DATE : December. 08. 2004

SAMSUNG TFT-LCD
MODEL NO.:LTP400WQ-F01

NOTE :

Any Modification of Spec is not allowed without SEC's permission.

APPROVED BY :

PREPARED BY : **Mobile Display R&D Team, AMLCD Division**

SAMSUNG ELECTRONICS CO., LTD.



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Revision History

Preliminary

| Date | Rev.No. | Page | Summary |
|---------------|---------|--------------------------------|---|
| Oct. 19. 2004 | 000 | | Rev.000 was first issues. |
| Oct. 20. 2004 | 001 | 13 22 | Connector instances were added. Packing case attach was revised. |
| Oct. 28. 2004 | 002 | 4 7 12 15 18 20 | Viewing angle was chaned.(6 -> 12 o'clock) Interface mode was revised.(DE, Sync mode -> DE mode) Optical Characteristics was revised. TFT LCD Module was revised. Pixel format was revised. Power Sequence was revised. Outline Dimension was revised. |
| Dec. 4. 2004 | 003 | 5 7 | Module weight was added. Absolute Maximum Rating was revised. MIN.MAX. values of color chromaticity was removed. |
| Dec. 8. 2004 | 004 | 7 15 16 | Optical Characteristics was revised. Pixel format was revised. Timing Parameters was revised. |

Doc.No.

LTP400WQ-F01

Rev.No

004

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GENERAL DESCRIPTION

DESCRIPTION

LTP400WQ-F01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The resolution of a 4.0" Contains 480 x 272 pixels and can display up to 16,777,216 colors. 12 o'clock direction is the optimum viewing angle.

FEATURES

- High Brightness
- High contrast ratio
- 8Bits color depth
- WQVGA (480 x 272 pixels) resolution
- Low power consumption
- DE(Data enable) mode, SYNC mode

APPLICATIONS

- PMP(Personal Multimedia Player), MP3 application product
- Display terminals for AV application products

GENERAL INFORMATION

| ITEM | SPECIFICATION | UNIT | NOTE |
|-------------------|---------------------------------------|-------|--------|
| Display area | 87.84(H) x 49.776(V) (4.0" diagonal) | mm | |
| Driver element | a-Si TFT active matrix | | |
| Display colors | 16,777,212 | | |
| Number of pixel | 480×RGB(H) x 272(V) | pixel | |
| Pixel arrangement | RGB vertical stripe | | |
| Pixel pitch | 0.183(H) x 0.183(V) (TYP.) | mm | 138ppi |
| Display Mode | Normally white | | |
| Surface treatment | Haze (25), Hard-Coating 3H | | |

MECHANICAL INFORMATION

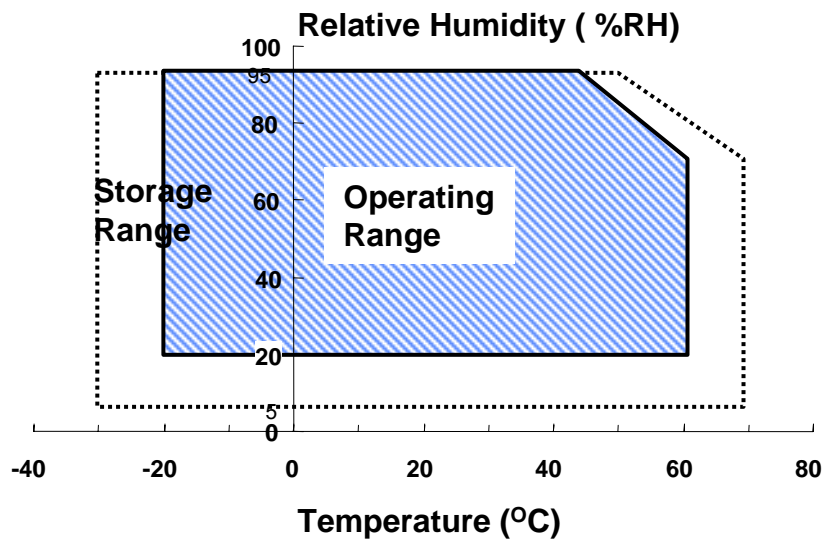
| ITEM | | MIN. | TYP. | MAX. | UNIT |
|-------------|----------------|------|-------|------|------|
| Module size | Horizontal (H) | 98.1 | 98.3 | 98.5 | mm |
| | Vertical (V) | 62.4 | 62.6 | 62.8 | mm |
| | Depth (D) | 5.05 | 5.25 | 5.45 | mm |
| Weight | | - | 51.88 | | g |

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

| ITEM | SYMBOL | MIN. | MAX. | UNIT | NOTE |
|---|-----------|------|------|------|------|
| Storage temperature | T_{STG} | -30 | 70 | °C | (1) |
| Operating temperature (Temperature of glass surface) | T_{OPR} | -20 | 60 | °C | (1) |

Note (1) Temperature and relative humidity range are shown in the figure below.
 95 % RH Max. ($50\text{ }^{\circ}\text{C} \geq T_a$)
 Maximum wet - bulb temperature at $39\text{ }^{\circ}\text{C}$ or less. ($T_a > 50\text{ }^{\circ}\text{C}$) No condensation.



1.2 ELECTRICAL ABSOLUTE RATINGS**(1) TFT LCD MODULE**(V_{SS} = GND = 0 V)

| ITEM | SYMBOL | MIN. | MAX. | UNIT | NOTE |
|----------------------|--------|------|------|------|------|
| Logic Input Voltage | VDD | 2.3 | 2.7 | V | (1) |
| Analog Input Voltage | AVDD5 | 4.8 | 5.2 | V | (1) |

NOTE (1) Within Ta = 25 ± 2 °C

(2) BACK-LIGHT UNIT

Ta = 25 ± 2 °C

| ITEM | SYMBOL | MIN. | MAX. | UNIT | NOTE |
|--------------|--------|------|------|------|------|
| Lamp current | IB | - | 25 | mA | (1) |

NOTE (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage loaded.
Functional operation should be restricted to the conditions described under Normal Operating Conditions.

