# Model Name: T315HW04 V6

## Issue Date : 2010/2/5

( )Preliminary Specifications
(*)Final Specifications

| Customer Signature | Date | AUO | Date |
|---|---|---|---|
| Approved By | | Approval By PM Director<br>*Frank Hsu*<br>Yen Ting Chiu for Frank Hsu. | |
| Note | | Reviewed By RD Director<br>*Eugene CC Chen*<br>Eugene Chen<br>Reviewed By Project Leader<br>*Matt Pan*<br>Matt Pan. | |
| | | Prepared By PM<br>*Joanne Hsu*<br>Joanne Hsu. | |

# Contents

# Record of Revision

| Version | Date | Page | Description |
|---|---|---|---|
| 0.1 | 2009/10/10 | | First release |
| 0.2 | 2010/1/10 | | Preliminary spec |
| 0.3 | 2010/2/5 | | Final spec |
| | | | |
| | | | |
| | | | |

# 1. General Description

This specification applies to the 31.5 inch Color TFT-LCD Module T315HW04 V6. This LCD module has a TFT active matrix type liquid crystal panel 1,920 x 1080 pixels, and diagonal size of 31.5 inch. This module supports 1,920 x 1080 mode. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes. Gray scale or the brightness of the sub-pixel color is determined with a 10-bit (8 bit+FRC) gray scale signal for each dot.

The T315HW04 V6 has been designed to apply the 10-bit (8 bit+FRC) 2 channel LVDS interface method. It is intended to support displays where high brightness, wide viewing angle, high color saturation, and high color depth are very important.

*** General Information**

| Items | Specification | Unit | Note |
|---|---|---|---|
| Active Screen Size | 31.55 | inch | |
| Display Area | 698.4 (H) x 392.85 (V) | mm | |
| Outline Dimension | 760.0 (H) x 450.0 (V) x 46.9 (D) | mm | With inverter |
| Driver Element | a-Si TFT active matrix | | |
| Display Colors | 8 bit+FRC, 1.07B | Colors | |
| Number of Pixels | 1,920 x 1080 | Pixel | |
| Pixel Pitch | 0.36375 | mm | |
| Pixel Arrangement | RGB vertical stripe | | |
| Display Operation Mode | Normally Black | | |
| Surface Treatment | Anti-Glare, 3H | | Haze=11% |

# 2. Absolute Maximum Ratings

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

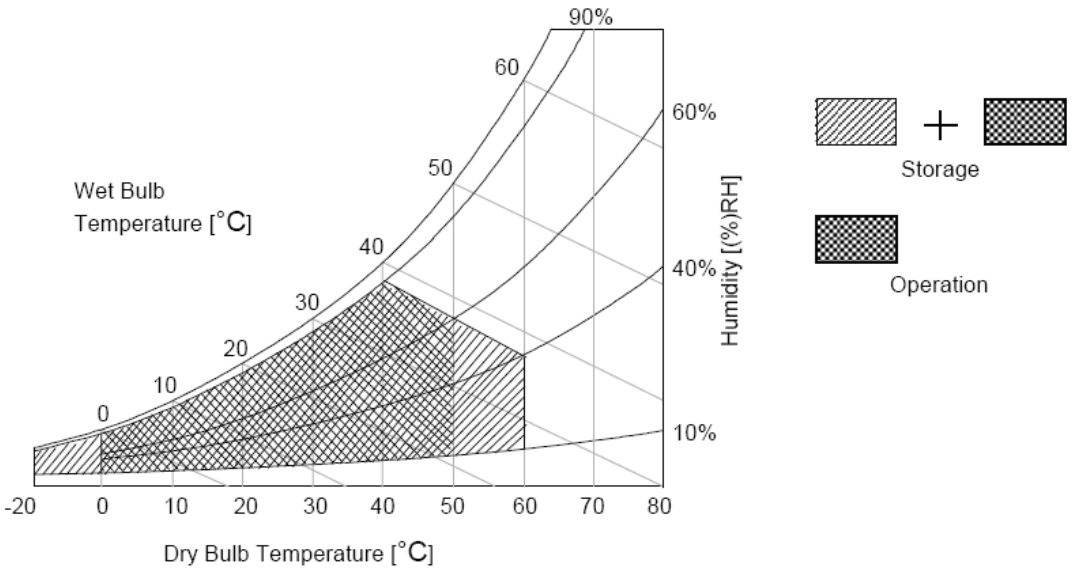
| Item | Symbol | Min | Max | Unit | Conditions |
|---|---|---|---|---|---|
| Logic/LCD Drive Voltage | $V_{DD}$ | -0.3 | 14 | [Volt] | Note 1 |
| Input Voltage of Signal | Vin | -0.3 | 4 | [Volt] | Note 1 |
| Operating Temperature | TOP | 0 | +50 | [°C] | Note 2 |
| Operating Humidity | HOP | 10 | 90 | [%RH] | Note 2 |
| Storage Temperature | TST | -20 | +60 | [°C] | Note 2 |
| Storage Humidity | HST | 10 | 90 | [%RH] | Note 2 |
| Panel Surface Temperature | PST | | 65 | [°C] | Note 3 |

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39℃ and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40℃ or less. At temperatures greater than 40℃, the wet bulb temperature must not exceed 39℃.

Note 3: Surface temperature is measured at 50℃ Dry condition



# 3. Electrical Specification

The T315HW04 V6 requires two power inputs. One is employed to power the LCD electronics and to drive the TFT array and liquid crystal. The second input for BLU is to power inverter.

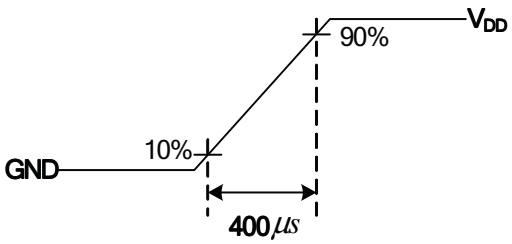
## 3.1 Electrical Characteristics

| Parameter | | Symbol | Value | | | Unit | Note |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max | | |
| LCD | | | | | | | |
| Power Supply Input Voltage | | $V_{DD}$ | 10.8 | 12 | 13.2 | $V_{DC}$ | 1 |
| Power Supply Input Current | | $I_{DD}$ | -- | 1.57 | 1.94 | A | 2 |
| Power Consumption | | $P_C$ | -- | 18.84 | 23.3 | Watt | 2 |
| Inrush Current | | $I_{RUSH}$ | -- | -- | 4 | A | 3 |
| LVDS Interface | Input Differential Voltage | $\lvert V_{ID} \rvert$ | 200 | 400 | 600 | $mV_{DC}$ | 4 |
| | Differential Input High Threshold Voltage | $V_{TH}$ | -- | -- | +100 | 4 | 4 |
| | Differential Input Low Threshold Voltage | $V_{TL}$ | -100 | -- | -- | 4 | 4 |
| | Input Common Mode Voltage | $V_{ICM}$ | 0.6 | 1.2 | 1.8 | $V_{DC}$ | 4 |
| | Input Channel Pair Skew Margin | $t_{SKEW\ (CP)}$ | -500 | -- | +500 | ps | 5 |
| CMOS Interface | Input High Threshold Voltage | $V_{IH}$ (High) | 2.7 | -- | 3.3 | $V_{DC}$ | -- |
| | Input Low Threshold Voltage | $V_{IL}$ (Low) | 0 | -- | 0.6 | $V_{DC}$ | -- |
| Backlight Power Consumption | | $P_{BL}$ | 61 | 67 | 73 | Watt | -- |
| Life Time | | | 50,000 | -- | -- | Hours | 6 |

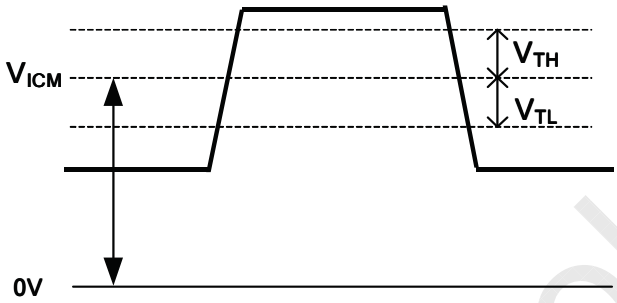
**Note :**

1. The ripple voltage should be controlled under 10% of $V_{CC}$
2. Test Condition:
   (1) $V_{DD}$ = 12.0V
   (2) Fv = 60Hz
   (3) $F_{CLK}$ = 80 Mhz (typ.), 86Mhz (max)
   (4) Temperature = 25 ℃
   (5) Test Pattern : White Pattern

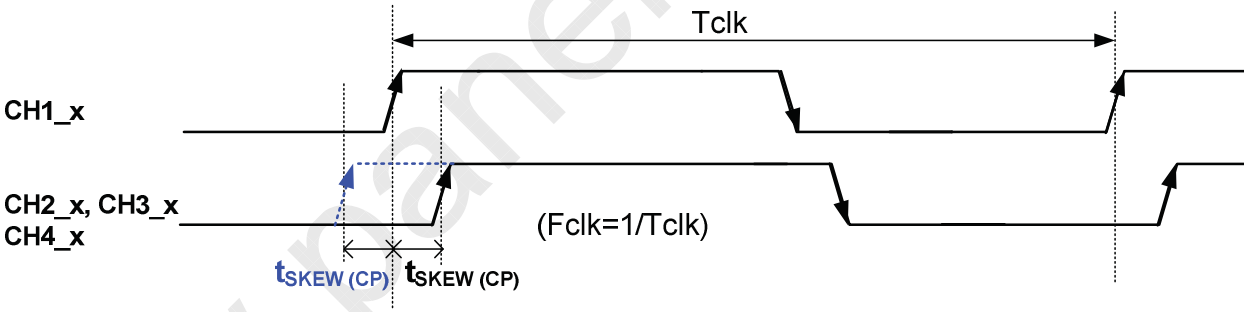
3. Measurement condition : Rising time = 400us




