LG Display

LH500WF2-SH01
Liquid Crystal Display

**Product Specification**

# SPECIFICATION
# FOR
# APPROVAL

**( ) Preliminary Specification**
**(●) Final Specification**

| Title | **5.0" FHD TFT-LCD** |
|---|---|

| | |
|---|---|
| BUYER | Open |
| MODEL | |

| | |
|---|---|
| SUPPLIER | LG Display Co., Ltd. |
| *MODEL | LH500WF2 |
| SUFFIX | SH01 |

* LGD cannot guarantee any defect and mura which is occurred after laminating Touch.

*When you obtain standard approval, please use the above model name without suffix

| SIGNATURE | DATE |
|---|---|
| / | |
| / | |
| / | |

Please return 1 copy for your confirmation with your signature and comments.

| | DATE |
|---|---|
| **APPROVED BY** | |
| S.D. Jung / Team Leader | 2013. 7/4 |
| **REVIEWED BY** | |
| Y.S. Kim / Part Leader | 7/4 |
| **PREPARED BY** | |
| J.S. Yoon / Research Engineer | 7/4 |

**Mobile Panel Design Team.**
**LG Display Co., Ltd.**

**Ver 1.0** **July. 02. 2013**

# Product Specification

## Contents

## 1. Record of Revisions

| Revision No. | Date | Contents of Revision Change | Remark |
|---|---|---|---|
| 0.0 | 13.06.12 | Preliminary Specification Release | All page |
| 1.0 | 13.07.02 | Final Specification Release | All page |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

## 2. General Description

The LH500WF2 is a color transmissive display with wide viewing angle function. This matrix employs LTPS (Low Temperature Poly-Silicon) thin film transistors as the active elements. The gate drivers are integrated on this panel. This model has 4.97 inch diagonal size with FHD pixel format(1,080 x RGB x 1,920). This model operates in the normally black mode.
Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus, presenting a palette of more than 16,777,216 colors.

## 3. General Features

| No | Item | Specification | Remark |
|---|---|---|---|
| 1 | Display Method | Active Matrix TFT | |
| 2 | Display Mode | Transmissive Type | |
| 3 | Outline Dimensions [mm] | 63.884(H) X 116.596(V) X 0.3(D) | w/o Polarizer |
| 4 | Active Area [mm] | 61.884(H) × 110.016(V) | |
| 5 | Display Resolution | 1080(H) X RGB X 1920(V) | |
| 6 | Pixel Pitch [mm] | 0.0191 × RGB(H) × 0.0573(V) | 443 PPI |
| 7 | Pixel Arrangement | RGB Vertical stripes | |
| 8-1 | Panel Transmittance (/w Polarizer) | 2.73% | VSP 5V, VSN -5V |
| 8-2 | | 2.9% | VSP 5.2V, VSN -5.2V |
| 9 | Color Gamut | 70%(typ.), only C/F | CIE standard C light source is used |
| 10 | Inversion Type | Column inversion | |
| 11 | Interface | MIPI 4-lanes | |
| 12 | Driver IC | R63315 | 29.8mm(H) × 0.85mm(V) × 0.17mm(D) |
| 13 | Weight [g] | 5.53g±10% | w/o Polarizer |

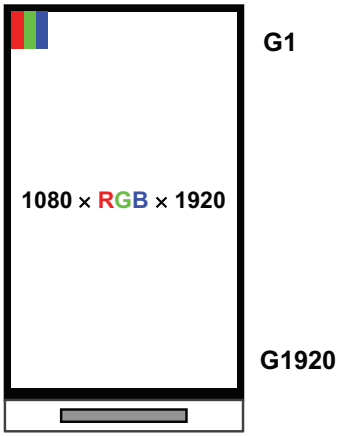



**Fig 3.1. Block Diagram of LH500WF2-SH01**

## 4. Absolute Maximum Rating

The following are maximum values which, if exceeded, may cause operation or damage to the unit.

| Item | Symbol | Min. | Max. | Unit | Remark |
|---|---|---|---|---|---|
| LC Operating Voltage | $V_{OP}$ | 4.5 (Typ.) | | V | Note 1), 1-1) |
| | | 4.7 (Typ.) | | | Note 1), 1-2) |
| Storage Humidity | $H_{STG}$ | 10 | 90 | %RH | Note 2), 3) |
| Storage Temperature | $T_{STG}$ | -30 | 80 | °C | Note 2), 3) |
| Operating Ambient Humidity | $H_{OP}$ | 10 | 90 | %RH | Note 2), 3) |
| Operating Ambient Temperature | $T_{OP}$ | -20 | 70 | °C | Note 2), 3) |

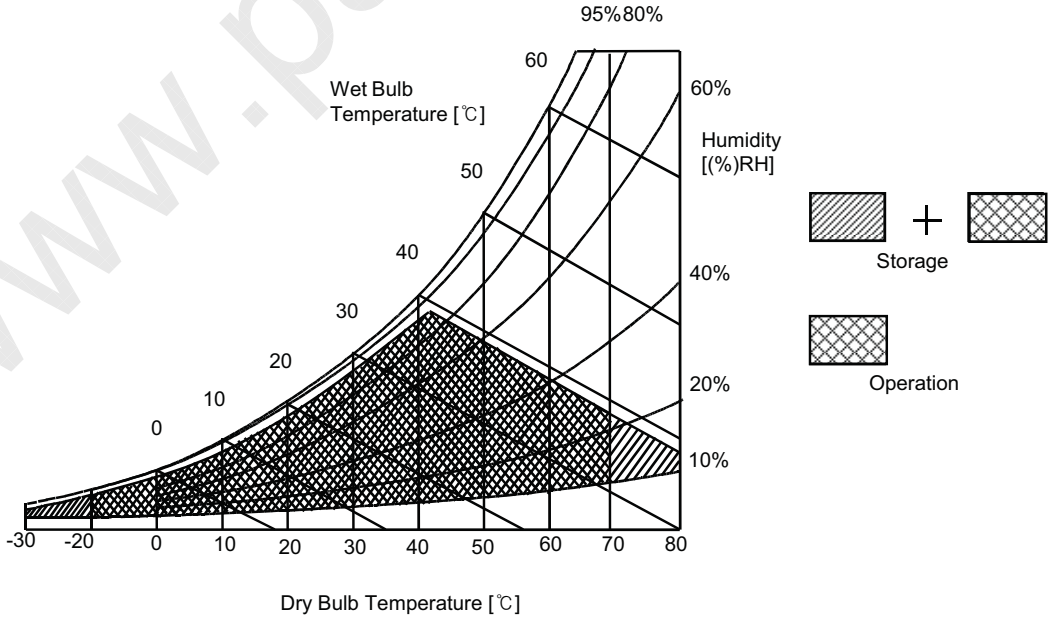
Note 1) Liquid Crystal (LC) driving voltage.
Due to the characteristics of LC materials, this voltage vary with environmental temperature.
The typical value is the LC driving voltage at the room temperature, 25±5℃

Note 1-1) VSP 5V, VSN -5V

Note 1-2) VSP 5.2V, VSN -5.2V

Note 2) Temp. ≤ 60℃ , 90% RH MAX.
Temp. ＞60℃ , Absolute humidity shall be less than 90% RH at 60℃.

Note 3) The diagram below indicates the peripheral environment of the module.
The wet bulb temperature should be kept under 39 °C and there should be no compensation.
If the LSI is used above these absolute maximum ratings, it may become permanently damaged.



## 6. Optical Specifications

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface.

