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Product Specification

5.6" color TFT-LCD module

Model name: A056DN01 V2
Original model name: A056DN01

- (.....) Preliminary Specification
- (◆) Final Specification

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

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A. Physical specifications

| NO. | Item | Specification | Remark |
|------------|-------------------------|------------------------|---------------|
| 1 | Display resolution(dot) | 960(W)×234(H) | |
| 2 | Active area(mm) | 113.3(W)×84.7(H) | |
| 3 | Screen size(inch) | 5.6(Diagonal) | |
| 4 | Dot pitch(mm) | 0.118(W)×0.362(H) | |
| 5 | Color configuration | R. G. B. stripe | |
| 6 | Overall dimension(mm) | 126.5(W)×100(H)×6.8(D) | Note 1 |
| 7 | Weight(g) | 145±10 | |

Note 1: 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 _{CC} | I | Supply voltage of logic control circuit for scan driver | |
| 3 | V _{GL} | I | Negative power for scan driver | |
| 4 | V _{GH} | I | Positive power for scan driver | |
| 5 | STVR | I/O | Vertical start pulse | Note 1 |
| 6 | STVL | 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 | OEV | 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 | Q1H | I | Analog signal rotate input | |
| 14 | OEH | 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 _{CC} | 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 _{DD} | I | Supply voltage for analog circuit | |
| 26 | AV _{SS} | - | Ground for analog circuit | |

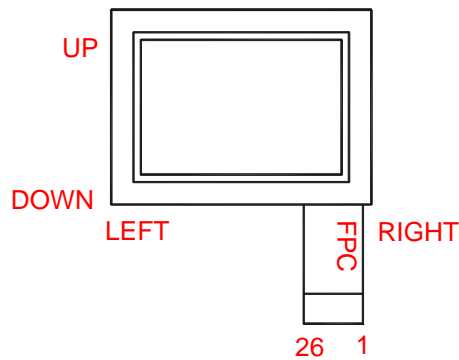
Note 1: Selection of scanning mode (please refer to the following table)

| Setting of scan control input | | IN/OUT state For start pulse | | | | Scanning direction |
|-------------------------------|-----------------|------------------------------|------|------|------|--|
| U/D | L/R | STVR | STVL | STHR | STHL | |
| GND | V _{CC} | OUT | IN | OUT | IN | From up to down, and from left to right. |
| V _{CC} | 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 _{CC} | V _{CC} | 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:



b. Backlight driving section(Refer to Fig. 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} | | - | 31 | V | |
| Input signal voltage | V _i | | -0.3 | AV _{DD} +0.3 | V | Note 1 |
| | V _I | | -0.3 | V _{CC} +0.3 | V | Note 2 |
| | V _{COM} | | -2.9 | 5.2 | V | |
| Operating temperature | Topa | | 0 | 60 | °C | Ambient temperature |
| Storage temperature | Tstg | | -25 | 60 | °C | Ambient temperature |

Note 1: VR, VG, VB

Note 2: STHL, STHR, Q1H, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.

3. Electrical characteristics

a. Typical operating conditions (GND=AVss=0V, Note 5)

| Item | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------------------------|-------------------|-----------------------|---------------------|-----------------------|--------------------|---|
| Power supply | V _{CC} | 4.8 | 5 | 5.2 | V | |
| | AV _{DD} | 4.8 | 5 | 5.2 | V | |
| | V _{GH} | 14.3 | 15 | 15.7 | V | |
| | V _{GLAC} | - | 5 | - | Vp-p | AC component of V _{GL} . Note 1 |
| | V _{GL-H} | -10.5 | -10 | -9.5 | V | High level of V _{GL} . |
| Video signal Amplitude (VR, VG, VB) | V _{iA} | AV _{SS} +0.4 | - | AV _{DD} -0.4 | V | Note 2 |
| | V _{iAC} | - | 3 | - | V | AC component |
| | V _{iDC} | - | AV _{DD} /2 | - | V | DC component |
| VCOM | V _{CAC} | - | 5 | - | Vp-p | AC component, Note 3 |
| | V _{CDC} | 1.3 | 1.4 | 1.5 | V | DC component |
| Input Signal voltage | H Level | V _{IH} | 0.8V _{CC} | - | V _{CC} | Note 4 |
| | L Level | V _{IL} | 0 | - | 0.2V _{CC} | |

Note 1: The same phase and amplitude with common electrode driving signal(VCOM).

Note 2: Refer to Fig.4-(a)

Note 3: The brightness of LCD panel could be adjusted by the adjustment of the AC component of VCOM.

Note 4: STHL, STHR, Q1H, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.

Note 5: 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 | - | 0.2 | 0.8 | mA | |
| | I _{GL} | V _{GL} =-10V | - | -0.5 | -1 | mA | |
| | I _{CC} | V _{CC} =5V | - | 4 | 8 | mA | |
| | I _{DD} | AV _{DD} =5V | - | 12 | 20 | mA | |
| | I _{VCOM} | V _{CAC} =5V | - | 10 | 18 | mA | |
| | I _{LI1} | - | -10 | - | 10 | μA | Note 1 |

Note 1: Logic Input Leakage Current

c. Backlight driving conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-----------------------|----------------|-------|------|------|-------|----------|
| Lamp voltage | V _L | - | 470 | 528 | Vrms | |
| Lamp current | I _L | - | 6 | 7 | mArms | |
| Frequency | F _L | - | 60 | 80 | KHz | Note 4 |
| Lamp starting Voltage | V _S | - | - | 650 | Vrms | Note 1,5 |
| | | - | - | 910 | Vrms | Note 2,5 |
| | | - | - | 910 | Vrms | Note 3,5 |
| Backlight Life | | 15000 | | | Hr | Note 6 |

Note 1: $T_a = 25^{\circ}\text{C}$, in normal environment

Note 2: $T_a = 0^{\circ}\text{C}$, in normal environment

Note 3: $T_a = 25^{\circ}\text{C}$, in 14lux dark environment after leaving for 24hrs.