4. $V_{ICM}$ = 1.25V




5. Input Channel Pair Skew Margin




**Note: x = 0, 1, 2, 3, 4**

6. Specified values are for a single lamp only which is aligned horizontally. The lifetime is defined as the time which luminance of the lamp is 50% compared to its original value.
[Operating condition: Continuous operating at Ta = 25±2℃]



## 3.2 Interface Connections

- LCD connector: 187059-51221 (P-TWO, LVDS connector)

| PIN | Symbol | Description | PIN | Symbol | Description |
|---|---|---|---|---|---|
| 1 | $V_{DD}$ | Power Supply, +12V DC Regulated | 26 | CH2_0+ | LVDS Channel 2, Signal 0+ |
| 2 | $V_{DD}$ | Power Supply, +12V DC Regulated | 27 | CH2_1- | LVDS Channel 2, Signal 1- |
| 3 | $V_{DD}$ | Power Supply, +12V DC Regulated | 28 | CH2_1+ | LVDS Channel 2, Signal 1+ |
| 4 | $V_{DD}$ | Power Supply, +12V DC Regulated | 29 | CH2_2- | LVDS Channel 2, Signal 2- |
| 5 | $V_{DD}$ | Power Supply, +12V DC Regulated | 30 | CH2_2+ | LVDS Channel 2, Signal 2+ |
| 6 | Reserved | AUO Internal Use Only | 31 | GND | Ground |
| 7 | GND | Ground | 32 | CH2_CLK- | LVDS Channel 2, Clock - |
| 8 | GND | Ground | 33 | CH2_CLK+ | LVDS Channel 2, Clock + |
| 9 | GND | Ground | 34 | GND | Ground |
| 10 | CH1_0- | LVDS Channel 1, Signal 0- | 35 | CH2_3- | LVDS Channel 2, Signal 3- |
| 11 | CH1_0+ | LVDS Channel 1, Signal 0+ | 36 | CH2_3+ | LVDS Channel 2, Signal 3+ |
| 12 | CH1_1- | LVDS Channel 1, Signal 1- | 37 | CH2_4- | LVDS Channel 2, Signal 4- |
| 13 | CH1_1+ | LVDS Channel 1, Signal 1+ | 38 | CH2_4+ | LVDS Channel 2, Signal 4+ |
| 14 | CH1_2- | LVDS Channel 1, Signal 2- | 39 | GND | Ground |
| 15 | CH1_2+ | LVDS Channel 1, Signal 2+ | 40 | SCL | I2C Serial Clock Bus |
| 16 | GND | Ground | 41 | SDA | I2C Serial Data Bus |
| 17 | CH1_CLK- | LVDS Channel 1, Clock - | 42 | LVDS_SEL | LVDS Format Selection<br>Open/High(3.3V) for NS 8bits<br>Low(GND) for JEIDA 10bits |
| 18 | CH1_CLK+ | LVDS Channel 1, Clock + | 43 | NC | No connection |
| 19 | GND | Ground | 44 | NC | No connection |
| 20 | CH1_3- | LVDS Channel 1, Signal 3- | 45 | NC | No connection |
| 21 | CH1_3+ | LVDS Channel 1, Signal 3+ | 46 | Reserved | AUO Internal Use Only |
| 22 | CH1_4- | LVDS Channel 1, Signal 4- | 47 | Reserved | AUO Internal Use Only |
| 23 | CH1_4+ | LVDS Channel 1, Signal 4+ | 48 | Reserved | AUO Internal Use Only |
| 24 | GND | Ground | 49 | Reserved | AUO Internal Use Only |
| 25 | CH2_0- | LVDS Channel 2, Signal 0- | 50 | Reserved | AUO Internal Use Only |
| | | | 51 | FR_SELECT | Input Frame Rate Selection.<br>High(3.3V) for 1 : 50Hz<br>Low/Open(GND) for 0 : 60Hz |

# MEMC Function Description

## Setting By Hardware

| Pin name | Content | Note | Default |
|---|---|---|---|
| FR_SEL | Input Frame Rate Selection<br>0: 60Hz<br>1: 50Hz | | 1'b0 |
| LVDS_SEL | LVDS Format Selection<br>0: JEIDA Mode 10bits<br>1: NS Mode 8bits | | 1'b1 |
| I2C_SDA *2 | I2C Serial Data Bus | | |
| I2C_SCL *2 | I2C Serial Data Bus | | |

**Note 1.**
MEMC ON/OFF can also control by external I2C. If users want to change the setting, only need to change hardware setting or provide external I2C command. Ex: When MEMC_SEL of the hardware is 00 for MEMC OFF, external I2C can set address=0x79 and data=0x02 for MEMC OFF.

**Note 2.**
The next figure shows the I2C format of customer's single-byte command. Ex. Address : 0x65.

| START | 0XE4 (*1) | ACK (*2) | Address | ACK | Data | ACK | STOP |
|---|---|---|---|---|---|---|---|

The next figure shows the I2C format of customer's multi-byte command. Ex. Address : 0x23.

| START | 0XE4 | ACK | Add ress | ACK | Data (Byte 0) | ACK | Data (Byte 1) | ACK | Data (Byte 2) | ACK | Data (Byte 3) | ACK | STOP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

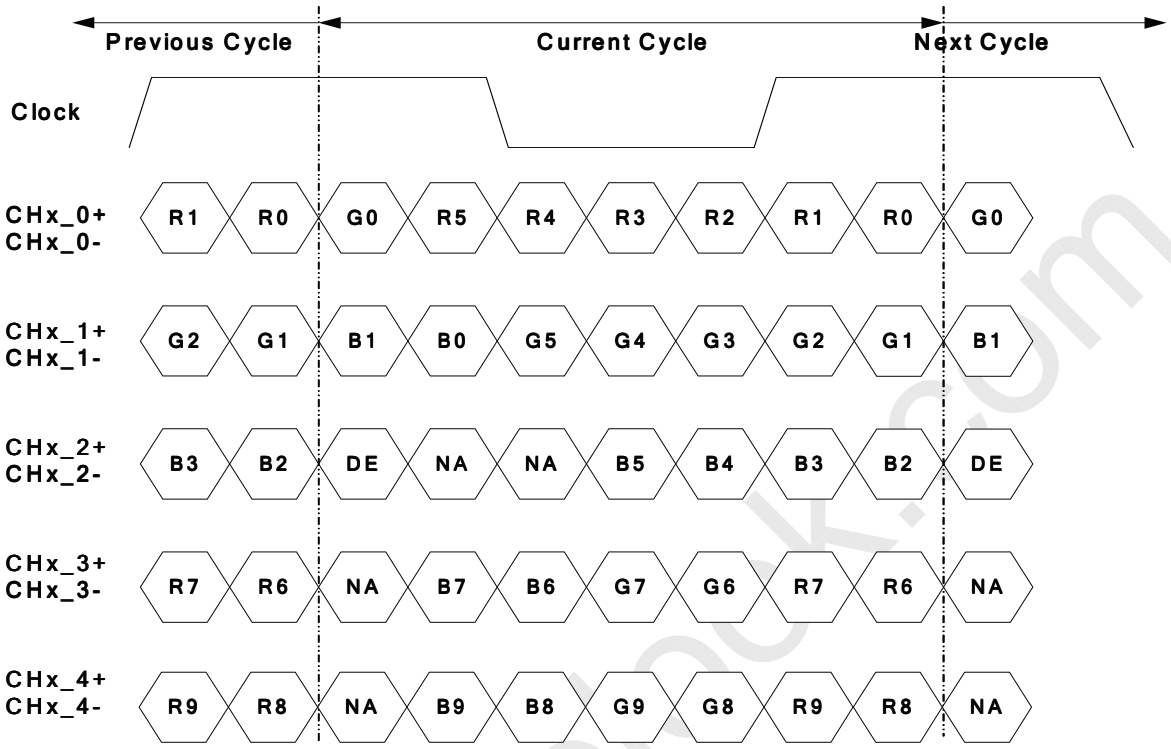
Note (1): Slave address of MEMC chip is 0x72 plus the least significant bit indicating a write (0xE4).
Note (2): Shaded items are issued by the slave (MEMC chip).