Measurement condition
Optical Test Equipment & method refer to Note 6-1. (LED back light with 20mA/1ea)
1) : with polarizer
cf. Polarizer attachment tolerance + optical axis = ±0.1°
The tolerance of the angle between rubbing axis of cell and absorption axis of polarizer is ±0.1°
2) : Only Color Filter glass. (CIE standard C light source is used)

| Item | Symbol | Condition | Unit | Min. | Typ. | Max | Notes |
|---|---|---|---|---|---|---|---|
| Viewing Angle (1) | Top | CR>10˚ | Degree | 70 | 80 | - | Note 1),4) |
| | Bottom | | | 70 | 80 | - | |
| | Right | | | 70 | 80 | - | |
| | Left | | | 70 | 80 | - | |
| Contrast Ratio (1) | C/R | | - | 800 | 1000 | - | Note 1),3) |
| Panel Transmittance (1) | BP | | % | 2.3 | 2.73 | - | VSP 5V, VSN -5V |
| | | | | 2.45 | 2.9 | - | VSP 5.2V, VSN -5.2V |
| Crosstalk | | | % | - | - | 6 | Note 1),2) |
| Response Time (1) | Tr+Tf | | ms | - | 30 | 35 | Note 1),5) |
| Color Chromaticity (2) | Rx | Θ = 0˚ | NTSC (x.y) | 0.620 | 0.640 | 0.660 | |
| | Ry | | | 0.310 | 0.330 | 0.350 | |
| | Gx | | | 0.280 | 0.300 | 0.320 | |
| | Gy | | | 0.580 | 0.600 | 0.620 | |
| | Bx | | | 0.140 | 0.150 | 0.170 | |
| | By | | | 0.040 | 0.060 | 0.080 | |
| | Wx | | | 0.290 | 0.310 | 0.330 | |
| | Wy | | | 0.300 | 0.320 | 0.340 | |

※ Optical Test Equipment & Method Refer to Note 1, 2, 3, 4, 5,

※ Guarantee Crosstalk
just in case of operation with '9.1. Recommended Software Flow' on page 16.

# 5. Electrical Characteristics

## 5.1 DC Characteristics

$T_a$ = 25°C

| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|
| TFT Gate ON Voltage | VGH | 8.4 | 9.4 | 10.4 | V | Note 1) |
| TFT Gate OFF Voltage | VGL | -10.4 | -9.4 | -8.4 | V | Note 2) |
| TFT Common Electrode Voltage | VCOM | -0.5 | -0.3 | -0.1 | V | Note 3) |

Note 1) VGH is TFT Gate operating voltage.

Note 2) VGL is TFT Gate off voltage.

Note 3) VCOM must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.
In order to get the optimized display quality, the setting-voltage should be changed as based on customer's developing condition.
(The display quality could be changed by customer's setting-voltage.)

**We just kindly recommend the setting-voltage as the reference value.**

**In order to get the optimized display quality, the setting-voltage should be changed as based on customer's developing condition.**
**(The display quality could be changed by customer's setting-voltage.)**

Note 1) Optical Test Equipment Setup

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 5 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface. In case of backlight on, measured on the center area of the panel by PHOTO RESEARCH photometer PR-880&PR650 or Equivalent.

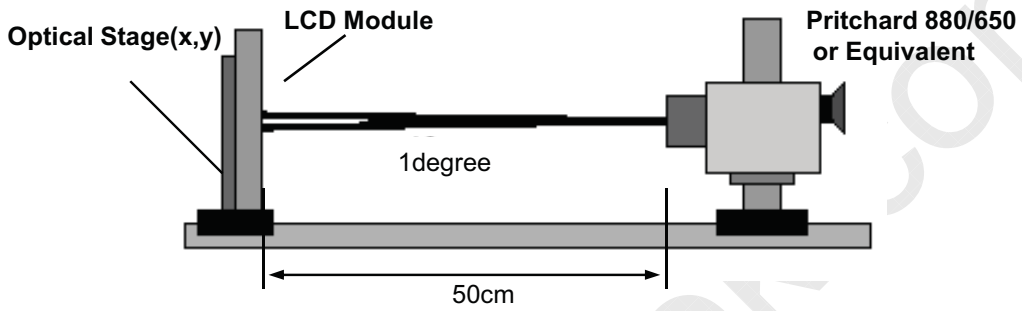



**Fig. 6.1.1 Optical Characteristic Measurement Equipment and Method**

※ Measuring Condition:

- Measuring surroundings
  : Dark Room
- Measuring temperature
  : $T_a$=25°C
- Adjust operating voltage
  to get optimum contrast
  at the center of the display.
- Measured value
  at the center P1 point of LCD panel
  after more than 5 minutes
  while backlight turning on.

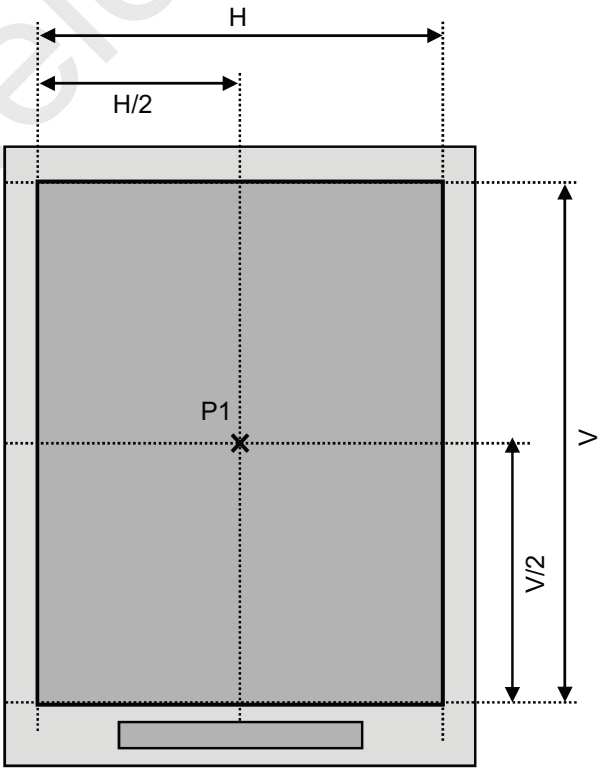



**Fig 6.1.2. LCD measurement point**

Note 2) Crosstalk

A: Luminance for P1 ~ P4
with all 127gray pixels

B: Luminance for P1 ~ P4
with 127gray pixels
when the white box is applied

Crosstalk [%] =

$$\text{Maximum}\left[\text{Absolute}\left(\frac{A - B}{A}\right)\right]$$

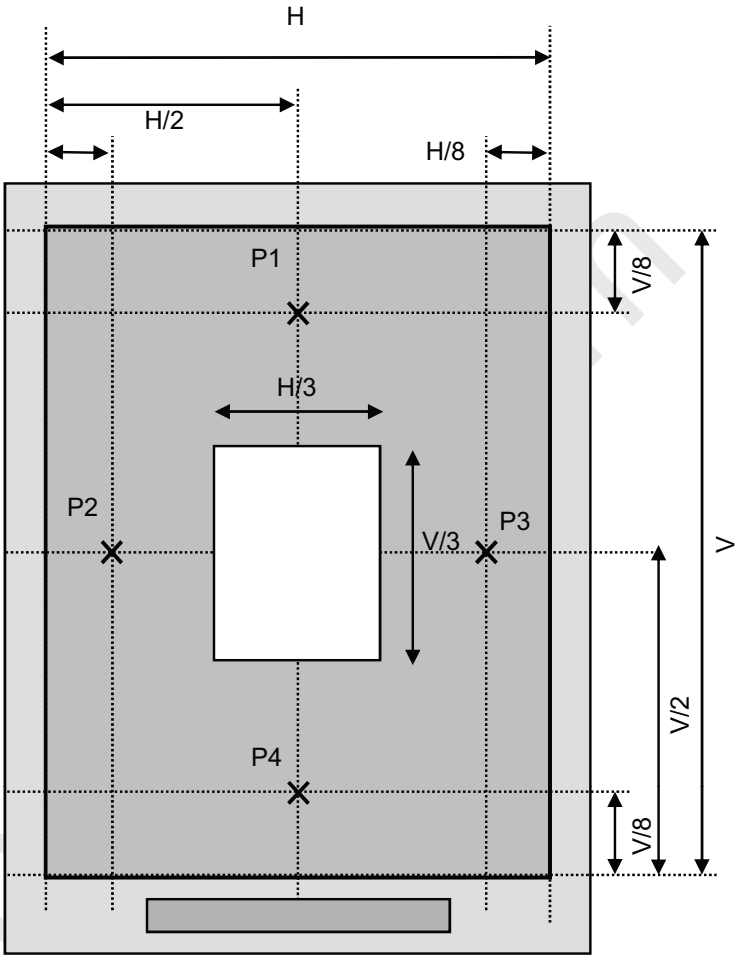



**Fig. 6.3. Crosstalk measurement points**

Note 3)

