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| Version     | 0.3        |
| Total pages | 21         |
| Date        | 2007.07.11 |

# Product Specification

**Color TFT-LCD module**

**MODEL NAME: A085FW01 V7**

( ◆ ) Preliminary Specification

( ..... ) Final Specification

Note: The content of this specification is subject to change.

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## Record of Revision

[illegible]

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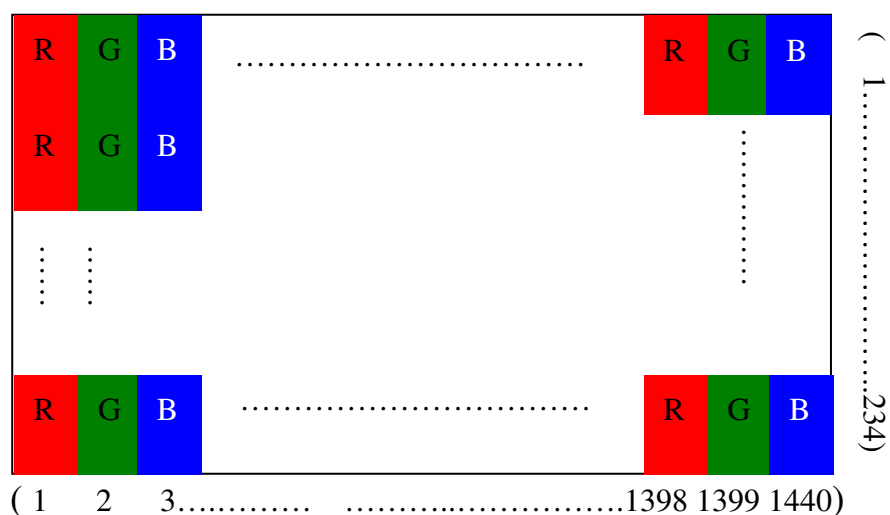
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## A. Physical specifications

| NO. | Item                    | Specification            | Remark |
|-----|-------------------------|--------------------------|--------|
| 1   | Display resolution(dot) | 480RGB(W)×234(H)         |        |
| 2   | Active area(mm)         | 187.2(W)×105.3(H)        |        |
| 3   | Dot pitch(mm)           | 0.130(W)×0.450(H)        |        |
| 4   | Color configuration     | R. G. B. stripe          | Note 1 |
| 5   | Overall dimension(mm)   | 199.0(W)×119.0(H)×5.8(D) | Note 2 |
| 6   | Weight(g)               | 232 ±10                  |        |
| 7   | Surface treatment       | Anti-Glare               |        |
| 8   | Backlight unit          | LED                      |        |

Note 1: Below figure shows the dot stripe arrangement.



Note 2: Refer to Fig. 1

## B. Electrical specifications

### 1. Pin assignment

#### a. TFT-LCD panel driving section

| Pin no | Symbol           | I/O | Description   | Remark   |
|--------|------------------|-----|---|----------|
| 1      | GND              | -   | Ground for logic circuit                                |          |
| 2      | V <sub>CC</sub>  | I   | Supply voltage of logic control circuit for scan driver |          |
| 3      | V <sub>GL</sub>  | I   | Negative power for scan driver                          |          |
| 4      | V <sub>GH</sub>  | I   | Positive power for scan driver                          |          |
| 5      | STVD             | I/O | Vertical start pulse                                    | Note 1   |
| 6      | STVU             | I/O | Vertical start pulse                                    | Note 1   |
| 7      | CKV              | I   | Shift clock input for scan driver                       |          |
| 8      | U/D              | I   | UP/DOWN scan control input                              | Note 1,2 |
| 9      | OE <sub>V</sub>  | I   | Output enable input for scan driver                     |          |
| 10     | VCOM             | I   | Common electrode driving signal                         |          |
| 11     | VCOM             | I   | Common electrode driving signal                         |          |
| 12     | L/R              | I   | LEFT/RIGHT scan control input                           | Note 1,2 |
| 13     | MOD              | I   | Sequential sampling and simultaneous sampling setting   | Note 3   |
| 14     | OE <sub>H</sub>  | I   | Output enable input for data driver                     |          |
| 15     | STHL             | I/O | Start pulse for horizontal scan line                    | Note 1   |
| 16     | STHR             | I/O | Start pulse for horizontal scan line                    | Note 1   |
| 17     | CPH3             | I   | Sampling and shifting clock pulse for data driver       |          |
| 18     | CPH2             | I   | Sampling and shifting clock pulse for data driver       |          |
| 19     | CPH1             | I   | Sampling and shifting clock pulse for data driver       |          |
| 20     | V <sub>CC</sub>  | I   | Supply voltage of logic control circuit for data driver |          |
| 21     | GND              | -   | Ground for logic circuit                                |          |
| 22     | VR               | I   | Alternated video signal input(Red)                      |          |
| 23     | VG               | I   | Alternated video signal input(Green)                    |          |
| 24     | VB               | I   | Alternated video signal input(Blue)                     |          |
| 25     | AV <sub>DD</sub> | I   | Supply voltage for analog circuit                       |          |
| 26     | AV <sub>SS</sub> | -   | Ground for analog circuit                               |          |

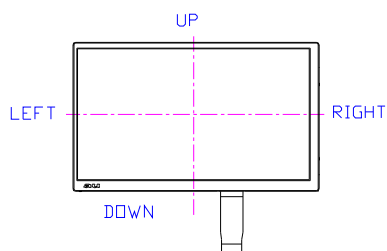
Note 1: Selection of scanning mode (please refer to the following table)

| Setting of scan control input |                 | IN/OUT state for start pulse |      |      |      | Scanning direction                       |
|-------------------------------|-----------------|------------------------------|------|------|------|--|
| U/D                           | L/R             | STVD                         | STVU | STHR | STHL |  |
| GND                           | V <sub>CC</sub> | OUT                          | IN   | OUT  | IN   | From up to down, and from left to right. |
| V <sub>CC</sub>               | GND             | IN                           | OUT  | IN   | OUT  | From down to up, and from right to left. |
| GND                           | GND             | OUT                          | IN   | IN   | OUT  | From up to down, and from right to left. |
| V <sub>CC</sub>               | V <sub>CC</sub> | IN                           | OUT  | OUT  | IN   | From down to up, and from left to right. |

IN: Input; OUT: Output.

Note 2: Definition of scanning direction.

Refer to figure as below:



Note 3: MOD = H: Simultaneous sampling.

MOD = L: Sequential sampling.

Please set CPH2 and CPH3 to GND when MOD = H.

#### b. Backlight driving section (Refer to Figure 1)

| No. | Symbol | I/O | Description                                    | Remark |
|-----|--------|-----|--|--------|
| 1   | HI     | I   | Power supply for backlight unit (High voltage) | --     |
| 2   | GND    | -   | Ground for backlight unit                      | --     |

## 2. Absolute maximum ratings

| Item                 | Symbol            | Condition   | Min. | Max.          | Unit | Remark |
|----------------------|-------------------|-------------|------|---------------|------|--------|
| Power voltage        | $V_{CC}$          | GND=0       | -0.3 | 7             | V    |        |
|                      | $AV_{DD}$         | $AV_{SS}=0$ | -0.3 | 7             | V    |        |
|                      | $V_{GH}$          | GND=0       | -0.3 | 18            | V    |        |
|                      | $V_{GL}$          |             | -15  | 0.3           | V    |        |
|                      | $V_{GH} - V_{GL}$ |             | -    | 33            | V    |        |
| Input signal voltage | $V_i$             |             | -0.3 | $AV_{DD}+0.3$ | V    | Note 1 |
|                      | $V_l$             |             | -0.3 | $V_{CC}+0.3$  | V    | Note 2 |
|                      | VCOM              |             | -2.9 | 5.2           | V    |        |

Note 1: VR, VG, VB.