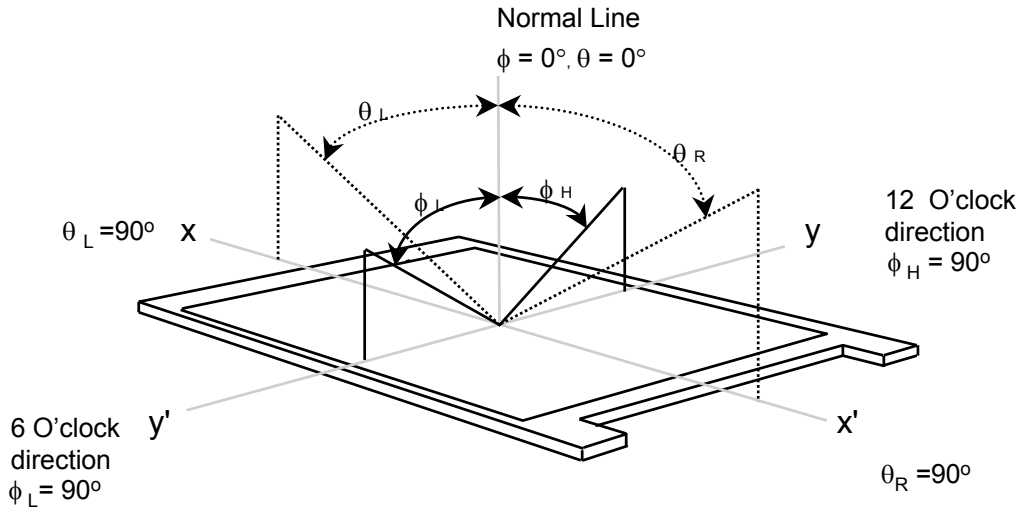
2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (5).
Measuring equipment : TOPCON BM-5A,EZ-CONTRAST

* Ta = 25 ± 2°C , VDD=2.5V, fv= 60Hz, fbCLK=9.0MHz, IL = 20mA

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE | |
|----------------------------------|------------|---|-------|-------|--------|---------|--------------------|---------------|
| Contrast Ratio (1 Points) | CR | $\phi = 0,$ $\theta = 0$ Normal Viewing Angle | 150 | 200 | | | (1), (2), (5) | |
| Response Time at Ta | Rising | | T_R | - | 10 | 15 | msec | (1), (3) |
| | Falling | | T_F | - | 25 | 30 | | |
| Luminance of White (center) | Y_L | | | 150 | 180 | | cd/m ² | (1), (4), (5) |
| Color Chromaticity (CIE) | Red | | R_x | | 0.5815 | | | (1), (5) |
| | | | R_y | | 0.3295 | | | |
| | Green | | G_x | | 0.349 | | | |
| | | | G_y | | 0.565 | | | |
| | Blue | | B_x | | 0.1545 | | | |
| | | | B_y | | 0.1327 | | | |
| | White | W_x | | 0.304 | | | | |
| | | W_y | | 0.332 | | | | |
| Viewing Angle | Hor. | θ_L | | 69 | - | Degrees | (1) | |
| | | θ_R | | 68 | - | | | |
| | Ver. | ϕ_H | | 59 | - | | | |
| | | ϕ_L | | 53 | - | | | |
| 5 Points White Variation | δL | | - | 87.22 | | % | (6) Ez-contrast | |

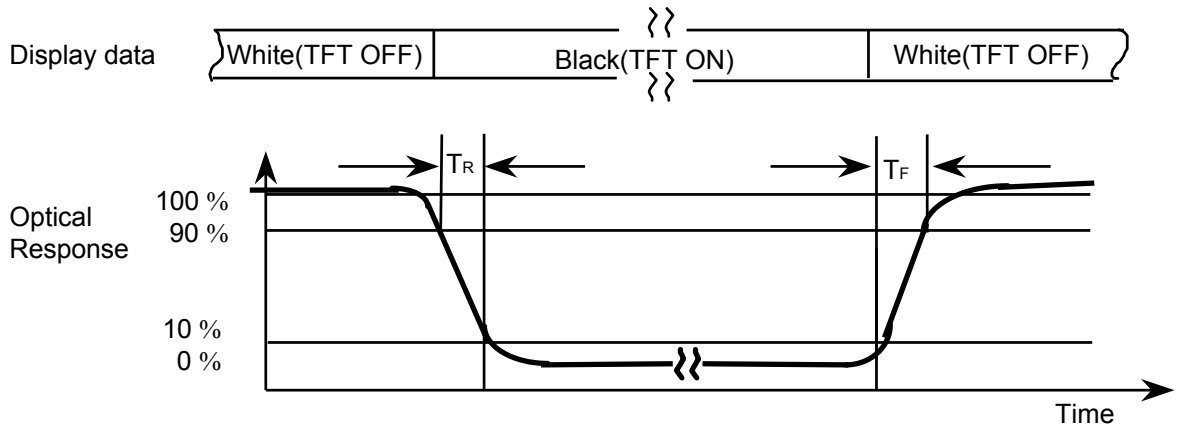
Note 1) Definition of Viewing Angle : Viewing angle range($10 \leq C/R$)



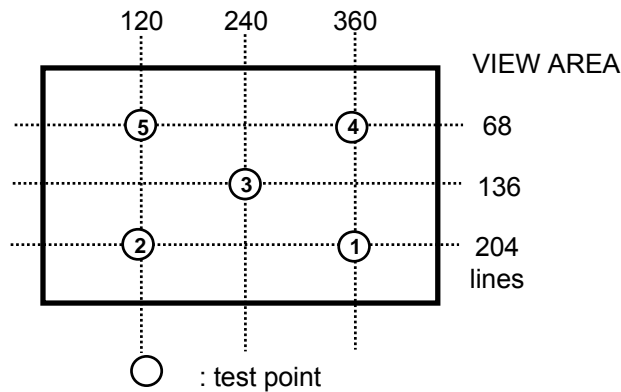
Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at center point

$$CR = \frac{\text{gray max (Gmax)}}{\text{gray min (Gmin)}}$$

Note 3) Definition of Response time :