Contrast Ratio is defined as follows ;

$$\text{Contrast Ratio (CR)} = \frac{\text{Photo detector output with LCD being “White”}}{\text{Photo detector output with LCD being “Black”}}$$

Note 4)

Viewing Angle Range is defined as follows;

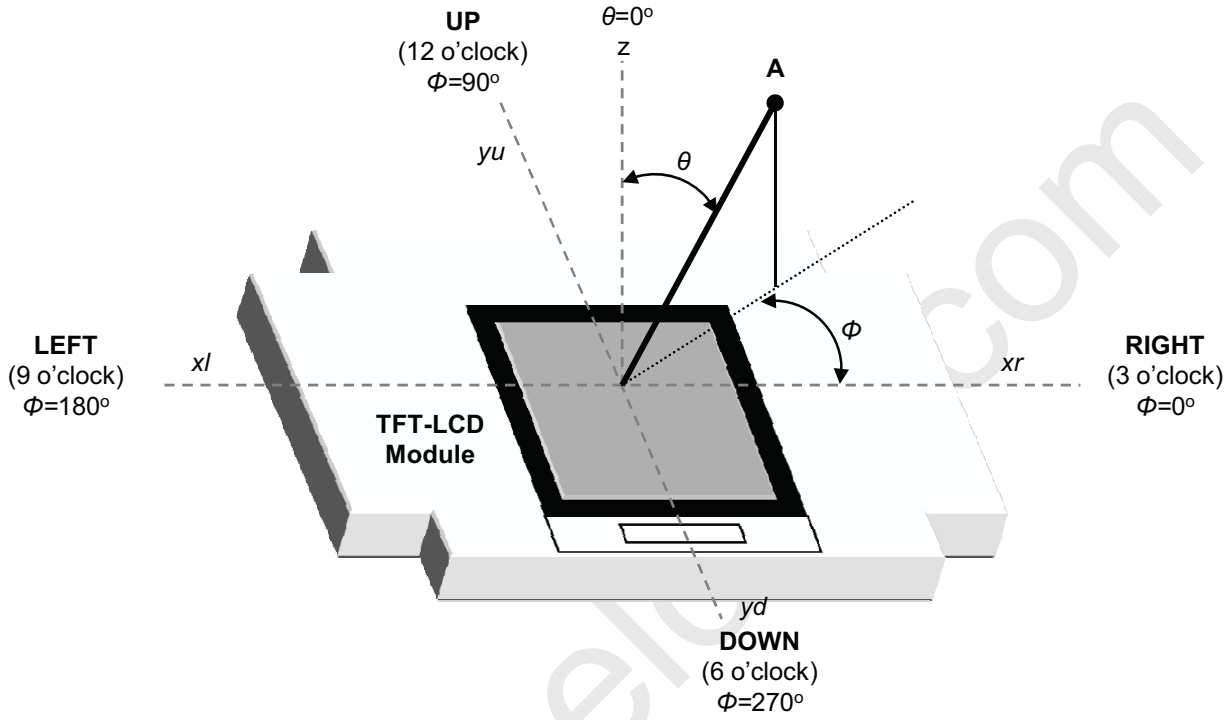



**Fig. 6.5. Viewing Angle Definitions**

Note 5)

Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".

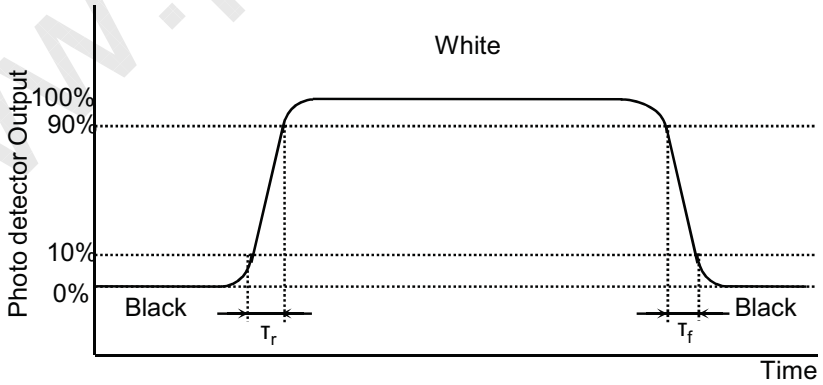



**Fig. 6.6. Response Time Definition**

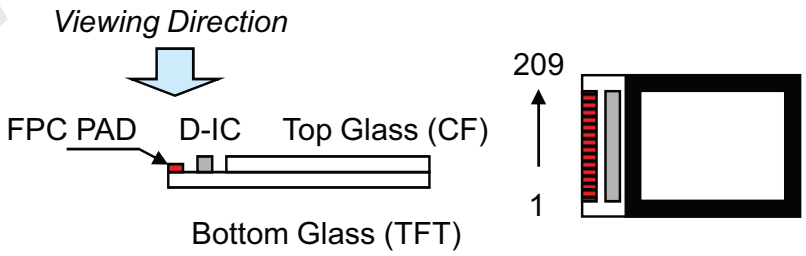
# 7. FPC Description

## 7.1 Pin Configuration to design FPC

| No. | Symbol | Description | No. | Symbol | Description |
|---|---|---|---|---|---|
| 1~5 | Dummy | | 57,58 | VDD | For the internal logic operation |
| 6 | GND | | 59 | IOVCCRF | IOVCC |
| 7 | Dummy | | 60~62 | IOVCC | |
| 8 | AG_PASTE | | 63 | GNDRF | GND |
| 9,10 | VCOM | | 64,65 | GND | |
| 11 | AGND | | 66 | LEDPWM | |
| 12 | GVSS | | 67 | EXCK | Connected GND at FPC |
| 13 | GND | | 68 | DBIST | |
| 14 | PBCTLA1 | Open | 69 | LNSW1 | Connected IOVCC at FPC |
| 15 | PBCTLA2 | | 70 | LNSW0 | |
| 16 | PBCTLB1 | | 71 | PNSW | |
| 17 | PBCTLB2 | | 72 | IM2 | |
| 18,19 | GVDD | | 73 | IM1 | |
| 20,21 | VGH | | 74 | IM0 | Connected GND at FPC |
| 22~24 | C21P | Capacitor connection Pins for step-up circuit | 75 | VSOUT | VSYNC OUT |
| 25~27 | C21M | | 76 | HSOUT | Open |
| 28~30 | SVDD | | 77 | TE2 | |
| 31~33 | VSP | | 78 | TE | |
| 34 | EXPWRP | VSP | 79 | CSX | Connected IOVCC at FPC |
| 35 | VSWP | Open | 80 | DCX | |
| 36,37 | SVSS | | 81 | WRX/SCL | |
| 38,39 | VSN | | 82 | DOUT | Open |
| 40,41 | AGND | | 83 | DIN | Connected IOVCC at FPC |
| 42,43 | C41M | Open | 84 | RESX | |
| 44,45 | C41P | | 85,86 | IOVCC | |
| 46,47 | VCL | | 87~90 | GND | |
| 48~50 | VCI | | 91~94 | AGND | |
| 51 | Dummy | | 95~98 | VCI | |
| 52,53 | VCOM | | 99~103 | SVDD | |
| 54 | VCOMDC | Capacitor connection Pins for internal VCOM | 104,105 | VGS | |
| 55,56 | AGND | | 106~110 | SVSS | |