Note 2: STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D.

### 3. Electrical characteristics

#### a. Typical operating conditions (GND=AVss=0V, Note 3 )

| Item                              | Symbol    | Min.     | Typ.         | Max.          | Unit         | Remark       |
|-----------------------------------|-----------|----------|--------------|---------------|--------------|--------------|
| Power supply                      | $V_{CC}$  | 3        | 5            | 5.5           | V            |              |
|                                   | $AV_{DD}$ | 4.5      | 5            | 5.5           | V            |              |
|                                   | $V_{GH}$  | 14.3     | 15           | 15.7          | V            |              |
|                                   | $V_{GL}$  | -10.5    | -10          | -9.5          | V            |              |
| Video signal amplitude (VR,VG,VB) | $V_{iA}$  | 0.4      | -            | $AV_{DD}-0.4$ | V            | Note 1       |
|                                   | $V_{iAC}$ | -        | 3            | -             | V            | AC component |
|                                   | $V_{iDC}$ | -        | $AV_{DD}/2$  | -             | V            | DC component |
| VCOM                              | $V_{CAC}$ | 5.3      | 5.6          | 5.9           | Vp-p         | AC component |
|                                   | $V_{CDC}$ | 1.6      | 1.9          | 2.2           | V            | DC component |
| Input signal voltage              | H Level   | $V_{IH}$ | 0.8 $V_{CC}$ | -             | $V_{CC}$     | Note 2       |
|                                   | L Level   | $V_{IL}$ | 0            | -             | 0.2 $V_{CC}$ |              |

Note 1: Refer to Fig.4- (a).

Note 2: STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D.

Note 3: Be sure to apply GND,  $V_{CC}$  and  $V_{GL}$  to the LCD first, and then apply  $V_{GH}$ .

#### b. Current consumption (GND=AVss=0V)

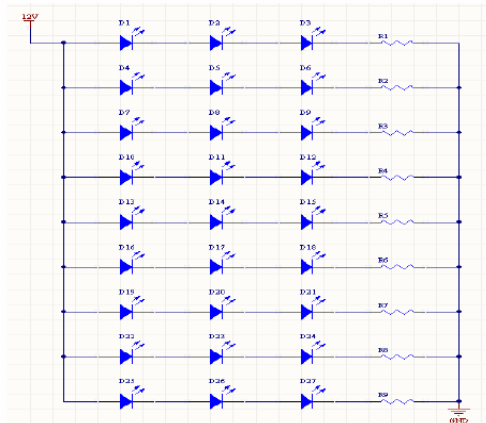
| Parameter          | Symbol   | Condition     | Min. | Typ. | Max. | Unit | Remark |
|--------------------|----------|---------------|------|------|------|------|--------|
| Current for driver | $I_{GH}$ | $V_{GH}=15V$  | -    | 0.20 | 0.5  | mA   |        |
|                    | $I_{GL}$ | $V_{GL}=-10V$ | -    | 0.20 | 0.5  | mA   |        |
|                    | $I_{CC}$ | $V_{CC}=5V$   | -    | 3.0  | 6.0  | mA   |        |
|                    | $I_{DD}$ | $AV_{DD}=5V$  | -    | 15.0 | 30   | mA   |        |

#### c. Backlight driving conditions

| Parameter              | Symbol | Min.   | Typ. | Max. | Unit | Remark       |
|------------------------|--------|--------|------|------|------|--------------|
| LED lightbar voltage   | $V_L$  | 10     | 12   | 12   | V    | Note 1, 2    |
| LED Lightbar current   | $I_L$  | -      | 225  |      | mA   | Note 1, 2    |
| LED Lightbar life time |        | 10,000 | -    | -    | Hr   | Note 1, 2, 3 |

Note 1: LED backlight is 27 pcs of LED lightbar type.

Note 2: Definition of "LED Lifetime": brightness is decreased to 50% of the initial value. LED Lifetime is restricted under normal condition, ambient temperature = 25°C and LED voltage = 12V



Note 3: The value is only for reference.



#### 4. AC Timing

##### a. Timing conditions

| Parameter                       | Symbol                              | Min. | Typ.        | Max.        | Unit.       | Remark     |
|---------------------------------|-------------------------------------|------|-------------|-------------|-------------|------------|
| Rising time                     | $t_r$                               | -    | -           | 10          | ns          | Note 1     |
| Falling time                    | $t_f$                               | -    | -           | 10          | ns          | Note 1     |
| High and low level pulse width  | $t_{CPH}$                           | 99   | 103         | 107         | ns          | CPH1~CPH3  |
| CPH pulse duty                  | $t_{CWH}$                           | 40   | 50          | 60          | %           | CPH1~CPH3  |
| CPH pulse delay                 | $t_{C12}$<br>$t_{C23}$<br>$t_{C31}$ | 30   | $t_{CPH}/3$ | $t_{CPH}/2$ | ns          | CPH1~CPH3  |
| STH setup time                  | $t_{SUH}$                           | 20   | -           | -           | ns          | STHR, STHL |
| STH hold time                   | $t_{HDH}$                           | 20   | -           | -           | Ns          | STHR, STHL |
| STH pulse width                 | $t_{STH}$                           | -    | 1           | -           | $t_{CPH}$   | STHR, STHL |
| STH period                      | $t_H$                               | 61.5 | 63.5        | 65.5        | $\mu s$     | STHR, STHL |
| OEH pulse width                 | $t_{OEH}$                           | -    | 1.22        | -           | $\mu s$     | OEH        |
| Sample and hold disable time    | $t_{DIS1}$                          | -    | 8.28        | -           | $\mu s$     |            |
| OEV pulse width                 | $t_{OEV}$                           | -    | 5.40        | -           | $\mu s$     | OEV        |
| CKV pulse width                 | $t_{CKV}$                           | -    | 4.18        | -           | $\mu s$     | CKV        |
| Clean enable time               | $t_{DIS2}$                          | -    | 3.74        | -           | $\mu s$     |            |
| Horizontal display start        | $t_{SH}$                            | -    | 0           | -           | $T_{CPH}/3$ |            |
| Horizontal display timing range | $t_{DH}$                            | -    | 1440        | -           | $T_{CPH}/3$ |            |
| STV setup time                  | $t_{SUV}$                           | 400  | -           | -           | ns          | STVU, STVD |
| STV hold time                   | $t_{HDV}$                           | 400  | -           | -           | ns          | STVU, STVD |
| STV pulse width                 | $t_{STV}$                           | -    | -           | 1           | $t_H$       | STVU, STVD |
| Horizontal lines per field      | $t_V$                               | 256  | 262         | 268         | $t_H$       | Note 2     |
| Vertical display start          | $t_{SV}$                            |      | 3           | -           | $t_H$       |            |
| Vertical display timing range   | $t_{DV}$                            |      | 234         | -           | $t_H$       |            |
| VCOM rising time                | $t_{rCOM}$                          |      | -           | 5           | $\mu s$     |            |
| VCOM falling time               | $t_{fCOM}$                          |      | -           | 5           | $\mu s$     |            |
| VCOM delay time                 | $t_{DCOM}$                          |      | -           | 3           | $\mu s$     |            |
| RGB delay time                  | $t_{DRGB}$                          |      | -           | 1           | $\mu s$     |            |

Note 1: For all of the logic signals.