## Setting By External I2C

| Address (Hex) | Byte | Bit | Description | Note | Default |
|---|---|---|---|---|---|
| 1B | 0 | 7:0 | Output black data<br>0x00: unblank (normal display)<br>0x01: blank (output black data) | Initial state is unblanked. | 0x00 |
| 79 | 0 | 7:0 | MEMC ON/OFF Selection<br>0x00: MEMC ON<br>0x02: MEMC OFF<br>0x04: TRUE MOVIE (5:5 pull down for 120Hz)<br>0x05: MEMC ON (Low latency) | **MEMC ON:** 10 frames latency (~170ms) for film FJC, MBR + video MBR<br>**MEMC OFF:** 1 frame latency (~16.7ms)<br>**TRUE MOVIE:** latency (~80ms) for film a frame repeat.<br>**MEMC ON(Low latency):** low latency (~125ms) | 0x00 |

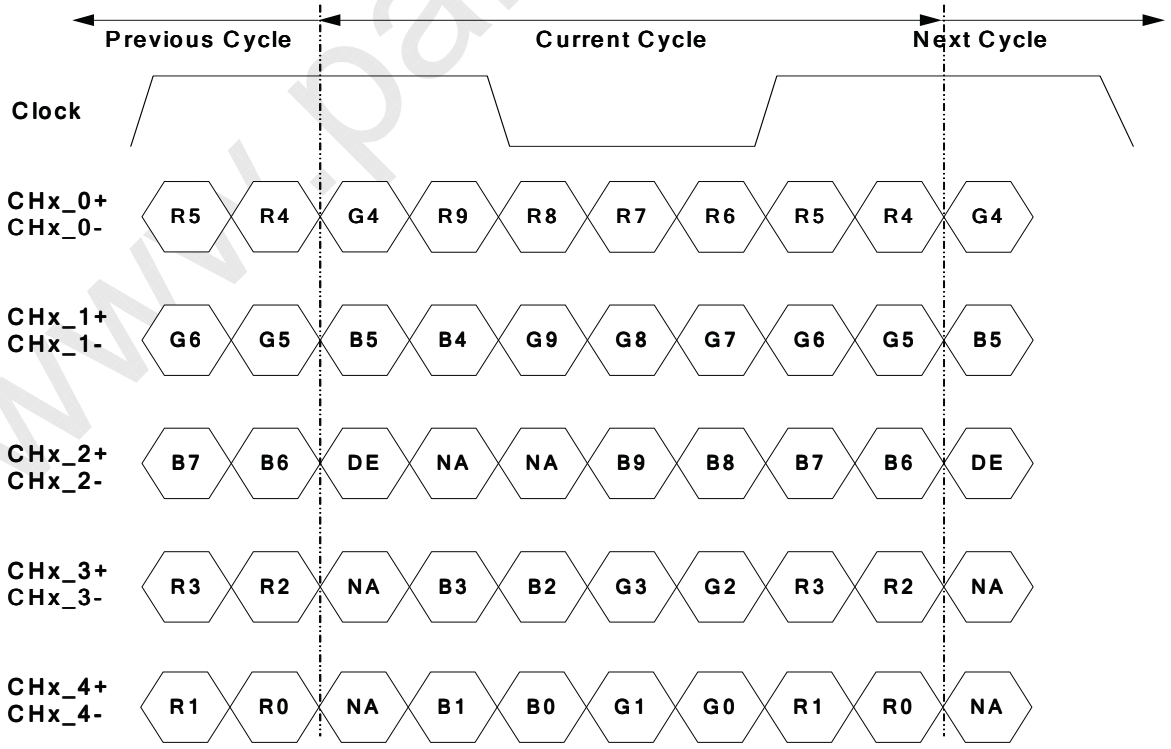
| | | | | | |
|---|---|---|---|---|---|
| 65 | 0:1 | 15:0 | Control the demo option<br>0x0000: Demo OFF.<br>0x0004: Demo ON. | Demo OFF : Normal display;<br>Demo ON : MEMC enable at Left side, and MEMC disable at right side. | 0x0000 |
| 59 | 0 | 7:0 | OSD ON/OFF control<br>0x00: OSD OFF<br>0x04: OSD ON | OSD On/Off Control | 0x00 |
| 23 | 0:1 | 15:0 | OSD width define<br>(Unit: pixel ; range 0~1920) | 1. OSD Protection Size Define (Width, height, x, y)<br>2. Usable in OSD ON status. (The data of address 0x59 must be 0x04.) | 0x0000 |
| | 2:3 | 15:0 | OSD height define<br>(Unit: pixel ; range 0~1080) | | 0x0000 |
| | 4:5 | 15:0 | The amount of H pixels that the left upper corner of the OSD is from the left top corner of the output window<br>(Unit: pixel ; range 0~1920) | | 0x0000 |
| | 6:7 | 15:0 | The amount of V pixels that the left upper corner of the OSD is from the left top corner of the output window<br>(Unit: pixel ; range 0~1080) | | 0x0000 |
| 25 | 0 | 6:0 | Thickness of the OSD left and right border<br>(Unit: pixel ; range 0~127) | 1. OSD border width and color decision<br>2. Usable in OSD ON status. (The data of address 0x59 must be 0x04.) | 0x00 |
| | 1 | 6:0 | Thickness of the OSD top and bottom border (Unit: pixel ; range 0~127) | | 0x00 |
| | 2:4 | 7:0 | Red component of the OSD border color | | 0x00 |
| | | 7:0 | Green component of the OSD border color | | 0x00 |
| | | 7:0 | Blue component of the OSD border color<br>(Unit: 8 bit level ; range 0~255) | | 0x00 |
| 6E | 0 | 7:0 | Different MEMC level selection<br>0x01: Middle MEMC level<br>0x02: Strong MEMC level<br>0x03: Weak MEMC level | Usable in MEMC ON status. (The data of address 0x79 must be 0x00.) | 0x01 |

## LVDS Option = High/Open➔NS




Note: x = 1, 2, 3, 4…

## LVDS Option = Low➔JEIDA




Note: x = 1, 2, 3, 4…

## 3.3 Signal Timing Specification

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

**(60Hz)**

| Signal | Item | Symbol | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Vertical Section | Period | Tv | 1100 | 1125 | 1200 | Th |
| | Active | Tdisp (v) | | 1080 | | Th |
| | Blanking | Tblk (v) | 20 | 45 | 120 | Th |
| | Front porch | Tfp (v) | 1 | 4 | 110 | Th |
| | Back porch | Tbp (v) | 1 | 36 | 110 | Th |
| | V_sync | TVsync_wdth | 2 | 5 | 110 | Th |
| | Polarity | POL (v) | | + | | |
| Horizontal Section | Period | Th | 1050 | 1100 | 1150 | Tclk |
| | Active | Tdisp (h) | | 960 | | Tclk |
| | Blanking | Tblk (h) | 90 | 140 | 190 | Tclk |
| | Front porch | Tfp (h) | 5 | 44 | 180 | Tclk |
| | Back porch | Tbp (h) | 5 | 74 | 180 | Tclk |
| | H_sync | THsync_wdth | 5 | 22 | 180 | Tclk |
| | Polarity | POL (h) | | + | | |
| Clock | Frequency | Fclk=1/Tclk | 70.875 | 74.25 | 76 | MHz |
| Vertical Frequency | Frequency | Fv | 59.5 | 60 | 60.5 | Hz |
| Horizontal Frequency | Frequency | Fh | 66 | 67.5 | 72 | KHz |



**(50Hz)**

| Signal | Item | Symbol | Min. | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Vertical Section | Period | Tv | 1100 | 1125 | 1200 | Th |
| | Active | Tdisp (v) | | 1080 | | Th |
| | Blanking | Tblk (v) | 20 | 45 | 120 | Th |
| | Front porch | Tfp (v) | 1 | 4 | 110 | Th |
| | Back porch | Tbp (v) | 1 | 36 | 110 | Th |
| | V_sync | TVsync_wdth | 2 | 5 | 110 | Th |
| | Polarity | POL (v) | | + | | |
| Horizontal Section | Period | Th | 1050 | 1100 | 1150 | Tclk |
| | Active | Tdisp (h) | | 960 | | Tclk |
| | Blanking | Tblk (h) | 90 | 140 | 190 | Tclk |
| | Front porch | Tfp (h) | 5 | 44 | 180 | Tclk |
| | Back porch | Tbp (h) | 5 | 74 | 180 | Tclk |
| | H_sync | THsync_wdth | 5 | 22 | 180 | Tclk |
| | Polarity | POL (h) | | + | | |
| Clock | Frequency | Fclk=1/Tclk | 59.5 | 61.88 | 65 | MHz |
| Vertical Frequency | Frequency | Fv | 49.5 | 50 | 50.5 | Hz |
| Horizontal Frequency | Frequency | Fh | 56.65 | 56.25 | 61.93 | KHz |

Notes:

(1) Display position is specific by the rise of DE signal only.
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(2) Vertical display position is specified by the rise of DE after a “Low” level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of 1st DE is displayed at the top line of screen.

