# DESCRIPTION

The following specifications are applied to the following TFT open cell.

Product Name: VVF37F115G00

## General Specifications

| | | |
|---|---|---|
| Effective Display Area | : (H) 819. 36 × (V) 460. 89 | (mm) |
| Number of Pixels | : (H)1,920×(V)1,080 | (pixels) |
| Pixel Pitch | : (H) 0. 42675× (V) 0. 42675 | (mm) |
| Color Pixel Arrangement | : R+G+B Vertical Stripe | |
| Display Mode | : Transmissive Mode<br>Normally Black Mode | |
| Top Polarizer Type | : Anti-Reflection Clear (Haze≦1%) | |
| Number of Colors | : 1,073,741,824 | (colors) |
| Viewing angle range | : Wide version | |
| External Dimensions | : (H)854 x (V)516.3 x (t)6 typ | (mm) |
| Weight | : Typ 1,700 | (g) |

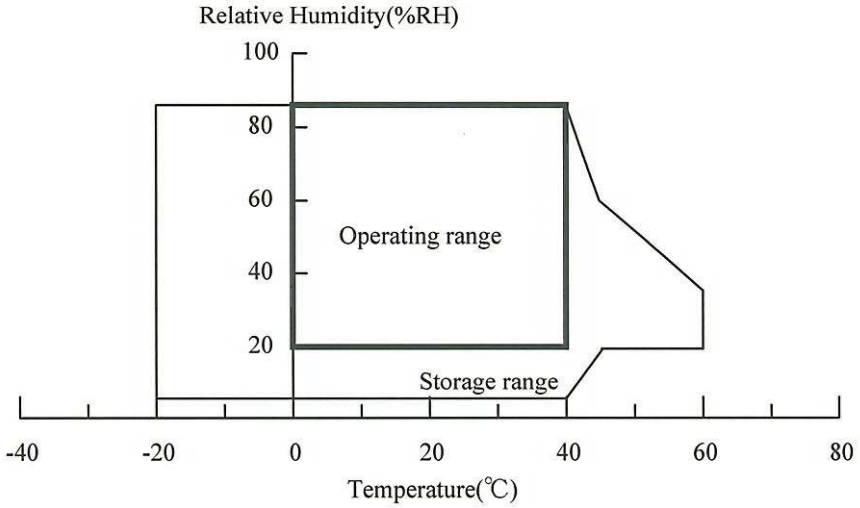
# 1. ABSOLUTE MAXIMUM RATINGS

## 1.1 Environmental Absolute Maximum Ratings

| ITEM | Operating | | Storage | | Unit | Note |
|---|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | | |
| Temperature | 0 | 50 | -20 | 60 | ℃ | 1),5),6),7) |
| Humidity | 2) | | 2) | | %RH | 1),7) |
| Vibration | - | 4.9(0.5G) | - | 9.8(1.0G) | $m/s^2$ | 3),7) |
| Shock | - | 29.4(3G) | - | 196(20G) | $m/s^2$ | 4),7) |
| Corrosive Gas | Not Acceptable | | Not Acceptable | | - | 7) |

Note 1) Temperature and Humidity should be applied to the glass surface of a IPS-Pro TFT LCD module, not to the system installed with a module.

2) Ta≦40 ℃ · · · · · Relative humidity should be less than 85 %RH max. Dew is prohibited.
Ta＞40 ℃ · · · · · Relative humidity should be lower than the moisture of the 85 %RH at 40 ℃.




3) Frequency of the vibration is between 15 Hz and 100 Hz.

4) Pulse width of the shock is 10 ms.

5) Long operation under low temperature may cause some portion of display area to be reddish for several minutes after turning on the product.
However, it does not affect the characteristics and reliability of the product.

6) The temperature of LCD front surface would be 65 ℃ in operating, it may affect the optical characteristics however it does not damage the function of the module.

7) Environmental Absolute Maximum Ratings is Based on IPS Alpha Technology TFT standard module. Leave TFT open cell alone,this environmental ratings can't be guaranteed. The users have a responsibility in considering ability of other parts of TFT module and TFT module process.

1.2 Electrical Absolute Maximum Ratings

Based on IPS Alpha Technology, Ltd. Standard Module Vss = 0 V

| ITEM | SYMBOL | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | VDD | 0 | 13.2 | V | |
| Input Voltage for logic | V1 | -0.3 | 4.0 | V | 1) |
| Electrostatic Durability | VESD0 | ±100 | | V | 2),3) |
| | VESD1 | ±8 | | kV | 2),4) |

Note 1)It is applied to pixel data signal and clock signal.
2)Discharge Coefficient : 200pF-250 Ω, Environmental : 25℃-70%RH
3)It is applied to I/F connector pins.
4)It is applied to the surface of a metallic bezel and a LCD panel.

1.3 Environmental Absolute Ratings of TFT open cell

Storage Condition : With shipping package
Storage temperatue range : 25±5 ℃
Storage humidity range : 50±10%RH
Shelf life : 1 month from the delivery date

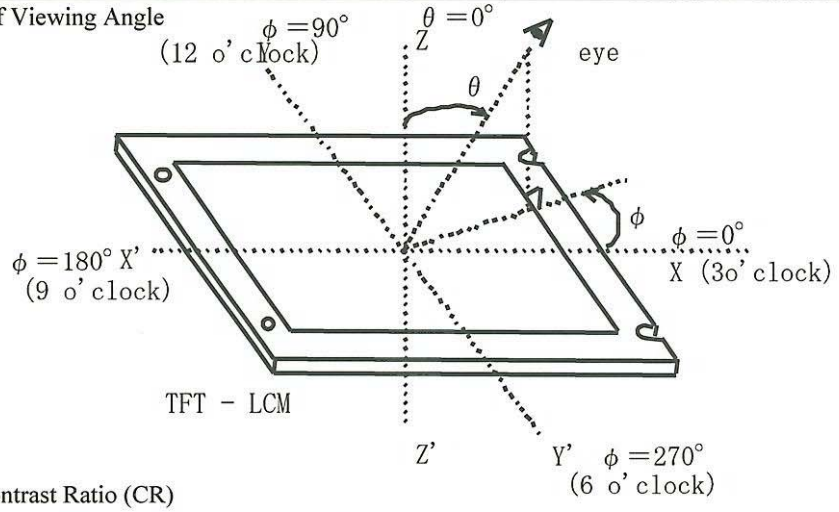
## 2. INITIAL OPTICAL CHARACTERISTICS

The following optical characteristics are measured under stable conditions. It takes about 30 minutes to reach stable conditions. The measuring point is the center of display area unless otherwise noted.
The optical characteristics should be measured in a dark room or equivalent state.

Measuring equipment : CS-1000A, or equivalent
Ambient Temperature =25℃、VDD=12.0V、f V=120Hz、
Light source is backlight of AX094G077H module.

| ITEM | | SYMBOL | CONDITION | Min. | Typ. | Max. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|---|
| Contrast Ratio | | C R | θ = 0° 1) | 800 | 1400 | - | - | 2) |
| Response Time | Rise | ton | | - | 8 | 20 | ms | 3) |
| | Fall | toff | | - | 6 | 20 | ms | 3) |
| Brightness of white | | Bwh | | 370 | 470 | - | cd/m$^2$ | |
| Brightness uniformity | | Buni | | - | - | 30 | % | 4) |
| Color Chromaticity (CIE) | Red | χ | | 0.618 | 0.648 | 0.678 | - | 【Gray scale =1023】 |
| | | y | | 0.300 | 0.330 | 0.360 | | |
| | Green | χ | | 0.271 | 0.301 | 0.331 | | |
| | | y | | 0.589 | 0.619 | 0.649 | | |
| | Blue | χ | | 0.123 | 0.153 | 0.183 | | |
| | | y | | 0.035 | 0.065 | 0.095 | | |
| | White | χ | | 0.243 | 0.273 | 0.303 | | |
| | | y | | 0.245 | 0.275 | 0.305 | | |
| Variation of Color Position (CIE) | Red | Δ χ | θ= 50° φ= 0°, 90°, 180°, 270° 1) | - | - | 0.04 | - | 5) 【Gray scale =1023】 |
| | | Δ y | | - | - | 0.04 | | |
| | Green | Δ χ | | - | - | 0.04 | | |
| | | Δ y | | - | - | 0.04 | | |
| | Blue | Δ χ | | - | - | 0.04 | | |
| | | Δ y | | - | - | 0.04 | | |
| | White | Δ χ | | - | - | 0.04 | | |
| | | Δ y | | - | - | 0.04 | | |
| Contrast Ratio at 89° | | CR89 | 6) | 10 | (100) | - | - | Estimated value |