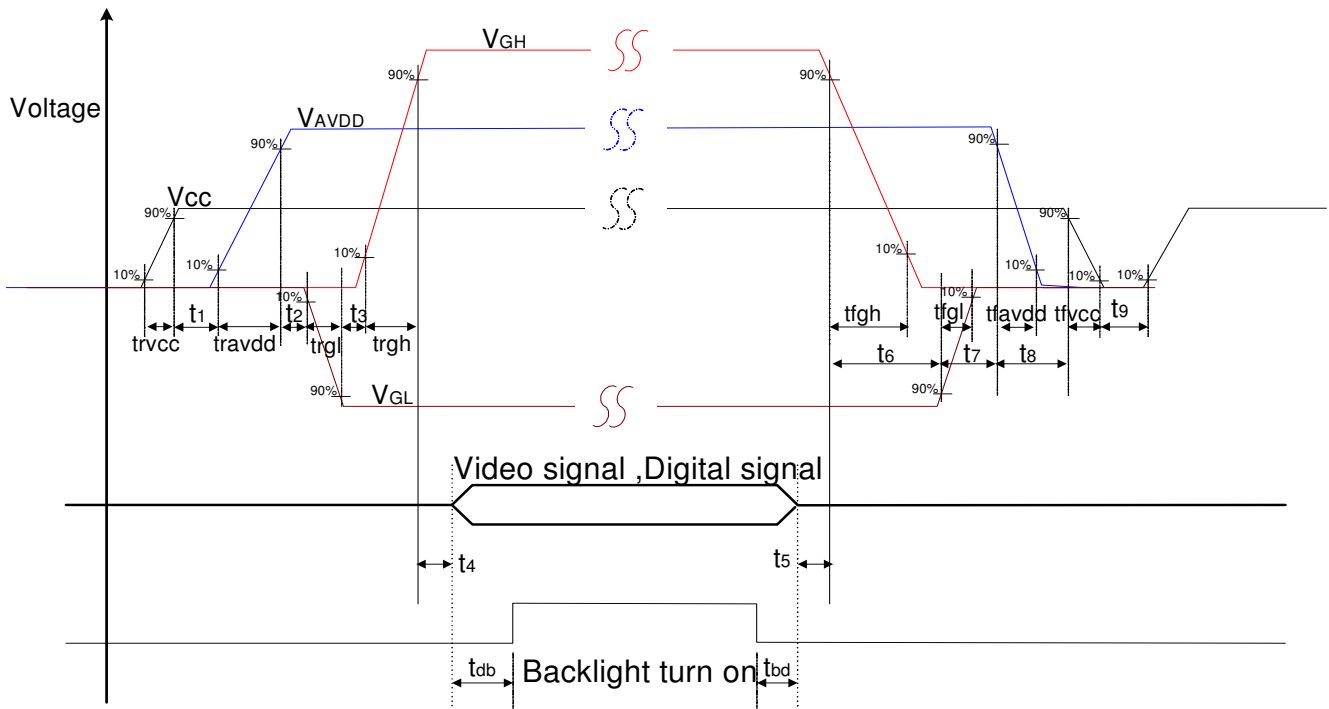
Note 2: Please don't use odd horizontal lines to drive LCD panel for both odd and even field simultaneously.

##### b. Timing diagram

Please refer to the attached drawing, from Fig.2 to Fig.6.

## 5. Power Sequence

Sequence for power on/off and Signal on/off



$t_{rvcc} \square 15\text{ms}$  (From 10% VCC to 90% VCC ,when VCC is low to high)

$t_{ravdd} \square 15\text{ms}$  (From 10% VAVDD to 90% VAVDD ,when VAVDD is low to high)

$t_{trgh} \square 15\text{ms}$  (From 10% VG\_H to 90% VG\_H ,when VG is low to high)

$t_{trgl} \square 15\text{ms}$  (From 10% VG\_L to 90% VG\_L ,when VG is low to high)

$t_{fvcc} \square 20\text{ms}$  (From 90% VCC to 10% VCC ,when VCC is high to low)

$t_{favdd} \square 20\text{ms}$  (From 90% VAVDD to 10% VAVDD ,when VAVDD is high to low)

$t_{fgh} \square 20\text{ms}$  (From 90% VG\_H to 10% VG\_H ,when VG is high to low)

$t_{fgl} \square 20\text{ms}$  (From 90% VG\_L to 10% VG\_L ,when VG is high to low)

$0 \square t_1 \square 10\text{ms}$  (From 90% VCC to 10% VAVDD , when VCC is low to high)

$0 \square t_2 \square 10\text{ms}$  (From 90% VAVDD to 10% VG\_L , when VCC is low to high)

$0 \square t_3 \square 10\text{ms}$  (From 90% VG\_L to 10% VG\_H , when VCC is low to high)

$0 \square t_4 \square 10\text{ms}$  (From 90% VG\_H to video signal start ,when VG is low to high)

$0 \square t_5 \square 10\text{ms}$  (From video signal end to 90% VG\_H ,when VG is low to high)

$t_6 \square 10\text{ms}$  (From 10% VG\_H to 90% VG\_L ,when VCC is high to low)

$t_7 \square 10\text{ms}$  (From 10% VG\_L to 90% VAVDD , when VCC is high to low)

$t_8 \square 10\text{ms}$  (From 10% VAVDD to 90% VCC , when VCC is high to low)

$t_9 \square 0.4\text{s}$  (From 10% VCC is H  $\rightarrow$  L to 10% VCC is L  $\rightarrow$  H )

$0 \square t_{db} \square 10\text{ms}$  (From video signal start to backlight on)

$0 \square t_{bd} \square 10\text{ms}$  (From backlight off to video signal end)

**Note:** Please follow above power off sequence or turn off all power simultaneously.

### C. Optical specification (Note 1, Note 2)

| Item               |        | Symbol       | Condition                  | Min. | Typ. | Max. | Unit              | Remark    |
|--------------------|--------|--------------|----------------------------|------|------|------|-------------------|-----------|
| Response time      | Rise   | Tr           | $\theta = 0^\circ$         | -    | 12   | 24   | ms                | Note 3,5  |
|                    | Fall   | Tf           |                            | -    | 18   | 36   | ms                |           |
| Contrast ratio     |        | CR           | At optimized Viewing angle | 200  | 300  | -    |                   | Note 4, 5 |
| Viewing angle      | Top    | $CR \geq 10$ |                            | 40   | 50   | -    | deg.              | Note 5, 6 |
|                    | Bottom |              |                            | 55   | 65   | -    |                   |           |
|                    | Left   |              |                            | 55   | 65   | -    |                   |           |
|                    | Right  |              |                            | 55   | 65   | -    |                   |           |
| Brightness         |        | $Y_L$        | $V_L = 12V, 25^\circ C$    | 180  | 220  | -    | cd/m <sup>2</sup> | Note 7    |
| White chromaticity |        | X            | $\theta = 0^\circ$         | 0.26 | 0.31 | 0.36 |                   | Note 7    |
|                    |        | Y            | $\theta = 0^\circ$         | 0.28 | 0.33 | 0.38 |                   |           |