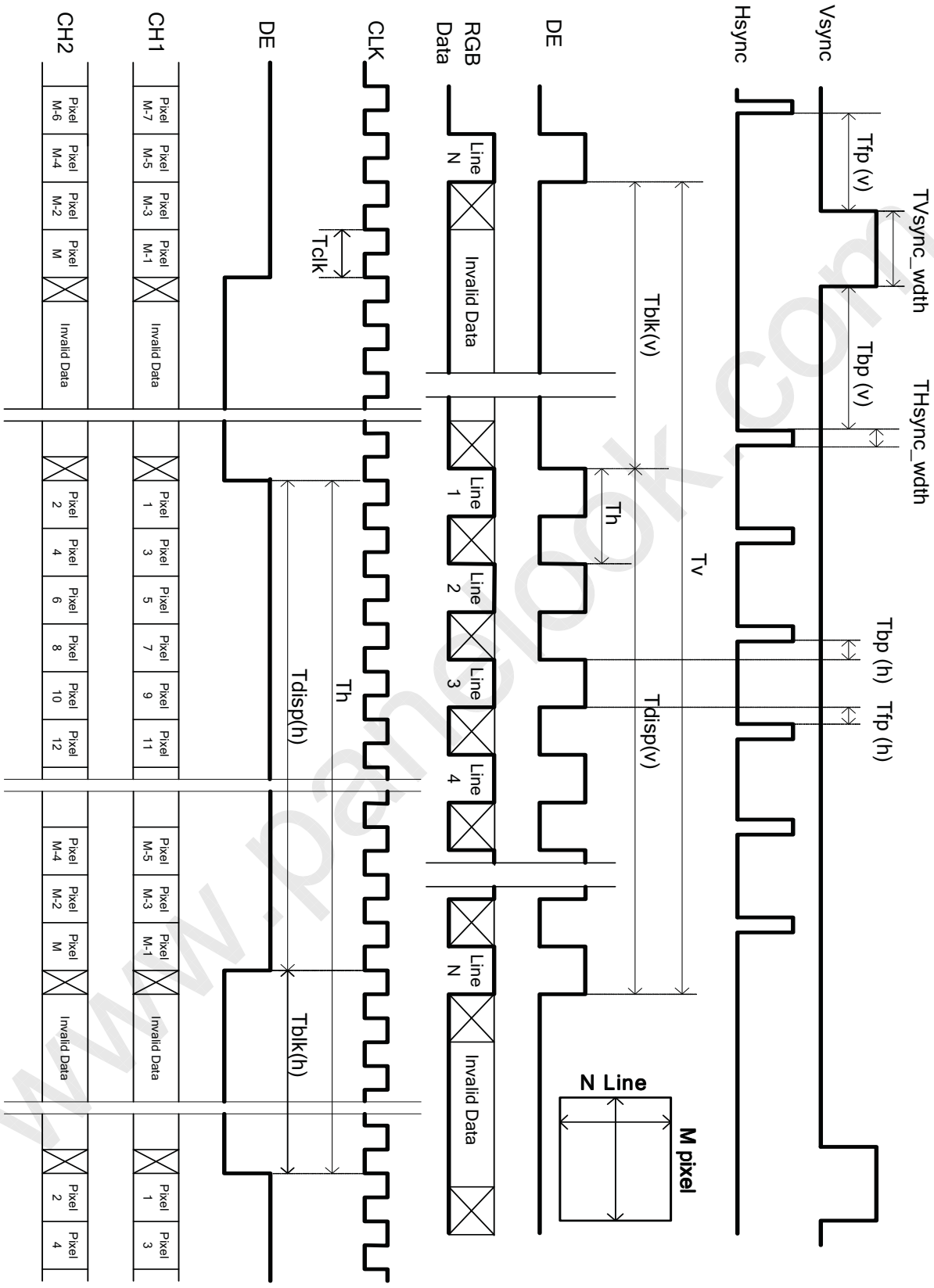
(3) If a period of DE “High” is less than 1,920 DCLK or less than 1080 lines, the rest of the screen displays black.

(4) The display position does not fit to the screen if a period of DE “High” and the effective data period do not synchronize with each other.

(5) Tblk (v) = Tfp(v) + TVsync_wdth + Tbp(v)

(6) Tblk (h) = Tfp(h) + THsync_wdth + Tbp(h)

## 3.4 Signal Timing Waveforms



## 3.5 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 10 bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

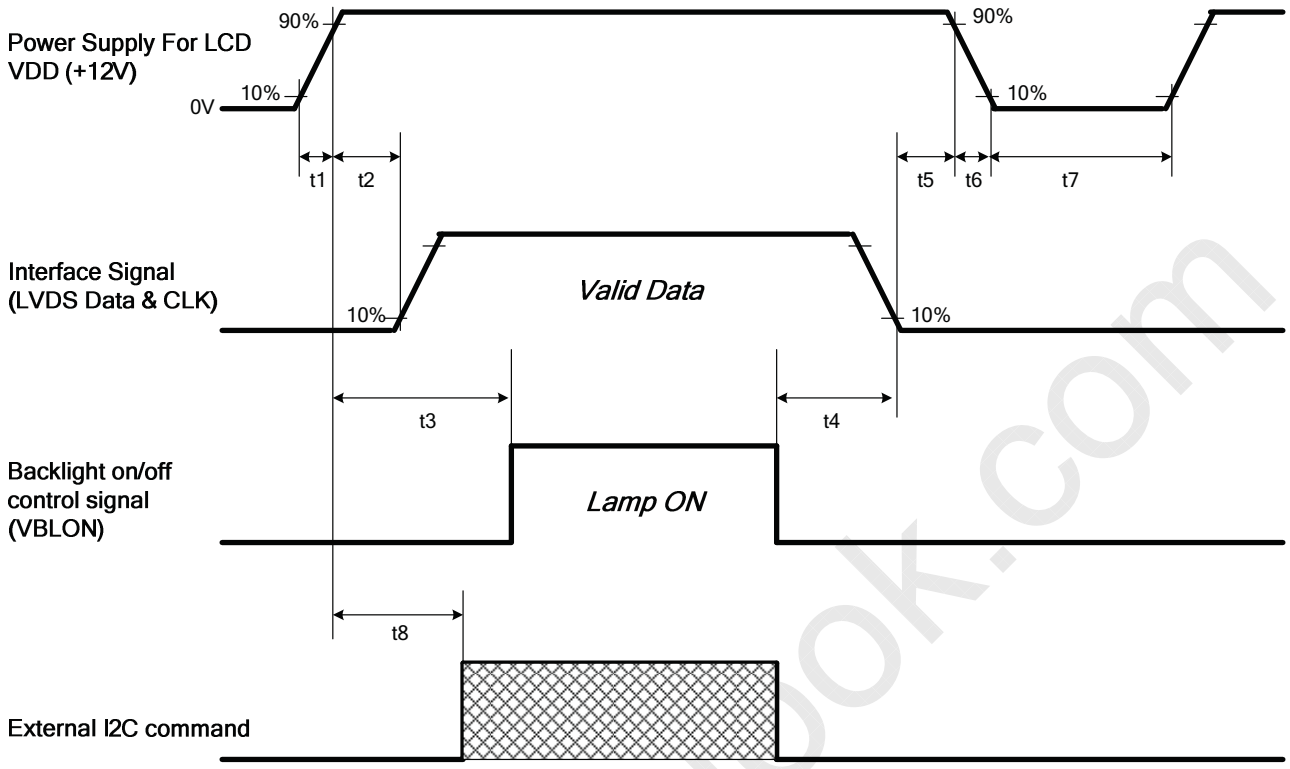
Color Data Reference

| Color | | Input Color Data | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RED | | | | | | | | | | GREEN | | | | | | | | | | BLUE | | | | | | | | | |
| | | MSB | | | | | | | | | LSB | MSB | | | | | | | | | LSB | MSB | | | | | | | | | LSB |
| | | R9 | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G9 | G8 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B9 | B8 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red(1023) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green(1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue(1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 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 | 1 | 1 | 1 | 1 | 0 | 0 | 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 | 1 | 1 | 1 | 1 | 1 | 1 |
| R | RED(000) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | RED(1022) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RED(1023) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| G | GREEN(000) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN(001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | GREEN(1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | GREEN(1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | BLUE(000) | 0 | 0 | 0 | 0 | 0 | 0 | 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(001) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | ---- | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | BLUE(1022) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | BLUE(1023) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |



## 3.6 Power Sequence for LCD




| Parameter | Values | | | Unit |
|---|---|---|---|---|
| | Min. | Type. | Max. | |
| t1 | 0.4 | --- | 30 | ms |
| t2 | 0.1 | --- | 2000 | ms |
| t3 | 3400 | --- | --- | ms |
| t4 | 0*1 | --- | --- | ms |
| t5 | 0 | --- | --- | ms |
| t6 | --- | --- | ---*2 | ms |
| t7 | 500 | --- | --- | ms |
| t8 | 2500 | --- | --- | ms |

Note:
(1) T4=0 : concern for residual pattern before BLU turn off.
(2) T6 : voltage of VDD must decay smoothly after power-off. (customer system decide this value)

Apply the lamp voltage within the LCD operating range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal.

**Caution:** The above on/off sequence should be applied to avoid abnormal function in the display. In case of handling, make sure to turn off the power when you plug the cable into the input connector or pull the cable out of the connector.