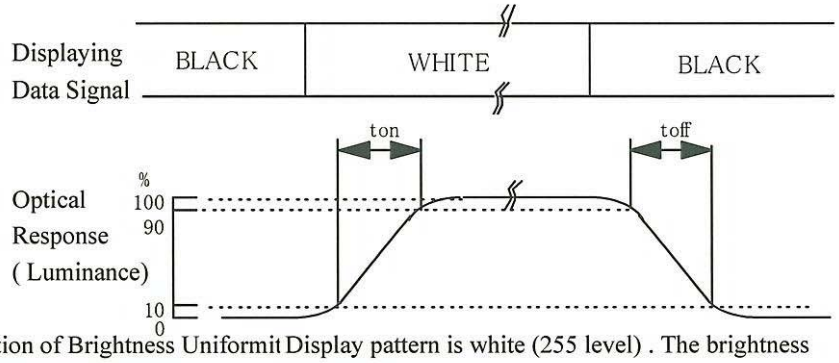
Note 1) Definition of Viewing Angle



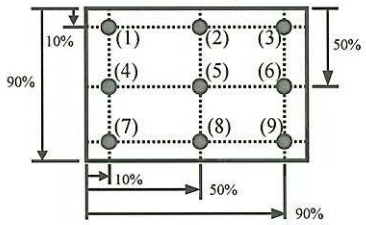

2) Definition of Contrast Ratio (CR)

$$CR = \frac{\text{(Luminance at displaying WHITE)}}{\text{(Luminance at displaying BLACK)}}$$

3) Definition of Response Time




4) Definition of Brightness Uniformit Display pattern is white (255 level) . The brightness uniformity is defined as the following equation. Brightness at each point is measured, and average, maximum and minimum brightness is calculated.




● : measuring points

$$Buni = \frac{\left| \text{Bmax or Bmin - Bave} \right|}{\text{Bave}} \times 100$$

where, Bmax = Maximum brightness

Bmin = Minimum brightness

$$Bave = \text{Average brightness} = \frac{\sum_{k=1}^{9} (B(k))}{9}$$

5) Variation of color position on CIE is defined as difference between colors at $\theta$ =0°and at $\theta$ =50°& $\phi$ =0°90°180°270°.

6) Contrast ratio at 89 °

Evaluation conditions are on horizontal & vertical axis

| IPS Alpha Technology, Ltd. | Date | Jul. 22, 2010 | Sheet No. | IPS4PS 2605 | Page | 5-2/2 |
|---|---|---|---|---|---|---|

## 3. ELECTRICAL CHARACTERISTICS

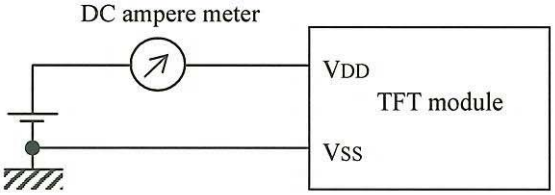
Based on IPS Alpha Technology, Ltd. Standard Module

### 3. 1 TFT-LCD module

Ta = 25 ℃ , VSS = 0 V

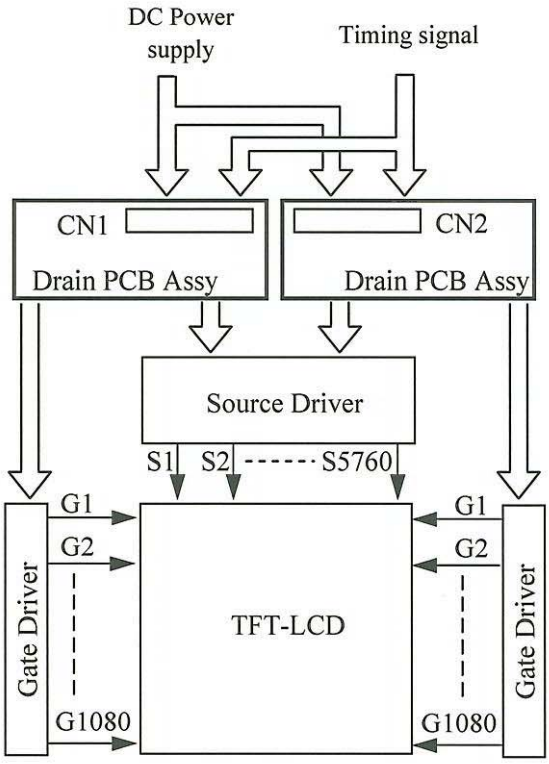
| ITEM | | SYMBOL | Min. | Typ. | Max. | UNIT | NOTE |
|---|---|---|---|---|---|---|---|
| Power supply voltage | | VDD | 11.4 | 12.0 | 12.6 | V | |
| Power supply current | | IDD | - | 0.8 | 1.2 | A | 1),2) |
| Ripple voltage of power supply | | VDDR | - | - | 150 | mV | |
| FRC on/off | High | FRC | 3.0 | 3.3 | 3.6 | V | |
| | Low | | 0 | 0 | 0.6 | V | |
| LVDS select | High | LVDSSEL | 3.0 | 3.3 | 3.6 | V | |
| | Low | | 0 | 0 | 0.6 | V | |

Note 1) fV=120.0Hz, fCLK=130MHz, VDD=12.0V, and display pattern is horizontal stripe.




2) Current fuse is built in a module. Current capacity of power supply for VDD should be larger than 4A, so that the fuse can be opened at the trouble of electrical circuit of module.

## 4. BLOCK DIAGRAM




| | | | | | | |
|---|---|---|---|---|---|---|
| IPS Alpha Technology, Ltd. | Date | Jul. 22, 2010 | Sheet No. | IPS4PS 2607 | Page | 7-1/1 |

## 5. INTERFACE PIN ASSIGNMENT

### 5. 1 TFT open cell.

CN1:IRISO IMSA-9637S-60Y922

(Matching FFC : SUMITOMO SML2CD-60X41.0-BDX6(BL)-P0.5-S4.0+4.0-M-N(35)-AUP UL20861)

| PIN No. | Symbol | Description | Note |
|---|---|---|---|
| 1 | VCOMS | Common Voltage | |
| 2 | CPV | Control Signal | |
| 3 | DATA1 | Control Signal | |
| 4 | DATA2 | Control Signal | |
| 5 | VON | Reference Voltage | |
| 6 | VOFF2 | | |
| 7 | NC | No Connection | |
| 8 | VSS | GND(0V) | |
| 9 | VRF1 | Reference Voltage | |
| 10 | VRF2 | | |
| 11 | VRF3 | | |
| 12 | VRF4 | | |
| 13 | VRF5 | | |
| 14 | VRF6 | | |
| 15 | LP | Control Signal | |
| 16 | POL | Control Signal | |
| 17 | VDD | Logic Voltage | |
| 18 | CSMODE | Control Signal | |
| 19 | VSS | GND(0V) | |
| 20 | D13- | Pixel Data | |
| 21 | D13+ | | |
| 22 | D12- | Pixel Data | |
| 23 | D12+ | | |
| 24 | VSS | GND(0V) | |
| 25 | D11- | Pixel Data | |
| 26 | D11+ | | |
| 27 | D10- | Pixel Data | |
| 28 | D10+ | | |
| 29 | VSS | GND(0V) | |
| 30 | CLK- | Pixel Clock | |

| PIN No. | Symbol | Description | Note |
|---|---|---|---|
| 31 | CLK+ | Pixel Clock | |
| 32 | VSS | GND(0V) | |
| 33 | D03- | Pixel Data | |
| 34 | D03+ | | |
| 35 | D02- | Pixel Data | |
| 36 | D02+ | | |
| 37 | VSS | GND(0V) | |
| 38 | D01- | Pixel Data | |
| 39 | D01+ | | |
| 40 | D00- | Pixel Data | |
| 41 | D00+ | | |
| 42 | VSS | GND(0V) | |
| 43 | VDD | Logic Voltage | |
| 44 | VDD | | |
| 45 | VRF8 | Reference Voltage | |
| 46 | VRF9 | | |
| 47 | VRF10 | | |
| 48 | VRF11 | | |
| 49 | VRF12 | | |
| 50 | VSS | GND(0V) | |
| 51 | AVDD | Analog Voltage | |
| 52 | AVDD | | |
| 53 | AVDDMH | | |
| 54 | AVDDMH | | |
| 55 | AVDDML | | |
| 56 | AVDDML | | |
| 57 | VSS | GND(0V) | |
| 58 | VSS | | |
| 59 | VCOM | Common Voltage | |
| 60 | VCOM | | |