Note 4: The lamp frequency should be selected as different as possible from display horizontal synchronous signal to avoid interference.

Note 5: For starting the backlight unit, V_s value is measured from connector of product. The output voltage of DC/AC's transformer should be larger than the maximum lamp starting voltage.

Note 6: The "Lamp life time" is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$, $I_L=6\text{mA}$

4. AC Timing

a. Timing conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit. | Remark |
|---------------------------------|-------------------------------------|------|-------------|-------------|---------------|-----------|
| Rising time | t_{r1} | - | - | 60 | ns | CPH1~CPH3 |
| Falling time | t_{f1} | - | - | 60 | ns | CPH1~CPH3 |
| Rising time | t_{r2} | - | - | 120 | ns | CKV |
| Falling time | t_{f2} | - | - | 120 | ns | CKV |
| High and low level pulse width | t_{CPH} | 150 | 154 | 158 | ns | CPH1~CPH3 |
| CPH pulse duty | t_{CWH} | 40 | 50 | 60 | % | CPH1~CPH3 |
| CPH pulse delay | t_{C12} t_{C23} 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 | μs | STHR,STHL |
| OEH pulse width | t_{OEH} | - | 7 | - | t_{CPH} | OEH |
| Sample and hold disable time | t_{DIS1} | - | 55 | - | t_{CPH} | |
| OEV pulse width | t_{OEV} | - | 27 | - | t_{CPH} | OEV |
| CKV pulse width | t_{CKV} | - | 41 | - | t_{CPH} | CKV |
| Clean enable time | t_{DIS2} | - | 16 | - | t_{CPH} | |
| Horizontal display start | t_{SH} | - | 0 | - | $t_{CPH}/3$ | |
| Horizontal display timing range | t_{DH} | - | 960 | - | $t_{CPH}/3$ | |
| STV setup time | t_{SUV} | 400 | - | - | ns | STVL,STVR |
| STV hold time | t_{HDV} | 400 | - | - | ns | STVL,STVR |
| STV pulse width | t_{STV} | - | - | 1 | t_H | STVL,STVR |
| Horizontal lines per field | t_V | 256 | 262 | 268 | t_H | Note 1 |
| Vertical display start | t_{SV} | - | 3 | - | t_H | |
| Vertical display timing range | t_{DV} | - | 234 | - | t_H | |
| VCOM rising time | t_{rCOM} | - | - | 5 | μs | |
| VCOM falling time | t_{fCOM} | - | - | 5 | μs | |
| VCOM delay time | t_{dCOM} | - | - | 3 | μs | |

| | | | | |
|----------------|------------|---|---|---------|
| RGB delay time | t_{DRGB} | - | 1 | μs |
|----------------|------------|---|---|---------|

Note 1: 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.

C. Optical specification (Note 1, Note 2, Note 3)

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|--------------------|--------|----------------------------|------|------|------|------|----------|
| Response time | Rise | $\theta = 0^\circ$ | - | 15 | 30 | Ms | Note 4,6 |
| | Fall | | - | 20 | 40 | | |
| Contrast ratio | CR | At optimized viewing angle | 100 | 250 | - | | Note 5,6 |
| Viewing angle | Top | $CR \geq 10$ | 30 | - | - | deg. | Note 6,7 |
| | Bottom | | 50 | - | - | | |
| | Left | | 50 | - | - | | |
| | Right | | 50 | - | - | | |
| Brightness | | $\theta = 0^\circ$ | 450 | 500 | - | nit | Note 8 |
| White chromaticity | X | $\theta = 0^\circ$ | 0.25 | 0.30 | 0.35 | | Note 8 |
| | Y | $\theta = 0^\circ$ | 0.30 | 0.35 | 0.40 | | |

Note 1. Ambient temperature =25°C . And lamp current $I_L = 6mA$ rms.

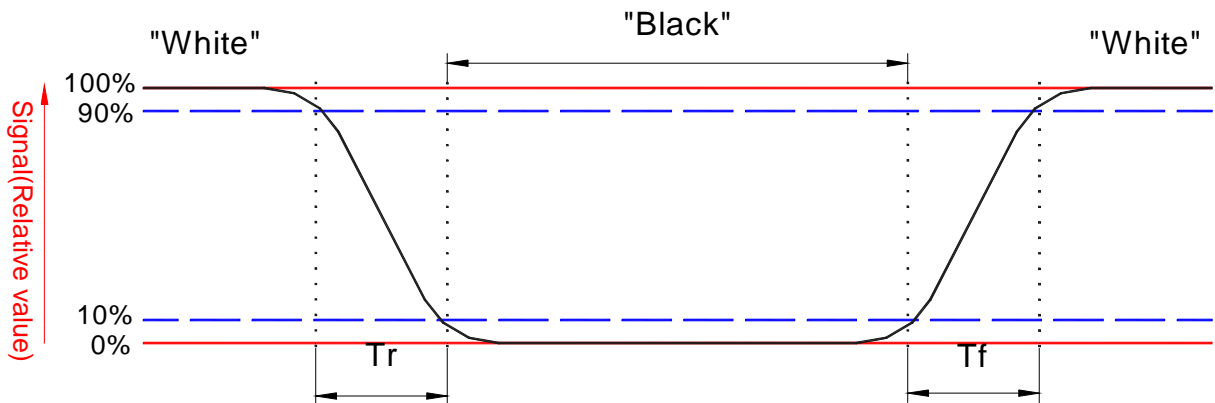
Note 2. To be measured in the dark room.