## 3.7 Backlight Specification (Inverter Type)

The backlight unit contains 4U CCFLs (Cold Cathode Fluorescent Lamp)

### 3.7.1 Electrical specification

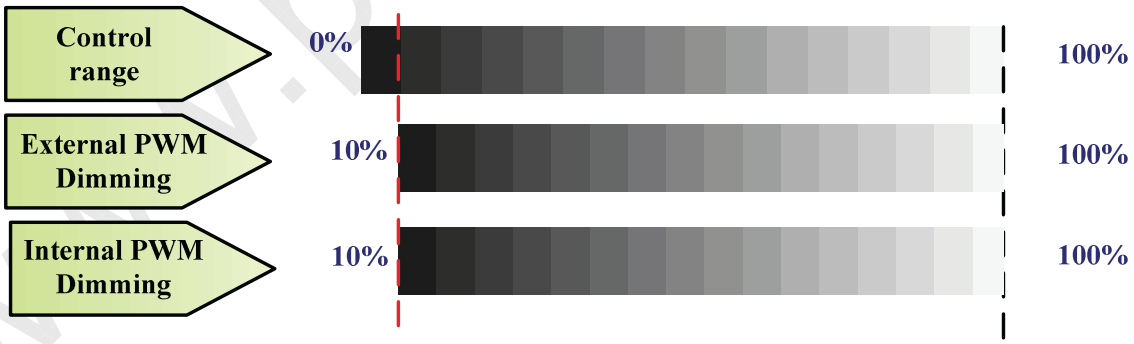
| Item | Symbol | | Condition | Spec | | | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | | |
| Input Voltage | $V_{DDB}$ | | - | 21.6 | 24 | 26.4 | VDC | - |
| Input Current | $I_{DDB}$ | | VDDB=24V | 2.54 | 2.79 | 3.04 | ADC | 1 |
| Input Power | $P_{DDB}$ | | VDDB=24V | 61 | 67 | 73 | W | 1 |
| Inrush Current | $I_{RUSH}$ | | VDDB=24V | - | - | 3.3 | ADC | 2 |
| Operating Frequency | FBL | | VDDB=24V | 53 | 55 | 57 | KHz | |
| On/Off control voltage | $V_{BLON}$ | ON | VDDB=24V | 3.3 | - | 5.5 | VDC | - |
| | | OFF | | 0 | - | 0.8 | | - |
| On/Off control current | $I_{BLON}$ | | VDDB=24V | - | - | 1.5 | mA | - |
| Internal PWM Dimming Control Voltage | V_IPWM | MAX | VDDB=24V | 3.0 | - | 3.3 | VDC | - |
| | | MIN | | - | 0 | - | VDC | - |
| Internal PWM Dimming Control Current | I_IPWM | | VDDB=24V | - | - | 2 | mADC | - |
| Internal PWM Dimming Ratio | R_IPWM | | VDDB=24V | 10 | - | 100 | % | |
| External PWM Control Voltage | V_EPWM | MAX | VDDB=24V | 2 | - | 3.3 | VDC | - |
| | | MIN | VDDB=24V | 0 | - | 0.8 | | - |
| External PWM Control Current | I_EPWM | | VDDB=24V | - | - | 2 | mADC | - |
| External PWM Duty ratio | D_EPWM | | VDDB=24V | 10 | - | 100 | % | 3 |
| External PWM Frequency | F_EPWM | | VDDB=24V | 140 | 180 | 240 | Hz | - |

Note 1 : Dimming ratio= 100% (MAX)（Ta=25±5℃, Turn on for 45minutes）
Note 2 : Measurement condition Rising time = 20ms (VDDB : 10%~90%);
Note 3 : For External PWM application, ≧5% dimming is function well and no backlight shutdown.

### 3.7.2 Input Pin Assignment

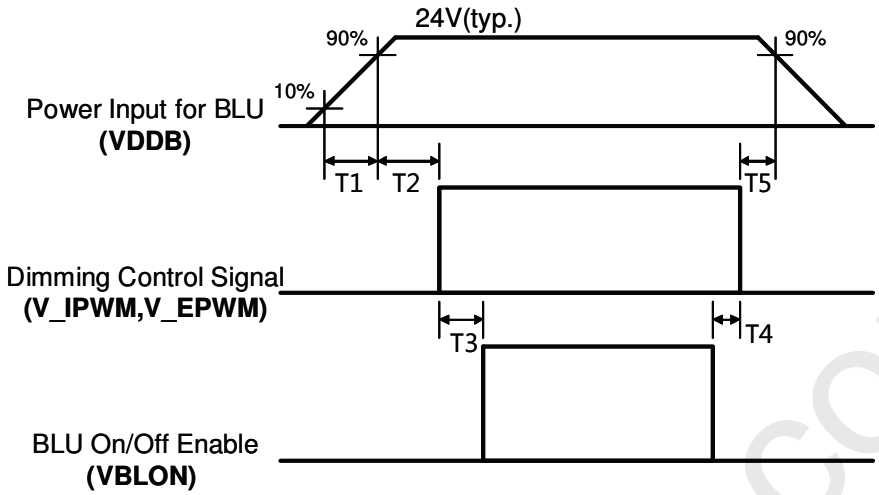
Inverter Connector: CI0114M1HRL-NH (Cvilux)

| Pin | Symbol | Description |
|---|---|---|
| 1 | VDDB | Operating Voltage Supply, +24V DC regulated |
| 2 | VDDB | Operating Voltage Supply, +24V DC regulated |
| 3 | VDDB | Operating Voltage Supply, +24V DC regulated |
| 4 | VDDB | Operating Voltage Supply, +24V DC regulated |
| 5 | VDDB | Operating Voltage Supply, +24V DC regulated |
| 6 | BLGND | Ground and Current Return |
| 7 | BLGND | Ground and Current Return |
| 8 | BLGND | Ground and Current Return |
| 9 | BLGND | Ground and Current Return |
| 10 | BLGND | Ground and Current Return |
| 11 | DET | BLU status detection:<br>Normal : 0~0.8V ; Abnormal : Open collector |
| 12 | VBLON | BLU On-Off control:<br>BL On : High/Open (3.3V~5.5V);<br>BL off : Low (0~0.8V/GND) |
| 13 | VDIM | Internal PWM (0~3.3V for 10~100% Duty, open for 100%)<br>< NC ; at External PWM mode> |
| **14** | **PDIM** | **External PWM (10%~100% Duty, open for 100%)**<br>**< NC ; at Internal PWM mode>** |

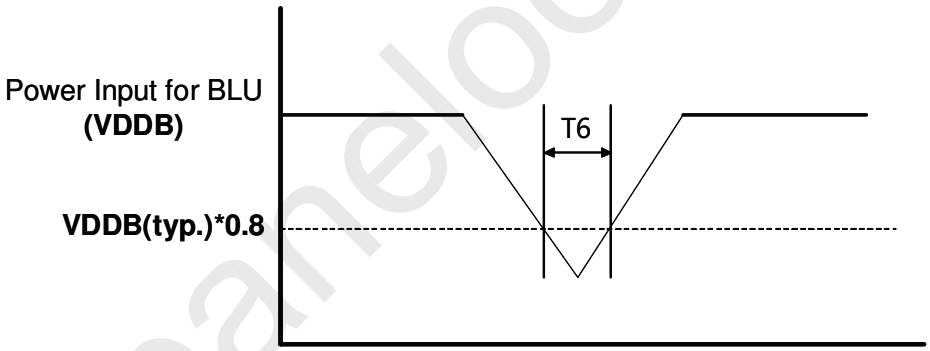



PWM Dimming : include Internal and External PWM Dimming

### 3.7.3 Power Sequence for Inverter




### Dip condition for Inverter

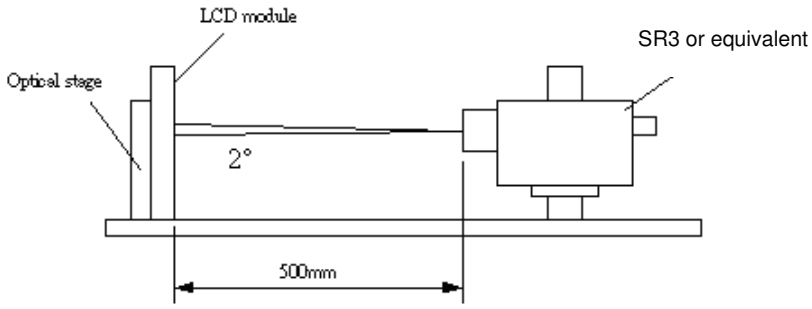



| Parameter | Value | | | Units |
|---|---|---|---|---|
| | Min | Typ | Max | |
| T1 | 20 | - | - | ms |
| T2 | 500 | - | - | ms |
| T3 | 250 | - | - | ms |
| T4 | 0 | - | - | ms |
| T5 | 1 | - | - | ms |
| T6 | - | - | 10 | ms |

# 4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes in a dark environment at 25℃. The values specified are at an approximate distance 50cm from the LCD surface at a viewing angle of φ and θ equal to 0°.