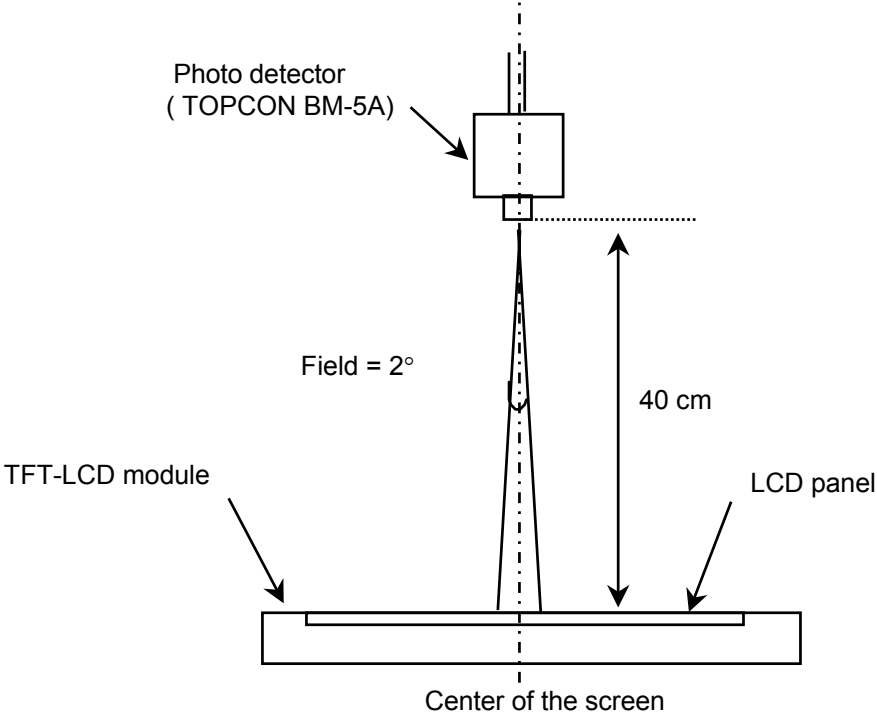


Note 4) Definition of Luminance of White : measure the luminance of white at center point(@)



Note 5) After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. This should be measured in the center of screen.

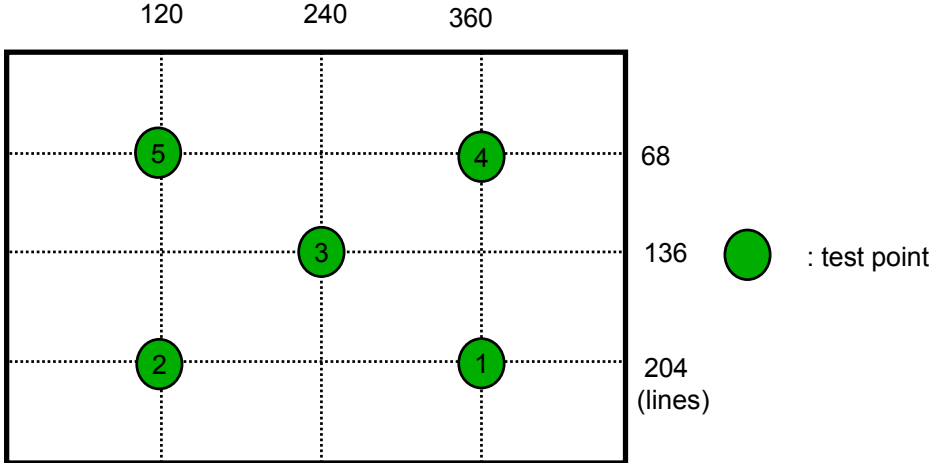
LED current : 20 mA
 Environment condition : $T_a = 25 \pm 2 \text{ }^\circ\text{C}$



Optical characteristics measurement setup

Note 6) Definition of 5 points white variation (δ_L) [~]

$$\delta_L = \frac{\text{Minimum luminance of 5 points}}{\text{Maximum luminance of 5 points}} \times 100 (\%)$$



3. ELECTRICAL CHARACTERISTICS

Preliminary

3.1 TFT LCD MODULE

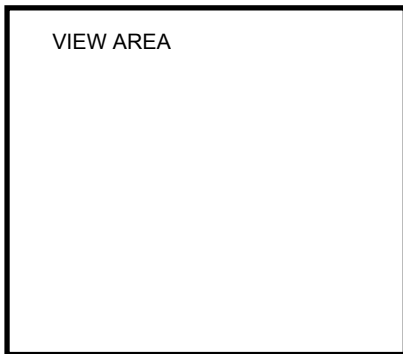
Ta = 25 ± 2°C

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|-----------------------|-------------------|-----|-------|------|------|---------|
| Logic Supply Voltage | VDD | 2.3 | 2.5 | 2.7 | V | |
| Analog Supply Voltage | AVDD5 | 4.8 | 5.0 | 5.2 | V | |
| Vsync Frequency | f _v | | 59.94 | | Hz | |
| Hsync Frequency | f _H | | 17.14 | | kHz | |
| Main Frequency | f _{DCLK} | | 9.0 | 15.0 | MHz | |
| Power Consumption | White | | 47 | | mW | (1),(2) |
| | Black | | 78.75 | | mW | |

Note (1) f_v=60Hz, f_{DCLK} = 9.0MHZ, VDD = 2.5V , AVDD5 = 5.0V, DC Current.

(2) Power dissipation check pattern

*a) White Pattern



*b) Black Pattern



3.2 BACKLIGHT UNIT

Preliminary

The back-light system is an edge - lighting type with six white LED(Light Emitting Diode)s.

Ta=25 ± 2°C

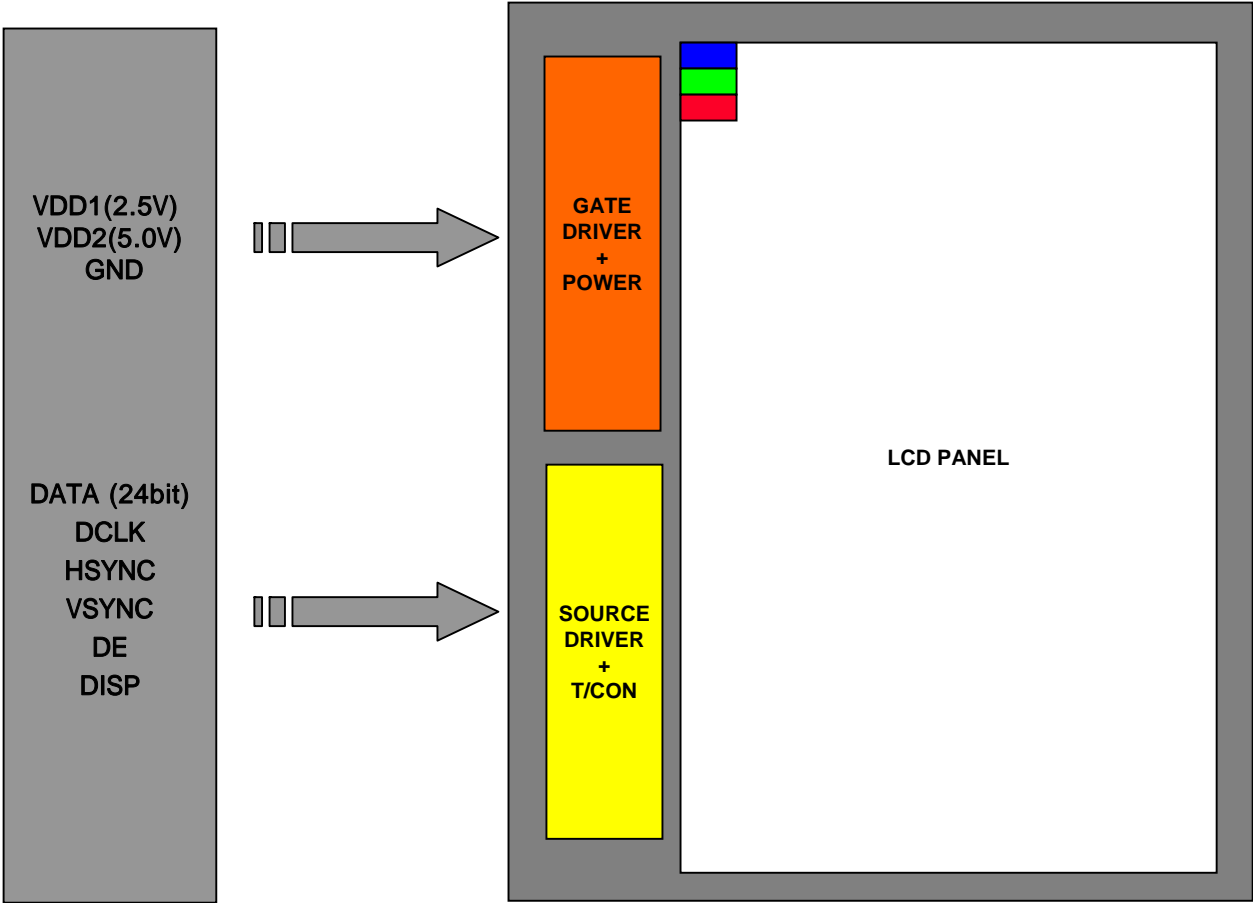
| ITEM | SYMB | MIN | TYP | MAX | UNIT | NOTE |
|-------------------|------|-----|-------|-------|------|------|
| LEDs Current | IB | - | 20 | 25 | mA | (1) |
| Power Consumption | PBL | - | (372) | (500) | mW | (2) |