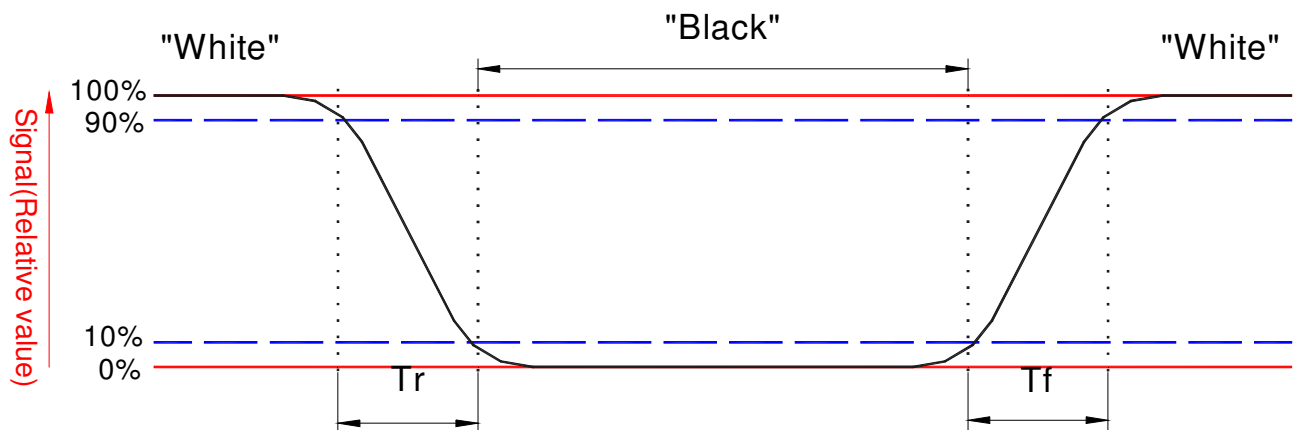
Note 1 : To be measured in the dark room. Ambient temperature =25°C , and LED lightbar current  $I_L = 225$  mA.

Note 2 :To be measured on the center area of panel with a viewing cone of 1°by Topcon luminance meter BM-7, after 15 minutes operation.

Note 3. Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively.

The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



Note 4. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

Note 5. White  $V_i = V_{i50} + 1.5V$

Black  $V_i = V_{i50} \pm 2.0V$

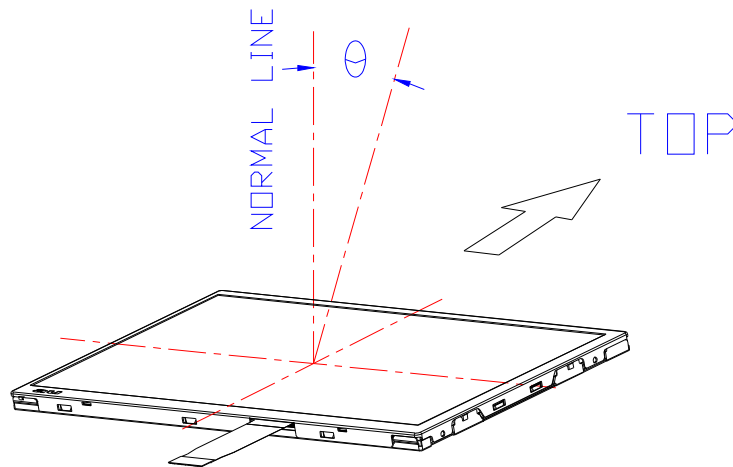
“ $\pm$ ” means that the analog input signal swings in phase with  $V_{COM}$  signal.

“ $\mp$ ” means that the analog input signal swings out of phase with  $V_{COM}$  signal.

$V_{i50}$  : The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6. Definition of viewing angle, Refer to figure as below.



Note 7. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

## D. Reliability test conditions (Note 2):

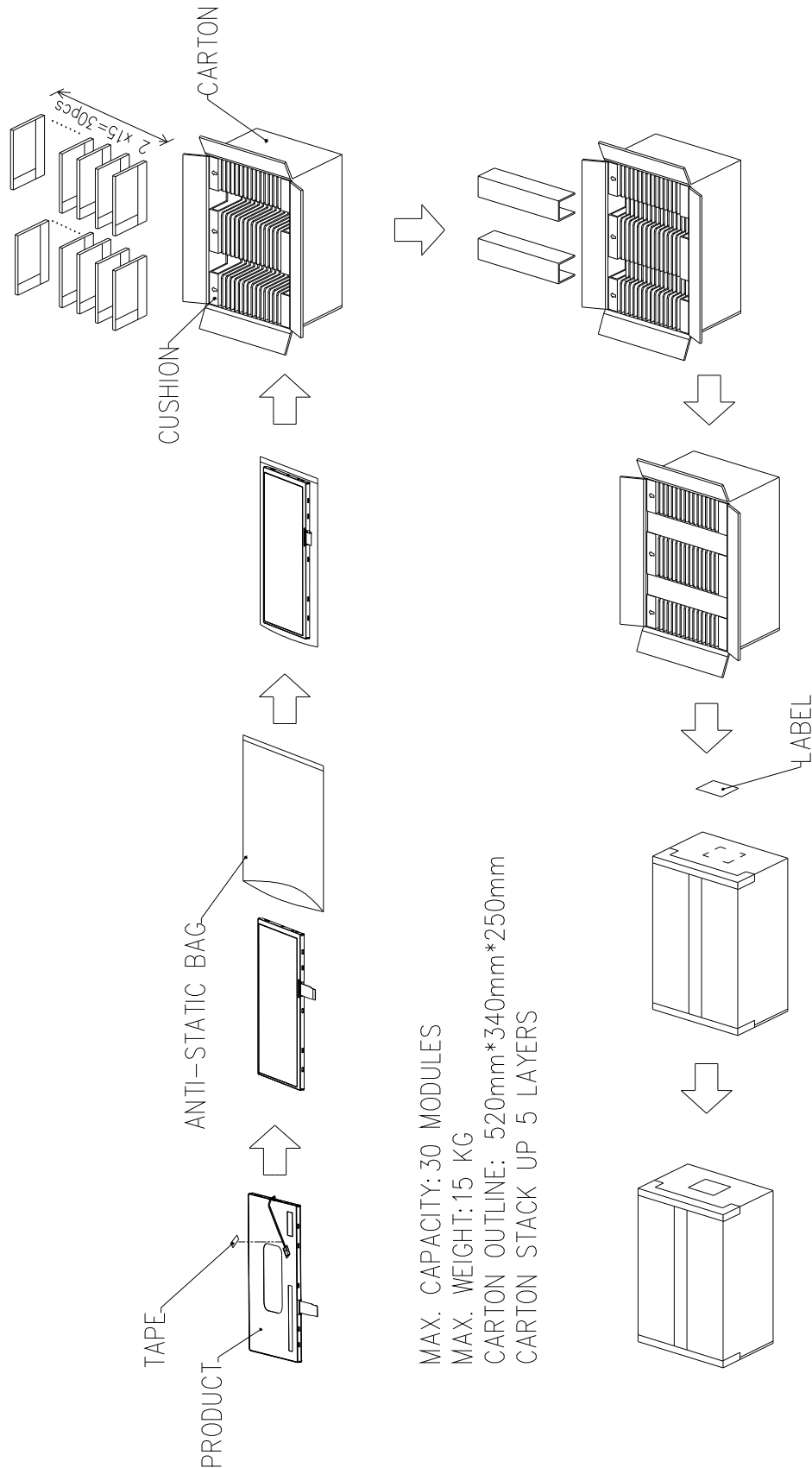
| No. | Test items                         | Conditions   | Remark                            |
|-----|------------------------------------|--|-----------------------------------|
| 1   | High temperature storage           | Ta= 70℃ 200Hrs   |                                   |
| 2   | Low temperature storage            | Ta= -20℃ 200Hrs  |                                   |
| 3   | High temperature operation         | Tp= 60℃ 200Hrs   |                                   |
| 4   | Low temperature operation          | Ta= -10℃ 200Hrs  |                                   |
| 5   | High temperature and high humidity | Tp= 50℃, 80% RH 200Hrs   | Operation                         |
| 6   | Heat shock                         | -30℃~70℃/ 50 cycles 1Hrs/cycle   | Non-operation                     |
| 7   | Electrostatic discharge            | ±200V,200pF(0Ω), once for each terminal  | Non-operation                     |
| 8   | Vibration                          | Frequency range : 10~55Hz<br>Stoke : 1.5mm<br>Sweep : 10 ~ 55 ~ 10Hz<br>2 hours for each direction of X,Y,Z<br>(6 hours for total) | JIS C7021,<br>A-10<br>Condition A |
| 9   | Mechanical shock                   | 100G, 6ms, ±X,±Y,±Z<br>3 times for each direction  | JIS C7021,<br>A-7<br>Condition C  |
| 10  | Vibration (with carton)            | Random vibration:<br>0.015G <sup>2</sup> /Hz from 5~200Hz<br>-6dB/octave from 200~500Hz  | IEC 68-34                         |
| 11  | Drop (with carton)                 | Height: 60cm<br>1 corner, 3 edges, 6 surfaces  | JIS Z0202                         |

Note1: Ta: Ambient Temperature.