**Fig.1 presents additional information concerning the measurement equipment and method.**




| Parameter | | Symbol | Values | | | Unit | Notes |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max | | |
| Contrast Ratio | | CR | 3,200 | 4,000 | -- | | 1 |
| Surface Luminance (White) | | $L_{WH}$ | 360 | 450 | -- | cd/m$^2$ | 2 |
| Luminance Variation | | $\delta_{WHITE(9P)}$ | -- | -- | 1.3 | | 3 |
| Response Time (G to G) | | Tγ | -- | 6.5 | -- | ms | 4 |
| Color Gamut | | NTSC | | 72 | | % | |
| Color Coordinates | | | | | | | |
| | Red | $R_X$ | Typ.-0.03 | 0.64 | Typ.+0.03 | | |
| | | $R_Y$ | | 0.33 | | | |
| | Green | $G_X$ | | 0.29 | | | |
| | | $G_Y$ | | 0.60 | | | |
| | Blue | $B_X$ | | 0.15 | | | |
| | | $B_Y$ | | 0.06 | | | |
| | White | $W_X$ | | 0.280 | | | |
| | | $W_Y$ | | 0.290 | | | |
| Viewing Angle | | | | | | | 5 |
| | x axis, right(φ=0°) | $\theta_r$ | -- | 89 | -- | degree | |
| | x axis, left(φ=180°) | $\theta_l$ | -- | 89 | -- | degree | |
| | y axis, up(φ=90°) | $\theta_u$ | -- | 89 | -- | degree | |
| | y axis, down (φ=270°) | $\theta_d$ | -- | 89 | -- | degree | |

Note:

1. Contrast Ratio (CR) is defined mathematically as:

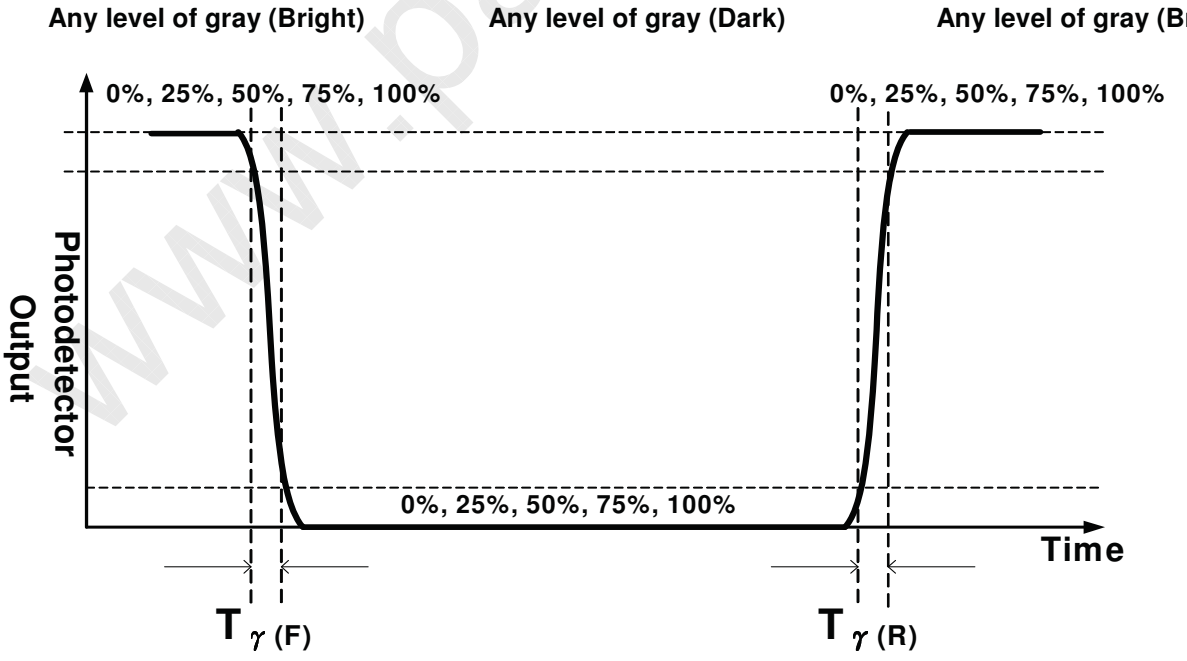
$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{on5}}{\text{Surface Luminance of } L_{off5}}$$

2. Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2. When lamp current $I_H$ = 11mA. $L_{WH}$=Lon5 where Lon5 is the luminance with all pixels displaying white at center 5 location.
3. The variation in surface luminance, δWHITE is defined (center of Screen) as:

   $\delta_{WHITE(9P)}$= Maximum($L_{on1}$, $L_{on2}$,…,$L_{on9}$)/ Minimum($L_{on1}$, $L_{on2}$,…$L_{on9}$)
4. Response time $T_\gamma$ is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on $F_v$=120Hz to optimize.

| Measured Response Time | | Target | | | | |
|---|---|---|---|---|---|---|
| | | 0% | 25% | 50% | 75% | 100% |
| Start | 0% | | 0% to 25% | 0% to 50% | 0% to 75% | 0% to 100% |
| | 25% | 25% to 0% | | 25% to 50% | 25% to 75% | 25% to 100% |
| | 50% | 50% to 0% | 50% to 25% | | 50% to 75% | 50% to 100% |
| | 75% | 75% to 0% | 75% to 25% | 75% to 50% | | 75% to 100% |
| | 100% | 100% to 0% | 100% to 25% | 100% to 50% | 100% to 75% | |

The response time is defined as the following figure and shall be measured by switching the input signal for “any level of grey(bright) “ and “any level of gray(dark)”.



5. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG3.

**FIG. 2 Luminance**

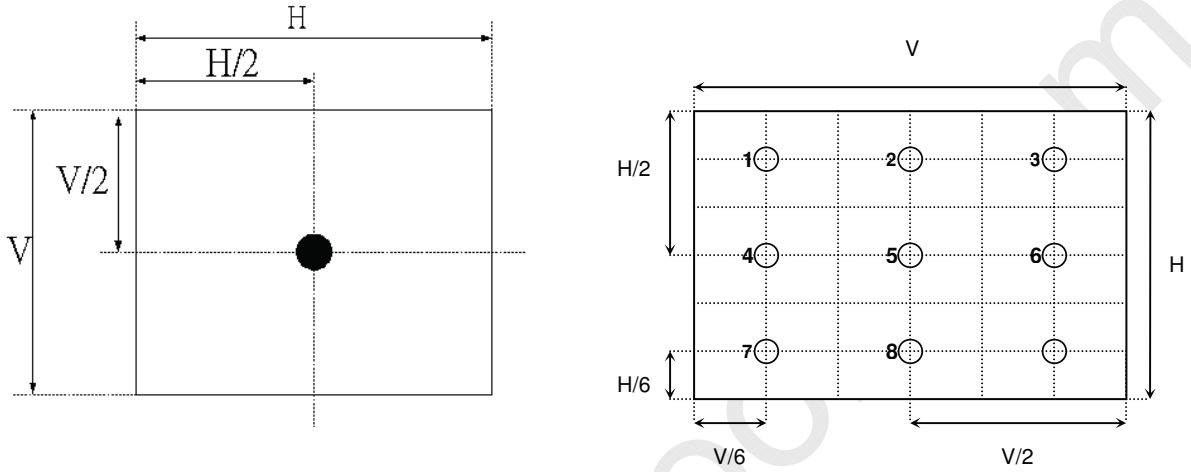
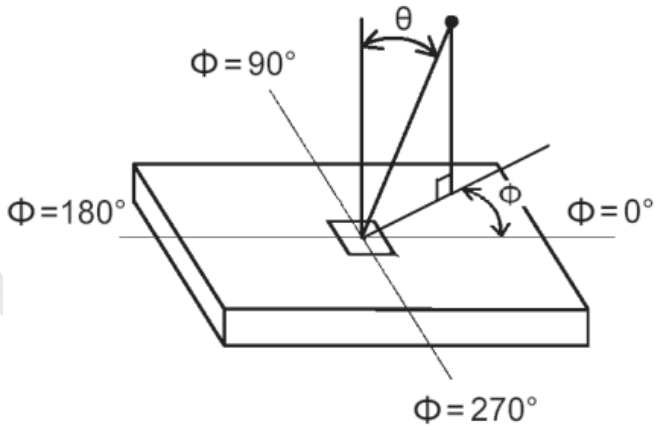