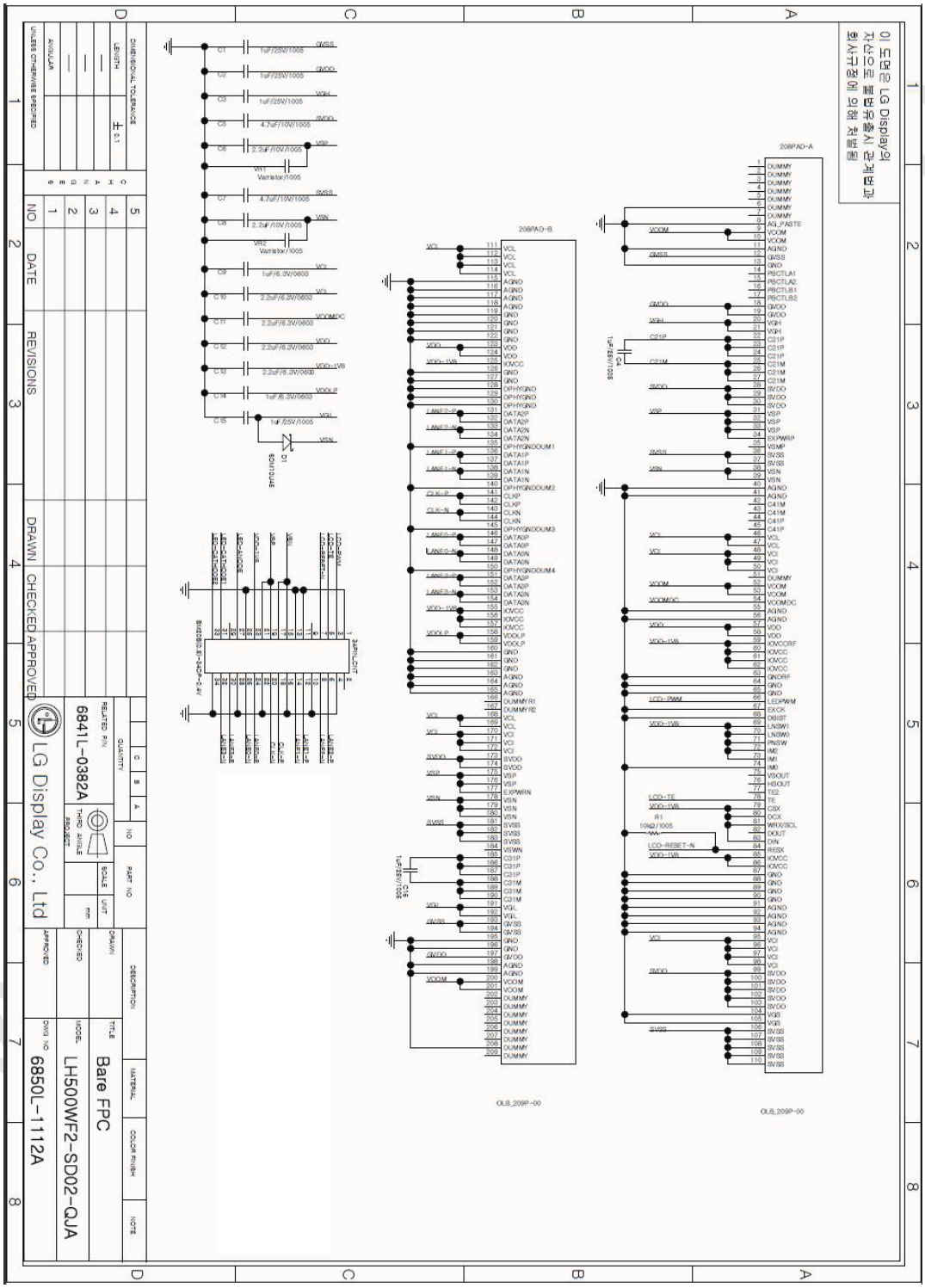
Table 7-1. FPC Pin Configuration (*Continued.*)

| No. | Symbol | Description | No. | Symbol | Description |
|---|---|---|---|---|---|
| 111~114 | VCL | | 160~162 | GND | |
| 115~118 | AGND | | 163~165 | AGND | |
| 119~122 | GND | | 166 | DUMMYR1 | Open |
| 123,124 | VDD | | 167 | DUMMYR2 | |
| 125 | IOVCC | | 168,169 | VCL | |
| 126,127 | GND | | 170~172 | VCI | |
| 128~130 | DPHYGND | GND | 173,174 | SVDD | |
| 131,132 | DATA2P | MIPI Data2+ | 175,176 | VSP | |
| 133,134 | DATA2N | MIPI Data2- | 177 | EXPWRN | VSP |
| 135 | DPHYGNDDUM1 | GND | 178~180 | VSN | |
| 136,137 | DATA1P | MIPI Data1+ | 181~183 | SVSS | |
| 138,139 | DATA1N | MIPI Data1- | 184 | VSWN | Open |
| 140 | DPHYGNDDUM2 | GND | 185~187 | C31P | Capacitor connection Pins for step-up circuit |
| 141,142 | CLKP | MIPI CLK + | 188~190 | C31M | |
| 143,144 | CLKN | MIPI CLK - | 191,192 | VGL | |
| 145 | DPHYGNDDUM3 | GND | 193,194 | GVSS | |
| 146,147 | DATA0P | MIPI Data0+ | 195,196 | GND | |
| 148,149 | DATA0N | MIPI Data0- | 197 | GVDD | |
| 150 | DPHYGNDDUM4 | GND | 198,199 | AGND | |
| 151,152 | DATA3P | MIPI Data3+ | 200,201 | VCOM | |
| 153,154 | DATA3N | MIPI Data3- | 202~207 | Dummy | |
| 155~157 | DPHYVCC | Connected IOVCC at FPC | 208 | GND | |
| 158,159 | VDDLP | Capacitor connection Pins for internal LDO | 209 | Dummy | |



## 7.2. Recommended FPC Schematic

The following schematic is one of the recommendation for the optimized performance of this LCD.

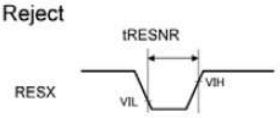


# 8. Power on/off Sequence

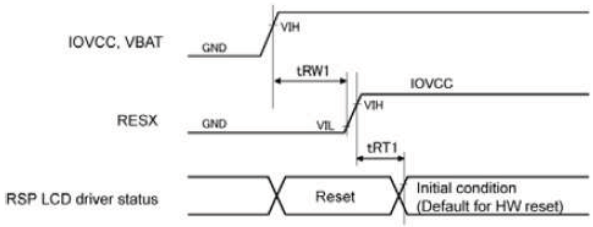
## 8.1 Reset Timing

| Item | Symbol | Unit | Test condition | Min. | Max. |
|---|---|---|---|---|---|
| Reset low-level width1 | tRW1 | us | Power supply on | 1000 | – |
| Reset low-level width2 | tRW2 | us | Operation | 1000 | – |
| Reset time (Sleep IN) | tRT1 | ms | – | – | 3 |
| Reset time (Sleep OUT) | tRT2 | ms | – | – | 3 |
| Noise reject width | tRESNR | us | – | – | 1 |