Note 3. To be measured on the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 10 minutes operation.

Note 4. Definition of response time:

The output signals of photodetector 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 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula.

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

Note 6. 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 COM signal.

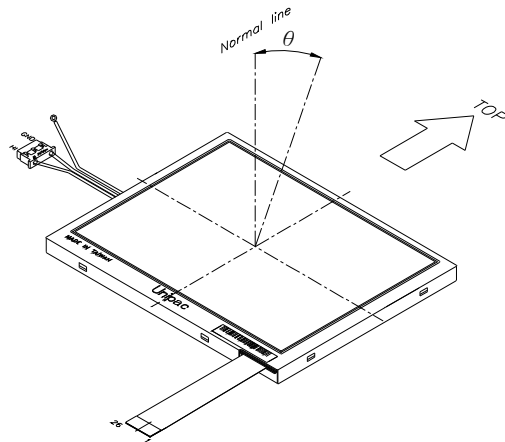
" $+$ " means that the analog input signal swings out of phase with COM signal.

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 7. Definition of viewing angle:

Refer to figure as below.



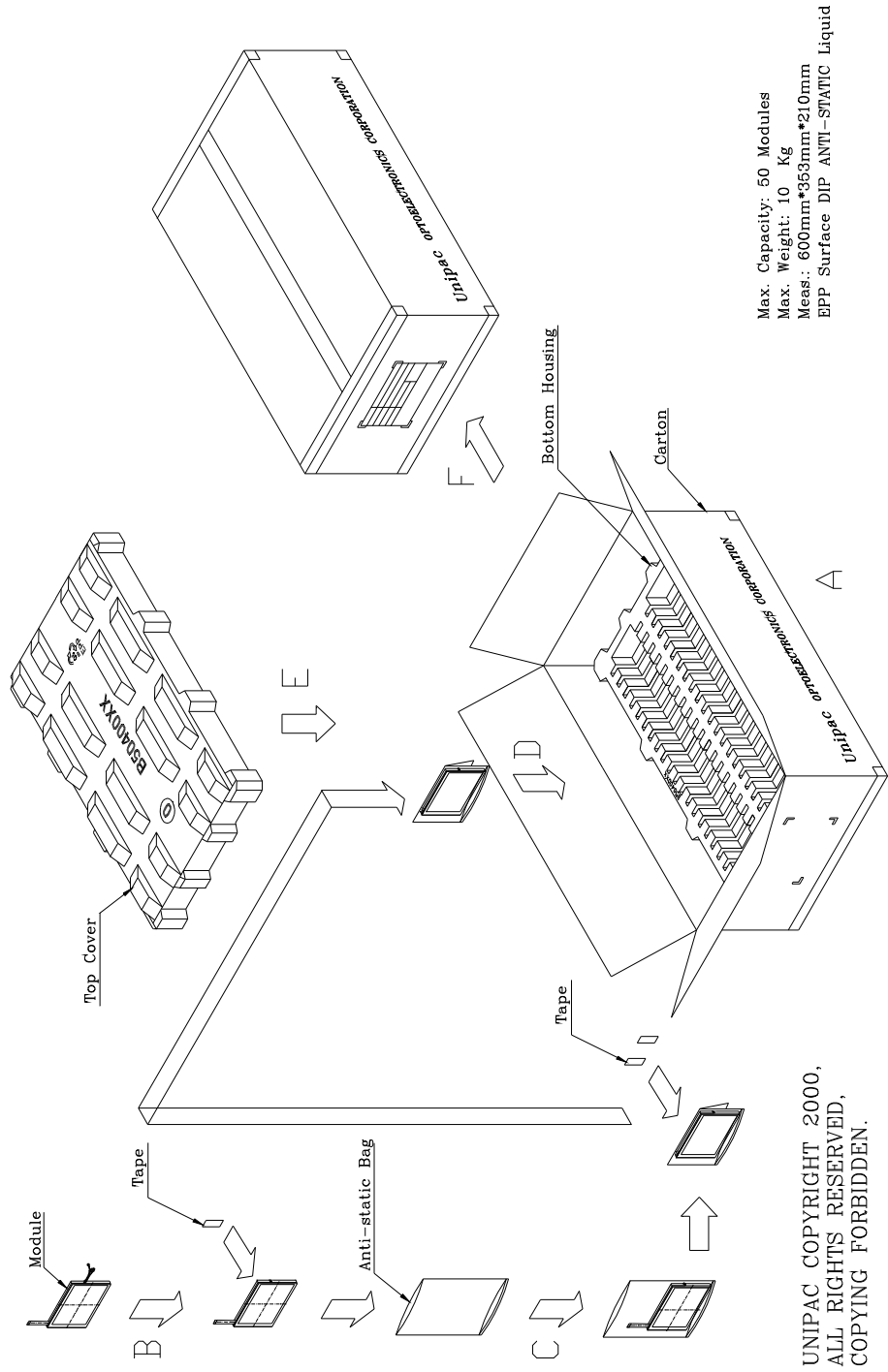
Note 8. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