## 5. INTERFACE PIN ASSIGNMENT

CN2:IRISO IMSA-9637S-60Y922

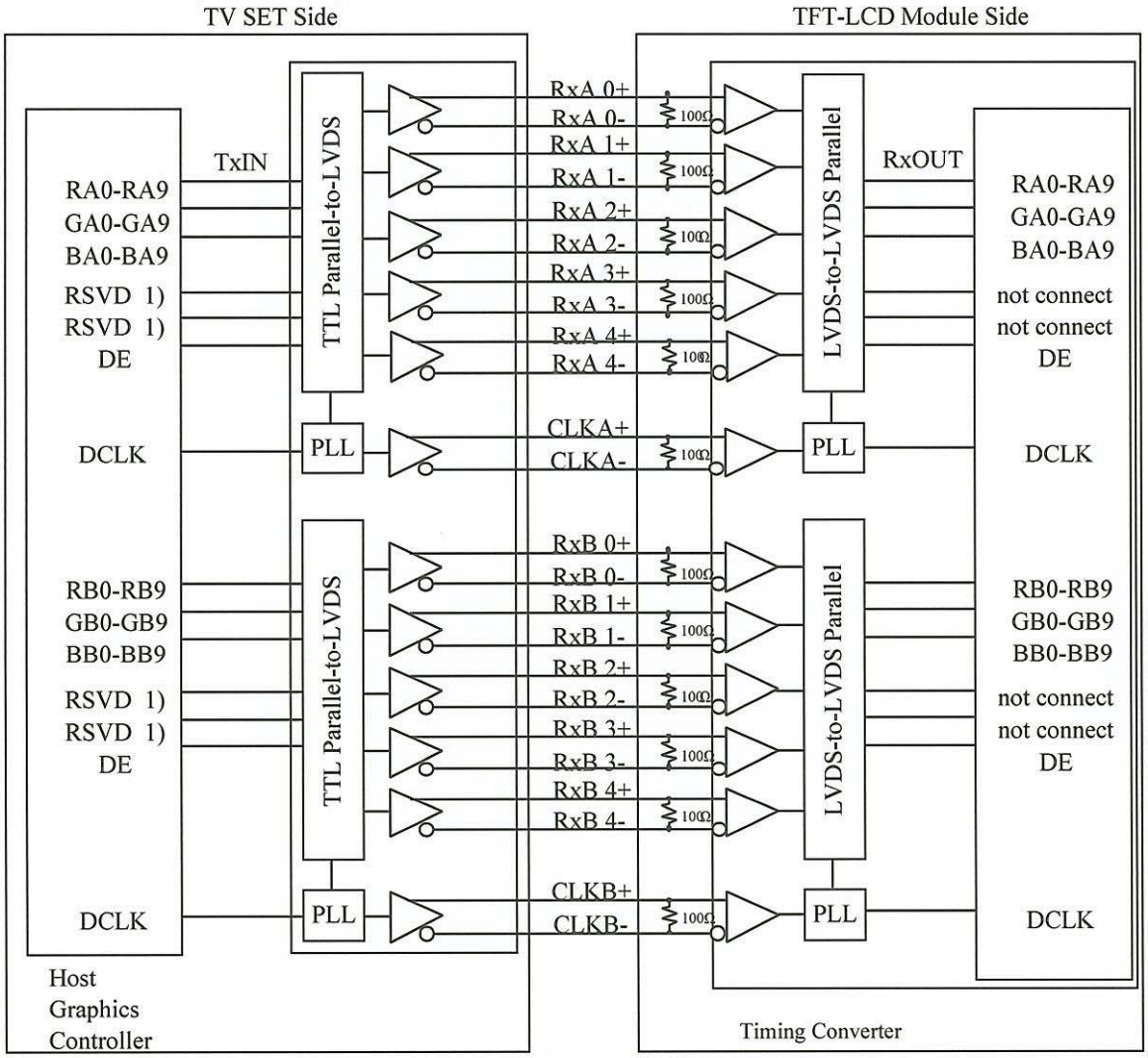
(Matching FFC : SUMITOMO SML2CD-60X41.0-BDX6(BL)-P0.5-S4.0+4.0-M-N(35)-AUP UL20861)

| PIN No. | Symbol | Description | Note |
|---|---|---|---|
| 1 | VSS | GND(0V) | |
| 2 | CPV | Control Signal | |
| 3 | DATA1 | Control Signal | |
| 4 | DATA2 | Control Signal | |
| 5 | VON | Reference Voltage | |
| 6 | VOFF2 | | |
| 7 | NC | No Connection | |
| 8 | VSS | GND(0V) | |
| 9 | VRF1 | Reference Voltage | |
| 10 | VRF2 | | |
| 11 | VRF3 | | |
| 12 | VRF4 | | |
| 13 | VRF5 | | |
| 14 | VRF6 | | |
| 15 | LP | Control Signal | |
| 16 | POL | Control Signal | |
| 17 | VDD | Logic Voltage | |
| 18 | CSMODE | Control Signal | |
| 19 | VSS | GND(0V) | |
| 20 | D13- | Pixel Data | |
| 21 | D13+ | | |
| 22 | D12- | Pixel Data | |
| 23 | D12+ | | |
| 24 | VSS | GND(0V) | |
| 25 | D11- | Pixel Data | |
| 26 | D11+ | | |
| 27 | D10- | Pixel Data | |
| 28 | D10+ | | |
| 29 | VSS | GND(0V) | |
| 30 | CLK- | Pixel Clock | |

| PIN No. | Symbol | Description | Note |
|---|---|---|---|
| 31 | CLK+ | Pixel Clock | |
| 32 | VSS | GND(0V) | |
| 33 | D03- | Pixel Data | |
| 34 | D03+ | | |
| 35 | D02- | Pixel Data | |
| 36 | D02+ | | |
| 37 | VSS | GND(0V) | |
| 38 | D01- | Pixel Data | |
| 39 | D01+ | | |
| 40 | D00- | Pixel Data | |
| 41 | D00+ | | |
| 42 | VSS | GND(0V) | |
| 43 | VDD | Logic Voltage | |
| 44 | VDD | | |
| 45 | VRF8 | Reference Voltage | |
| 46 | VRF9 | | |
| 47 | VRF10 | | |
| 48 | VRF11 | | |
| 49 | VRF12 | | |
| 50 | VSS | GND(0V) | |
| 51 | AVDD | Analog Voltage | |
| 52 | AVDD | | |
| 53 | AVDDMH | | |
| 54 | AVDDMH | | |
| 55 | AVDDML | | |
| 56 | AVDDML | | |
| 57 | VSS | GND(0V) | |
| 58 | VSS | | |
| 59 | VCOM | Common Voltage | |
| 60 | VCOM | | |

5. 2 Block diagram of interface

Based on IPS Alpha Technology, Ltd. Standard Module




| | | |
|---|---|---|
| RA0～RA9, RB0～RB9 | : Pixel R Data | (9; MSB, 0; LSB) |
| GA0～GA9, GB0～GB9 | : Pixel G Data | (9; MSB, 0; LSB) |
| BA0～BA9, BB0～BB9 | : Pixel B Data | (9; MSB, 0; LSB) |
| DE | : Data Enable | |

Note 1) The system must have the transmitter to drive the module.