Note

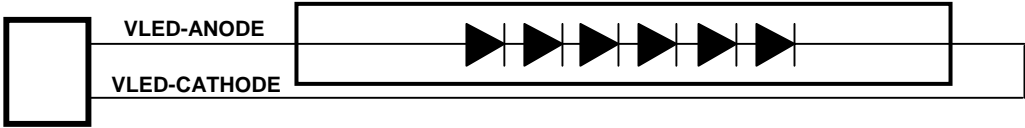
- (1) Six LEDs serial type
- (2) Where IB = 15mA & 20mA, VB = PBL / IB

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT



5. INPUT TERMINAL PIN ASSIGNMENT

5.1. Input Signal & Power (connector type ; 40pin / 0.5mm pitch / Top contact) - kyocera elco : 6212 series, Molex connector : 51296 series

| Pin NO | Symbol | Description | Remark | Pin NO | Symbol | Description | Remark |
|--------|--------|---------------------|--------|--------|--------|--------------------------|--------|
| 1 | VSS | Ground | | 21 | B0 | Blue data(LSB) | |
| 2 | VSS | Ground | | 22 | B1 | Blue data | |
| 3 | VDD | POWER SUPPLY(+2.5V) | | 23 | B2 | Blue data | |
| 4 | VDD | POWER SUPPLY(+2.5V) | | 24 | B3 | Blue data | |
| 5 | R0 | Red data(LSB) | | 25 | B4 | Blue data | |
| 6 | R1 | Red data | | 26 | B5 | Blue data | |
| 7 | R2 | Red data | | 27 | B6 | Blue data | |
| 8 | R3 | Red data | | 28 | B7 | Blue data(MSB) | |
| 9 | R4 | Red data | | 29 | VSS | Ground | |
| 10 | R5 | Red data | | 30 | PCLK | Pixel clock | |
| 11 | R6 | Red data | | 31 | DISP | Display on/off | |
| 12 | R7 | Red data(MSB) | | 32 | HSYNC | Horizontal Sync Signal | |
| 13 | G0 | Green data(LSB) | | 33 | VSYNC | Vertical Sync Signal | |
| 14 | G1 | Green data | | 34 | DE | Data Enable | |
| 15 | G2 | Green data | | 35 | AVDD5 | Power supply(+5V) | |
| 16 | G3 | Green data | | 36 | AVDD5 | Power supply(+5V) | |
| 17 | G4 | Green data | | 37 | VSS | Ground | |
| 18 | G5 | Green data | | 38 | VSS | Ground | |
| 19 | G6 | Green data | | 39 | VLED- | LED Voltage(LED cathode) | |
| 20 | G7 | Green data(MSB) | | 40 | VLED+ | LED Voltage(LED anode) | |

5.2 Input Signal, Basic Display Colors and Gray Scale of Each Colors

| Color | Display | Data Signal | | | | | | | | | | | | | | | | | | | | Gray Scale Level | | | | |
|---------------------|---------|-------------|----|----|----|----|----|----|-------|----|----|----|----|----|----|------|----|----|----|----|----|------------------|----|----|------|----|
| | | Red | | | | | | | Green | | | | | | | Blue | | | | | | | | | | |
| | | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | | B4 | B5 | B6 | B7 |
| 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 | - | |
| | 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R0 | |
| | Dark | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R1 | |
| | | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R2 | |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Light | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R253 | |
| | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R254 | |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | R255 | |
| Gray Scale of Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G0 | |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G1 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G2 | |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Light | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G253 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G254 | |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | G255 | |
| Gray Scale of Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | B0 | |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | B1 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | B2 | |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | Light | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | B253 | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | B254 | |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | B255 | |