D. Reliability test items:

| No. | Test items | Conditions | Remark |
|-----|------------------------------------|--|-----------------------------------|
| 1 | High temperature storage | Ta= 60°C 240Hrs | |
| 2 | Low temperature storage | Ta= -25°C 240Hrs | |
| 3 | High temperature operation | Ta= 60°C 240Hrs | |
| 4 | Low temperature operation | Ta= 0°C 240Hrs | |
| 5 | High temperature and high humidity | Ta= 60°C, 95% RH 240Hrs | Operation |
| 6 | Heat shock | -25°C ~60°C/50 cycle 2Hrs/cycle | Non-operation |
| 7 | Electrostatic discharge | ±200V,200pF(0Ω), once for each terminal | Non-operation |
| 8 | Vibration | Frequency range : 10~55Hz Stoke : 1.5mm Sweep : 10~55Hz~10Hz 2 hours for each direction of X,Y,Z (6 hours for total) | JIS C7021, A-10 condition A |
| 9 | Mechanical shock | 100G, 6ms, ±X,±Y,±Z 3 times for each direction | JIS C7021, A-7 condition C |
| 10 | Vibration (with carton) | Random vibration: 0.015G ² /Hz from 5~200Hz -6dB/Octave from 200~500Hz | IEC 68-34 |
| 11 | Drop (with carton) | Height: (60)cm 1 corner, 3 edges, 6 surfaces | JIS Z0202 |

Note: Ta: Ambient temperature.