2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

5. 3 LVDS interface

Based on IPS Alpha Technology, Ltd. Standard Module

The LVDSSEL signal of CN1 pin No.7 specification is "L" or open.【LVDSSEL = L or open】

| | SIGNAL | TRANSMITTER THC63LVD1023B | | INTERFACE CONNECTOR | | RECEIVER | | TFT CONTROL |
|---|---|---|---|---|---|---|---|---|
| | | PIN | INPUT | TV Set | TFT-LCD | PIN | OUTPUT | INPUT |
| | RA0/RB0 | 76/120 | TA10/TA20 | | | 67/18 | RA10/RA20 | RA0/RB0 |
| | RA1/RB1 | 77/121 | TA11/TA21 | | | 68/19 | RA11/RA21 | RA1/RB1 |
| | RA2/RB2 | 78/122 | TA12/TA22 | TA1+/TA2+ | RA1+/RA2+ | 69/20 | RA12/RA22 | RA2/RB2 |
| | RA3/RB3 | 79/123 | TA13/TA23 | | | 72/23 | RA13/RA23 | RA3/RB3 |
| | RA4/RB4 | 80/124 | TA14/TA24 | | | 73/24 | RA14/RA24 | RA4/RB4 |
| | RA5/RB5 | 81/127 | TA15/TA25 | TA1-/TA2- | RA1-/RA2- | 74/25 | RA15/RA25 | RA5/RB5 |
| | GA0/GB0 | 84/128 | TA16/TA26 | | | 79/33 | RA16/RA26 | GA0/GB0 |
| | GA1/GB1 | 85/129 | TB10/TB20 | | | 82/34 | RB10/RB20 | GA1/GB1 |
| | GA2/GB2 | 86/130 | TB11/TB21 | | | 83/35 | RB11/RB21 | GA2/GB2 |
| | GA3/GB3 | 87/131 | TB12/TB22 | TB1+/TB2+ | RB1+/RB2+ | 84/36 | RB12/RB22 | GA3/GB3 |
| | GA4/GB4 | 88/132 | TB13/TB23 | | | 85/37 | RB13/RB23 | GA4/GB4 |
| | GA5/GB5 | 89/133 | TB14/TB24 | | | 86/40 | RB14/RB24 | GA5/GB5 |
| | BA0/BB0 | 90/134 | TB15/TB25 | TB1-/TB2- | RB1-/RB2- | 93/45 | RB15/RB25 | BA0/BB0 |
| 30bit | BA1/BB1 | 91/135 | TB16/TB26 | | | 94/48 | RB16/RB26 | BA1/BB1 |
| | BA2/BB2 | 92/136 | TC10/TC20 | | | 95/49 | RC10/RC20 | BA2/BB2 |
| | BA3/BB3 | 95/139 | TC11/TC21 | | | 96/50 | RC11/RC21 | BA3/BB3 |
| | BA4/BB4 | 96/140 | TC12/TC22 | TC1+/TC2+ | RC1+/RC2+ | 99/51 | RC12/RC22 | BA4/BB4 |
| | BA5/BB5 | 97/141 | TC13/TC23 | | | 100/52 | RC13/RC23 | BA5/BB5 |
| | RSVD1) | 98/142 | TC14/TC24 | | | 101/- | RC14/RC24 | RSVD1) |
| | RSVD1) | 99/143 | TC15/TC25 | TC1-/TC2- | RC1-/RC2- | 102/- | RC15/RC25 | RSVD1) |
| | DE/DE | 100/144 | TC16/TC26 | | | 103/- | RC16/RC26 | DE/DE |
| | RA6/RB6 | 101/1 | TD10/TD20 | | | 65/16 | RD10/RD20 | RA6/RB6 |
| | RA7/RB7 | 102/2 | TD11/TD21 | | | 66/17 | RD11/RD21 | RA7/RB7 |
| | GA6/GB6 | 103/5 | TD12/TD22 | TD1+/TD2+ | RD1+/RD2+ | 77/31 | RD12/RD22 | GA6/GB6 |
| | GA7/GB7 | 106/6 | TD13/TD23 | | | 78/32 | RD13/RD23 | GA7/GB7 |
| | BA6/BB6 | 107/7 | TD14/TD24 | | | 91/43 | RD14/RD24 | BA6/BB6 |
| | BA7/BB7 | 108/8 | TD15/TD25 | TD1-/TD2- | RD1-/RD2- | 92/44 | RD15/RD25 | BA7/BB7 |
| | RSVD 1) | 110/9 | TD16/TD26 | | | 104/55 | RD16/RD26 | RSVD 1) |
| | RA8/RB8 | 111/10 | TE10/TE20 | | | 63/14 | RE10/RE20 | RA8/RB8 |
| | RA9/RB9 | 112/11 | TE11/TE21 | | | 64/15 | RE11/RE21 | RA9/RB9 |
| | GA8/GB8 | 115/12 | TE12/TE22 | TE1+/TE2+ | RE1+/RE2+ | 75/26 | RE12/RE22 | GA8/GB8 |
| | GA9/GB9 | 116/17 | TE13/TE23 | | | 76/27 | RE13/RE23 | GA9/GB9 |
| | BA8/BB8 | 117/18 | TE14/TE24 | | | 87/41 | RE14/RE24 | BA8/BB8 |
| | BA9/BB9 | 118/19 | TE15/TE25 | TE1-/TE2- | RE1-/RE2- | 90/42 | RE15/RE25 | BA9/BB9 |
| | RSVD 1) | 119/20 | TE16/TE26 | | | 105/56 | RE16/RE26 | RSVD 1) |
| | DCLK | 15,16 | CLKIN1<br>CLKIN2 | TCLK1+/TCLK2+<br>TCLK1-/TCLK2- | RCLK1+/RCLK2+<br>RCLK1-/RCLK2- | 60 | CLKOUT | DCLK |

RA0～RA9, RB0～RB9 : Pixel R Data (9; MSB, 0; LSB)
GA0～GA9, GB0～GB9 : Pixel G Data (9; MSB, 0; LSB)
BA0～BA9, BB0～BB9 : Pixel B Data (9; MSB, 0; LSB)
DE : Data Enable

Note 1) RSVD(reserved) pins on the transmitter shall be tied to"H"or"L".