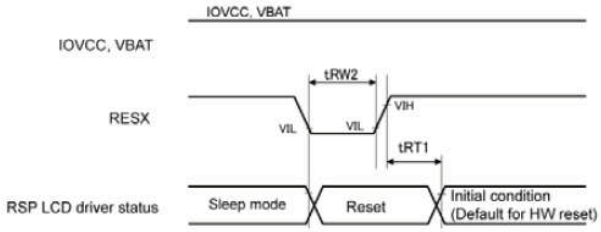
(1)Reset Reject



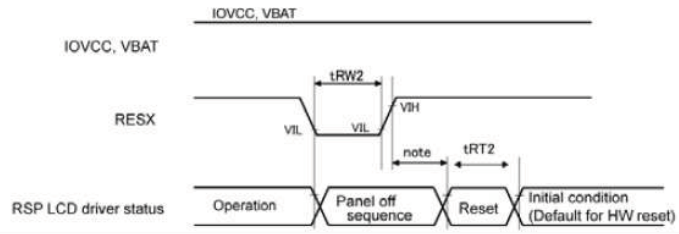

(2-a) Reset timing at power supply on



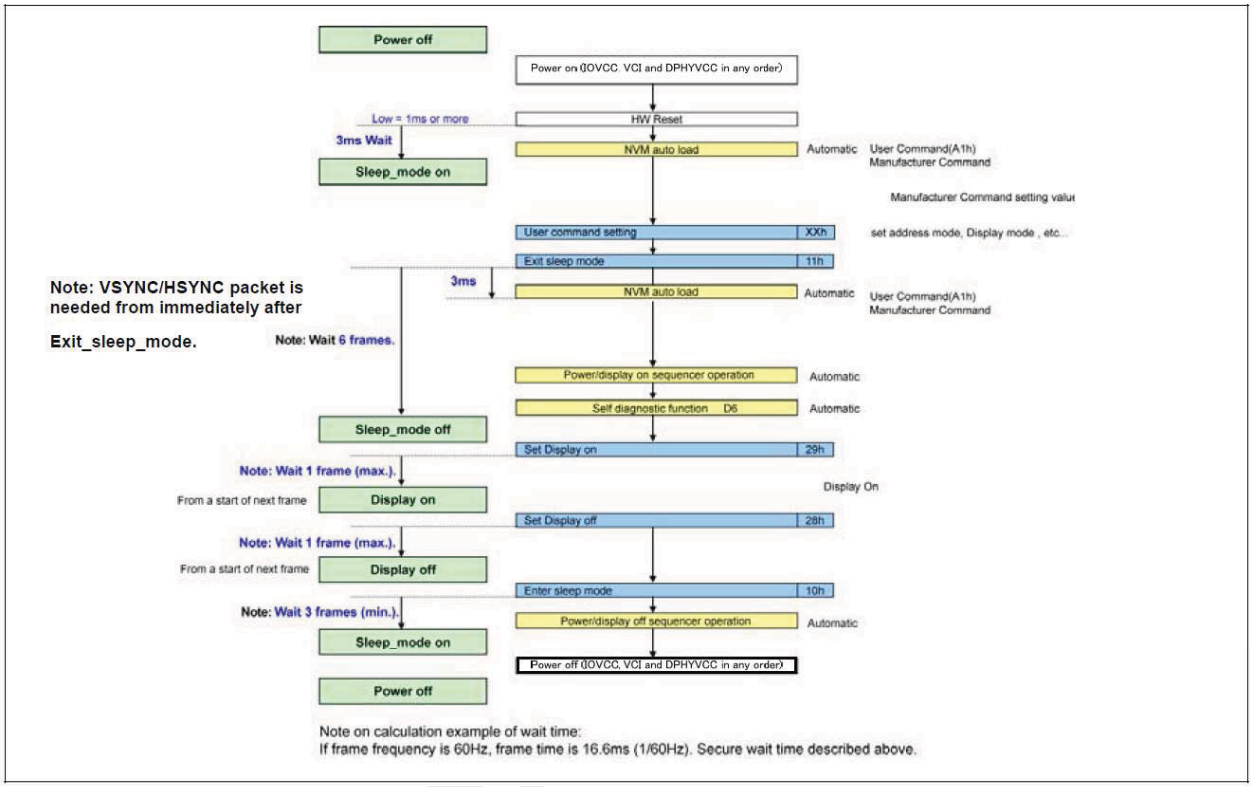

(2-b) Reset timing during operation (sleep in)




(2-c) Reset timing during operation (sleep out)

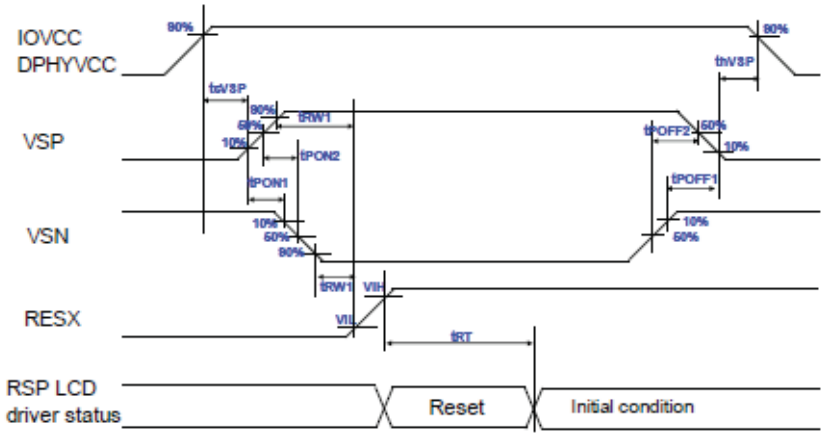


## 8.2 Power On/Off Sequence

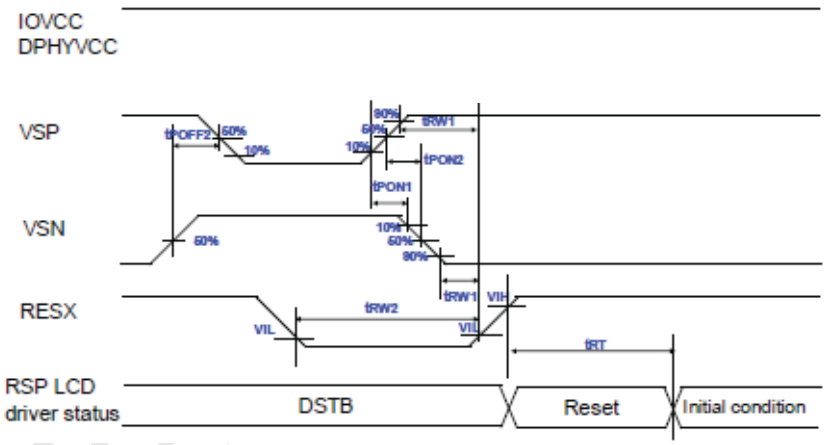


## 8.2 Power On/Off Sequence (continued)

**a)Power On Sequence**




**b)Deep standby mode Sequence**




| Item | Symbol | Unit | Test Condition | Min | Max |
|---|---|---|---|---|---|
| VSP-VSN delay time (10% to 10%) | tPON1 | us | Power On | 0 | – |
| VSP-VSN delay time (50% to 50%) | tPON2 | us | Power On | 0 | – |
| System power on to VSP ON time | tsVSP | ms | Power On | 1 | – |
| Reset low-level width1 | tRW1 | ms | Power On | 1 | – |
| Reset low-level width2 | tRW2 | ms | Power Off | 1 | – |
| Reset time (Sleep IN) | tRT | ms | Power On | 3 | – |
| VSN-VSP delay time (10% to 10%) | tPOFF1 | us | Power Off | 0 | – |
| VSN-VSP delay time (50% to 50%) | tPOFF2 | us | Power Off | 0 | – |
| VSP OFF to system power off time | thVSP | us | Power Off | 0 | – |

# 9. Initial Sequence

## 9.1. Recommended Software Flow

The following flow is one of the recommendation for the optimized performance of this LCD.