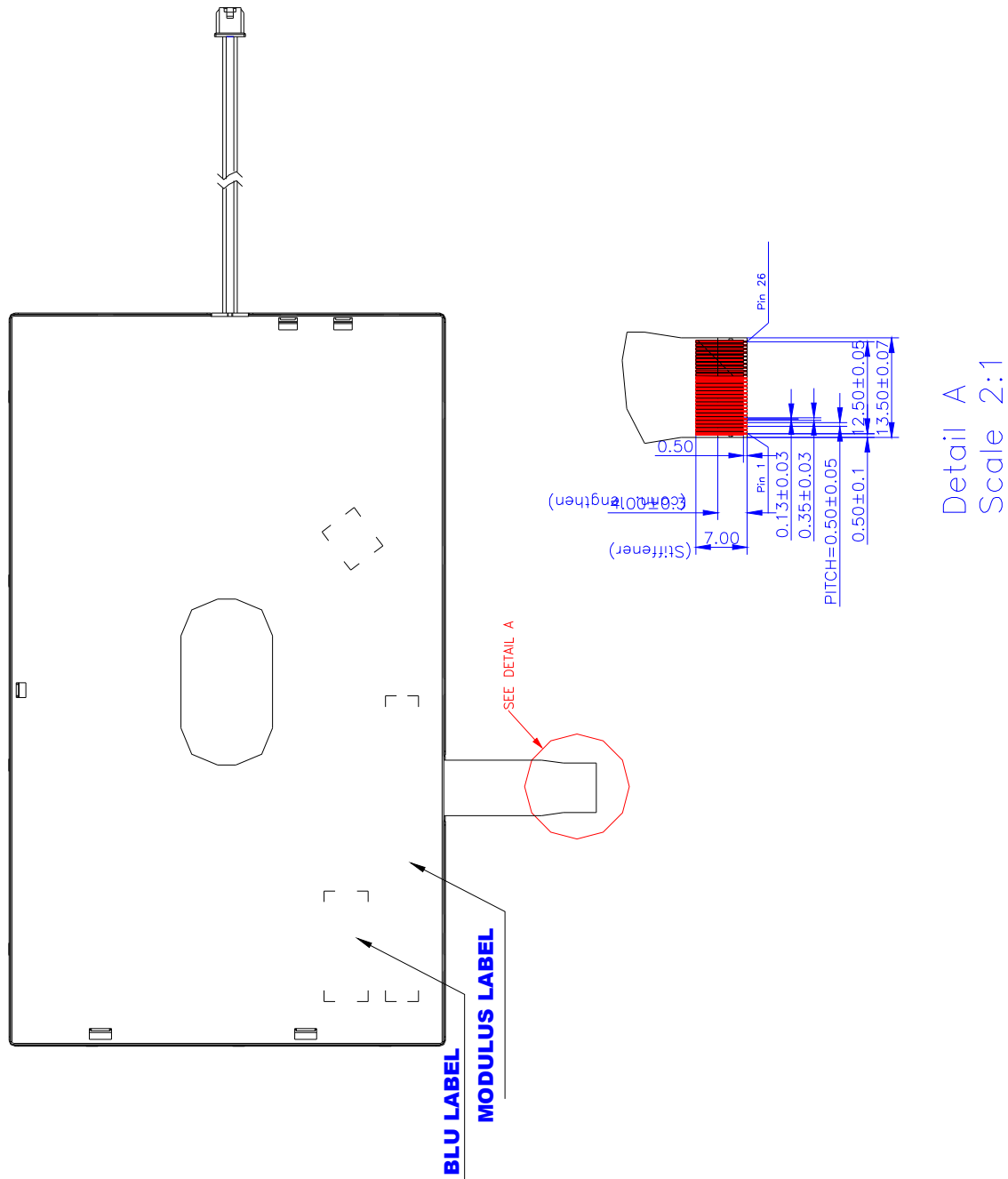
Note2: Tp: Panel Surface Temperature

Note3: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

## E. Packing form

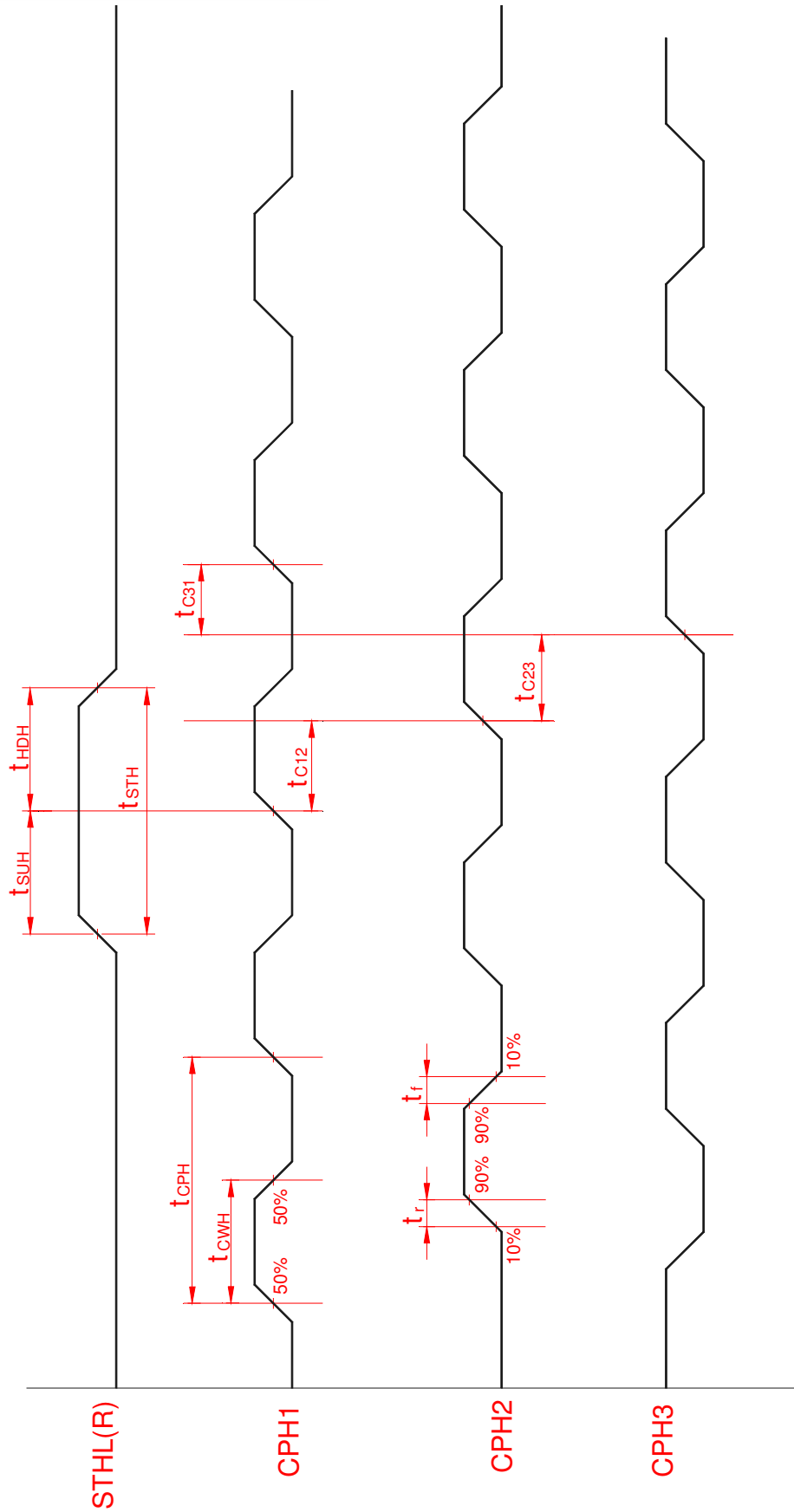