The LVDSSEL signal of CN1 pin No.7 specification is "H".【LVDSSEL = H】

| | SIGNAL | TRANSMITTER THC63LVD1023B | | INTERFACE CONNECTOR | | RECEIVER | | TFT CONTROL |
|---|---|---|---|---|---|---|---|---|
| | | PIN | INPUT | TV Set | TFT-LCD | PIN | OUTPUT | INPUT |
| 30bit | RA4/RB4 | 76/120 | TA10/TA20 | TA1+/TA2+ | RA1+/RA2+ | 67/18 | RA10/RA20 | RA4/RB4 |
| | RA5/RB5 | 77/121 | TA11/TA21 | | | 68/19 | RA11/RA21 | RA5/RB5 |
| | RA6/RB6 | 78/122 | TA12/TA22 | | | 69/20 | RA12/RA22 | RA6/RB6 |
| | RA7/RB7 | 79/123 | TA13/TA23 | | | 72/23 | RA13/RA23 | RA7/RB7 |
| | RA8/RB8 | 80/124 | TA14/TA24 | | | 73/24 | RA14/RA24 | RA8/RB8 |
| | RA9/RB9 | 81/127 | TA15/TA25 | TA1-/TA2- | RA1-/RA2- | 74/25 | RA15/RA25 | RA9/RB9 |
| | GA4/GB4 | 84/128 | TA16/TA26 | | | 79/33 | RA16/RA26 | GA4/GB4 |
| | GA5/GB5 | 85/129 | TB10/TB20 | TB1+/TB2+ | RB1+/RB2+ | 82/34 | RB10/RB20 | GA5/GB5 |
| | GA6/GB6 | 86/130 | TB11/TB21 | | | 83/35 | RB11/RB21 | GA6/GB6 |
| | GA7/GB7 | 87/131 | TB12/TB22 | | | 84/36 | RB12/RB22 | GA7/GB7 |
| | GA8/GB8 | 88/132 | TB13/TB23 | | | 85/37 | RB13/RB23 | GA8/GB8 |
| | GA9/GB9 | 89/133 | TB14/TB24 | | | 86/40 | RB14/RB24 | GA9/GB9 |
| | BA4/BB4 | 90/134 | TB15/TB25 | TB1-/TB2- | RB1-/RB2- | 93/45 | RB15/RB25 | BA4/BB4 |
| | BA5/BB5 | 91/135 | TB16/TB26 | | | 94/48 | RB16/RB26 | BA5/BB5 |
| | BA6/BB6 | 92/136 | TC10/TC20 | TC1+/TC2+ | RC1+/RC2+ | 95/49 | RC10/RC20 | BA6/BB6 |
| | BA7/BB7 | 95/139 | TC11/TC21 | | | 96/50 | RC11/RC21 | BA7/BB7 |
| | BA8/BB8 | 96/140 | TC12/TC22 | | | 99/51 | RC12/RC22 | BA8/BB8 |
| | BA9/BB9 | 97/141 | TC13/TC23 | | | 100/52 | RC13/RC23 | BA9/BB9 |
| | RSVD1) | 98/142 | TC14/TC24 | | | 101/- | RC14/RC24 | RSVD1) |
| | RSVD1) | 99/143 | TC15/TC25 | TC1-/TC2- | RC1-/RC2- | 102/- | RC15/RC25 | RSVD1) |
| | DE/DE | 100/144 | TC16/TC26 | | | 103/- | RC16/RC26 | DE/DE |
| | RA2/RB2 | 101/1 | TD10/TD20 | TD1+/TD2+ | RD1+/RD2+ | 65/16 | RD10/RD20 | RA2/RB2 |
| | RA3/RB3 | 102/2 | TD11/TD21 | | | 66/17 | RD11/RD21 | RA3/RB3 |
| | GA2/GB2 | 103/5 | TD12/TD22 | | | 77/31 | RD12/RD22 | GA2/GB2 |
| | GA3/GB3 | 106/6 | TD13/TD23 | | | 78/32 | RD13/RD23 | GA3/GB3 |
| | BA2/BB2 | 107/7 | TD14/TD24 | | | 91/43 | RD14/RD24 | BA2/BB2 |
| | BA3/BB3 | 108/8 | TD15/TD25 | TD1-/TD2- | RD1-/RD2- | 92/44 | RD15/RD25 | BA3/BB3 |
| | RSVD 1) | 110/9 | TD16/TD26 | | | 104/55 | RD16/RD26 | RSVD 1) |
| | RA0/RB0 | 111/10 | TE10/TE20 | TE1+/TE2+ | RE1+/RE2+ | 63/14 | RE10/RE20 | RA0/RB0 |
| | RA1/RB1 | 112/11 | TE11/TE21 | | | 64/15 | RE11/RE21 | RA1/RB1 |
| | GA0/GB0 | 115/12 | TE12/TE22 | | | 75/26 | RE12/RE22 | GA0/GB0 |
| | GA1/GB1 | 116/17 | TE13/TE23 | | | 76/27 | RE13/RE23 | GA1/GB1 |
| | BA0/BB0 | 117/18 | TE14/TE24 | | | 87/41 | RE14/RE24 | BA0/BB0 |
| | BA1/BB1 | 118/19 | TE15/TE25 | TE1-/TE2- | RE1-/RE2- | 90/42 | RE15/RE25 | BA1/BB1 |
| | RSVD 1) | 119/20 | TE16/TE26 | | | 105/56 | RE16/RE26 | RSVD 1) |
| | DCLK | 15,16 | CLKIN1<br>CLKIN2 | TCLK1+/TCLK2+<br>TCLK1-/TCLK2- | RCLK1+/RCLK2+<br>RCLK1-/RCLK2- | 60 | CLKOUT | DCLK |

RA0～RA9, RB0～RB9 : Pixel R Data (9; MSB, 0; LSB)
GA0～GA9, GB0～GB9 : Pixel G Data (9; MSB, 0; LSB)
BA0～BA9, BB0～BB9 : Pixel B Data (9; MSB, 0; LSB)
DE : Data Enable

Note 1) RSVD(reserved) pins on the transmitter shall be tied to"H"or"L".

5. 4 Correspondence between input data and display image

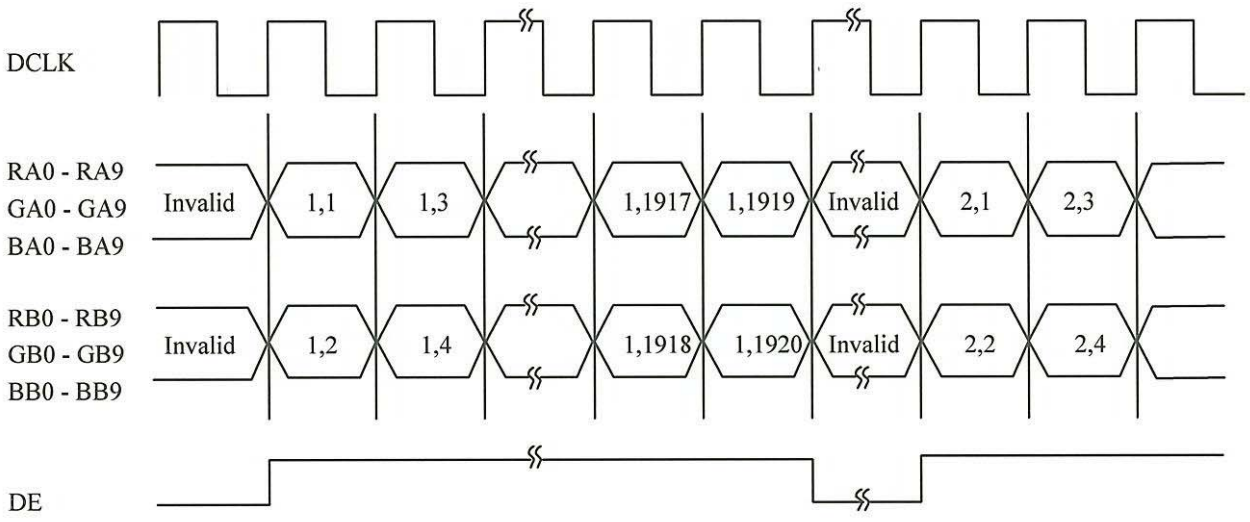
Based on IPS Alpha Technology, Ltd. Standard Module

Display data of adjacent one pixel is latched during one cycle of DCLK.

| | (1,1) | | | (1,2) | |
|---|---|---|---|---|---|
| RA | GA | BA | RB | GB | BB |

ODD pixel : RA0 - RA9 : R data
GA0 - GA9 : G data
BA0 - BA9 : B data
EVEN pixel RB0 - RB9 : R data
GB0 - GB9 : G data
BB0 - BB9 : B data

| | | | | |
|---|---|---|---|---|
| 1 , 1 | 1 , 2 | 1 , 3 | ---------- | 1 , 1920 |
| 2 , 1 | 2 , 2 | 2 , 3 | ---------- | 2 , 1920 |
| 3 , 1 | 3 , 2 | 3 , 3 | ---------- | 3 , 1920 |
| 1080 , 1 | 1080 , 2 | 1080 , 3 | | 1080, 1920 |



5. 5 Relationship between display colors and input signals

| Color \ Input | | Red Data | | | | | | | | | | Green Data | | | | | | | | | | Blue Data | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 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 |
| | | MSB | | | | | | | | | LSB | MSB | | | | | | | | | LSB | MSB | | | | | | | | | LSB |
| 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 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red (1) | 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 (2) | 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 | 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 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green (1) | 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 (2) | 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 | 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 |
| 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 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue (1) | 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 (2) | 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 | 0 |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : |
| | 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 |

Note 1) Definition of gray scale :

Color(n) • • • Number in parenthesis indicates gray scale level.

Larger n correspondsto brighter level.