E. Packing form



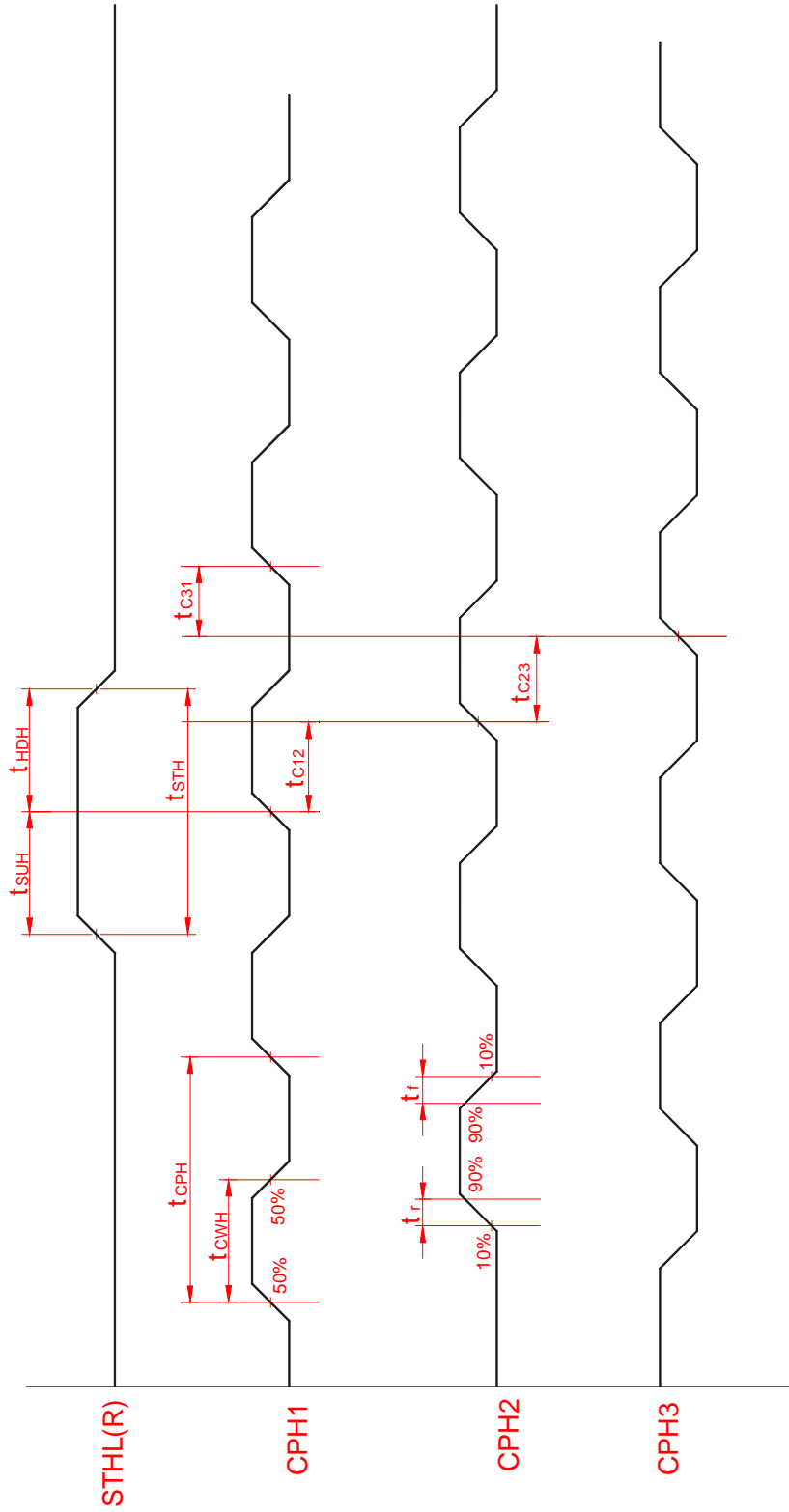


Fig. 2 Sampling clock timing

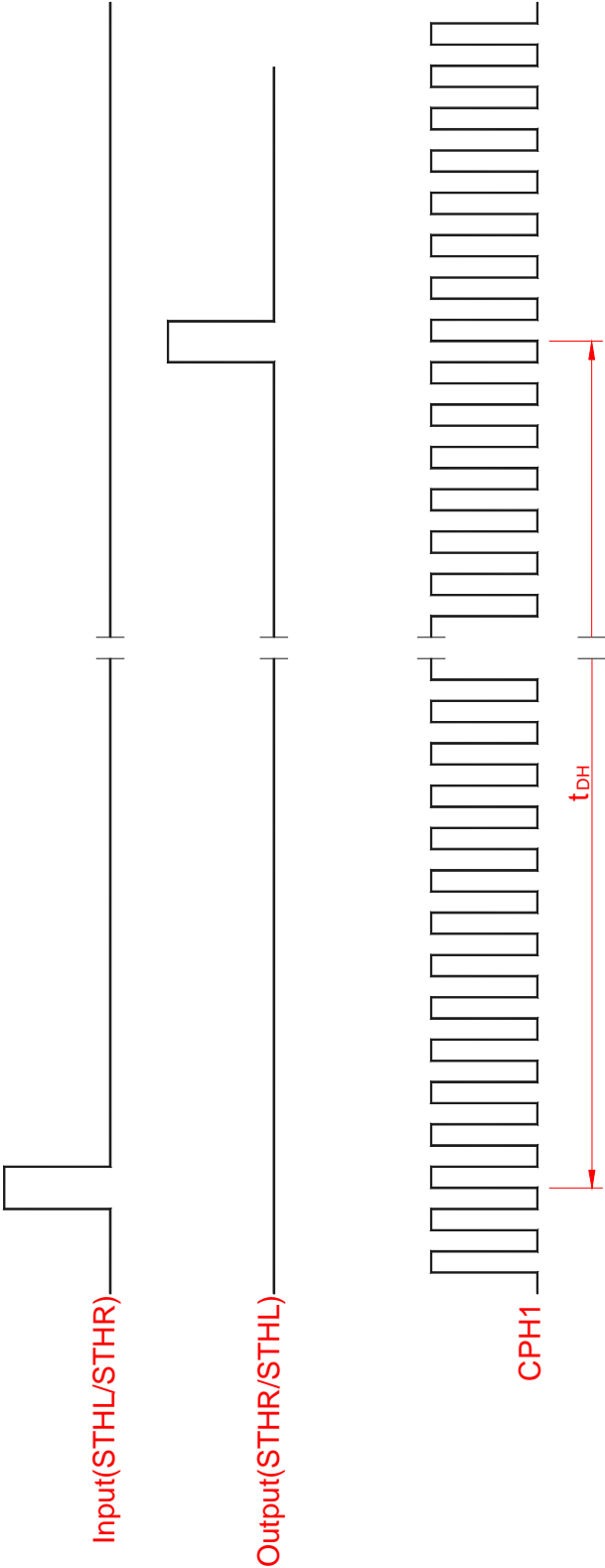