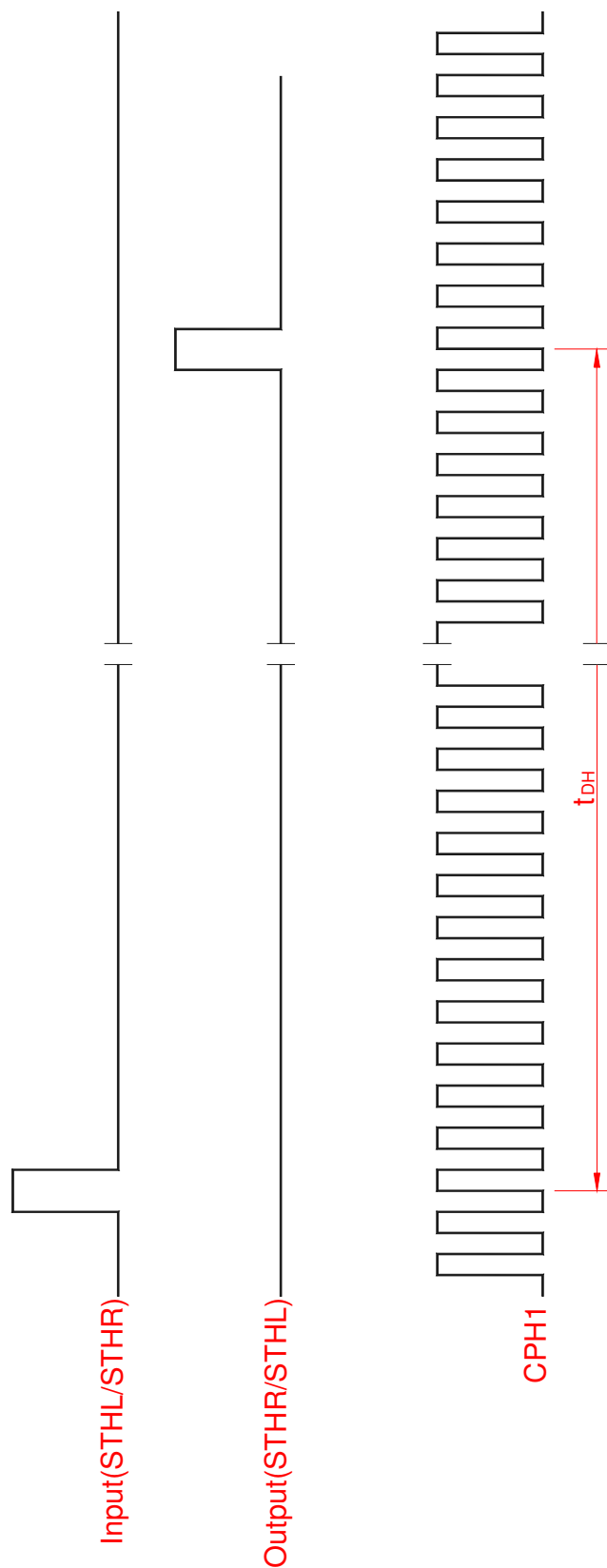


**Fig.1-(b) Outline dimension of TFT-LCD module (Back side)**

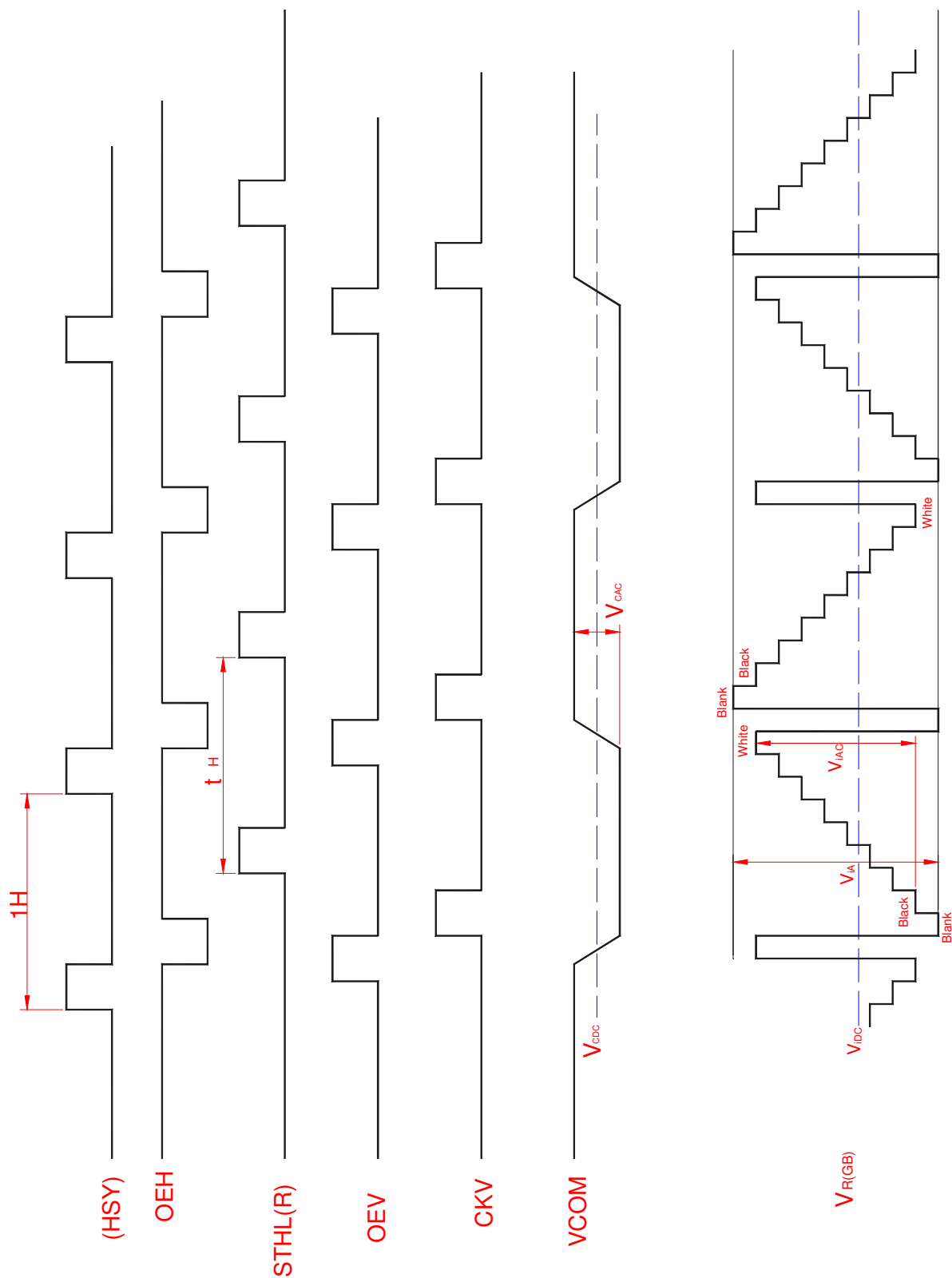




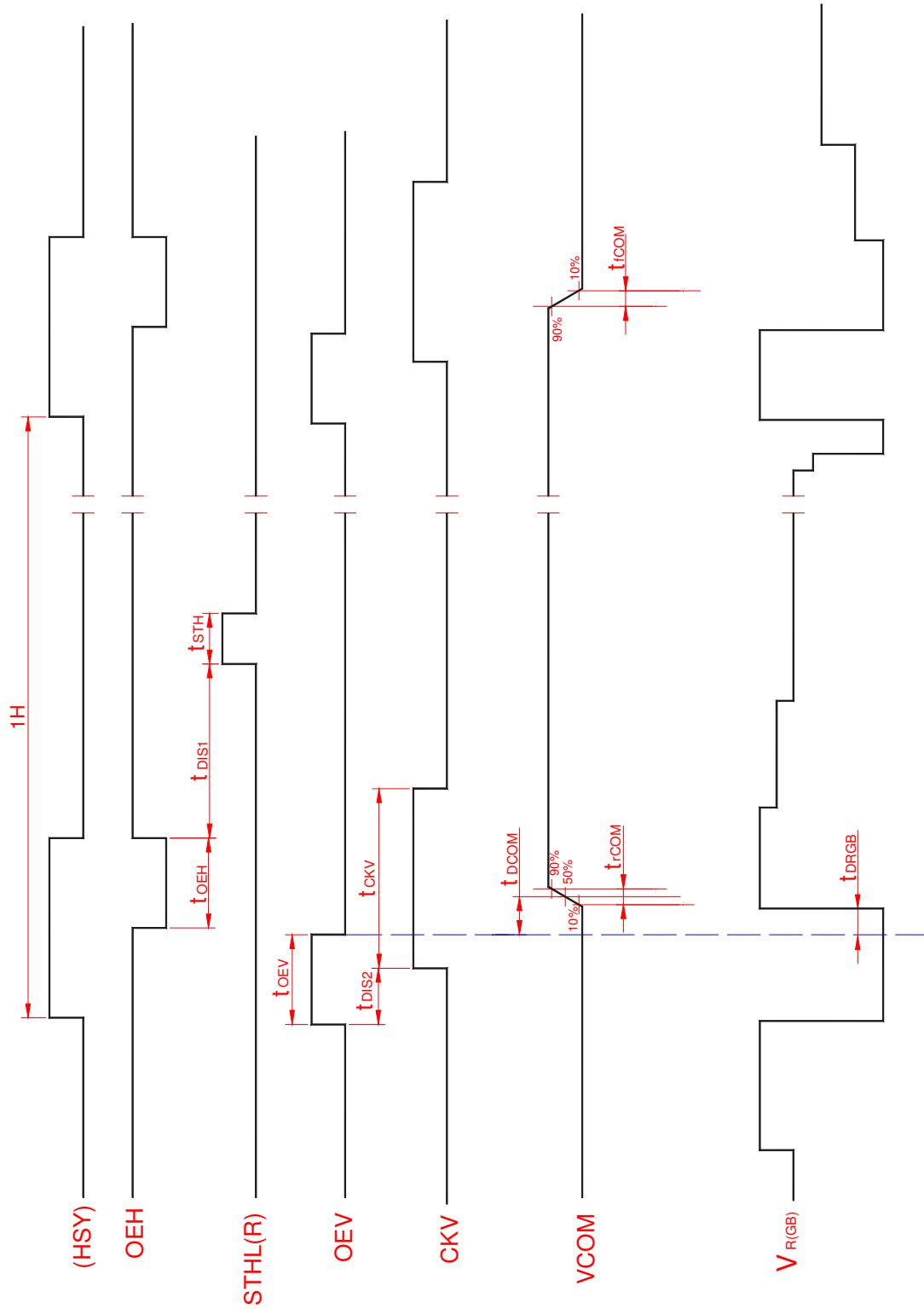
**Fig.2 Sampling clock timing**



**Fig.3 Horizontal