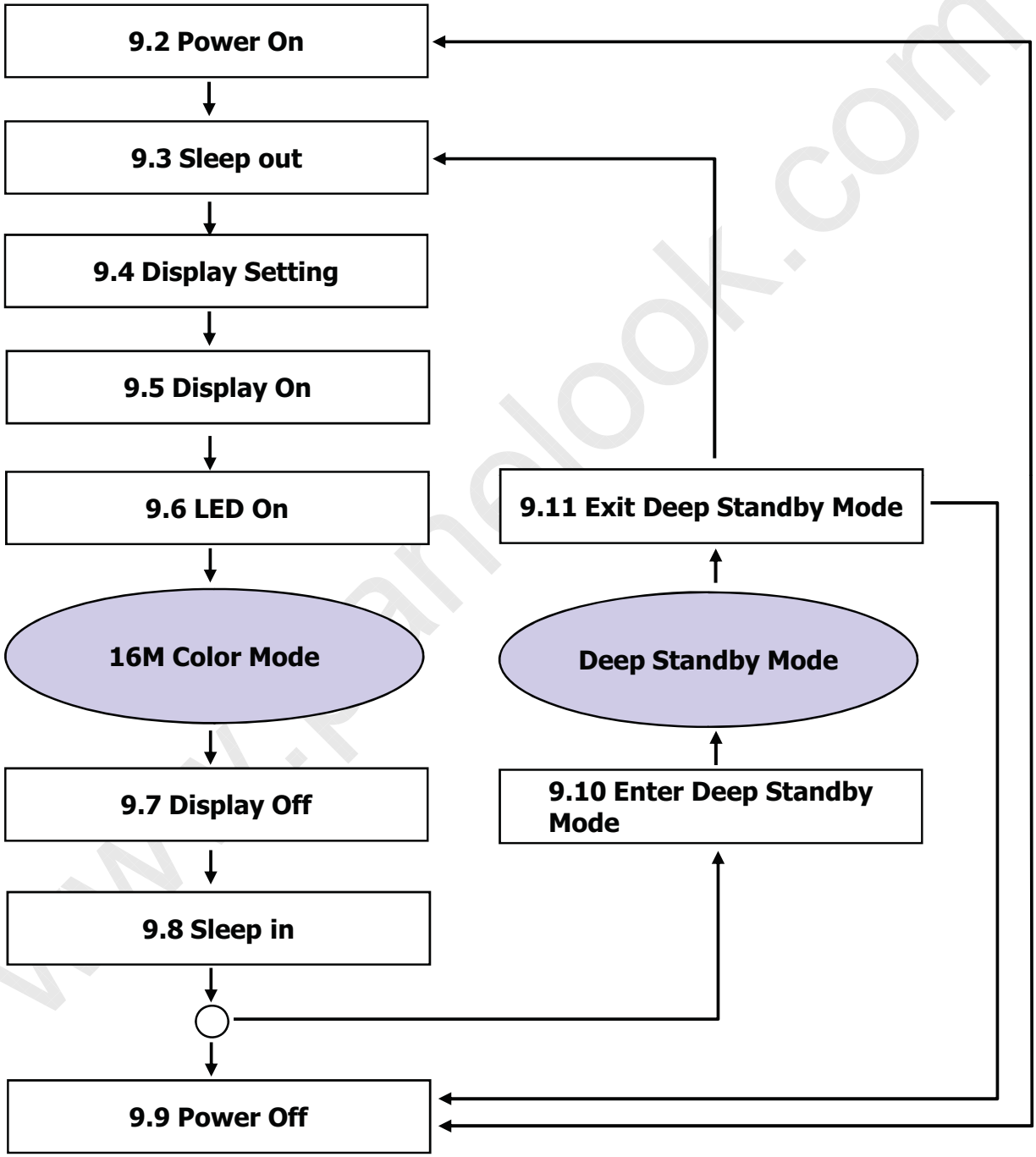


**Table 9.2. Power On Set**

| Step | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|
| 1 | Power on ( IOVCC ) | | |
| 2 | Wait > 1ms | | |
| 3 | Power on ( VSP, VSN in any order ) | | |
| 4 | Wait > 1ms | | |
| 5 | RESX high | | |
| 6 | Wait > 3ms | | |

**Table 9.3. Sleep Out**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x05 | Sleep Out | INDEX | 0x11 |
| 2 | | Wait > 100.2ms (6-frame) | | |

**Table 9.4. Display Initial Set**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x23 | Manufacturer Command Access Protect | INDEX | 0xB0 |
| | | | DATA | 0x04 |
| 2 | 0x29 | Interface Setting | INDEX | 0xB3 |
| | | | DATA | 0x14 0x00 0x00 0x00 0x00 |
| | | | | 0x00 |
| 3 | 0x29 | DSI Control (MIPI Speed) | INDEX | 0xB6 |
| | | | DATA | 0x3A 0xD3 |
| 4 | 0x29 | Slew Rate Setting | INDEX | 0xC0 |
| | | | DATA | 0x00 |
| 5 | 0x29 | Display Setting1 | INDEX | 0xC1 |
| | | | DATA | 0x84 0x60 0x10 0xEB 0xFF |
| | | | | 0x6F 0xCE 0xFF 0xFF 0x17 |
| | | | | 0x12 0x58 0x73 0xAE 0x31 |
| | | | | 0x20 0xC6 0xFF 0xFF 0x1F |
| | | | | 0xF3 0xFF 0x5F 0x10 0x10 |
| | | | | 0x10 0x10 0x00 0x62 0x01 |
| | | | | 0x22 0x22 0x00 0x01 |
| 7 | 0x29 | Display Setting2 | INDEX | 0xC2 |
| | | | DATA | 0x31 0xF7 0x80 0x06 0x08 |
| | | | | 0x80 0x00 |

**Table 9.4. *continued***

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 9 | 0x29 | Source Timing Setting | INDEX | 0xC4 |
| | | | DATA | 0x70 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0x00 0x00 0x0C |
| | | | | 0x06 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0x00 0x00 0x00 |
| | | | | 0x0C 0x06 |
| 10 | 0x29 | LTPS Timing Setting | INDEX | 0xC6 |
| | | | DATA | 0x00 0x02 0x6c 0x02 0x6c |
| | | | | 0x00 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0x0C 0x19 0X0A |
| | | | | 0x01 0x02 0x6c 0x02 0x6c |
| | | | | 0x00 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0x0C 0x19 0x0a |
| 11 | 0x29 | Gamma Setting | INDEX | 0xC7 |
| | | | DATA | 0x00 0x05 0x0A 0x12 0x20 |
| | | | | 0x30 0x3D 0x51 0x39 0x43 |
| | | | | 0x50 0x60 0x66 0x6D 0x78 |
| | | | | 0x00 0x05 0x0A 0x12 0x20 |
| | | | | 0x30 0x3D 0x51 0x39 0x43 |
| | | | | 0x50 0x60 0x66 0x6D 0x78 |
| 12 | 0x29 | Digital Gamma Setting | INDEX | 0xC8 |
| | | | DATA | 0x01 0x00 0x00 0x00 0x00 |
| | | | | 0xFC 0x00 0x00 0x00 0x00 |
| | | | | 0x00 0xFC 0x00 0x00 0x00 |
| | | | | 0x00 0x00 0xFC 0x00 |

**Table 9.4. *continued***

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 14 | 0x29 | Panel PIN Control | INDEX | 0xCB |
| | | | DATA | 0x31 0xFC 0x3F 0x8C 0x00 |
| | | | | 0x00 0x00 0x00 0xC0 |
| 15 | 0x23 | Panel Interface Control | INDEX | 0xCC |
| | | | DATA | 0x0B |
| 16 | 0x29 | Power Setting For Charge Pump | INDEX | 0xD0 |
| | | | DATA | 0x11 0x81 0xBB 0x1B 0x1B |
| | | | | 0x4C 0x19 0x19 0x0C 0x00 |
| 17 | 0x29 | Power Setting for Internal Power | INDEX | 0xD3 |
| | | | DATA (VSP 5V, VSN -5V) | 0x1B 0x33 0xBB 0xBB 0xB3 |
| | | | | 0x33 0x33 0x33 0x01 0x01 |
| | | | | 0x00 0xA0 0xD8 0xA0 0x0d |
| | | | | **0x56 0x56** 0x33 0x3B 0x22 |
| | | | | 0x72 0x07 0x3D 0xBF **0x33** |
| | | | DATA (VSP 5.2V, VSN -5.2V) | 0x1B 0x33 0xBB 0xBB 0xB3 |
| | | | | 0x33 0x33 0x33 0x01 0x01 |
| | | | | 0x00 0xA0 0xD8 0xA0 0x0d |
| | | | | **0x5F 0x5F** 0x33 0x3B 0x22 |
| | | | | 0x72 0x07 0x3D 0xBF **0x55** |
| 18 | 0x29 | VCOM Setting | INDEX | 0xD5 |
| | | | DATA | 0x06 0x00 0x00 0x01 0x32 |
| | | | | 0x01 0x32 |

**Table 9.5. Display On**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x05 | Display On | INDEX | 0x29 |
| 2 | | Wait > 16.7ms (1-frame) | | |

**Table 9.6. LED On**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x15 | Write Display Brightness (Amount of light: 100%) | INDEX | 0x51 |
| | | | DATA | 0xFF |
| 2 | 0x15 | Write Control Display (LEDPWM) | INDEX | 0x53 |
| | | | DATA | 0x2C |
| 3 | 0x15 | Write Content Adaptive Brightness Control (SRE off, CABC Off) | INDEX | 0x55 |
| | | | DATA | 0x00 |