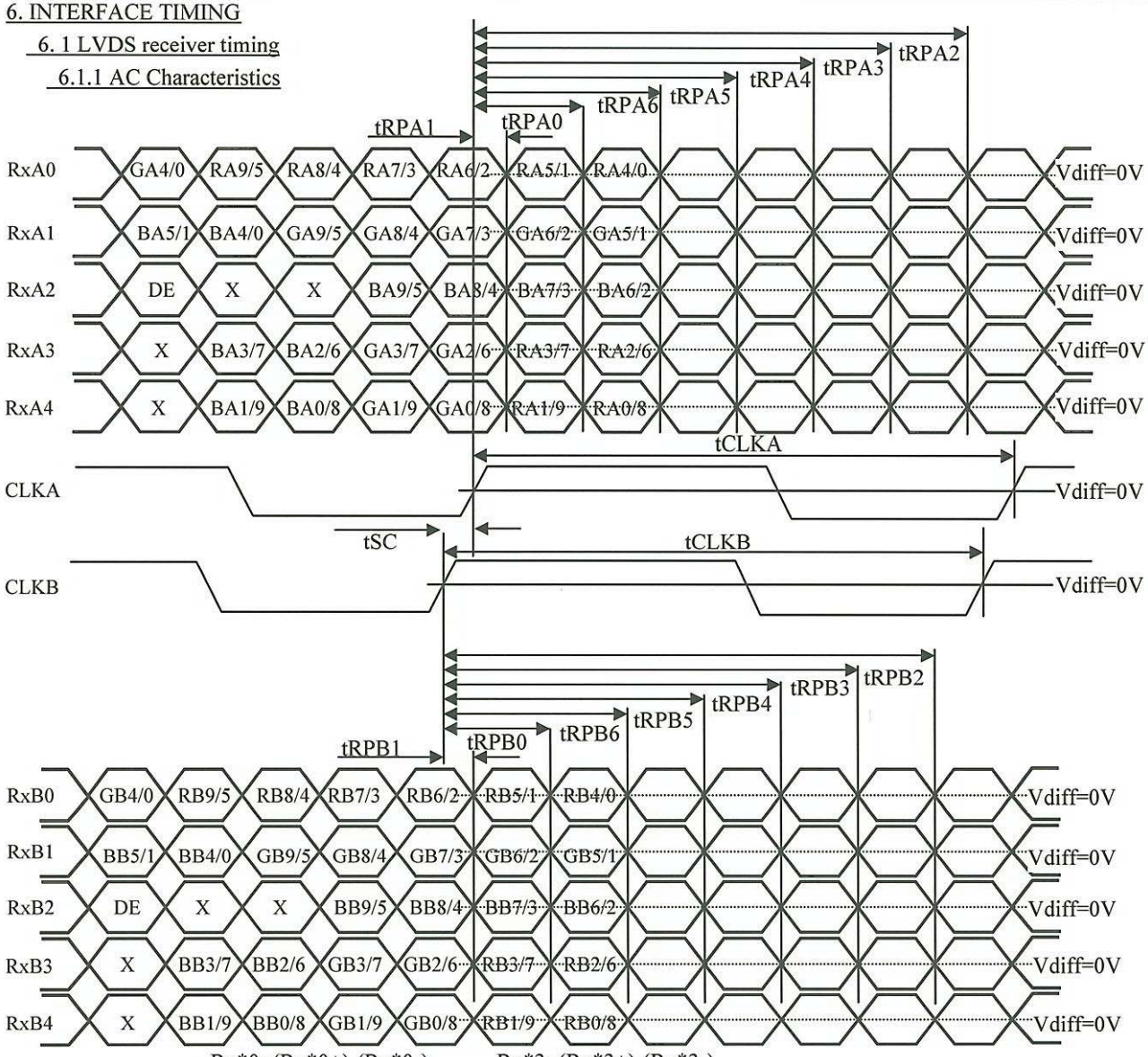
2) Data : 1 : High, 0 : Low

Based on IPS Alpha Technology, Ltd. Standard Module

## 6. INTERFACE TIMING

### 6. 1 LVDS receiver timing

#### 6.1.1 AC Characteristics




Rx*0=(Rx*0+)-(Rx*0-) Rx*3=(Rx*3+)-(Rx*3-)

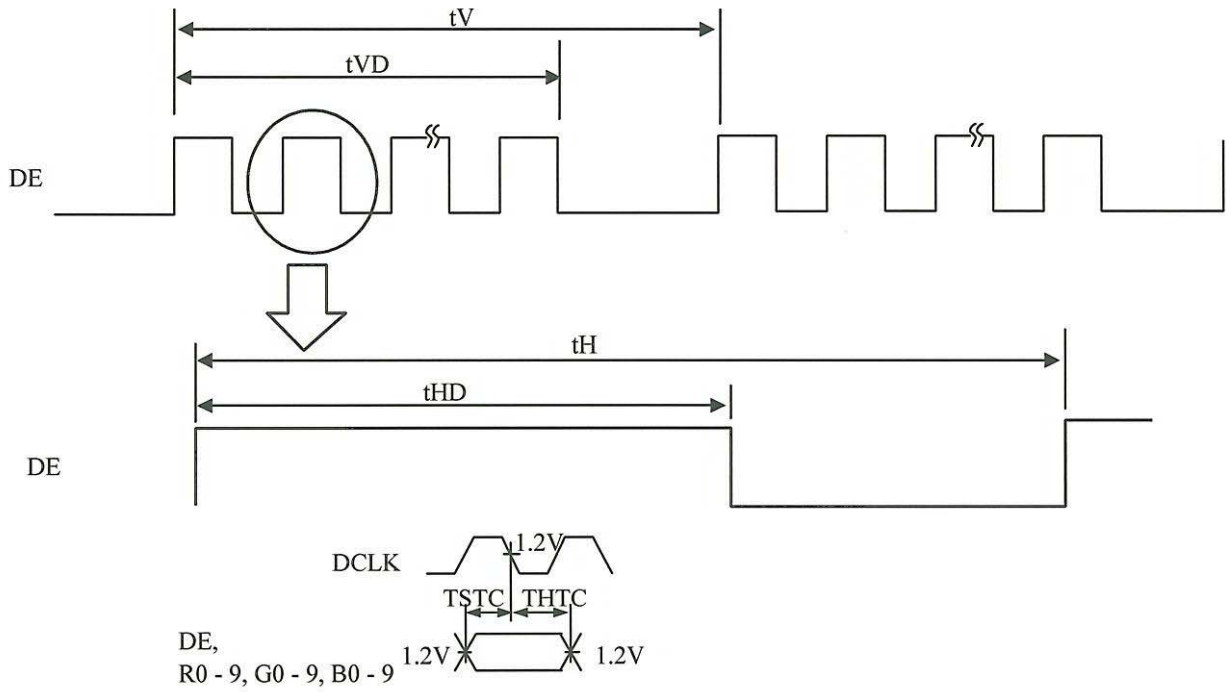
Rx*1=(Rx*1+)-(Rx*1-) Rx*4=(Rx*4+)-(Rx*4-)

Rx*2=(Rx*2+)-(Rx*2-) CLK=(CLK+)-(CLK-)

| Item | | Symbol | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| CLK | Frequency | DCLK | 128 | 132 | 135 | MHz | =1/tCLK |
| | CLK Skew | tSC | -2.0 | 0 | 2.0 | ns | |
| Rx*0 | 0 data position | tRP0 | 1/7tCLK - 0.25 | 1/7tCLK | 1/7tCLK +0.25 | ns | |
| Rx*1 | 1st data position | tRP1 | -0.25 | 0 | 0.25 | | |
| Rx*2 | 2nd data position | tRP2 | 6/7tCLK -0.25 | 6/7tCLK | 6/7tCLK +0.25 | | |
| Rx*3 | 3rd data position | tRP3 | 5/7tCLK -0.25 | 5/7tCLK | 5/7tCLK + 0.25 | | |
| Rx*4 | 4th data position | tRP4 | 4/7tCLK - 0.25 | 4/7tCLK | 4/7tCLK +0.25 | | |
| | 5th data position | tRP5 | 3/7tCLK - 0.25 | 3/7tCLK | 3/7tCLK + 0.25 | | |
| | 6th data position | tRP6 | 2/7tCLK - 0.25 | 2/7tCLK | 2/7tCLK + 0.25 | | |

Based on IPS Alpha Technology, Ltd. Standard Module

6. 2 Syncronization signal timing




Note 1) Reference level for each timing signal is 1.2 V unless it is stated on the chart, high level voltage(VIH) and low level voltage(VIL) are defined as follows:

VIH ≧ 2.0 V VIL ≦ 0.8 V

2) The timing of DCLK to other signals conforms to the specifications of LVDS transmitter.