display timing range**

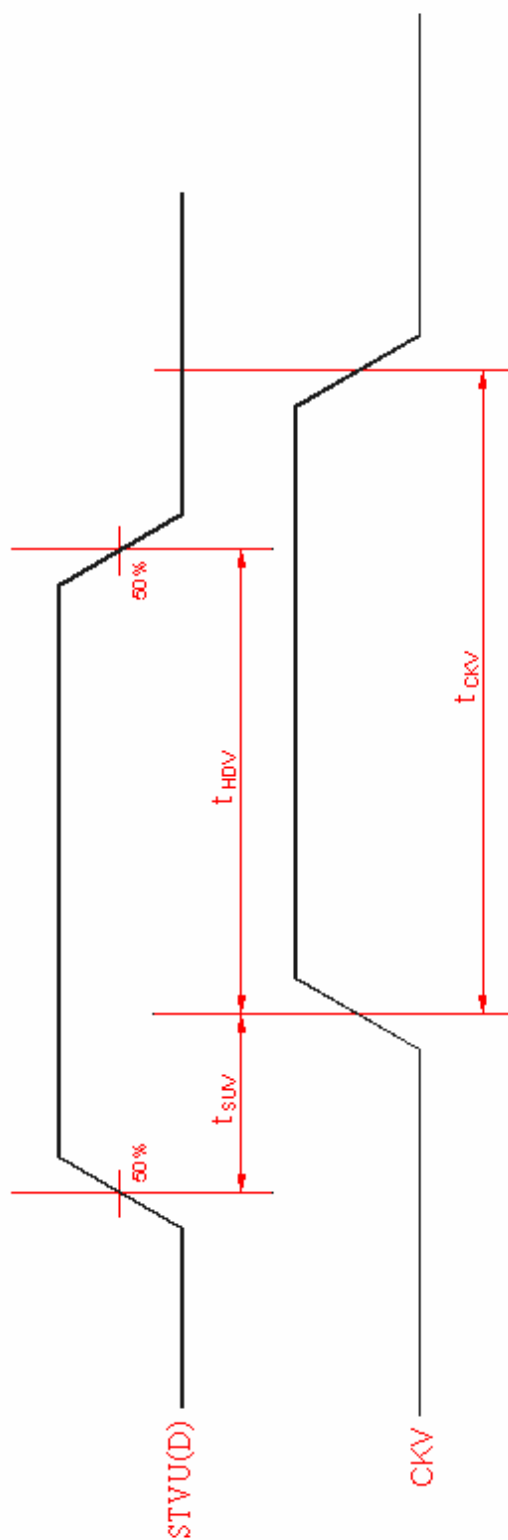


**Fig.4-(a) Horizontal timing**

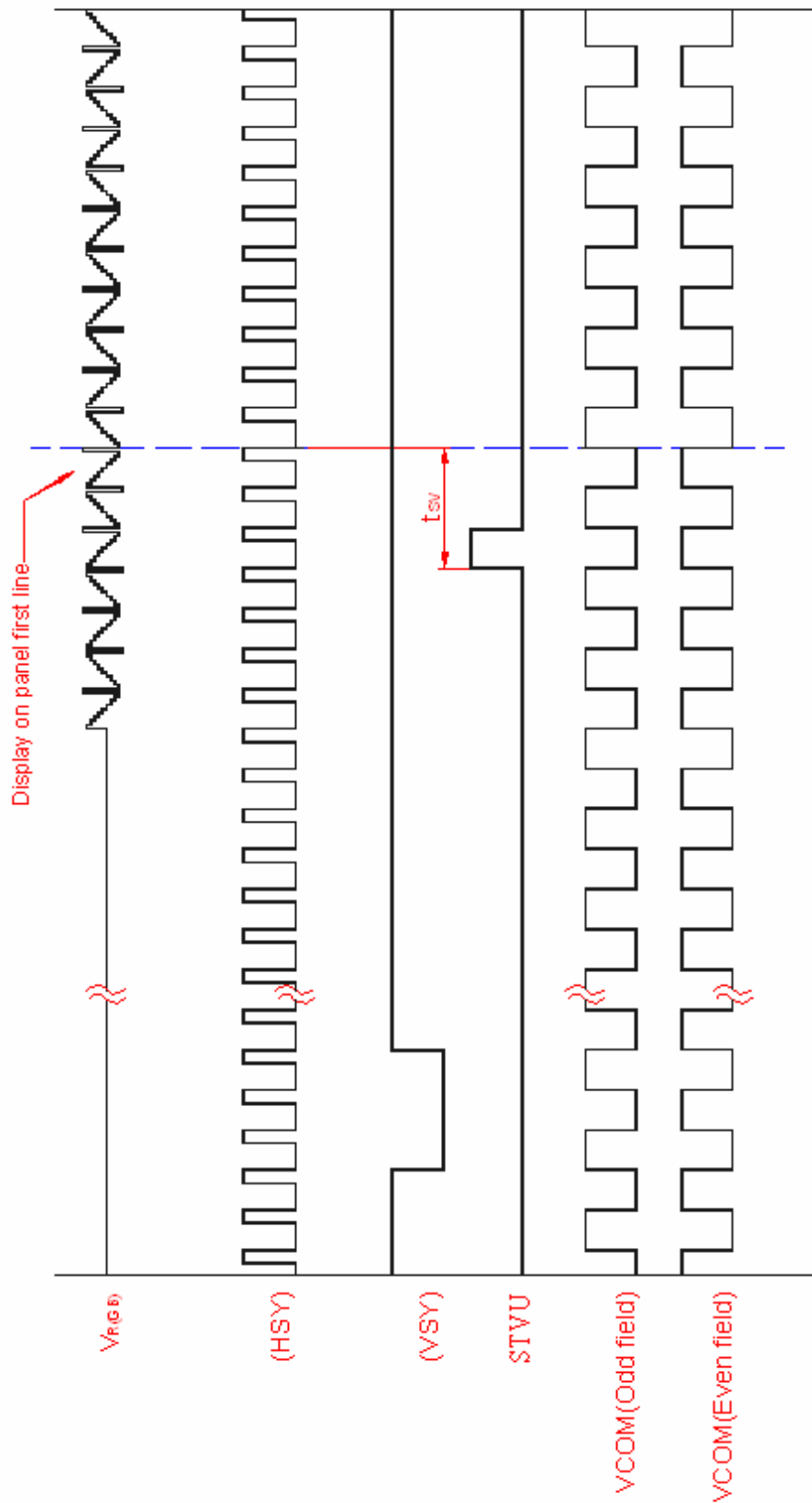


Note: The falling edge of OEV should be synchronized with the falling edge of OEH