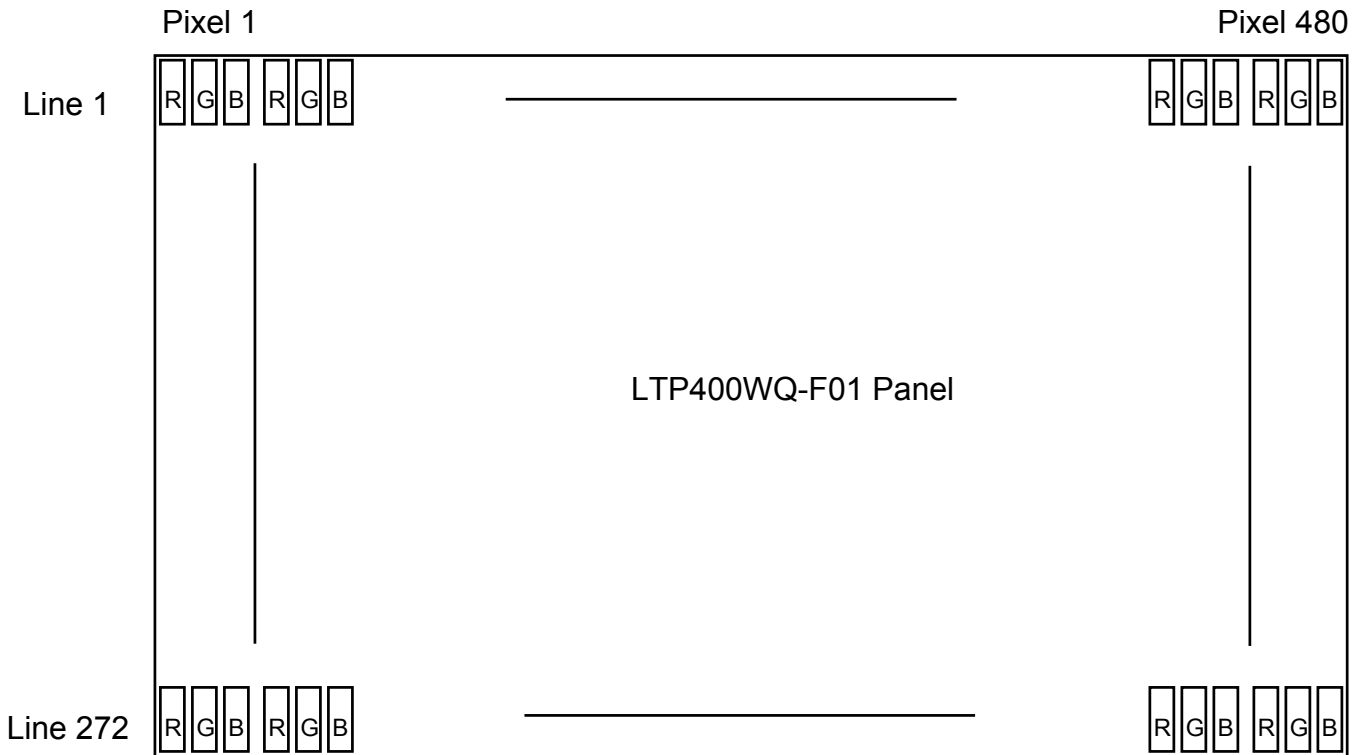
Note

(1) Definition of Gray : Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

(2) Input Signal : 0 = Low level voltage, 1 = High level voltage

5.3 PIXEL FORMAT

Preliminary



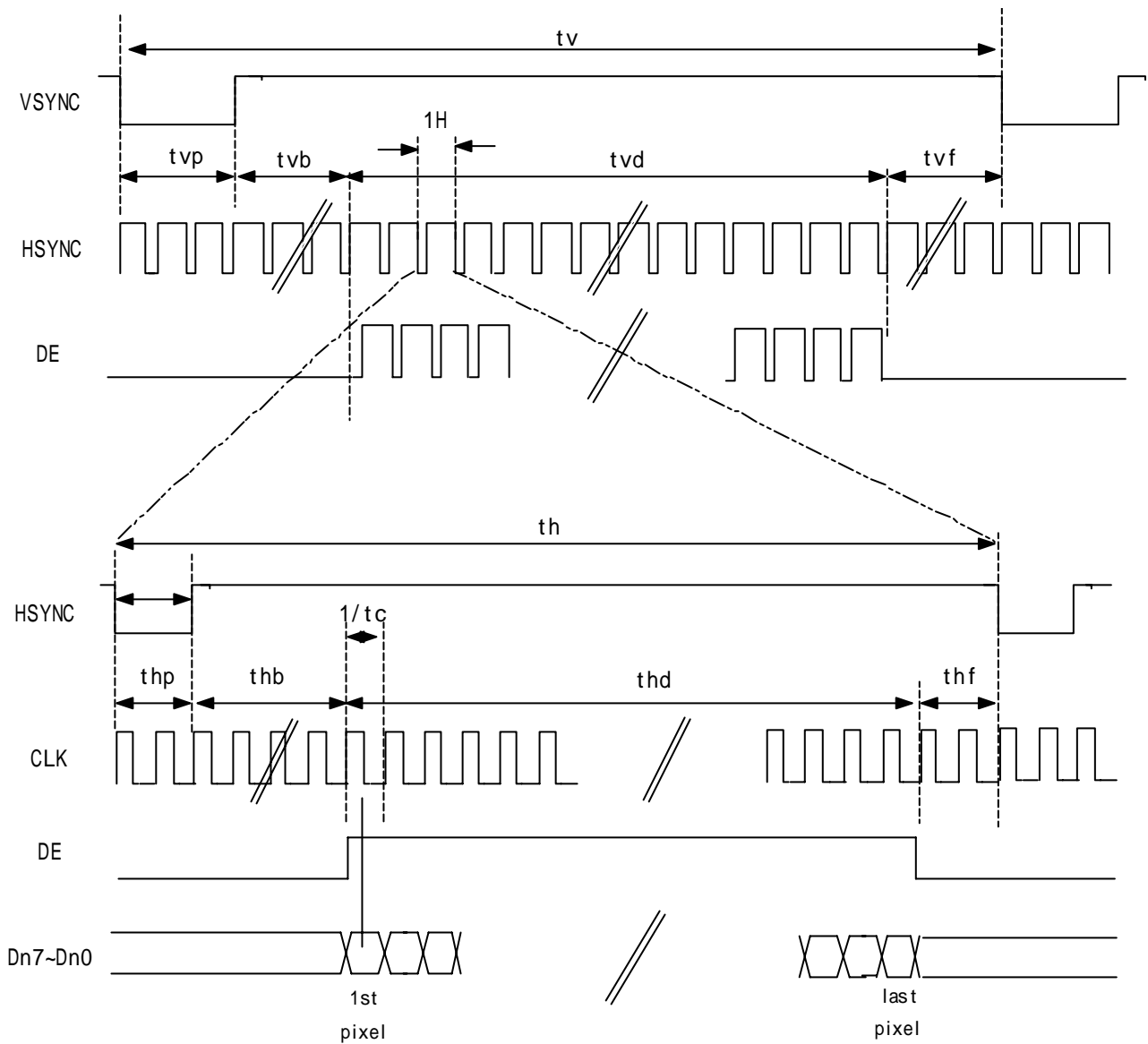
6. INTERFACE TIMING

6.1 Timing Parameters

| Signal | Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-----------------------|----------------|-----------------|------|-------|------|------|---------|
| Clock | Frequency | 1/Tc | | 9.0 | 15 | MHz | |
| | High Time | TCH | 26.7 | | | nsec | |
| | Low Time | TCL | 26.7 | | | nsec | |
| Data | Setup Time | TDS | 10 | | | nsec | |
| | Hold Time | TDH | 10 | | | nsec | |
| Frame Frequency | Cycle | tv | | 16.7 | | msec | |