I)120Hz 2pxl/clk

| Item | | Symbol | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| DE | Vertical Frequency | fV | 115 | 120 | 125 | Hz | |
| | Vertical Period | tV | 1090 | 1100 | 1150 | tH | |
| | Vertical Valid | tVD | | 1080 | | tH | |
| | Horizontal Frequency | fH | 127 | 132 | 134 | kHz | |
| | Horizontal Period | tH | 972 | 1000 | 1035 | tCLK | |
| | Horizontal Valid | tHD | | 960 | | tCLK | |

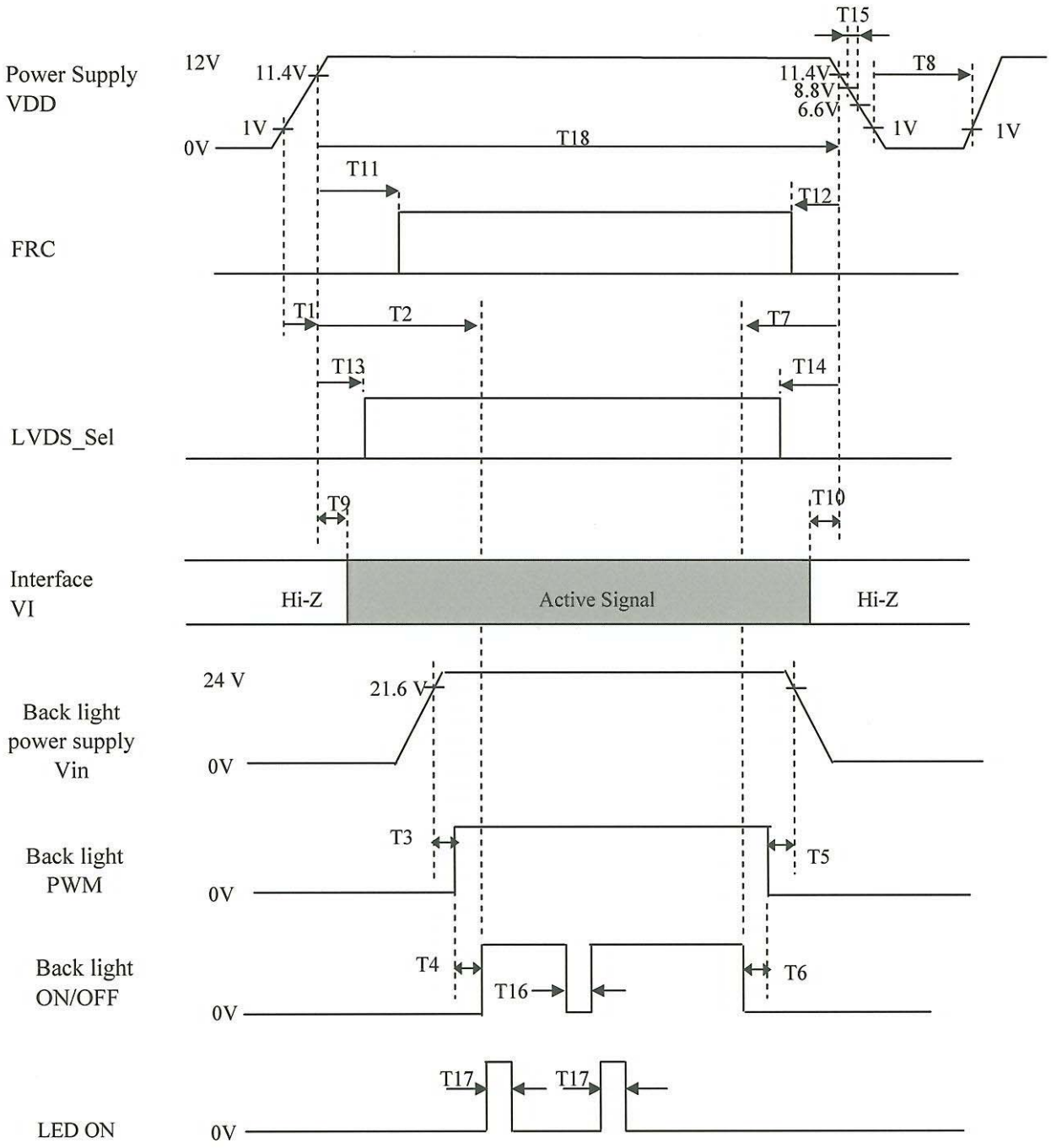
II)100Hz 2pxl/clk

| Item | | Symbol | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| DE | Vertical Frequency | fV | 93 | 100 | 105 | Hz | |
| | Vertical Period | tV | 1310 | 1320 | 1370 | tH | |
| | Vertical Valid | tVD | | 1080 | | tH | |
| | Horizontal Frequency | fH | 127 | 132 | 134 | kHz | |
| | Horizontal Period | tH | 972 | 1000 | 1035 | tCLK | |
| | Horizontal Valid | tHD | | 960 | | tCLK | |

Based on IPS Alpha Technology, Ltd. Standard Module

6.3 Timing between interface signals power supply

Based on IPS Alpha Technology, Ltd. Standard Module




| | | | | |
|---|---|---|---|---|
| 0 ≦ T1 ≦ 10 | 0 ≦ T7 | 0 ≦ T10 | T13 ≦T2 - 150 | T16＞500 (wait to the restart) |
| 500 ≦ T2 | 1000 ≦ T8 | T11 ≦T2 - 150 | T14 don't care | T17=(4.2s typ ( Ta = 25℃)) |
| 0 ＜ T3,T4,T5,T6 | 30 ≦ T9 | T12 don't care | 20 ＜ T15 | T18＞500 |