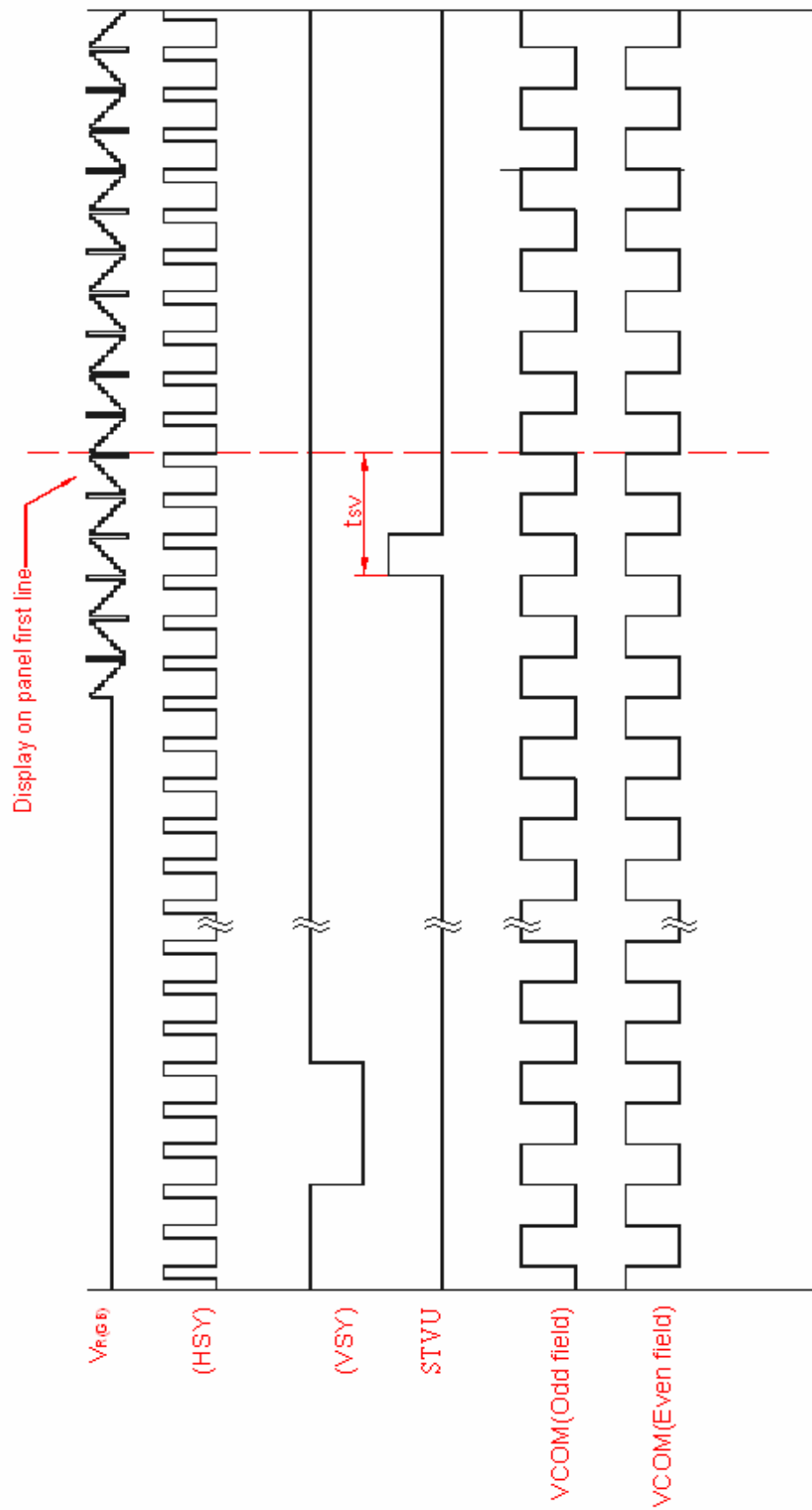
**Fig.4-(b) Detail horizontal timing**



**Fig.5 Vertical shift clock timing**



**Fig.6-(a) Vertical timing (From up to down)**



**Fig.6-(b) Horizontal timing (From down to up)**