**Table 9.7. Display Off**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x05 | Display Off | INDEX | 0x28 |
| 2 | | Wait > 16.7ms (1-frame) | | |

**Table 9.8. Sleep In**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x05 | Sleep In | INDEX | 0x10 |
| 2 | | Wait > 50.1ms (3-frame) | | |

**Table 9.9. Power Off**

| Step | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|
| 1 | Power Off (VSP, VSN In Any Order ) | | |
| 2 | Wait > 0ms | | |
| 3 | Power Off (IOVCC) | | |

**Table 9.10. Enter Deep Standby Mode**

| Step | Data Type | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|---|
| 1 | 0x23 | Manufacture Command Access | INDEX | 0xB0 |
| | | | DATA | 0x04 |
| 2 | 0x29 | DSTB | INDEX | 0xB1 |
| | | | DATA | 0x01 |

**Table 9.11. Exit Deep Standby Mode**

| Step | REGISTER FUNCTION | INDEX/DATA | HEX |
|---|---|---|---|
| 1 | RESX low | | |
| 2 | Wait > 1ms | | |
| 3 | RESX high | | |
| 4 | Wait > 3ms | | |

Table 9.1.7. DCS Data Type List

| DCS Command/Parameter | | W/R | Host to RSP LCD driver Data Type (RX) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Write Type | | | | | | Read Type | | | Other |
| | | Data Type | 05'h | 15'h | 39'h | 13'h | 23'h | 29'h | 14'h | 24'h | 06'h | 37'h |
| | | Packet | Short | Short | Long | Short | Short | Long | Short | Short | Short | Short |
| | | DCS para | DCS no para | DCS 1 para | DCS | Generic 1 para | Generic 2 para | Generic - | Generic 1 para | Generic 2 para | DCS no para | Set max. return packet size |
| 00h | nop | C | Yes | No | Yes | No | No | No | No | No | No | - |
| 01h | soft_reset | C | Yes | No | Yes | No | No | No | No | No | No | - |
| 04h | read_DDB_start | 16 | No | No | No | No | No | No | No | No | Yes | 16'h10 |
| 05h | read_Number_of_the_Errors_on_DSI | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 06h | get_red_channel | 1 | No | No | No | No | No | No | No | No | Yes | |
| 07h | get_green_channel | 1 | No | No | No | No | No | No | No | No | Yes | |
| 08h | get_blue_channel | 1 | No | No | No | No | No | No | No | No | Yes | |
| 0Ah | get_power_mode | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 0Bh | get_address_mode | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 0Ch | get_pixel_format | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 0Dh | get_display_mode | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 0Eh | get_signal_mode | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 0Fh | get_diagnostic_result | 1 | No | No | No | No | No | No | No | No | Yes | 16'h1 |
| 10h | enter_sleep_mode | C | Yes | No | Yes | No | No | No | No | No | No | - |
| 11h | exit_sleep_mode | C | Yes | No | Yes | No | No | No | No | No | No | - |
| 26h | set_gamma_curve | 1 | No | Yes | Yes | No | No | No | No | No | No | - |
| 28h | set_display_off | C | Yes | No | Yes | No | No | No | No | No | No | - |
| 29h | set_display_on | C | Yes | No | Yes | No | No | No | No | No | No | - |

Table 9.1.8. MCS Data Type List

| | | Host to RSP LCD driver Data Type (RX) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MCS Command/Parameter | W/R | Write Type | | | | | | Read Type | | | Other |
| | Data Type | 05'h | 15'h | 39'h | 13'h | 23'h | 29'h | 14'h | 24'h | 06'h | 37'h |
| | Packet | Short | Short | Long | Short | Short | Long | Short | Short | Short | Short |
| | MCS para | DCS no para | DCS 1 para | DCS | Generic 1 para | Generic 2 para | Generic - | Generic 1 para | Generic 2 para | DCS no para | Set max. return packet size |
| MCS Read only command | 1 | No | No | No | No | No | No | Yes | No | No | 16'h1 |
| MCS write/read command | 1 | No | No | No | No | Yes | Yes | Yes | No | No | 16'h1 |
| MCS write/read command | 1 < n | No | No | No | No | No | Yes | Yes | No | No | 16'hn |

Note) When each data type packet is sent, it is necessary to write all parameters of each DCS and MCS.

# 10. Outline Dimension

## 10.1. LCD Layout

The contents provide general outline dimension characteristics for the model LH500WF2-SH01. Symbols and reference of the outline dimension are summarized in Fig 9.1.

Table 10.1. Mechanical Characteristics of the LH500WF2-SH01

| Parameter | Symbol | Specification | Unit | Notes |
|---|---|---|---|---|
| Active Area | A | 61.884 | mm | |
| | B | 110.016 | mm | |
| Upper Glass Size | C | 63.884 | mm | |
| | D | 113.136 | mm | |
| Bottom Glass Size | E | 63.884 | mm | |
| | F | 116.596 | mm | |
| Panel Thickness | T | 0.3 | mm | |
| Cell Margin | G | 1.0 | mm | |
| | H | 2.12 | mm | |
| | I | 1.0 | mm | |
| | J | 1.0 | mm | |
| COG PAD Area | K | 3.46 | mm | |
| Upper Glass Edge to D-IC | L | 0.6 | mm | |
| Bottom Glass Edge to D-IC | M | 1.2 | mm | |
| D-IC to FPC | N | 0.4 | mm | |
| FPC to Glass Edge | O | 0.8 | mm | |
| FPC Length | P | 32.823 | mm | |
| FPC Pad Length (Metal) | Q | 0.6 | mm | |
| FPC Pad to Glass Edge (No Metal) | R | 0.2 | mm | |