| | | | | 59.94 | | Hz | |
| 1 Frame Scanning Time | Cycle | tv | | 286 | | CLK | |
| | Display Period | tvd | 272 | | | CLK | |
| | Front porch | tvf | 2 | 2 | | CLK | |
| | Pulse width | tv _p | 2 | 10 | | CLK | |
| | Back porch | tv _b | 2 | 2 | | CLK | |
| 1 Line Scanning Time | Cycle | th | | 525 | | H | NOTE(1) |
| | Display Period | thd | 480 | | | H | |
| | Front porch | thf | 2 | | | H | NOTE(2) |
| | Pulse width | th _p | 2 | 41 | | H | NOTE(2) |
| | Back porch | th _b | 2 | | | H | NOTE(2) |

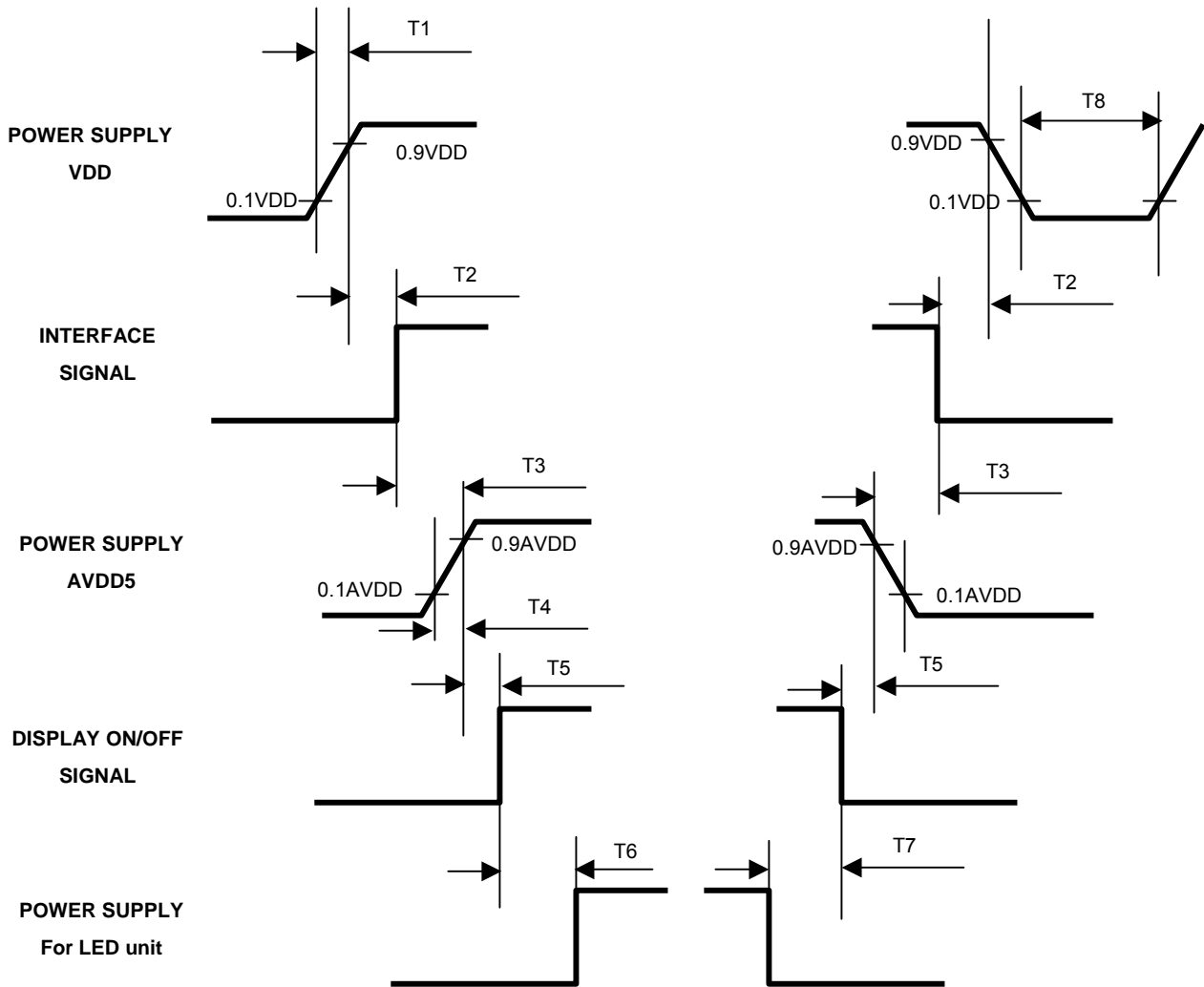
NOTE(1) $thd = 480CLK$, $thf = 2CLK$, $thp = 41CLK$, $thb = 2CLK$
 $525CLK = 480CLK + 2CLK + 41CLK + 2CLK$

NOTE(2) $thf + thp + thb > 44$



6.2 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the diagram below.