**FIG.3 Viewing Angle**



# 5. Mechanical Characteristics

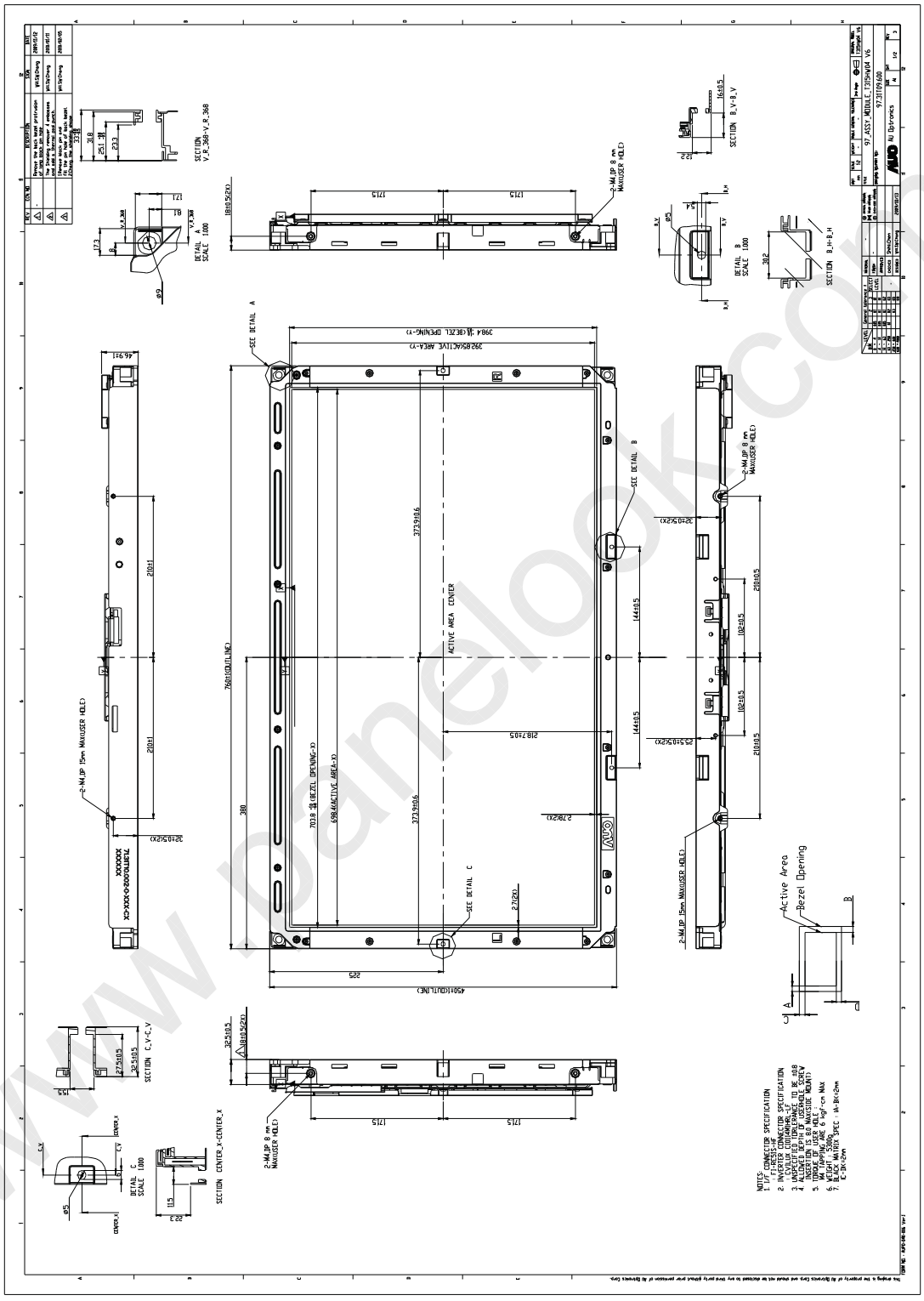
The contents provide general mechanical characteristics for the model T315HW04 V6. In addition the figures in the next page are detailed mechanical drawing of the LCD.

| | | |
|---|---|---|
| Outline Dimension | Horizontal | 760.0mm |
| | Vertical | 450.0mm |
| | Depth | 46.9mm<br>(w/ inverter & shielding) |
| Bezel Opening | Horizontal | 703.6mm |
| | Vertical | 398.3mm |
| Active Display Area | Horizontal | 698.4 mm |
| | Vertical | 392.85 mm |
| Weight | 5,300 g (Typ.) | |
| Surface Treatment | AG, Haze=11%, 3H | |

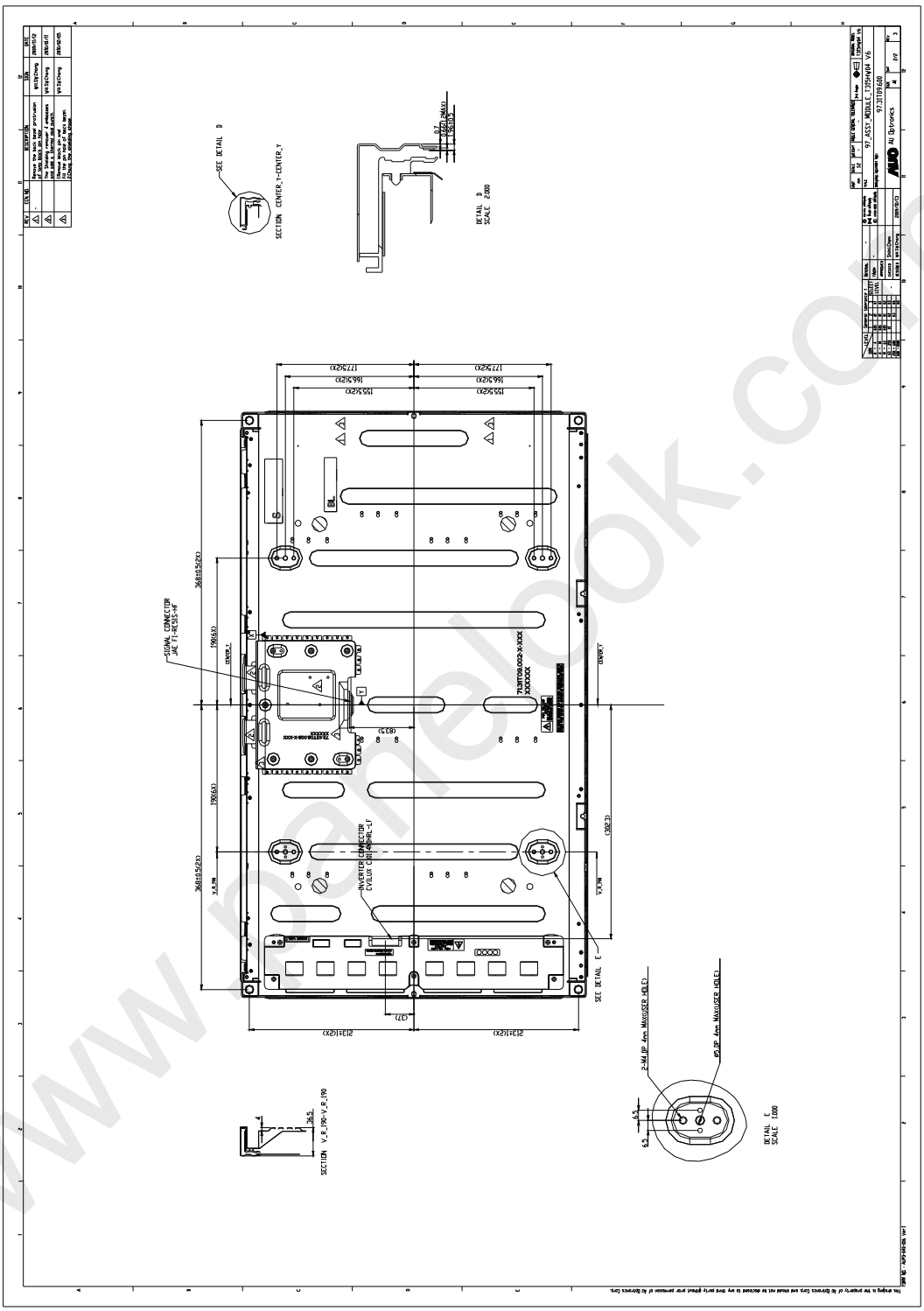


# Front View



# Back View



# 6. Reliability Test Items

| | Test Item | Q'ty | Condition |
|---|---|---|---|
| 1 | High temperature storage test | 3 | 60℃, 300hrs |
| 2 | Low temperature storage test | 3 | -20℃, 300hrs |
| 3 | High temperature operation test | 3 | 50℃, 300hrs |
| 4 | Low temperature operation test | 3 | -5℃, 300hrs |
| 5 | Vibration test (non-operation) | 3 | Wave form: random<br>Vibration level: 1.5G RMS<br>Bandwidth: 10-300Hz,<br>Duration: X, Y, Z 30min<br>One time each direction |
| 6 | Shock test (non-operation) | 3 | Shock level: 50G<br>Waveform: half since wave, 11ms<br>Direction: ±X, ±Y, ±Z, One time each direction |
| 7 | Vibration test (With carton) | 3 | Random wave (1.5G RMS, 10-200Hz)<br>30mins/ Per each X,Y,Z axes |
| 8 | Drop test (With carton) | 3 | Height: 45.7cm<br>1 corner, 3 edges, 6 surfaces<br>(ASTMD5276) |



# 7. International Standard

## 7.1 Safety

(1) UL 60950-1, UL 60065; Standard for Safety of Information Technology Equipment Including electrical Business Equipment.

(2) IEC 60950-1 : 2001, IEC 60065:2001 ; Standard for Safety of International Electrotechnical Commission

(3) EN 60950 : 2001+A11, EN 60065:2002+A1:2006; European Committee for Electrotechnical Standardization (CENELEC), EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

## 7.2 EMC

(1) ANSI C63.4 “Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. “American National standards Institute(ANSI), 1992

(2) C.I.S.P.R “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.” International Special committee on Radio Interference.