Fig. 3 Horizontal display timing range

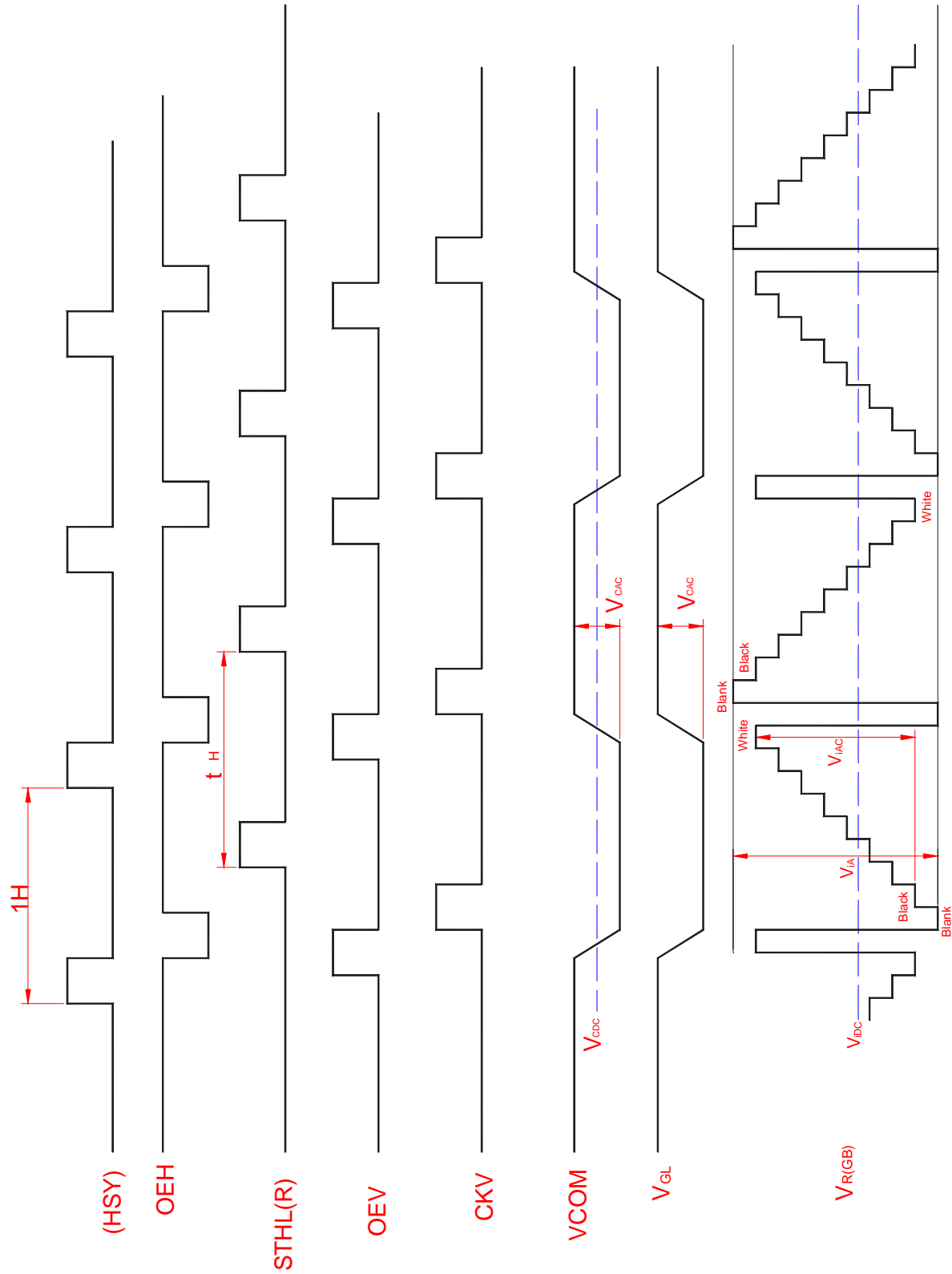
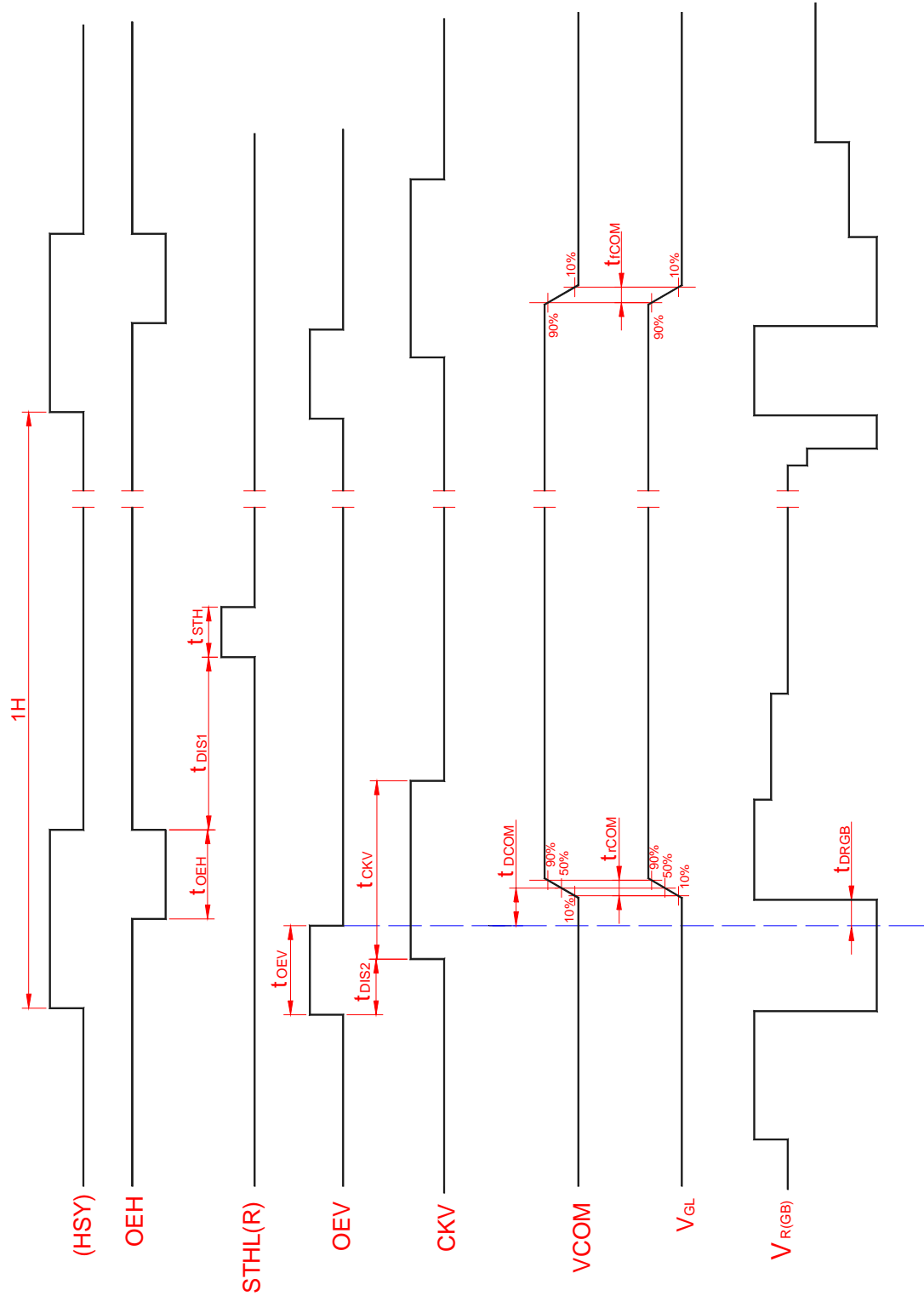