Power ON/OFF Sequence

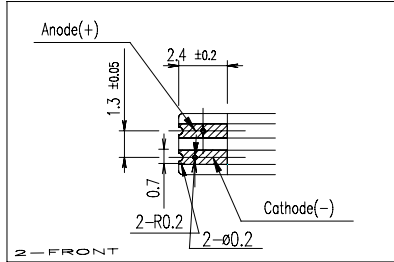
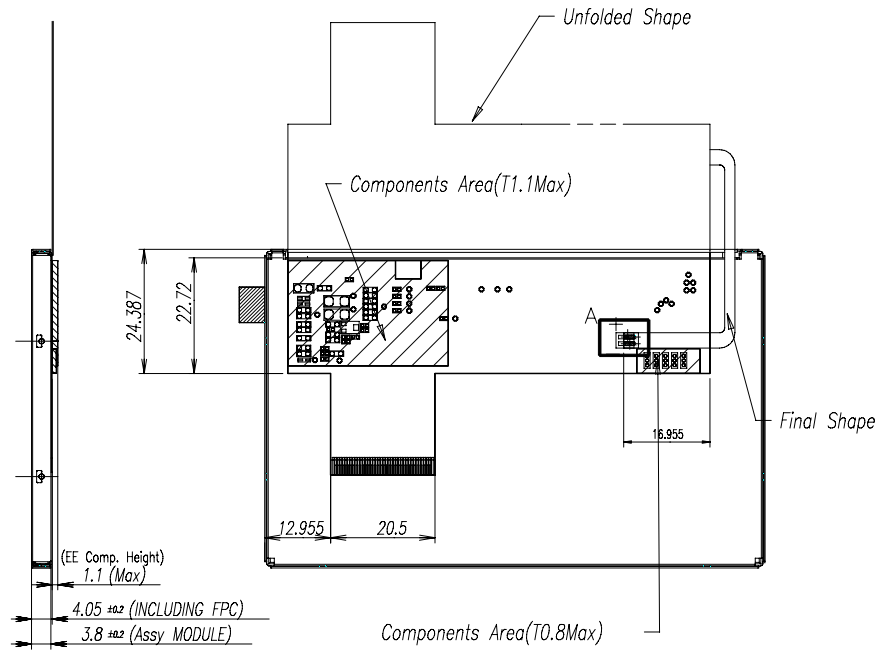
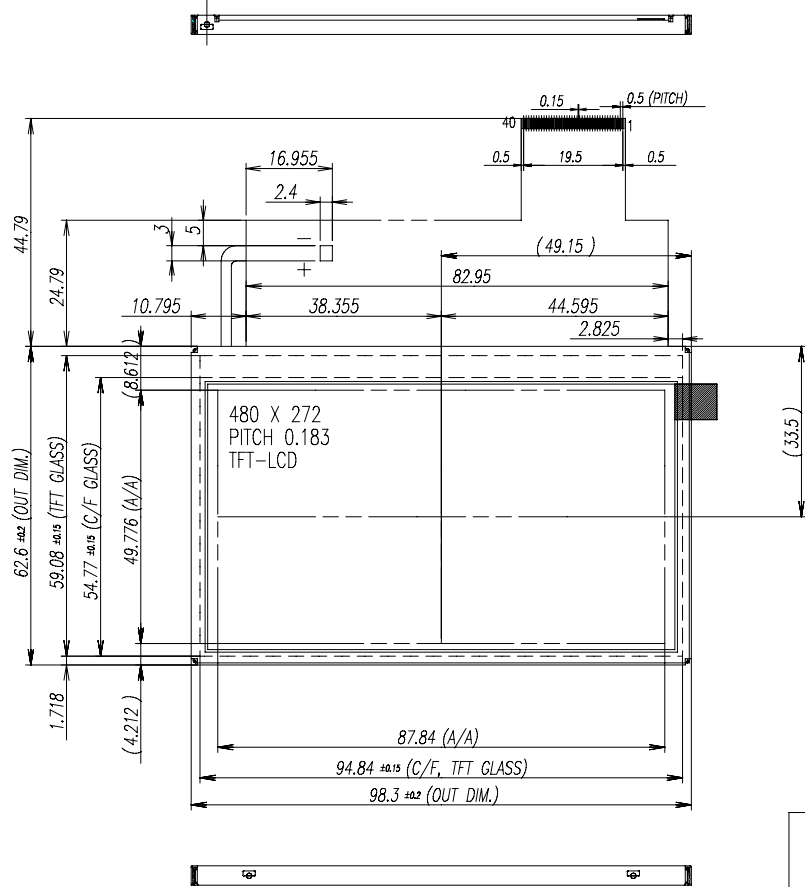
| Symbol | Specification | Symbol | Specification |
|--------|----------------------------------|--------|----------------------------------|
| T1 | $0 \leq T1 \leq 10 \text{ msec}$ | T5 | $0 \leq T5 \leq 50 \text{ msec}$ |
| T2 | $0 \leq T2 \leq 50 \text{ msec}$ | T6 | $160 \text{ msec} \leq T6$ |
| T3 | $0 \leq T3 \leq 50 \text{ msec}$ | T7 | $160 \text{ msec} \leq T7$ |
| T4 | $0 \leq T4 \leq 10 \text{ msec}$ | T8 | $1 \text{ sec} \leq T8$ |

NOTE.

- (1) The supply voltage of the external system for the module input should be the same as the definition of V_{DD} and V_{DD} .
- (2) Apply the LED voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the LEDs turns off, the display may momentarily become white.
- (3) In case of V_{DD} = off level, please keep the level of input signals on the low or keep a high impedance.
- (4) T8 should be measured after the module has been fully discharged between power off and on period.
- (5) Interface signal shall not be kept at high impedance when the power is on.

| NO | PART NAME | CODE NO | SPECIFICATION | Q'TY | SPEC NO | REMARK |
|----|-----------|---------|---------------|------|---------|--------|
| | | | | | | |