(3) EN 55022 “Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment.” European Committee for Electrotechnical Standardization. (CENELEC), 1998

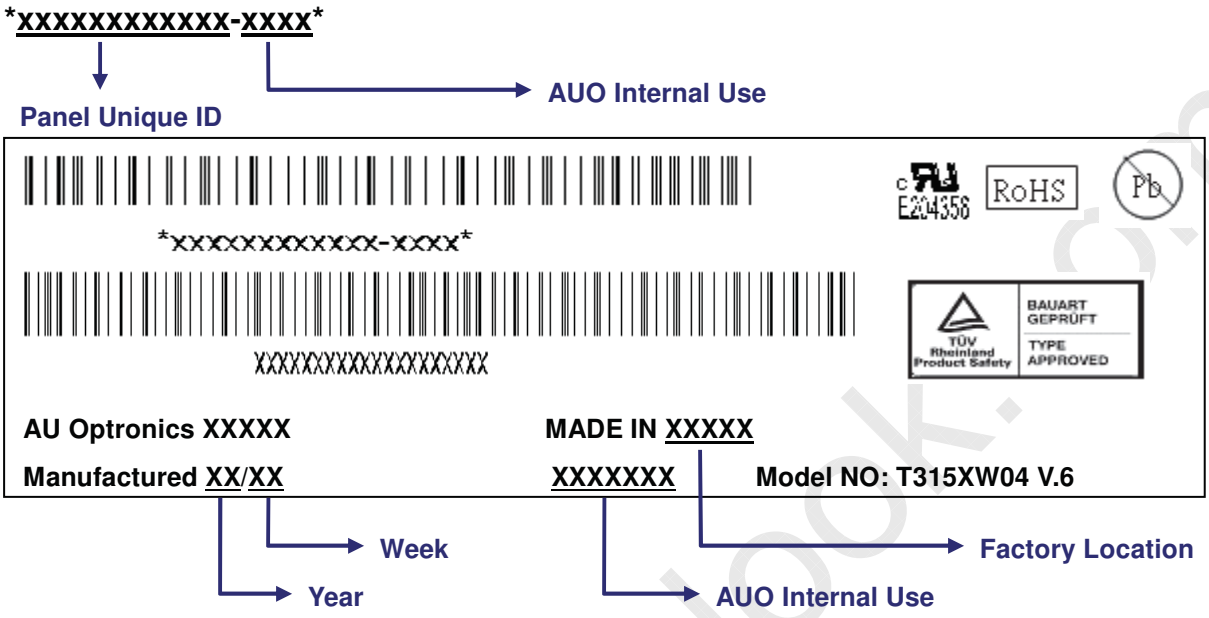


# 8. Packing

## 8-1 DEFINITION OF LABEL:

### A. Panel Label:




**Green mark description**

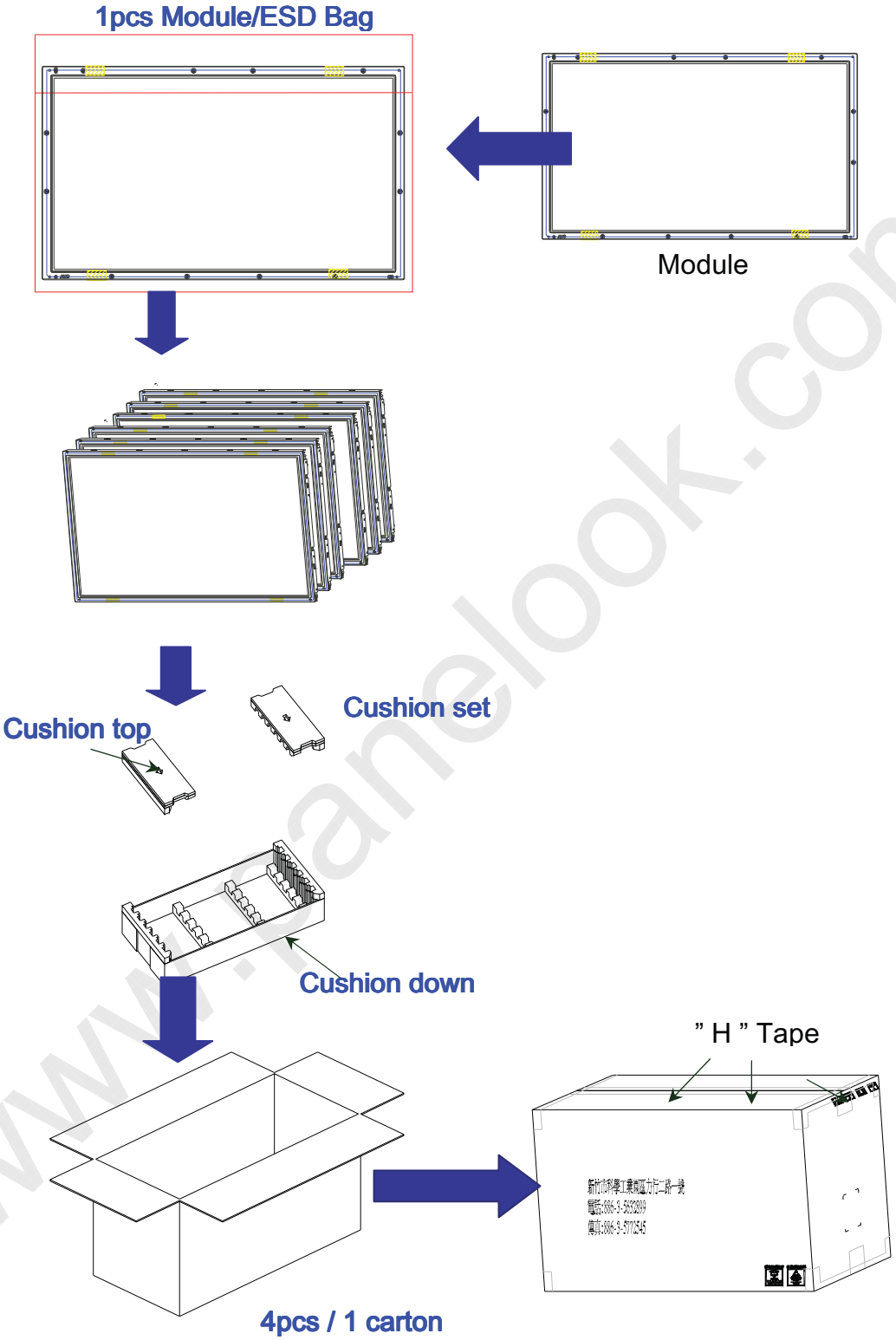
(1) For Pb Free Product, AUO will add Pb for identification.

(2) For RoHs compatible products, AUO will add RoHS for identification.

Note: The green Mark will be present only when the green documents have been ready by AUO internal green team. (definition of green design follows the AUO green design checklist.)

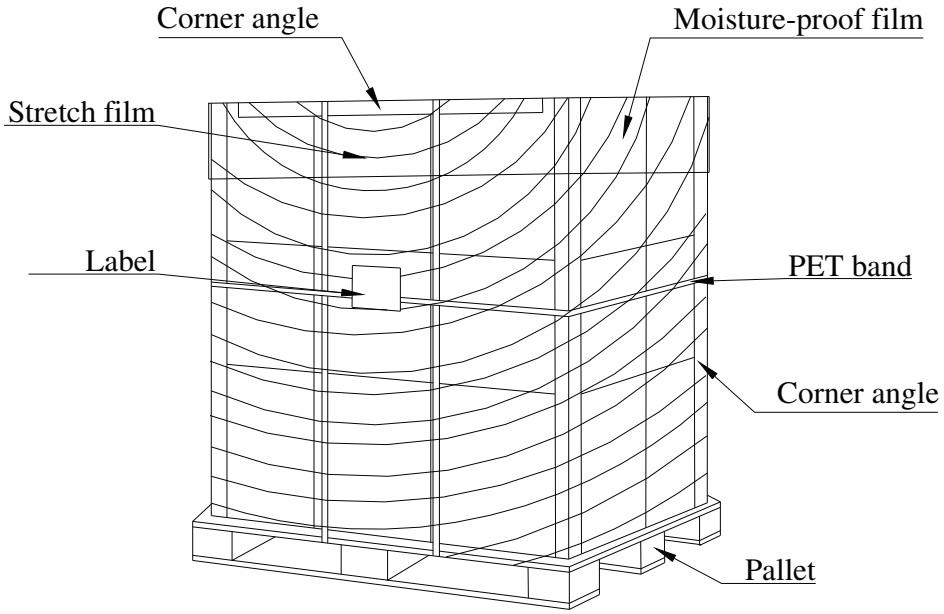
### B. Carton Label:

## 8-2 PACKING METHODS:



## 8-3 Pallet and Shipment Information

| | Item | Specification | | | Packing Remark |
|---|---|---|---|---|---|
| | | Quantity | Dimension | Weight (kg) | |
| 1 | Packing BOX | 4pcs/box | 832(L)mm*283(W)mm*545(H)mm | 24.1 | Packing Box |
| 2 | Pallet | 1 | 1150(L)mm*840(W)mm*132(H)mm | 13 | Pallet |
| 3 | Boxes per Pallet | 8 boxes/Pallet | | | |
| 4 | Panels per Pallet | 32pcs/pallet | | | |
| 5 | Pallet after packing | N/A | 1150(L)mm*840(W)mm*2460(H)mm | 205.8 | Pallet after packing |



# 7. PRECAUTIONS

Please pay attention to the followings when you use this TFT LCD module.

## 9-1 MOUNTING PRECAUTIONS

(1) You must mount a module using holes arranged in four corners or four sides.

(2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.

(3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to the resist external force.

(4) You should adopt radiation structure to satisfy the temperature specification.

(5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter cause circuit broken by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)

(7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.

(8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.

(9) Do not open the case because inside circuits do not have sufficient strength.

## 9-2 OPERATING PRECAUTIONS

(1) The device listed in the product specification sheets was designed and manufactured for TV application

(2) The spike noise causes the mis-operation of circuits. It should be lower than following voltage: V=±200mV(Over and under shoot voltage)

(3) Response time depends on the temperature. (In lower temperature, it becomes longer..)

(4) Brightness of CCFL 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.

(5) 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.

(6) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(7) 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 interface.

## 9-3 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 wristband etc. And don't touch interface pin directly.

## 9-4 PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

## 9-5 STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

(1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5℃ and 35℃ at normal humidity.

(2) The polarizer 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.

## 9-6 HANDLING PRECAUTIONS FOR PROTECTION FILM

(1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

(2) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.

(3) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.