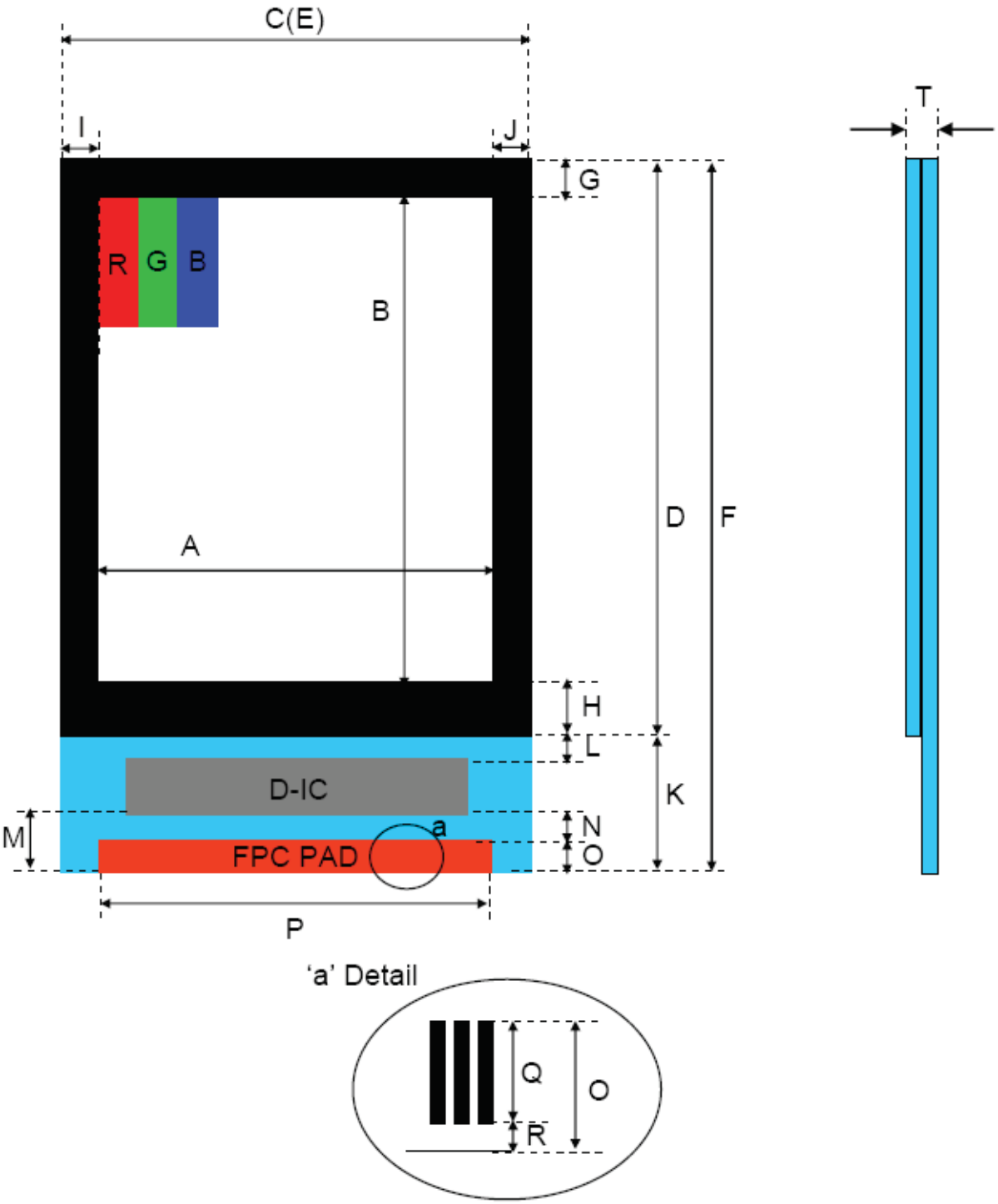


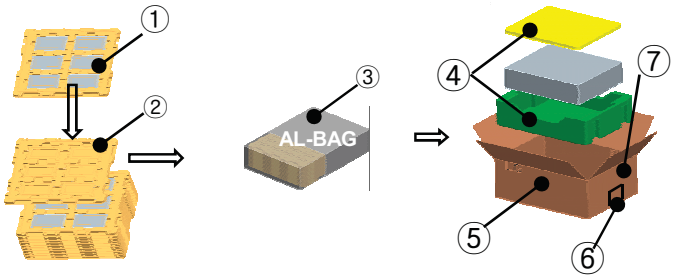

**Fig 10.1. Symbol and reference of the outline dimension of LH500WF2-SH01 model**

# 11. Packing Form

a) Package quantity in one box : 90 pcs

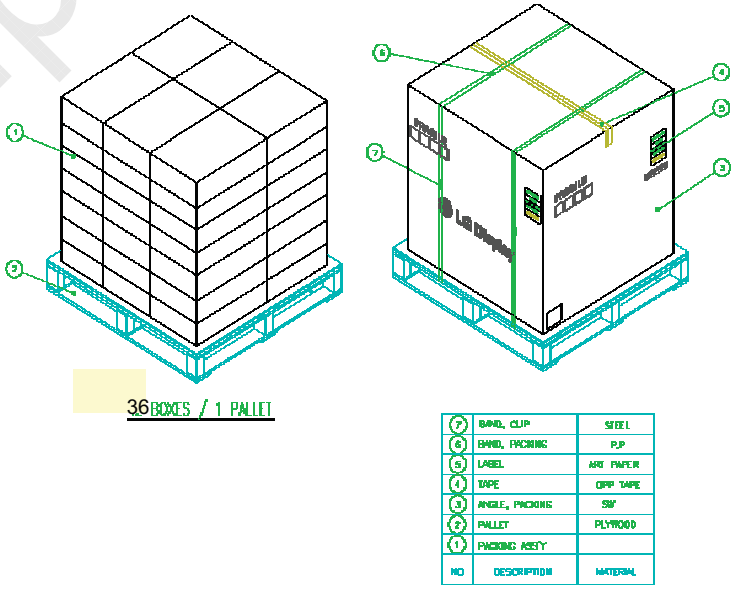
b) Box Size : 393mm X 339mm X 135mm

## 11.1. PACKING ASS'Y




| NO. | Description | Material |
|---|---|---|
| 1 | Cell | |
| 2 | Packing Tray | PET |
| 3 | Bag | AL |
| 4 | Packing | EPS |
| 5 | Carton Box | SW |
| 6 | Tape | OPP 70MMx300m |
| 7 | Label | YUPO Paper 100x70 |

## 11.2. PALLET ASS'Y



# 12. Reliability

## 12.1 Environmental Reliability Tests

Reliability test conditions ( Polarizer characteristics null )

| No. | Test Items | Test Condition | Remark |
|---|---|---|---|
| 1 | Low Temperature Storage | Ta = -30℃ 240hrs | Module (Without Contamination) |
| 2 | High Temperature Storage | Ta = 80℃ 240hrs | |
| 3 | Low Temperature Operation | Ta = -20℃ 240hrs *1) | |
| 4 | High Temperature Operation | Ta = 70℃ 240hrs | |
| 5 | High Temperature and High Humidity Operation | Ta = 60℃/ 90%RH 240hrs (But no condensation dew) | |
| 6 | Thermal Shock (Non-operation) | -30 ~ 80℃, 100cycle | |
| 7 | Image Sticking *2) | Mosaic 8x6 1hr Sticking → Half Gray Under Level 2 within 2sec | |
| 8 | Packing Shock | 1coner, 3edge, 6face / 76cmDrop | Package |
| 9 | Packing Vibration | Random 1.5Grms Z direction 1hr. | |

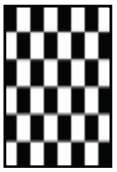
Notes :

No.1~ No.7 : No guarantee for panel, only for module with the above test conditions.

No.8~ No.9 : Refer to '11.1 Packing Ass'y' on page 26.

* 1) But no condensation of dew

* 2) Display for 1hr on Mosaic 8 x 6 Pattern and then change Half Gray Pattern.
(Image Sticking Test are implemented after LCD has been 'ON' and stable for approximately 30 minutes in a *Standard circumstance at 25°C.)
[Judgment]
Under *Level 2 within 2 sec in a Dark room with naked eye
* Standard circumstance : IEC60068-1
* Level 2: No image sticking with ND Filter 10%


Mosaic 8 X 6 Pattern

※ Guarantee Image Sticking
just in case of operation with '9.1. Recommended Software Flow' on page 16.

[Result Evaluation Criteria]
LCD Panel should be at room temperature for minimum 24 hours after the reliability test is over.
There should be no particular change which might affect the practical display function and the display quality should be conducted under only normal LCD operating condition.

## CAUTION & HANDLING PRECAUTIONS

Please pay attention to the following when you use this TFT-LCD panel.

### 1. MOUNTING PRECAUTIONS

1) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials.
2) Since a TFT-LCD Panel is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc .
3) Do not leave at the high temperature and high humidity in long time.
4) Do not leave the TFT-LCD panel from direct sunlight.
5) Do not contact with water to avoid Metal corrosion.
6) The TFT-LCD Panel shall be installed flat, without twisting or bending

### 2. OPERATING PRECAUTIONS

1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage : V=±200mV(Over and under shoot voltage)
2) Response time depends on the temperature.(In lower temperature, it becomes longer.)
3) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time(required time that brightness is stable after turned on) becomes longer.
4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
6) The TFT-LCD shall be operated within the temperature limits specified. When you operate the TFT-LCD panel at below(beyond) the limit specified, It may cause damage or image degradation. This phenomenon may not recover.

### 3. ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

## 4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of color filter. It may not recover

## 5. STORAGE

When storing TFT-LCD panel as spares for a long time, the following precautions are necessary.

1) Store them in a dark place. Do not expose to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
2) The TFT-LCD glass surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.
3) As TFT-LCD panels are packed in a vacuum with PE bag and Al bag in Nitrogen gas environment ,

**Customer is required to keep the product under a good condition(25 degree, 50%) to prevent any of unwanted damage from the moisture, and chemicals, etc. And recommended to use it in a short-time period, after it's unpacked.**

## 6. HANDLING PRECAUTIONS FOR TFT-LCD Glass

Be careful when TFT-LCD panel is broken.(TFT-LCD is made of glass)

## 7. PACKING

When you must re-package a LCD after it has been removed from the original packaging, it is recommended to re-pack using the original package box and package material. And the LCD should be input to Module line as soon as it's unpacked to prevent panel corrosion because this gate material is consisted of Al/Mo which is weak in moisture, and chemicals, etc.