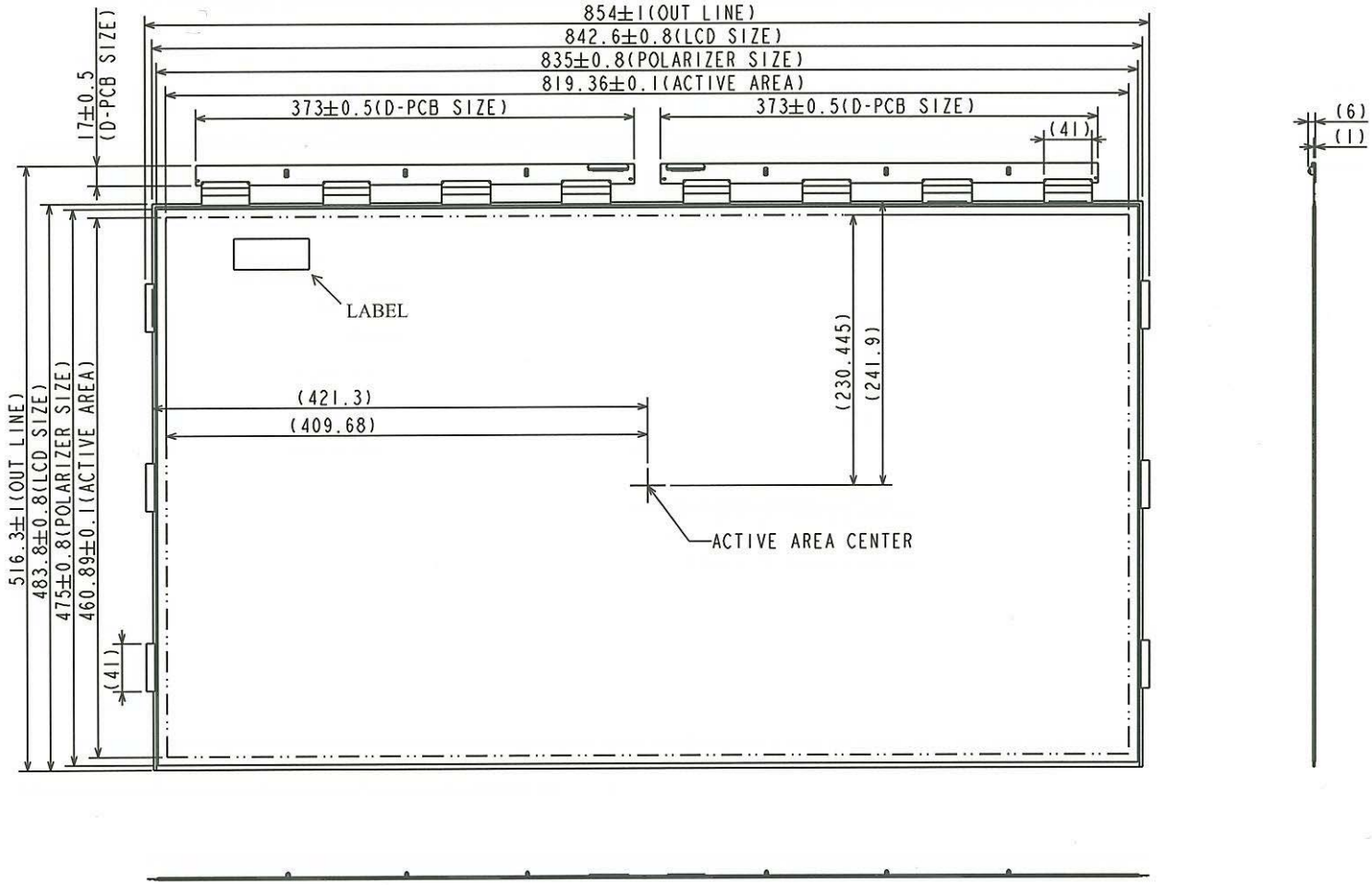
Unit : ms

Note 1) T16 : Wait to the restart

2) T17 : LED lighting period

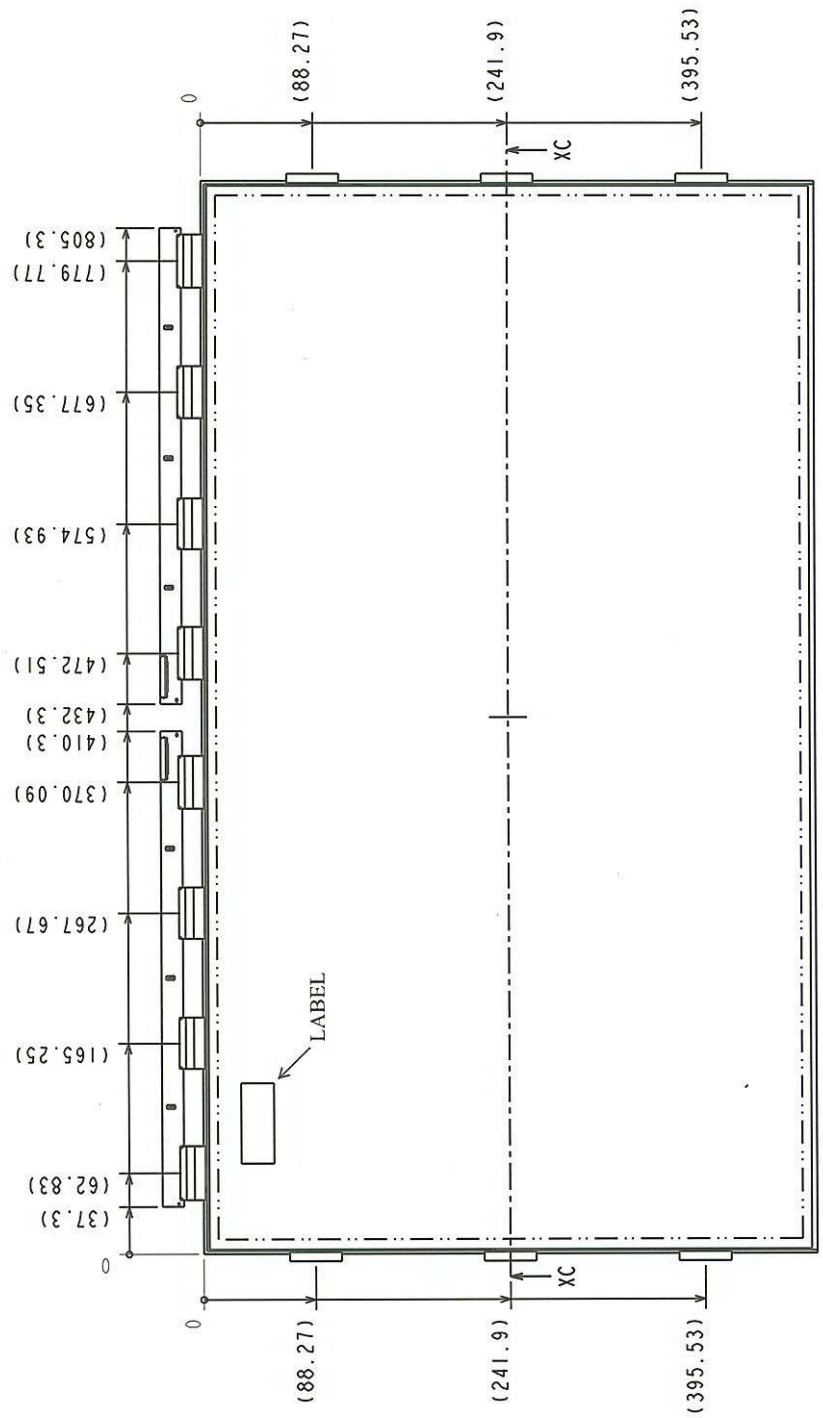
# 7. DIMENSIONAL OUTLINE

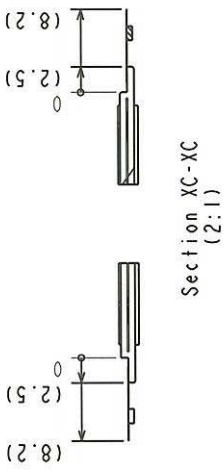
## (1)FRONT VIEW I




Note 1) The dimension in a parenthesis is a reference value
2) Unspecified tolerance to be ±0.8

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| IPS Alpha Technology, Ltd. | Date | Jul. 22, 2010 | Sh. No. | IPS4PS 2610 | | Page | 10-1/3 |

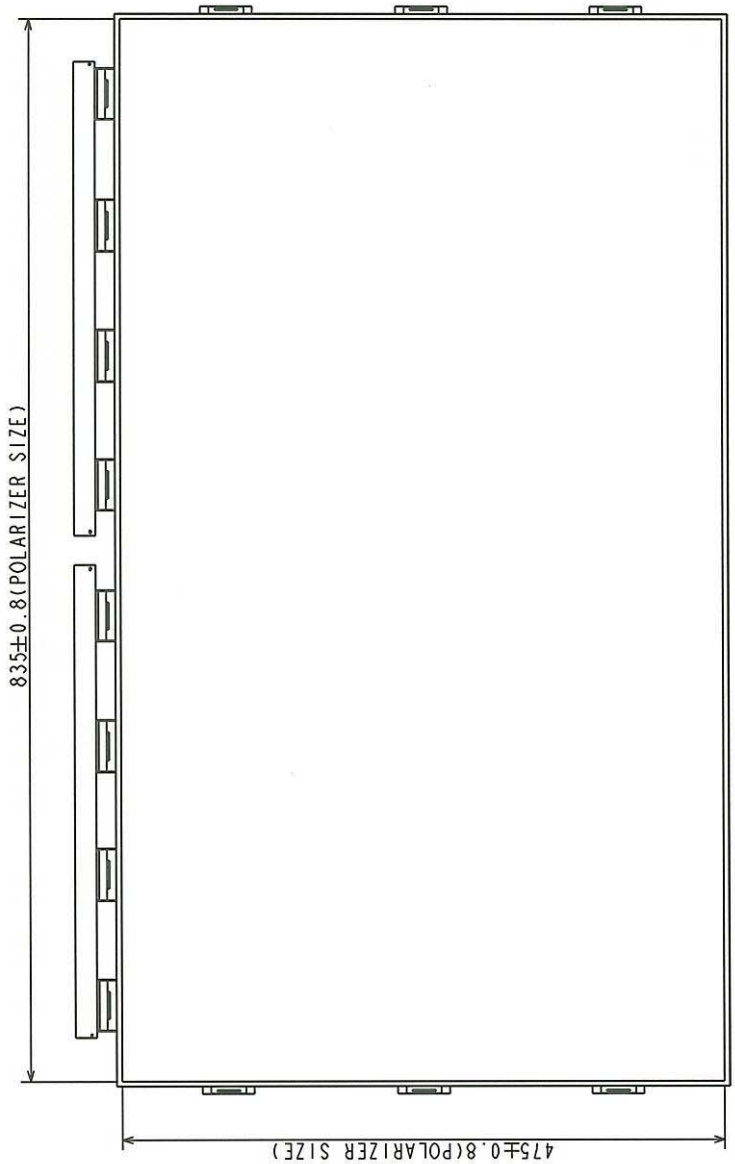



Section XC-XC
(2:1)

(1)FRONT VIEW 2

| IPS Alpha Technology, Ltd. | Date | Jul. 22, 2010 | Sh. No. | IPS4PS 2610 | Page | 10-2/3 |
|---|---|---|---|---|---|---|




(2)BACK VIEW

| IPS Alpha Technology, Ltd. | Date | Jul. 22, 2010 | Sh. No. | IPS4PS 2610 | Page | 10-3/3 |
|---|---|---|---|---|---|---|