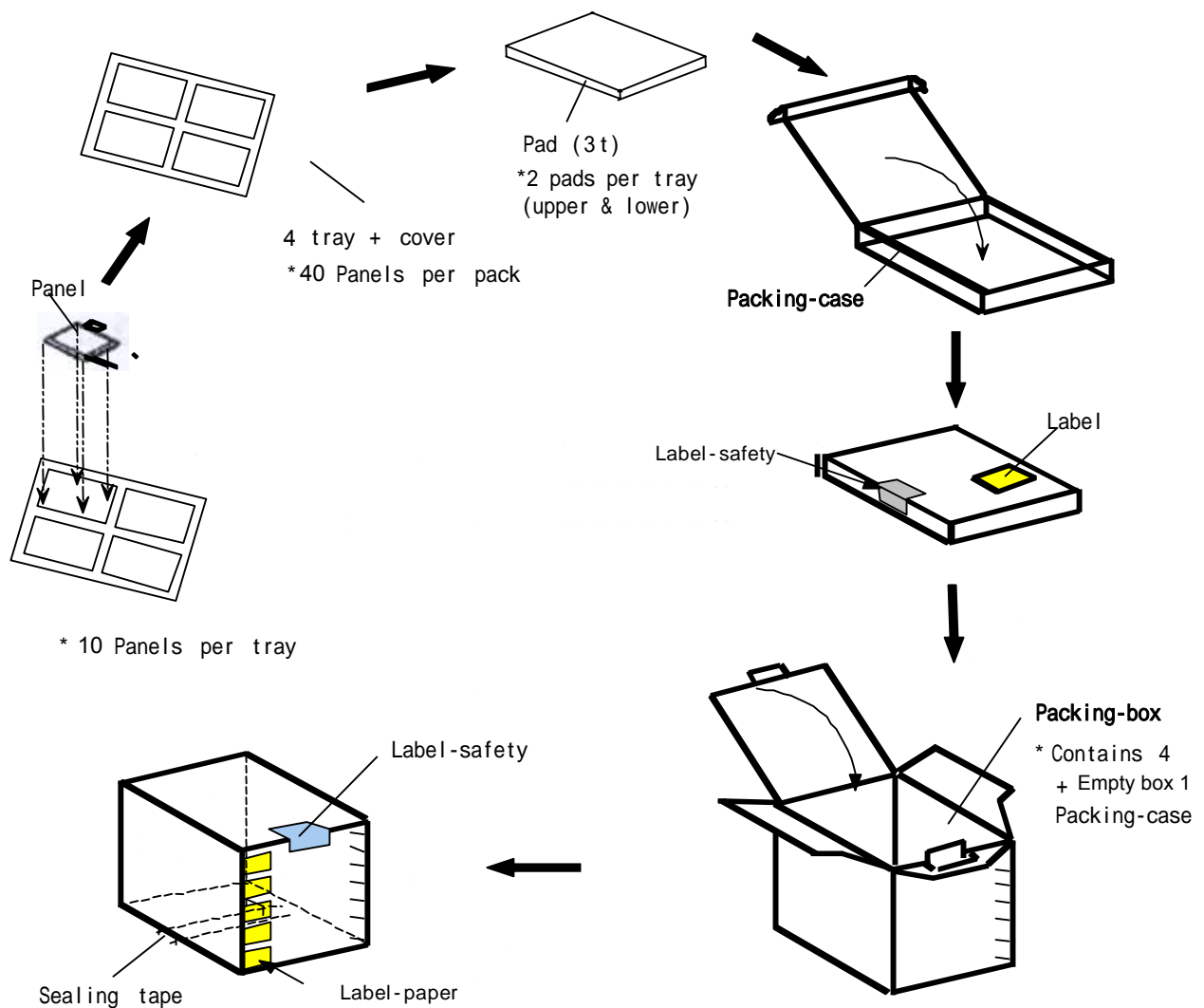
7. Outline Dimension



PRELIMINARY

| GENERAL TOLERANCE | | | | | REV | DATE | | | | | | | |
|-------------------|---------|---------|---------|-----------|---------------------|----------|----------|----------|----------|----------|-----------------|-------------------|-----------|
| STEP | LEVEL 1 | LEVEL 2 | LEVEL 3 | | UNIT | mm | DRA'N BY | DES'D BY | CHK'D BY | APP'D BY | MODEL NAME | LTP400WQ-F01 | |
| 0 < X ≤ 4 | ±0.05 | ±0.1 | ±0.2 | | SCALE | 1/1 | J.H.KIM | 04.10.29 | I.S.LEE | Y.B.Chu | PART/SHEET NAME | Outline Dimension | SHEET 1/1 |
| 4 < X ≤ 16 | ±0.08 | ±0.15 | ±0.3 | TOLERANCE | | 04.10.29 | | | | | 04.10.29 | 04.10.29 | SPEC. NO |
| 16 < X ≤ 64 | ±0.12 | ±0.25 | ±0.5 | | SAMSUNG ELECTRONICS | | | | | | | | |
| 64 < X ≤ 256 | ±0.25 | ±0.4 | ±0.8 | | | | | | | | | | |

8. Packing



Note

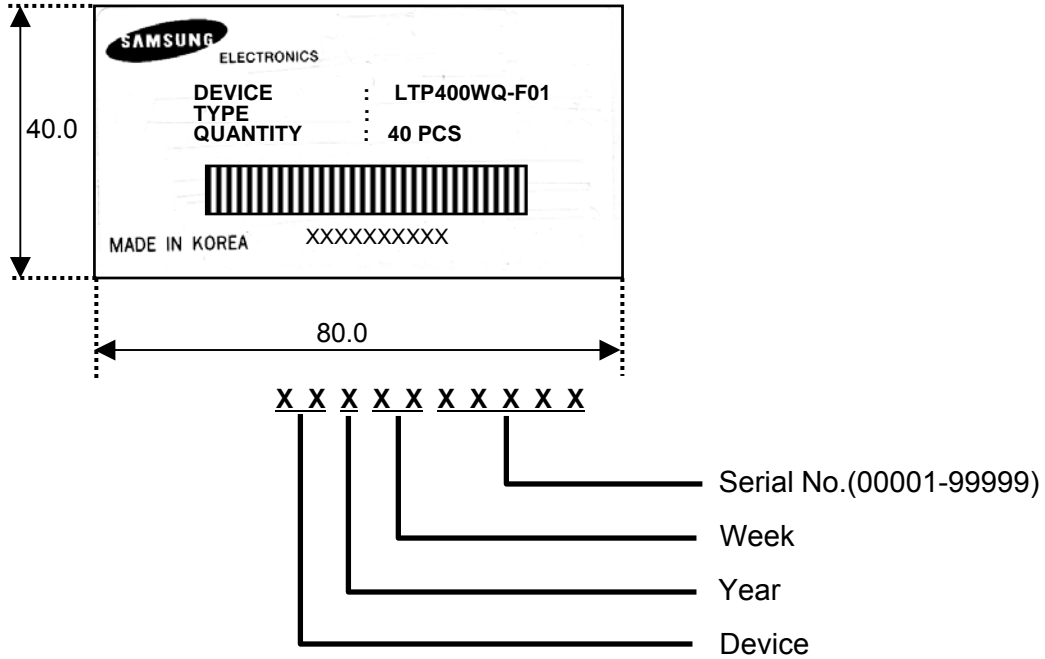
- (1) Total : Case: Approx. : TBD Kg
Box: Approx. : TBD Kg
- (2) Size : Case:TBD
Box: TBD
- (3) Place the panels in the tray facing the direction shown in the figure.
- (4) Place 2 tray and cover(empty tray) and pads inside the packing-case.
- (5) Place 4 packing-case and 1 Empty case inside the packing-box.(Affix the label)
- (6) Seal the packing-box. Affix the label-safety.

9. MARKINGS & OTHERS

Preliminary

A nameplate bearing followed by is affixed to a shipped product at the Specified location on each product.

9.1 Packing case attach



10. GENERAL PRECAUTIONS

Preliminary

1. Handling

- (a) When the module is assembled, It should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and LED back-light.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static, it may cause damage to the CMOS IC.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Do not adjust the variable resistor which is located on the back side.
- (l) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (m) Pins of I/F connector shall not be touched directly with bare hands.

2. STORAGE

- (a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

3. OPERATION

- (a) Do not connect, disconnect the module in the “ Power On” condition.
- (b) Power supply should always be turned on/off by following item 6.2 “ Power on/off sequence “.
- (c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

4. OTHERS

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on) Otherwise the module may be damaged.
- (d) If the module displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
- (e) This module has its circuitry FPC's on the rear side and should be handled carefully in order not to be stressed.