Fig.4-(a) Horizontal timing

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

Fig. 4-(b) Detail horizontal timing

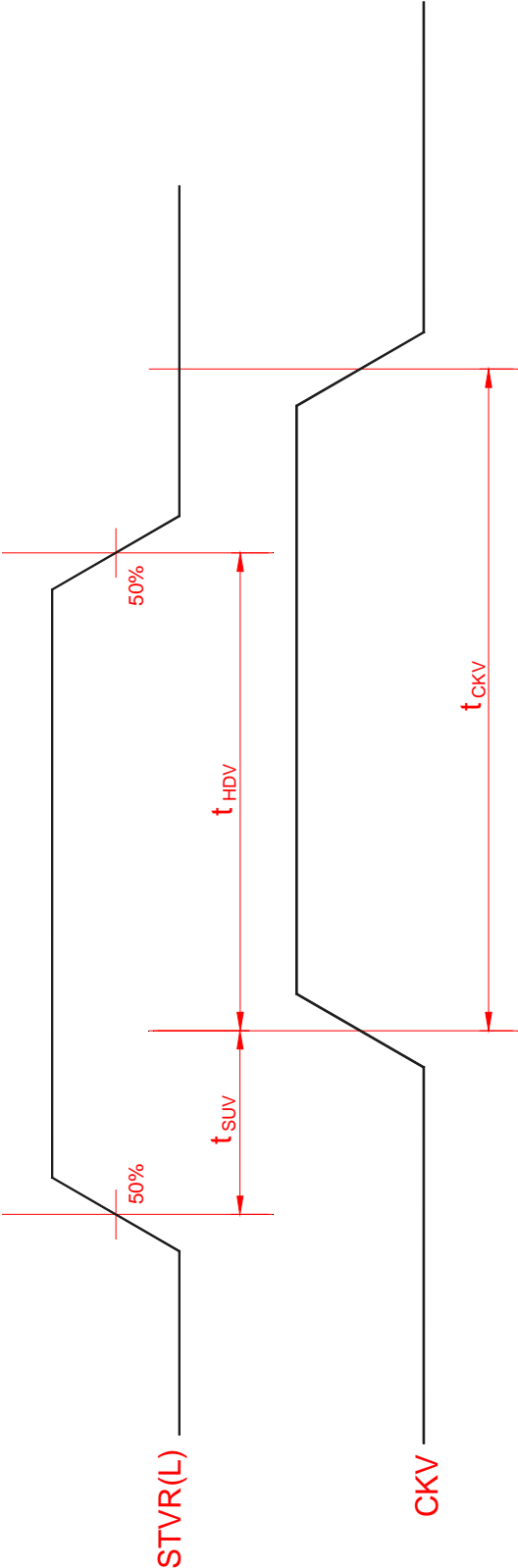


Fig.5 Vertical shift clock timing

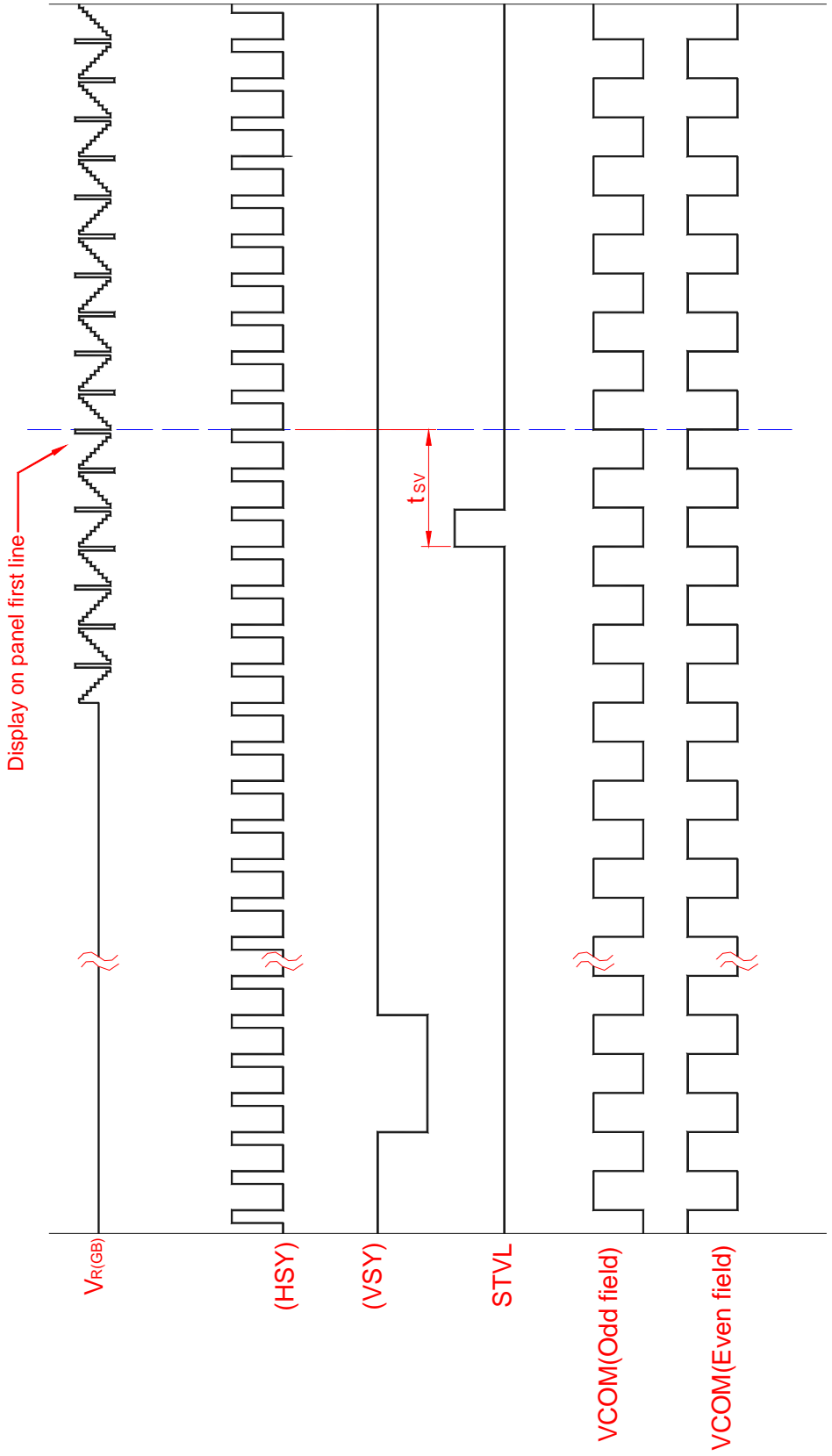


Fig.6-(a) Vertical timing (From up to down)

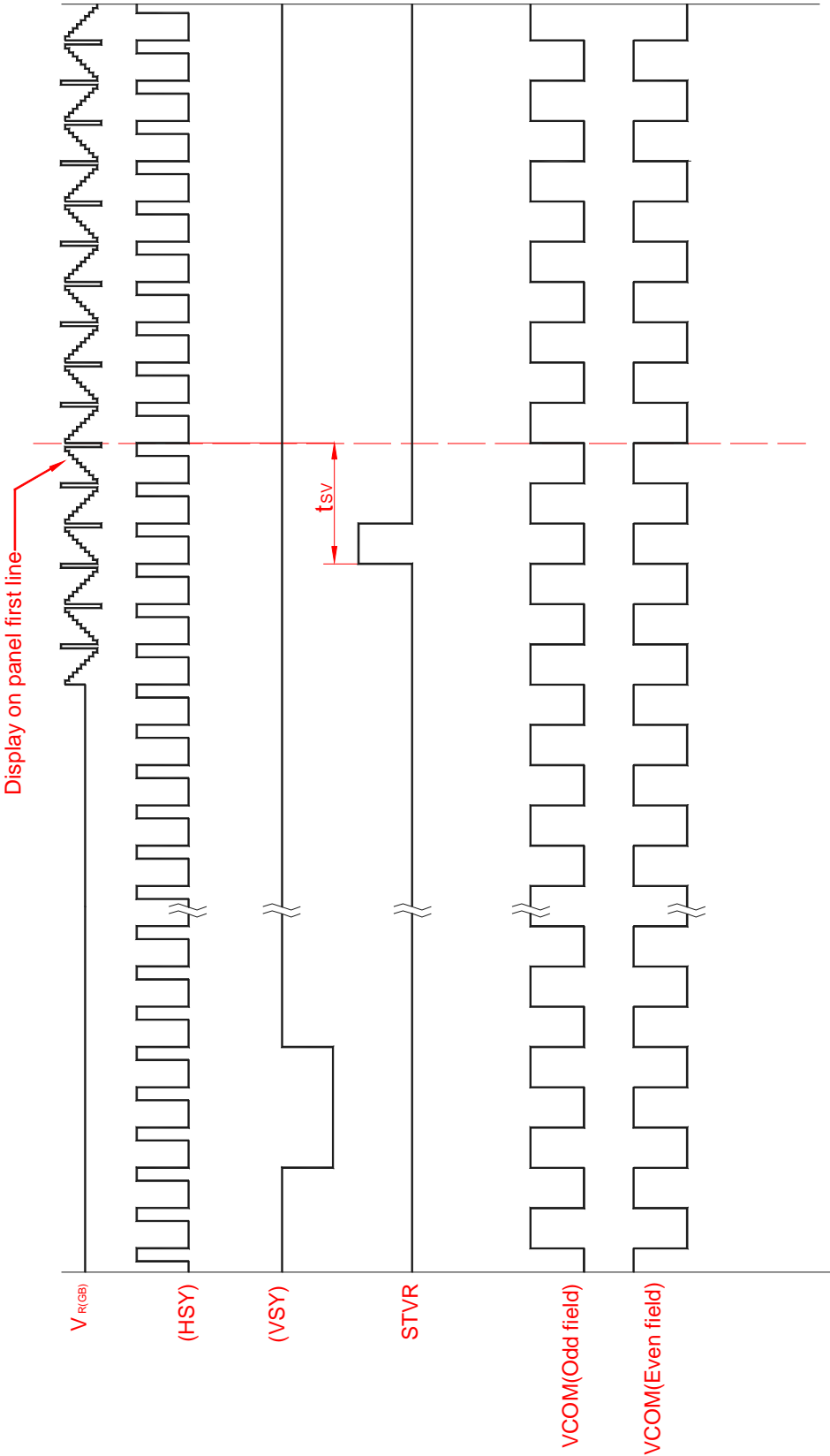


Fig.6-(b) Vertical timing (From down to up)